

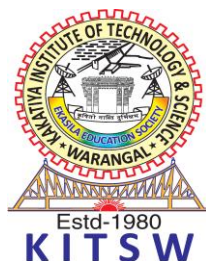
B.TECH. CURRICULUM

ACADEMIC YEAR: 2024-25

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (NETWORKS)

**Undergraduate Rules and Regulations-2024 (URR24)
In accordance with the National Education Policy 2020
w.e.f AY 2024-25**

**Regulations Governing the
Choice Based Credit System and
Multiple Entry and Multiple Exit Options
with
Competency-Focused Outcome Based Curriculum (CF-OBC)**



KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE, WARANGAL – 506 015 TELANGANA

(UGC Autonomous Institute Under Kakatiya University, Warangal)

B. Tech (CSE(Networks)) –CURRICULUM(KITSW-URR24)
SEMESTER-WISE CURRICULUM WITH SCHEME OF INSTRUCTIONS

Abbreviations

L	Lecture Hours	O	Outside the Class Work (Self Study) Hours
T	Tutorial Hours	E	Total Engagement in Hours
P	Practical Hours	C	Credit Assigned

I SEMESTER

Stream – II

Sl. No.	Category	Course Code	Course Title	Lectures/week					Credits
				L	T	P	O	E	C
-	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values-I)						-
1	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	2	1	-	6	9	3
2	BSC	U24CY102B	Engineering Chemistry	2	1	2	5	10	4
3	ESC	U24CI111	Digital Logic Design	2	1	-	4	7	3
4	ESC	U24CN104	Programming for Problem Solving with C	2	1	2	5	10	4
5	HSMC	U24MH105	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA106	Sports & Yoga	-	-	2	3	5	1
7	ESC	U24AE107	Engineering Graphics & CAD	-	-	2	2	4	1
8	ELC	U24EL108	Practicum-1	-	-	-	4	4	1
9	VAC	U24VA109XXXXX	SEA-I/SAA-1	-	-	-	2	2	1
10	AEC	U24AE110	Expert Talk Series-1	-	-	-	1	1	1
Total:				10	4	8	35	57	21

* For CE and ME, it will be a three (03) credit (1-0-4) course on Engineering Graphics & Design (Pedagogy: Sessions with conventional drafter and CAD). (For CE: U24CE107/U24CE207 and for ME: U24ME107A/U24ME207A)

Pool - III (Chemistry)		
S. No.	Course Code	Course Title
1.	U24CY102A	Engineering Chemistry (for Mechanical Engineering)
2.	U24CY102B	Engineering Chemistry (Common to CSM, CSD, CSN, CSO & IT)

II SEMESTER**Stream-II**

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24PY202B	Engineering Physics	2	1	2	5	10	4
3	PCC	U24CN203	Computer Architecture and Organization	2	1	-	4	7	3
4	ESC	U24CN204	Data Structures through C	2	1	2	5	10	4
5	ESC	U24EE205B	Basic Electrical Engineering	2	1	2	5	10	4
6	VAC	U24VA206	Environmental Studies	2	-	-	2	4	-
7	ESC	U24AE207	IDEA Lab Makerspace	-	-	2	2	4	1
8	SEC	U24SE208	Programming Skill Development (PSD) Lab - 1	-	-	2	2	4	1
9	ELC	U24EL209	Practicum-2	-	-	-	4	4	1
10	VAC	U24VA210XXXXX	SEA-2 / SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
Total:				10	5	12	38	65	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

Pool - I (Physics)		
S. No.	Course Code	Course Title
1.	U24PY202A	Engineering Physics (for Mechanical Engineering)
2.	U24PY202B	Engineering Physics (Common to CSM, CSD, CSN, CSO & IT)

Pool - II (Basic Electrical & Electronics Engineering)		
S. No.	Course Code	Course Title
1.	U24EE205A	Basic Electrical and Electronics Engineering (for Mechanical Engineering)
2.	U24EE205B	Basic Electrical Engineering (Common to CSM, CSD, CSN, CSO & IT)

Courses for exit:

Successful completion of two subjects (6-Credits) during 2-months internship at the institute
OR

Successful completion of two suitable skill based courses (external) to qualify for

Certification A. After First Year: (UG Certificate in CSE(N))

(i) The candidate should pass any two of the following additional courses (ITI Level) during the 2-Months internship at institute

Exit Option to Qualify UG Certificate in CSE(N) : Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24CN212X	Computer Networks Fundamentals	2	-	2	-	4	3
2	PCC	U24CN213X	Java Programming	2	-	2	-	4	3
3	PCC	U24CN214X	Fundamentals of DBMS	2	-	2	-	4	3
4	PCC	U24CN215X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify for Certification.

Exit Option to Qualify UG Certificate in CSE(N) : Any Two (02) Skill based Courses :-									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE212X	Programming with C++ (https://trainings/internshala.com/Cplusplus-course)	-	-	-	-	6	3
2	SEC	U24SE213X	Advance Excel (https://trainings/internshala.com/excel-course)	-	-	-	-	6	3
3	SEC	U24SE214X	CISCO: IT Essentials (offered by CISCO CoE KITSW)	-	-	-	-	6	3
4	SEC	U24SE215X	CISCO CCNA: Introduction to Networks (offered by CISCO CoE KITSW)	-	-	-	-	6	3
5	SEC	U24SE216X	Any other skill based course approved by BoS Chair and DeanAA	-	-	-	-	6	3

III SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24CN301	Automata Theory and Compiler Design	2	1	-	6	9	3
2	PCC	U24CN302	Operating Systems	2	1	2	5	10	4
3	PCC	U24CN303	Advanced Data Structures	2	1	2	5	10	4
4	PCC	U24CN304	Computer Networks	2	1	-	4	7	3
5	PCC	U24CN305	Object Oriented Programming through Java	2	1	2	5	10	4
6	VAC	U24VA306B	Soft & Interpersonal Skills	-	-	2	2	4	1
7	SEC	U24SE307	Programming Skill Development Lab-02	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309XXXXX	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
Total:				10	5	10	36	61	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

@ Dean AA will allot the courses QALR (Stream-I), Soft & Interpersonal Skills (Stream-II), to the branches as per Stream-I and Stream-II.

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	BSC	U24MH401D	Discrete Mathematics and Probability, Statistics	2	1	-	3	3
2	PCC	U24CN402	Database Management Systems	2	1	-	3	3
3	PCC	U24CN403	Design and Analysis of Algorithms	2	1	-	3	3
4	PCC	U24CN404	Internetworks and Virtualization	2	1	-	3	3
5	PCC	U24CN405	Python Programming	2	1	-	3	3
6	VAC	U24VA406B	Quantitative Aptitude and Logical Reasoning	2	-	-	2	2
7	SEC	U24SE407	Programming Skill Development Lab - 03 (DAA)			2	2	1
8	PCC	U24CN408	Database Management Systems Laboratory	-	-	2	2	1
9	PCC	U24CN409	Internetworks and Virtualization Laboratory	-	-	2	2	1
10	PCC	U24CN410	Python Programming Laboratory	-	-	2	2	1
11	VAC*	U24CY411*	Environmental Studies*	2*	-	-	2*	-
Total:				12	5	8	25	21

**For Lateral Entry Students Only*

*** Branch Specific Mathematics:**

Branch Specific Mathematics (Pool-4)			
S. No.	Course Code	Course Title	Common to
1.	U24MH401A	Numerical and Statistical Methods	CE
2.	U24MH401B	Applied Mathematics for Mechanical Engineering	ME
3.	U24MH401C	Applied Mathematics	EEE, ECE, ECI
4.	U24MH401D	Discrete Mathematics and Probability, Statistics	CSE, IT, CSN, CSO
5.	U24MH401E	Essential Mathematics and Statistics for Machine learning	CSM
6.	U24MH401F	Essential Mathematics and Statistics for Data science	CSD
7.	U24MH401X	Any other Course approved by BoS chair and Dean AA	-

@ Dean AA will allot the courses QALR (Stream-I), Soft and Interpersonal Skills (Stream-II), to the branches as per Stream-I and Stream-II.

Courses for exit:

Successful completion of two subjects (6-Credits)during2-months internship at the institute
OR

Successful completion of two suitable skill based courses (external) to qualify for Certification

B. After Second Year: (UG Diploma in CSE(Networks))

(i) The candidate should pass any two of the following additional courses (Diploma Level) during the 2-Months internship at institute

Exit Option to Qualify UG Diploma in CSE(N) : Any Two (02) Courses during the 2 - Months internship								
S. No.	Category	Course Code	Course Title	L	T	P	E	C
2	PCC	U24CN412X	Artificial Intelligence and Machine Learning	2	-	2	4	3
3	PCC	U24CN413X	Cryptography and Network Security	2	-	2	4	3
4	PCC	U24CN414X	Internet of Things	2	-	2	4	3
5	PCC	U24CN415X	Any other course approved by BoS Chair and Dean AA	2	-	2	4	3

(OR)

(ii) Any two suitable skill based courses to qualify for Diploma.

Exit Option to Qualify UG Diploma in CSE(N) : Any Two (02) Skill based Courses :-								
S. No	Category	Course Code	Course Title	L	T	P	E	C
1	SEC	U24SE412X	Drone Pilot Reference: https://agnipathvayu.cdac.in	-	-	-	6	3
2	SEC	U24SE413X	CISCO: Switching Routing and Wirelss Essentials Reference: Offered by CISCO CoE, KITSW	-	-	-	6	3
3	SEC	U24SE414X	Graphic Design Reference: https://trainings.internshala.com/graphic-design-course	-	-	-	6	3
4	SEC	U24SE415X	Andrioid App Development Reference: https://trainings.internshala.com/android-course/	-	-	-	6	3
5	SEC	U24SE416X	Any other skill based course approved by BoS Chair and DeanAA	-	-	-	6	3

B. Tech Honours with Research:

Students opting for B. Tech Honours with Research, shall undergo a 2-Month Mandatory Research Internship-I (5 Credits)at respective department during the summer vacation after IV Semester.

V SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	OEC	U24OE501X-SDG	Open Elective-SDG	2	1	-	3	3
2	PCC	U24CN502	FullStack Development	2	1	-	3	3
3	PCC	U24CN503	Internet of Things	2	1	-	3	3
4	PCC	U24CN504	Artificial Intelligence and Machine Learning	2	1	-	3	3
5	PCC	U24CN505	Network Automation	2	1	-	3	3
6	IKSC	U24IK506B	Essence of Indian Traditional Knowledge	2	-	-	2	2
7	SEC	U24CN507	FullStack Development Laboratory	-	-	2	2	1
8	PCC	U24CN508	Internet of Things Laboratory	-	-	2	2	1
9	PCC	U24CN509	Artificial Intelligence and Machine Learning Laboratory	-	-	2	2	1
10	ELC	U24CN510	Seminar	-	-	2	2	1
Total:				12	5	8	25	21
Additional Learning@: Maximum credits allowed for Honours/Minor				-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	26

Pool - XVI		
Sustainable Development Goals Basket (OE - SDGB)		
S. No.	Course Code	Course Title
1.	U24OE501A-SDG	Cloud Computing (Offered by CSE Department)
2.	U24OE501B-SDG	AI Ethics (Offered by CSE (AI & ML) Department)
3.	U24OE501C-SDG	Sustainable AI (Offered by CSE (AI & ML) Department)
4.	U24OE501D-SDG	Any other course approved by BoS Chair and Dean AA

VI SEMESTER (STREAM-II)

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	OEC	U24OE601X-SEB	OE- S&E Basket	2	1	-	3	3
2	PEC	U24CN602X	PE-I/MOOCs-I	2	1	-	3	3
3	PCC	U24CN603	Software Engineering	2	1	-	3	3
4	PCC	U24CN604	DevOps	2	1	-	3	3
5	PCC	U24CN605	Cryptography and Network Security	2	1	-	3	3
6	IKSC	U24IK606A	UHV-II	2	-	-	2	2
7	HSMC	U24MH607	Technical English	-	-	2	2	1
8	PCC	U24CN608	DevOps Laboratory	-	-	2	2	1
9	PCC	U24CN609	Cryptography and Network Security Laboratory	-	-	2	2	1
10	ELC	U24CN610	Mini Project	-	-	2	2	1
Total:				12	5	8	25	21
Additional Learning@: Maximum credits allowed for Honours/Minor				-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	26

Pool -XVIII		
Startups & Entrepreneurship Basket (OE - S&EB)		
S. No.	Course Code	Course Title
1.	U24OE601A-SEB	Design Thinking
2.	U24OE601B-SEB	Innovative Product Design and Development
3.	U24OE601C-SEB	Entrepreneurship
4.	U24OE601D-SEB	Design Studio
5.	U24OE601Z-SEB	Any other course approved by BoS Chair and Dean AA

Program Elective - I		
S. No.	Course Code	Course Title
1.	U24CN602A	Fundamentals of Cyber Security and Tools
2.	U24CN602B	Fog and Edge Computing
3.	U24CN602C	Deep Learning
4.	U24CN602D	Statistical Fundamentals
5.	U24CN602E	Any other course approved by BoS Chair and Dean AA

Bridge Courses for exit:

Successful completion of two subjects (6-Credits) during 2-months internship at the institute
OR

Successful completion of two suitable skill based courses (external) to qualify for Certification

C. After Third Year: (B. Voc. in CSE (Networks))

- (i) The candidate should pass any two of the following additional courses (Degree Level) during the 2-Months internship at institute

Exit Option to Qualify B. Voc in CSE (Networks) : Any Two (02) Courses during the 2 - Months internship								
S. No.	Category	Course Code	Course Title	L	T	P	E	C
1	PCC	U24CN611X	Blockchain Technologies	2	-	2	4	3
2	PCC	U24CN612X	Ethical Hacking	2	-	2	4	3
3	PCC	U24CN613X	Quantum Computing	2	-	2	4	3
4	PCC	U24CN614X	Any other course approved by BoS Chair and Dean AA	2	-	2	4	3

(OR)

- (ii) Any two suitable skill based courses to qualify for B. Voc in CSE (AI & ML) Degree.

Exit Option to Qualify B. Voc in CSE (Networks) : Any Two (02) Skill based Courses -:								
S. No.	Category	Course Code	Course Title	L	T	P	E	C
1	SEC	U24SE611X	Software Testing Tools and Selenium Reference: https://www.careerpedia.co/softwa-re-testing-course-hyderabad	-	-	6	6	3
2	SEC	U24SE612X	Digital Marketing Reference: https://trainings.internshala.com/di-gital-marketing-course	-	-	6	6	3
3	SEC	U24SE613X	CISCO: Enterprise Networking, Security & Automation Reference: <i>Offered by CISCO CoE, KITSW</i>	-	-	6	6	3
4	SEC	U24SE614X	Bussiness Analytics Reference: https://trainings.internshala.com/b-usiness-analytics-course	-	-	6	6	3
5	SEC	U24SE615X	Any other skill based course approved by BoS Chair and Dean AA	-	-	6	6	3

(Note to HoDs on PCC: Under PCC the departments shall plan appropriate courses upto 6th semester covering GATE syllabus).

VII SEMESTER (STREAM -II)

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	
1	OEC	U24OE701X-MB	OE-Management Basket	2	1	-	3	3
2	PEC	U24CN702X	PE-II/MOOCs-II	2	1	-	3	3
3	PCC	U24CN703	Software Defined Networking	2	1	-	3	3
4	PCC	U24CN704	Quantum Computing	2	1	-	3	3
5	PCC	U24CN705	Mobile Application Development Lab Laboratory	-	-	2	2	1
6	ELC	U24CN706	Internship Evaluation*	-	-	2	2	1
7	ELC	U24CN707	Major Project, Phase-1/ Industrial Internship-1	-	-	8	8	4
Total:				8	4	12	24	18
Additional Learning®: Maximum credits allowed for Honours/Minor				-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	22

Pool -XX Management Courses Basket (OE-MB)		
S. No.	Course Code	Course Title
1.	U24OE701A-MB	Management Economics and Accountancy
2.	U24OE701B-MB	Engineering Finance
3.	U24OE701C-MB	Organizational Behaviour
4.	U24OE701D-MB	E-Commerce and Digital Marketing
5.	U24OE701Z-MB	Any other course approved by BoS Chair and Dean AA

Professional Elective-II		
S. No.	Course Code	Course Title
1.	U24CN702A	Block chain Technologies
2.	U24CN702B	High Performance Computing
3.	U24CN702C	Computer Vision and Image Processing
4.	U24CN702D	Principles of Data Science
5.	U24CN702E	Any other course approved by BoS Chair and Dean AA

@ List of courses for additional learning through MOOCs towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula

B. Tech Honours with Research

- Students opting for B. Tech Honours with Research, shall complete Research Methodology Course (4 Credits) through MOOCs (OR) a workshop / FDP of not less than one week on "Research Methodologies" (4 Credits).
- Internship Evaluation for the students opting B. Tech Honours with Research, will be done on the 2-Month Research internship-II.

VIII SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	PEC	U24CN801X	PE-III/MOOCs-III	2	1	-	3	3
2	PEC	U24CN802X	PE-IV/MOOCs-IV	2	1	-	3	3
3	PCC	U24CN803	AI Networking	2	1	-	3	3
5	ELC	U24CN804	Major Project, Phase-2/ Industrial Internship-2	-	-	12	12	6
Total:				6	3	12	21	15
Additional Learning [@] : Maximum credits allowed for Honours/Minor				-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	19

Professional Elective-III		
S. No.	Course Code	Course Title
1.	U24CN801A	Ethical Hacking
2.	U24CN801B	Cloud Security
3.	U24CN801C	Natural Language Processing
4.	U24CN801D	Data Warehousing and Data Mining
5.	U24CN801E	Any other course approved by BoS Chair and Dean AA

Professional Elective-IV		
S. No.	Course Code	Course Title
1.	U24CN802A	Cyber Physical Systems
2.	U24CN802B	Bigdata with Cloud Computing
3.	U24CN802C	Introduction to Gen AI and LLM Models
4.	U24CN802D	Data Analysis and Visualization
5.	U24CN802E	Any other course approved by BoS Chair and Dean AA

@ List of courses for additional learning through MOOCs towards Honours/Minor in Engineering shall be prescribed by the department under Honours/ Minor Curricula

B. Tech Honours with Research

Students opting for B. Tech Honours with Research, shall Publish a research paper in reputed journal indexed by SCI/ SCOPUS/Web of Science (4 Credits)

SUMMARY

SEMESTER	I	II	III	IV	V	VI	VII	VIII	TOTAL
CREDITS	21	23	23	21	21	21	18	15	163

PROGRAM ELECTIVE COURSES (PEC)

There are four slots allotted to Program Elective Courses (PECs).

VERTICAL/ PE	PE1	PE2	PE3	PE4
VERTICAL 1: Cyber Security	U24CN602A: Fundamentals of Cyber Security and Tools	U24CN702A: Blockchain Technologies	U24CN801A: Ethical Hacking	U24CN802A: Cyber Physical Systems
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			
VERTICAL 2: Cloud Computing	U24CN602B: Fog and Edge Computing	U24CN702B: High Performance Computing	U24CN801B: Cloud Security	U24CN802B: Bigdata with Cloud Computing
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			
VERTICAL 3: Machine Learning	U24CN602C: Deep Learning	U24CN702C: Computer Vision and Image Processing	U24CN801C: Natural Language Processing	U24CN802C: Introduction to Generative AI Models and LLMs
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			
VERTICAL 4: Data Science	U24CN602D: Statistical Fundamentals	U24CN702D: Principles of Data Science	U24CN801D: Data Warehousing & Data Mining	U24CN802D: Data Analysis & Visualization
	(OR)			
	<i>Equivalent MOOC approved by BoS Chair and Dean AA</i>			

I SEMESTER**Stream - II**

Sl. No.	Category	Course Code	Course Title	Lectures/week					Credits
				L	T	P	O	E	C
-	IKSC	U24IK100	AICTE Mandated Student Induction Programme (Universal Human Values-I)						-
1	BSC	U24MH101	Differential Calculus and Ordinary Differential Equations	2	1	-	6	9	3
2	BSC	U24CY102B	Engineering Chemistry	2	1	2	5	10	4
3	ESC	U24CI111	Digital Logic Design	2	1	-	4	7	3
4	ESC	U24CN104	Programming for Problem Solving with C	2	1	2	5	10	4
5	HSMC	U24MH105	English Communication and Report Writing	2	-	-	3	5	2
6	VAC	U24VA106	Sports & Yoga	-	-	2	3	5	1
7	ESC	U24AE107	Engineering Graphics & CAD	-	-	2	2	4	1
8	ELC	U24EL108	Practicum-1	-	-	-	4	4	1
9	VAC	U24VA109XXXXX	SEA-I/SAA-1	-	-	-	2	2	1
10	AEC	U24AE110	Expert Talk Series-1	-	-	-	1	1	1
Total:				10	4	8	35	57	21

* For CE and ME, it will be a three (03) credit (1-0-4) course on Engineering Graphics & Design (Pedagogy: Sessions with conventional drafter and CAD). (For CE: U24CE107/U24CE207 and for ME: U24ME107A/U24ME207A)

Pool - III (Chemistry)		
S. No.	Course Code	Course Title
1.	U24CY102A	Engineering Chemistry (for Mechanical Engineering)
2.	U24CY102B	Engineering Chemistry (Common to CSM, CSD, CSN, CSO & IT)

DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS			
Class: B.Tech. I -Semester		Branch: Common to all branches	
Course Code:	U24MH101	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-6-9	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : examine the convergence of a series and interpret mean value theorems. CO2 : apply partial differentiation to functions of several variables in solving various engineering problems. CO3 : apply partial differentiation to functions of several variables in solving various engineering problems. CO4 : analyze the solutions of higher order linear differential equation with constant coefficients			
UNIT-I			9 Hrs
Infinite Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests-Limit form, Integral test, D'Alembert's Ratio test, Cauchy's root test Differential Calculus and its applications: Fundamental theorems-Rolle's theorem (Geometrical interpretation), Lagrange's mean value theorem (Geometrical interpretation), Cauchy's mean value theorem, Taylor's theorem (Generalized mean value theorem), Expansions of functions- Maclaurin's series, Taylor's series, Maxima and Minima- Conditions, Practical problems (rectangle, right circular cylinder, cone) Self-Learning Topics (SLTs): Review of basic concepts of limit, continuity and differentiability [Reference 1: topic (3.1,3.2,3.5,4.1)] Alternating series [(Text 1: topic 9.12, Solved problems: 9.16,9.17, Practice problems: exercise 9.7(1, 7)] Additional problems on fundamental theorems [(Text 1: topic 4.3, Solved problems: 4.13(i),4.14,4.17, Practice problems: exercise 4.4 (1(i),1(ii), 3(ii), 10(i), 10(ii))] Additional problems on Maclaurin's series [(Text 1: topic 4.4, Solved problems: 4.20, Practice problems: exercise 4.5 (3, 5)]			
UNIT-II			9 Hrs
Partial differentiation and its applications: Functions of two or more variables, Partial derivatives, Total derivative, Change of variables, Jacobians, Functional relationship, Geometrical Interpretation-Tangent plane and Normal to a surface, Taylor's theorem for function of two variables (without proof), Errors and approximations, Total differential, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers, Differentiation under the integral sign Self-Learning Topics (SLTs): Leibnitz rule of Differentiation under the integral sign for variable limits [(Text 1: topic 5.13(2)), Solved problems: 5.54, Practice problems: exercise 5.11 (1)] Additional problems on maxima and minima of function of two variables [(Text 1: topic 5.11 (1), Solved problems: 5.42, 5.43, Practice problems: exercise 5.10 (1(i),1(ii),1(iii))]. Additional problems on Lagrange's methods of undetermined multipliers [(Text 1: topic (5.12), Solved problems: 5.45, 5.48, Practice problems: exercise 5.10 (3(i), 3(ii))].			

UNIT-III	9 Hrs
Differential equations of first order (DE): Reorientation of differential equation of first order and first degree (Formation of a differential equation, variables separable method, homogeneous equations, Linear equations), Exact differential equations, Equations reducible to exact equations, Applications of differential equations of first order: Orthogonal trajectories - Orthogonal trajectories of the family of curves $f(x, y, c)=0$, Physical applications-Motion of a boat across a stream, Resisted motion, Velocity of escape from the earth, Simple electric circuits - RL series circuit, Newton's law of cooling, Rate of decay of Radio-active materials, Rate of growth of population Self-Learning Topics (SLTs): Review of DEs of first order (Text 1: topic 11.1, 11.2, 11.3, 11.4, 11.5) Solutions of Non-exact DEs by Inspection Method [(Text 1: topic 11.12(1), Solved Problems: 11.30, Practice problems: exercise 11.8(1,3)] Additional problems on Non-exact DEs [(Text 1: topic 11.12(2,3,4,5), Solved problems: 11.33, 11.35, 11.36, Practice problems: exercise 11.8(9,15)] Orthogonal Trajectories of family of curves in polar coordinates [(Text 1: topic 12.3(3), Solved problems: 12.7, 12.8, Practice problems: exercise 12.2(9,10)]	
UNIT-IV	9 Hrs
Linear differential equations: Linear differential equations with constant coefficients, Rules for finding complementary function, Inverse operator, Rules for finding the particular integral ($Q=e^{ax}$, $\sin(ax+b)$ or $\cos(ax+b)$, x^m and $e^{ax}V(x)$), Method of variation of parameters, Linear dependence of solutions Applications of linear differential equations: Simple harmonic motion, Simple pendulum, Oscillations of spring, Oscillatory electrical circuit-LCR circuit, Electro-mechanical analog Self-Learning Topics (SLTs): Finding the particular integral of $Q(X) = X^m V(X)$ [(Text 1: topic 13.7, Solved problems: 13.16, 13.17, 13.19, Practice problems: exercise 13.2 (21,22)]. Additional problems on method of variation of parameters [(Text 1: topic 13.8(1), Solved problems: 13.25, 13.26, Practice problems: exercise 13.3(1,5)] Cauchy's homogeneous linear differential equation [(Text 1: topic 13.9(1), Solved problems: 13.31, 13.34, Practice problems: exercise 13.4(3,6,9)]	
Textbook: 1. Grewal, B.S., <i>Higher Engineering Mathematics</i>, Khanna Publishers, Delhi, 44th edition, 2017	
Reference Book(s): 1. Shanti Narayan, Dr. Mittal P.K, <i>Differential Calculus</i>, S. Chand & Co., New Delhi, 1st edition, Reprint 2014 2. Kreyszig E, <i>Advanced Engineering Mathematics</i>, Inc, U.K, John Wiley & sons, 10th edition, 2020 3. S.S. Sastry, <i>Engineering Mathematics</i>, Vol.II, Prentice Hall of India, 3rd edition, 2014.	
Web and Video link(s): 1. https://youtu.be/4EYko9rdF7g?si=WUu12NPTEL NPTEL Video Lecture on Infinite series by Prof. S.K.Ray, Professor of Mathematics, IITK Kanpur. 2. https://youtu.be/0apMXhWG_W8?si=M-abw2Gq3buX5HLMNPTEL NPTEL Video Lecture on Fundamental mean value theorems by Prof. Jithendra Kumar, Professor of Mathematics, IITK Kharagpur. 3. https://youtu.be/6r5jfT8xrXM?si=ryLXYVJr4-iUkdIV, NPTEL Video Lecture on Exact Differential Equations, Prof. Jithendra Kumar, Professor of Mathematics, IIT Kharagpur.	

4. https://youtu.be/kbGhrqV9AOM?si=yGyK_V7kJKGa3OaR NPTEL Video Lecture on Orthogonal Trajectories of family of curves by Prof. Aditya Sharma, Professor of Physics, IISE Bhopal.
5. <https://youtu.be/btOCUmJkrrg?si=zq3nB00kplm7b5se>, NPTEL Video Lecture on Higher Order Linear Differential Equations, Prof. Jithendra Kumar, Professor of Mathematics, IIT Kharagpur.

Course Articulation Matrix (CAM):			U24MH101 DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24MH101.1	2	2	1	1	-	-	-	1	1	-	1	1	1
CO2	U24MH101.2	2	2	1	1	-	-	-	1	1	-	1	1	1
CO3	U24MH101.3	2	2	1	1	-	-	-	1	1	-	1	1	1
CO4	U24MH101.4	2	2	1	1	-	-	-	1	1	-	1	1	1
U24MH101		2	2	1	1	-	-	-	1	1	-	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Examine the convergence of a series and interpret mean value theorems.	SDG4	Quality Education	Develops analytical thinking, mathematical reasoning, and problem-solving skills essential for quality technical education.
CO2	Apply partial differentiation to functions of several variables in solving various engineering problems.	SDG9	Industry, Innovation and Infrastructure	Supports engineering design, optimization, modelling, and innovation in industrial and technological applications.
CO3	Apply appropriate methods of differential equations of first order and first degree to solve real-life engineering problems.	SDG9	Industry, Innovation and Infrastructure	Differential equation models are widely used in transportation, environmental systems, population studies, and engineering infrastructure.
CO4	Analyze the solutions of higher order linear differential equations with constant coefficients.	SDG9	Industry, Innovation and Infrastructure	Helps in analyzing dynamic systems, control systems, electrical/mechanical engineering applications, and technological advancement.

ENGINEERING CHEMISTRY			
Class: B.Tech. I Semester		Branches: CSM, CSD, CSN, CSO & IT	
Course Code:	U24CY102B	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60%
Total Number of Teaching Hours:	60 Hrs	ESE:	40%
Course Learning Outcomes (COs)			
After completion of this course, the students should be able to...			
(based on cognitive skills acquired from theory component)			
CO1: apply the concepts of electrochemical energy systems for batteries and fuel cells			
CO2: interpret suitable techniques of water analysis and corrosion treatment of solid materials			
CO3: apprise manufacturing of engineering materials and spectroscopic techniques of chemical analysis			
CO4: apprise the synthesis, applications of engineering materials and principles of green chemistry			
(based on psychomotor skills acquired from laboratory component)			
CO5: determine water quality parameters-alkalinity, hardness			
CO6: make use of analytical instruments for chemical analysis			
CO7: determine metals present in their ores			
CO8: design the synthesis of nanomaterial and polymer			
THEORY COMPONENT			
UNIT-I		9 Hrs	
Electrochemical Technology and Engineering: Introduction, Specific conductance, Equivalent conductance, Effect of dilution, Conductometric titrations-Acid base titrations-Strong acid vs strong base, Strong acid vs weak base, Weak acid vs strong base, Weak acid vs weak base, Advantages of conductometric titrations, Galvanic cell, Electrode potential, Electrochemical series, Nernst equation, Potentiometric titrations-Acid base titrations and advantages of potentiometric titrations			
Batteries: Classification, Lead-acid battery, Li-ion battery			
Fuel cells: Hydrogen-oxygen fuel cell			
Self Learning Topics (SLTs): Types of conductors (Text 1: Jain & Jain: chapter 5 topic 1), Ohms law (Text 1: Jain & Jain: chapter 5 topic 5)			
UNIT-II		9 Hrs	
Applied Chemistry:			
Water Technology: Introduction, Hardness of water, Estimation of hardness of water by complexometry, Alkalinity, Determination of alkalinity, Numerical problems. Determination of dissolved oxygen (DO), Biochemical oxygen demand (BOD), Chemical oxygen demand (COD), Softening methods-Ion exchange method, Desalination processes, Reverse osmosis, Quality parameters of potable water (BIS and WHO)			
Corrosion: Introduction, Dry corrosion, Pilling-Bedworth rule, Wet corrosion, Factors effecting corrosion-Purity of the metal, Relative areas of anodic and cathodic parts, Nature of surface film, Humidity, pH and Temperature, Prevention methods of corrosion-Cathodic protection- Impressed current cathodic protection, Sacrificial anodic protection			
Self Learning Topics (SLTs): Units of hardness (Text 1: Jain & Jain chapter 1 topic 5), Introduction to corrosion (Text 1: Jain & Jain: chapter 7 topic 1)			
UNIT-III		9 Hrs	
Engineering Materials: Nanomaterials-Introduction, Synthesis of nanomaterials-Top down and bottom-up approaches, Synthesis by sol-gel method, Nanoscale materials-Fullerenes, Carbon nanotubes and Graphene, Properties and applications, Biosensors			
Spectroscopy: Introduction to spectroscopy, Microwave spectroscopy-Principle, Selection rules,			

Applications, Infra-red spectroscopy-Principle, Selection rules, Applications, UV Spectroscopy-Lambert-Beer's law and its applications Self Learning Topics (SLTs): Introduction to nanotechnology (Text 1: Jain & Jain: chapter 37 topic 1), Electromagnetic spectrum (Text 1: Jain & Jain, chapter 35 topic 1)	
UNIT-IV	9 Hrs
Polymers: Introduction, Monomer, Polymer, Types of polymerization reactions-Addition and condensation, Preparation, Properties and Applications-Polythene, Polyvinyl cyanide, Polyvinyl chloride, Bakelite, Nylon 6:6, Thermosetting resins and thermoplastic resins, Conducting polymers and their applications Green Chemistry: Principles of green chemistry, Synthesis of adipic acid by traditional pathway and green pathway, Green methods in electronic production, Impact of electronic waste on environment and public health Self Learning Topics (SLTs): Mechanism of addition polymerization (Text 1: Jain & Jain: chapter 3, topic 6), Alternative solvents for green synthesis ((Text 2: Jain & Jain: chapter 36, topic 5)	
LABORATORY COMPONENT	
List of Experiments 1. Estimation of hydroxide ion by acidimetry using standard sodium carbonate solution 2. Estimation of alkalinity of water sample containing (i) carbonate, (ii) carbonate & bi carbonate in ground water 3. Estimation of alkalinity of water sample containing (i) bicarbonate, (ii) carbonate & hydroxide in potable water 4. Determination of hardness of water by complexometric method 5. Determination of dissolved oxygen in a sample of water 6. Standardization of sodium hydroxide (NaOH) by conductometry using standard hydrochloric acid (HCl) 7. Standardization of acetic acid (CH₃COOH) by conductometry using standard sodium hydroxide (NaOH) 8. Standardization of strong acid hydrochloric acid (HCl) by potentiometry using standard sodium hydroxide (NaOH) 9. Colorimetric analysis-verification of Lambert-Beer's law 10. Estimation of ferrous (Fe²⁺) ion in the given solution using potassium permanganate 11. Preparation of nanoparticles of cadmium sulphide (CdS) 12. Synthesis of polymer (phenol- formaldehyde)	
Text Book(s): 1. Jain and Jain, <i>Engineering Chemistry</i>, Dhanpat Rai Publishing Company, 17th Edn., 2019 (chapters 1, 3, 5, 6, 7, 35, 36, 37) 2. Dornfeld, D.A., <i>Green manufacturing: fundamentals and applications</i>, Springer Science & Business Media, 2012 (chapters 5, 8, 9)	
Reference Book(s): 1. J.C. Kuriacose and J. Rajaram, <i>Chemistry in Engineering and Technology</i> (vol. I), Tata Mc. Graw-Hills Education Pvt. Ltd., 2010 2. Shashi Chawla, <i>Text book of Engineering Chemistry</i>, 3rdEdn., Dhanpat Rai Publishers, 2003 3. S.S. Dara, S.S. Umare, <i>A Text book of Engineering Chemistry</i>, 12thEdn., S. Chand & Company Ltd., 2010	

Web and Video link(s):

<https://elearn.nptel.ac.in/shop/iit-workshops/completed/battery-cell-technology-materials-and-industrial-applications/?v=c86ee0d9d7ed> NPTEL Video Lecture on Battery technology by Dr. Kothandaraman, Professor of Chemistry, IIT Madras & Dr. Raghunathan, Professor of Chemical engineering, IIT Madras

Laboratory Manual (for laboratory component):

1. Engineering Chemistry Laboratory manual, Department of PS, KITSW

Course Articulation Matrix (CAM):		U24CY102B: ENGINEERING CHEMISTRY												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CY102B.1	2	-	-	-	1	1	1	-	1	-	1	-	-
CO2	U24CY102B.2	2	-	-	-	1	1	1	-	1	-	1	-	-
CO3	U24CY102B.3	2	-	-	-	1	1	1	-	1	-	1	-	-
CO4	U24CY102B.4	2	-	-	-	1	2	1	-	1	-	1	-	-
CO5	U24CY102B.5	2	1	-	-	-	1	1	-	1	-	1	-	-
CO6	U24CY102B.6	2	1	-	-	2	1	1	-	1	-	1	-	-
CO7	U24CY102B.7	2	1	-	-	-	1	1	-	1	-	1	-	-
CO8	U24CY102B.8	2	1	-	-	-	1	1	-	1	-	1	-	-
U24CY102B		2.00	1.00	-	-	1.20	1.12	1.00	-	1.00	-	1.00	-	-

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply the concepts of electrochemical energy systems for batteries and fuel cells	SDG7	Affordable and Clean Energy	Electrochemical energy systems such as batteries and fuel cells provide clean, reliable, and efficient energy storage and reduce dependence on fossil fuels, promote renewable energy utilization.
CO2	interpret suitable techniques of water analysis and corrosion treatment of solid materials	SDG3	Good Health and well being	Water analysis techniques help identify contaminants and ensure safe drinking water, thereby protecting human health and preventing water-borne diseases. Corrosion treatment of solid materials

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
				improves the safety and durability of pipelines, storage systems, and medical equipment.
CO3	apprise manufacturing of engineering materials and spectroscopic techniques of chemical analysis	SDG9	Industry, Innovation and Infrastructure	Engineering materials enhancing knowledge of manufacturing processes for engineering materials and Spectroscopic technique develops knowledge of modern spectroscopic techniques used in chemical analysis. These concepts promote industrial innovation, quality improvement, and advanced material development for sustainable industries.
CO4	apprise the synthesis, materials and principles of green chemistry applications of engineering	SDG9	Industry, Innovation and Infrastructure	Engineering materials, and principles of green chemistry promotes sustainable industrial development through the design of eco-friendly materials and processes. It encourages innovation in engineering applications by reducing waste, energy consumption, and environmental impact in manufacturing industries.

DIGITAL LOGIC DESIGN			
Class: B.Tech. I -Semester		Branch: CSE(Networks)	
Course Code:	U24CI111	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-4-7	CIE Marks (%):	60
Total Number of Teaching Hours:	36 Hrs	ESE Marks (%):	40
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : apply number systems, binary codes, complements, and binary arithmetic operations to represent and process digital information efficiently CO2 : analyze and simplify Boolean expressions using Boolean algebra, logic gates, Karnaugh maps, and Quine–McCluskey minimization techniques CO3 : design and evaluate combinational circuits including adders, comparators, encoders, decoders, and multiplexers for specified digital applications CO4 : design and analyze sequential circuits using latches, flip-flops, registers, shift registers, and counters to realize digital systems			
UNIT-I			9 Hrs
Number Systems and Codes: Representation of number systems, conversion of numbers from one radix to other, Binary arithmetic, 1's and 2's complement subtraction, Binary weighted and non-weighted codes – BCD, Self complementing, Gray Codes. Boolean Algebra and Minimization: Postulates and theorems, logic gates –symbols and truth tables, realization of switching functions - AOI, NAND-NAND and NOR-NOR realizations, minimization of switching functions - using theorems, standard SOP & POS forms, Karnaugh map Self Learning Topics (SLTs): <i>r's and (r-1)'s complements, (Text1: topic 1.5), Excess-3 Code (Text1: topics 1.7), Solved problems on Five Variable K-maps (Text1: topic 3.4)</i>			
UNIT-II			9 Hrs
Combinational circuits: Design of combinational circuits using logic gates – Half adder, Full adder, Half subtractor, Full subtractor, Parallel adder, Carry look ahead adder, BCD adder and 1's & 2's complement adder/subtractors, Decoders, Encoders, Priority encoders, Multiplexers, Demultiplexers, Realization of switching functions using Multiplexers. Self Learning Topics (SLTs): <i>Serial adder (Text1: topic 4.3), BCD to Seven Segment Decoder (Text1: topic 5.5), Solved problems on multiplexers (Ref.2: 4.29)</i>			
UNIT-III			9 Hrs
Sequential circuits: NAND RS latch, NOR RS latch, Flip flops- SR, JK, D and T, preset and clear inputs, truth tables, excitation tables, race around condition, Master slave flip flop, conversion of one flip flop to other, Binary counters – ripple and synchronous counters, Shift registers – modes of operation, Ring and Johnson counters. Self Learning Topics (SLTs): <i>Mod-n asynchronous counters (Ref.2: topic 6.26), Solved problems on synchronous counters (Ref.2: topic 6.29)</i>			
UNIT-IV			9 Hrs
Programmable logic devices (PLDs): Introduction to PLDs, read only memories (ROMs), programmable logic array devices (PLAs), programmable array logic devices (PALs), implementation of Boolean functions on various PLDs, Introduction to FPGAs and CPLDs. Self Learning Topics (SLTs): <i>Combinational circuit implementation (Ref.2: topic 8.4), Solved problems on ROM implementation (Ref.2: Example 8.1, 8.2, 8.3)</i>			

Textbook(s):

1. Moris Mano, *Digital Design*, PHI, 4th edition, New Delhi, 2003

2. Zvi. Kohavi, <i>Switching and Finite Automata Theory</i> , Tata McGraw-Hill, New Delhi, 2 nd edition, 2008
Reference Book(s):
1. R.P. Jain, <i>Modern Digital Electronics</i> , Tata McGraw-Hill, 3 rd edition, New Delhi, 2003
2. A. Anand Kumar, <i>Fundamentals of Digital Circuits</i> , PHI, 3 rd edition, New Delhi, 2014
3. Herbert Taub and Donald Schilling, <i>Digital Integrated Circuits</i> , Tata McGraw-Hill, New Delhi, 2008
Web and Video link(s):
1. NPTEL :: Electrical Engineering - NOC:Digital Circuits , NPTEL Video Lecture on Digital Circuits

Course Articulation Matrix (CAM):		U24CI111 DIGITAL LOGIC DESIGN												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CI111.1	2	2	-	1	1	-	-	-	-	-	1	1	1
CO2	U24CI111.2	2	2	2	1	1	-	-	-	-	-	1	1	1
CO3	U24CI111.3	2	2	2	1	1	-	-	-	-	-	1	1	1
CO4	U24CI111.4	2	2	2	1	1	-	-	-	-	-	1	1	1
U24CI111		2	2	1.5	1	1	-	-	-	-	-	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Perform number system conversions, represent data using binary codes, and apply binary arithmetic operations including addition, subtraction, multiplication, and division.	SDG4	Quality Education	Develops fundamental knowledge and computational skills required for understanding digital systems and computer engineering concepts.
CO2	Analyze and simplify Boolean functions using Boolean algebra, logic gates, Karnaugh maps, and Quine-McCluskey	SDG4	Quality Education	Enhances logical reasoning, analytical thinking, and problem-solving abilities essential for engineering education and lifelong learning.

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
	minimization techniques.			
CO3	Design and implement combinational logic circuits such as adders, comparators, encoders, decoders, and multiplexers for digital applications.	SDG9	Industry, Innovation and Infrastructure	Enables students to develop efficient digital hardware solutions that support innovation and modern technological infrastructure.
CO4	Enables students to develop efficient digital hardware solutions that support innovation and modern technological infrastructure.	SDG9	Industry, Innovation and Infrastructure	Contributes to the development of reliable digital systems used in computing, automation, communication, and industrial applications..

PROGRAMMING FOR PROBLEM SOLVING WITH C			
Class: B.Tech. I -Semester		Branch: CSE(Networks)	
Course Code:	U24CN104	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60 %
Total Number of Teaching Hours:	60 Hrs	ESE:	40 %
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to,</i> <i>(based on cognitive skills acquired from theory component)</i> CO1: enumerate programming development steps, design an algorithm and draw flow chart for a given application CO2: apply logical skills for problem solving using control structures and arrays CO3: develop string operations and modular programming with functions CO4: analyse and implement structures, unions, pointers and files in C programming <i>(based on psychomotor skills acquired from laboratory component)</i> CO5: develop programs using operators and decision making statements CO6: apply loops and arrays to develop a program of an application CO7: implement string operations and develop modular programs using user-defined functions, recursion, and storage classes CO8: develop programs using structures, unions, pointers and files			
THEORY COMPONENT			
UNIT-I		9 Hrs	
Introduction to Programming: Art of programming through algorithms and flowcharts Overview of C: History of C, Importance of C, Basic structure of C programs Constants, Variables and Data Types: Character set, C tokens, Declaration of variables, Defining symbolic constants Managing Input and Output Operations: Reading a character, Writing a character, Formatted input, Formatted output Operators and Expressions: Arithmetic, Relational, Increment, Decrement, Conditional, Logical, Bit-wise, Special operators, Arithmetic expressions, Evaluation of expressions, Operator precedence and associativity <i>Self Learning Topics (SLTs):</i> Components of a computer, concept of hardware and software (Text1: chapter 1), Executing a C program (Text1: chapter 2), Type conversions in expression (Text1: chapter 4) Solved problems (Text1: chapter 2 to chapter 5), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 2 to chapter 5)			
UNIT-II		9 Hrs	
Decision Making and Branching: Simple if statement, if-else statement, Nesting of if-else statements, else if ladder, switch statement, Conditional operator, goto statement Decision Making and Looping: while statement, do-while statement, for statement, Nested loops, Jumps in loops Arrays: One-dimensional arrays, Declaration of one-dimensional arrays, Initialization of one-dimensional arrays, Linear search, Two-dimensional arrays, Initializing two dimensional arrays, Multi-dimensional arrays			

Self Learning Topics (SLTs): Concise test expressions (Text1: chapter 7) Dynamic arrays (Text1: chapter 8), Solved problems (Text1: chapter 6 to chapter 8), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 6 to chapter 8)	
UNIT-III	9 Hrs
Character Arrays and Strings: Declaring and initializing string variable, Reading strings from terminal, Writing strings to screen, String handling functions, Table of strings Modular Programming with User Defined Functions: Need for user-defined functions, Elements of user-defined functions, Definition of functions, Return values and their types, Function calls, Function declaration, Category of functions, Recursion, The scope, visibility and lifetime of variables (storage classes) Self Learning Topics (SLTs): Arithmetic operations on characters, comparison of strings (Text1: chapter 9), Nesting of functions, (Text1: chapter 10), Solved problems (Text1: chapter 9 & chapter 10), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 9 & chapter 10).	
UNIT-IV	9 Hrs
Structures and Unions: Defining a structure, Declaring and initializing structure variables, Accessing structure members, Array of structures, Structures within structures, Unions Pointers: Understanding pointers, Declaring and initializing pointer variables, Pointer expressions, Pointers and arrays, Pointers and character strings, Pointers to functions, Pointers and structures File Management in C: Defining and opening a file, Closing a file, Input and output operations on sequential text files Self Learning Topics (SLTs): Operations on individual members (Text1: chapter 11), Chain of pointers, array of pointers (Text1: chapter 12), Random access to files, Command line arguments (Text1: chapter 13). Solved problems (Text1: chapter 11 to chapter 13), Review questions, debugging exercises, programming exercises, interview questions (Text1: chapter 11 to chapter 13).	
LABORATORY COMPONENT	
List of Experiments 1. Programs using input-output functions, operators (arithmetic, relational and conditional) 2. Programs using operators (bit-wise, logical, increment and decrement) 3. Programs using conditional control structures: if, if-else, nested if 4. Programs using else if ladder, switch and goto statements 5. Programs using loop control structures: while 6. Programs using loop control structures: do-while and for 7. Programs on one dimensional array and two-dimensional arrays 8. Programs on String operations and string handling functions 9. Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes 10. Programs using structures, unions, pointers to arrays and pointers to strings 11. Programs using array of pointers and pointers to structures 12. Programs on File operations and file handling functions for sequential text files	
Textbook: 1. Balagurusamy.E, <i>Programming in ANSI C</i>, McGraw Hill, 8th edition, 2022	

Reference Book(s):

1. Paul Deitel, Harvey Deitel, *C How to Program: With Case Studies Introducing Applications Programming and Systems Programming*, Pearson Education Limited, 9th edition, 2022
2. Brian W. Kernighan and Dennis Ritchie, *The C Programming Language*, Pearson Education India, 2nd edition, 2015
3. Reema Thareja, *Programming in C*, Oxford University Press, 3rd edition, 2023
4. Yashavant Kanetkar, *Let Us C*, BPB Publications, 19th edition, 2022
5. A.K.Sharma, *Computer Fundamentals and Programming in C*, Universities Press, 2nd edition, 2018

Web and Video link(s):

<https://nptel.ac.in/courses/106105171> NPTEL Video Lecture on Problem Solving through Programming in C by Prof. Anupam Basu, Professor of CSE, IIT Kharagpur.

<https://nptel.ac.in/courses/106104128> NPTEL Video Lecture on Introduction to Programming in C by Prof. Satyadev Nandakumar, Professor of CSE, IIT Kanpur

Laboratory Manual (for laboratory component):

Programming for Problem Solving with C Laboratory Manual and Record Book, Department of CSE, KITSW.

Course Articulation Matrix (CAM):					U24CN104: PROGRAMMING FOR PROBLEM SOLVING WITH C									
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN104.1	2	1	1	1	-	-	-	1	-	1	2	1	2
CO2	U24CN104.2	2	2	2	1	-	-	-	1	-	1	2	2	2
CO3	U24CN104.3	2	2	3	1	-	-	-	1	-	1	2	2	2
CO4	U24CN104.4	2	2	3	2	-	-	-	1	-	1	2	2	2
CO5	U24CN104.5	1	1	1	1	1	-	-	1	1	1	2	1	2
CO6	U24CN104.6	1	2	2	2	1	-	-	1	1	1	2	2	2
CO7	U24CN104.7	1	2	3	2	1	-	-	1	1	1	2	2	2
CO8	U24CN104.8	1	2	3	2	1	-	-	1	1	1	2	2	2
U24CN104		1.5	1.75	2.25	1.5	1	-	-	1	1	1	2	1.75	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	enumerate programming development steps, design an algorithm and draw flow chart for	SDG4	Quality Education	Algorithm design and flowchart development strengthen computational thinking and problem-solving skills, which are fundamental competencies for

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
	a given application			quality technical education and lifelong learning
CO2	apply logical skills for problem solving using control structures and arrays	SDG9	Industry, Innovation and Infrastructure	Control structures and arrays enable the development of efficient software solutions that support innovation, digital infrastructure, and technological advancement
CO3	develop string operations and modular programming with functions	SDG9	Industry, Innovation and Infrastructure	Modular programming promotes software reusability, maintainability, and scalable application development, contributing to innovative and sustainable software systems
CO4	analyse and implement structures, unions, pointers and files in C programming	SDG9	Industry, Innovation and Infrastructure	Advanced programming concepts such as data structures, pointers, and file handling form the foundation for developing reliable software systems and modern computing infrastructure

ENGLISH COMMUNICATION AND REPORT WRITING			
Class: B.Tech. I Semester		Branch: Common to all branches	
Course Code:	U24MH105	Credits:	2
Hours/Week(L-T-P-O-E):	2-0-0-3-5	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Outcomes(COs): <i>After completion of this course, the students should be able to,</i> CO1: apply basic grammar principles in speech and writing, read fast, form new words, make coherent paragraphs and adapt the real value of life CO2: maintain professionalism in speech and writing by using correct grammar and appropriate vocabulary and write letters and resumes effectively CO3: analyze the given texts and write clear and unambiguous reports CO4: deduct the superfluous information from lengthy text, prepare SoP (Statement of Purpose) effectively and solve critical problems in life with emotional balance			
UNIT-I			9Hrs
GRAMMAR - Tenses-Structures-usage-examples-exercises for practice - Sentence Correction-Correct use of Tenses, Verb forms, Punctuation. VOCABULARY - Word formation:Prefixes-Suffixes-Sentence Formation with newly formed words READINGSKILL - Definition-Sub skills of Reading-Emphasis on Skimming-Purpose-How to skim through the text-Examples, Exercises for practice WRITINGPRACTICES - ParagraphWriting-Definition-Organizing Principles of paragraphs-Making a paragraph through hints/ graphs and pictures-Coherence-Linking Devices-Systematic Development of Ideas - Paraphrasing-Précising lengthy expressions for clarityand brevity LIFE SKILLS: Ethical Values and Humanity, TheLastLeaf:AShortStorybyO.Henry SelfLearningTopics(SLTs): <i>Articles-(Text2,Unit-II),EnglishVocabulary(Text2,Unit-I,Unit-II,Unit-III)</i> <i>Verb Forms (Reference book1,Topic:31),Tenses(Referencebook1,Topics:16,17,18,19)</i> <i>Reported Speech (Reference book 2, Exercises for Practice, Topics : 161-167)</i>			

UNIT-II		9 Hrs
GRAMMAR - Tenses-Revision-Exercisesforpractice - Subject-VerbAgreement - ReportedSpeech-Transformation - SentenceCorrection-EmphasisConcord ,Report Speech, Sentence Structures VOCABULARY - Synonyms-Antonyms-SingleWordSubstitutes-PopularAbbreviations READINGSTRATEGY - EmphasisonScanningtheText-Purpose-Advantages-Examples,ExercisesandPracticethroughTeamwork WRITINGPRACTICES - LetterWriting-EffectiveLetterWritingTechniques-InformationSeekingLetters-JobApplicationLetters- Apology Letters-Explanation to Memos- E-mails-Cover Letters-Resume LIFESKILLS: Determination - HowIBecameaPublicSpeaker:AnessaybyGeorgeBernardShaw <i>SelfLearningTopics(SLTs):English Vocabulary(Text2, Unit-I, Unit-II, Unit-III), Tenses(Referencebook3, Topic-30, Exercises,30.1,30.2,30.3)</i>		
UNIT-III		9 Hrs
GRAMMAR - Tenses-Revision-Exercises for Practice - Nouns-Prepositions-Adverbs-Adjectives - Sentence Correction: Correct Useoftenses,nouns,prepositions,adverbsandadjectives VOCABULARY - PhrasalVerbs-TechnicalWords-LatinWords READINGSTRATEGY - IntensiveReading-purpose-TypesofComprehensionQuestions-Examples,ExercisesandPracticethrough Teamwork WRITINGPRACTICES - ReportWriting-Definition-Purpose-QualitiesofaGoodReport-FormalandInformalReports-Report Format-Sample Reports-Exercises - EmphasisonTechnicalReports LIFESKILLS: PositiveAttitude - BetheBestofWhateverYouAre:APoembyDouglasMalloch		

Self Learning Topics (SLTs): <i>Parts of Speech (Textbook 1, Unit-I), Tenses (Reference book 1, Topics-16, 17, 18, 19)</i> <i>Phrasal Verbs (Reference book 3)</i>	
UNIT-IV	9 Hrs
GRAMMAR - Tenses-Revision-Exercises for Practice - Clauses-Conjunctions-Transformation of Sentences - Sentence Correction (Based on Parts of Speech)-Clauses-Tenses VOCABULARY - Appropriate Use of Words in Communication-Commonly Confused Words ACTIVE READING and NOTE-MAKING - Note-Making-Definition-Purpose-Effectiveness WRITING PRACTICES - Précis Writing-Definition-Purpose-Uses-Examples and Exercises-Practice through Teamwork - Preparing Statement of Purpose (SoP) LIFE SKILLS: Emotional Balance A Poison Tree: Poem by William Blake Self-Learning Topics (SLTs): Tenses (Reference book 2, Topics: 152-157)	
Textbook(s): - Sanjay Kumar & Pushp Lata, "English Language and Communication Skills for Engineers" As per the latest AICTE syllabus, Oxford University Press, 1st edition 2018 "Language and Life: A Skill's Approach" Based on the latest AICTE model curriculum Orient Black swan Private Limited 2nd Edition 2019.	
Reference Book(s): - Thomson A.J., Martinet A.V., "A Practical English Grammar", Oxford University Press 3rd Edition 1997 - Thomson A.J., Martinet A.V., "A Practical English Grammar" Exercise 2, Oxford University Press 3rd Edition 1997 - Standard Allen W., "Living English Structure", Pearson India Education Pvt Ltd. 5th Edition 2009	
Web and Video link(s): https://onlinecourses.nptel.ac.in/noc20_hs5/6/preview Technical English for Engineers by Aisha Iqbal, IIT Madras https://onlinecourses.swayam2.ac.in/cec21_lg13/preview Indian Writing in English by Dr. Bindu Ann Philip, St Mary's College Trissur	

Course Articulation Matrix (CAM):				U24MH105: ENGLISH COMMUNICATION & REPORT WRITING										
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24MH105.1	-	-	-	-	-	1	-	2	2	2	2	-	1
CO2	U24MH105.2	-	-	-	-	-	1	-	2	2	2	2	-	1
CO3	U24MH105.3	-	-	-	-	-	1	-	2	2	2	2	-	1
CO4	U24MH105.4	-	-	-	-	-	1	-	2	2	2	2	-	1
U24MH105		-	-	-	-	-	1		2	2	2	2	-	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply basic grammar principles in speech and writing, read fast, form new words, make coherent paragraphs and adapt the real value of life.	SDG-3	Good health and well-being	This aligns with SDG-3 as it partially contributes to the negative impact of mental imbalance on health through the irrational fears of Johnsy who is certain of her death when the last leaf falls
		SDG-5	Gender equality	This also aligns with SDG-5 as it highlights women accomplishments on par with men by exposing Johnsy and Sue as painters who come out of their hometown to stay in another place and work along with men for societal exposure.
		SDG-4	Quality education	This aligns with SDG-4 as its primary focus is on enhancing the quality of language in speech and writing by strengthening grammar, vocabulary and writing skills.
CO2	Maintain professionalism in speech and writing by using correct grammar and appropriate vocabulary and write letters and resumes effectively	SDG-4	Quality education	This aligns with SDG-4 as its aim is to enhance reading and writing skills by helping students write letters and resumes effectively applying grammar rules and using relevant vocabulary.
		SDG-8	Decent work and economic	This aligns with SDG-8 as it indirectly contributes to economic

			growth	growth and helps students become aware of the inevitability of strengthening their resume by improving their skills.
CO3	analyze the given texts and write clear and unambiguous reports.	SDG-4	Quality education	This aligns with SDG-4 as it focuses on enhancing the speaking, reading and writing skills of students to prove their abilities and the best communicators in society and workplace by exhibiting professionalism in the usage of language.
CO4	deduct the superfluous information from lengthy text, prepare SoP (Statement of Purpose) effectively and solve critical problems in life with emotional balance.	SDG-4 SDG-16	Quality education Peace, justice, and strong institutions	This aligns with SDG-4 as it orientates the students towards reading and writing, and improves critical and critical thinking Though not completely, it aligns with SDG-16 partially as it emphasizes the need to give up anger which is the most potential enemy of man to enjoy peace and become morally strong.

SPORTS AND YOGA

Class: B.Tech. I-Semester		Branch: Common to all branches	
Course Code:	U24VA106	Credits:	1
Hours/Week(L-T-P-O-E):	0-0-2-2-4	CIE:	60(%)
Total Number of Teaching Hours:	24Hrs	ESE:	40(%)

Course Learning Outcomes(COs):

After completion of this course, the student should be able to..

CO1: demonstrate physical fitness by performing Yoga – Asanas

CO2: demonstrate physical fitness through various games & sports events with defined bench marks

CO3: demonstrate Sportsman spirit and ethics

CO4: demonstrate Physical, Psychological, Social and Emotional balance

Sports and Games

List of Sports and Games

Sl.No.	Game	Sl.No	Game
1	Badminton	7	Volleyball
2	Basketball	8	Cricket
3	Chess	9	Hand Ball
4	Carrom	10	Kabaddi
5	Foot Ball	11	Kho-Kho
6	Table Tennis	12	Yoga Aasanas

Textbook(s):

1. B.K.Chaturvedi, *Rules and Skills of Games and Sports*, Publisher – Goodwill Publishing House, B-9, Rattan Jyoti, 18 Rajendra Place, New Delhi.

ReferenceBook(s):

1. Dr.Sakure Girish Madhaorao, *Foundation of Physical Education and Sports*, Sports Publication, New Delhi.

Web and Video link(s):

1. Badminton game Video Link: <https://www.youtube.com/watch?v=HucIqi8Lw3E&t=22s>
2. Basketballgame Video Link: <https://www.youtube.com/watch?v=-tkE2IJoR58>
3. Chess Video Link: <https://www.youtube.com/watch?v=mDw7lgM8ePo>
4. Carrom game Video Link: <https://www.youtube.com/watch?v=z8vvJpNceeg>
5. Football game Video Link: <https://www.youtube.com/watch?v=mXjW78AgGu4>
6. Table Tennis game Video Link: <https://www.youtube.com/watch?v=bLrJGWvWI4U>
7. Volleyball game Video Link: <https://www.youtube.com/watch?v=BJJb3-O0Q1U>
8. Cricket game Video Link: https://www.youtube.com/watch?v=87hO_Vs3-wQ
9. Handball game Video Link: https://www.youtube.com/watch?v=VCa_0USaq8k
10. Kabaddi game Video Link: <https://www.youtube.com/watch?v=ai1m7ARNyNI>
11. Kho-Kho game Video Link: https://www.youtube.com/watch?v=P3_z3LKdLdg
12. Yoga Aasanas Video Link : <https://www.youtube.com/watch?v=e0Q88DUOXjk>
13. <https://www.youtube.com/watch?v=JoDKbXEUrvQ>

Course Articulation Matrix (CAM):			U24VA106 Sports and Yoga											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24VA106.1	-	-	-	-	-	-	-	-	-	-	1	1	1
CO2	U24VA106.2	-	-	-	-	-	-	-	-	1	-	-	1	1
CO3	U24VA106.3	-	-	-	-	-	-	-	2	-	-	-	1	1
CO4	U24VA106.4	-	-	-	-	-	-	-	-	-	1	1	1	1
U24VA106		-	-	-	-	-	-	-	2	1	1	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Demonstrate Physical Fitness by performing Yoga Asanas	SDG13, SDG5	Climate Action, Gender Equality	Promoting eco-friendly sports practices, minimal resource usage, outdoor yoga, and sustainable lifestyle habits. Promoting teamwork, leadership, inclusiveness, equal participation, and collaboration in sports and group yoga sessions.
CO2	Demonstrate Physical Fitness through various games & Sports	SDG3	Good Health & Well-being	Designing personalized fitness routines, yoga modules, and wellness programs to meet individual health needs.
CO3	Demonstrate Sportsman spirit and ethics	SDG16	Peace, Justice & Strong Institutions	Encouraging discipline, fairness, inclusivity, respect, mental balance, and ethical conduct through sportsmanship and yogic values.
CO4	Demonstrate Physical, Psychological, Social and Emotional balance	SDG3, SDG11	Good Health & Well-being, Sustainable Cities & Communities	Understanding the role of physical fitness and yoga in improving societal health, work-life balance, and community well-being.

ENGINEERING GRAPHICS THROUGH CAD			
Class: B. Tech. I –Semester		Branch: Common to all (except CE & ME)	
Course Code:	U24ME107	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-2-2-4	CIE :	100 %
Total Number of Teaching Hours:	36 Hrs	ESE :	-
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1: draw projections of points and straight lines inclined to one plane with Auto CAD. CO2: develop the projections of planes using Auto CAD CO3: construct the projections of solids and sections of solids using Auto CAD CO4: create orthographic and isometric projections and develop the simple electrical and electronic circuit using Auto CAD			
LABORATORY COMPONENT			
List of Experiments 1. Importance of Engineering Drawing, principles of engineering drawing, dimensioning, introduction to AutoCAD software-GUI, settings, standard toolbar, toolbars - draw, modify, dimension, properties, design centre and tool palettes 2. Introduction to orthographic projections-Vertical Plane, Horizontal plane, Views-Front view, Top view, and Side view and draw the Projection of points in different quadrants. 3. Draw the Projection of straight lines 4. Draw the Projection of planes 5. Draw the Projection of solids- Simple position(Axis perpendicular to HP or VP) 6. Draw the projections of solids inclined to both the planes 7. Draw the Sections of solids 8. Draw the Orthographic projections of given objects 9. Conversion of isometric view to orthographic projections 10. Draw the Isometric view from the given orthographic views 11. Draw the pictorial view (3D) from the given Isometric view 12. AutoCAD application in Electrical and Electronics circuits			
Textbook(s): 1. Bhatt N.D., <i>Elementary Engineering Drawing</i>, Charotar Publishing House, Anand, India, 2017. 2. Kulkarni D. M., Rastogi A. P., and Sarkar A., <i>Engineering Graphics with AutoCAD</i>, PHI publisher, revised edition, July 2010.			
Reference Book(s): 1. Dhananjay A Jolhe, <i>Engineering Drawing</i>, Tata Mc Graw- Hill, 2008. 2. Venugopal K. <i>Engineering Graphics with Auto CAD</i>, New Age International Publishers Ltd., Hyderabad, 2012. 3. Luzadder W.J and Duff J.M, <i>Fundamentals of Engineering Drawing</i>, Prentice-Hall of India, 1995			
Web and Video link(s): https://onlinecourses.nptel.ac.in/noc20_me79/preview NPTEL video link for <i>Engineering drawing and computer graphics</i> By Prof. Rajaram Lakkaraju, IIT Kharagpur.			
Laboratory Manual (for laboratory component): 1. <i>Engineering Graphics through CAD Laboratory Manual & Record Book</i>, Dept. of ME, KITSW.			

Course Articulation Matrix (CAM): U24ME107 ENGINEERING GRAPHICS THROUGH CAD														
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24ME107.1	2	1	1	-	2	-	-	1	-	2	1	1	1
CO2	U24ME107.2	2	1	1	-	2	-	-	1	-	2	1	1	1
CO3	U24ME107.3	2	1	1	-	2	-	-	1	-	2	1	1	1
CO4	U24ME107.4	2	1	1	-	2	-	-	1	-	2	1	1	1
U24ME107		2	1	1	-	2	-	-	1		2	1	1	1

PRACTICUM-1						
Class: B.Tech. I Semester	Branch: Common to all branches					
Course Code:	U24EL108	Credits:	1			
Hours/Week (L-T-P-O-E):	0-0-0-4-4	CIE Marks :	100%			
Total Number of Teaching Hours:	-	ESE Marks :	-			
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i>						
CO1: synthesize literature survey, identify research gaps and define objective & scope of practicum problem						
CO2: apply knowledge to design & conduct experiments, utilize modern tools for solution of practicum problem and develop working model/ process/ system						
CO3: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through practicum						
CO4: create a video pitch on practicum and make an effective oral presentation using PPTs						
Practicum is an independent project carried out by the student during the course period, under the supervision of allotted course faculty. It helps to reinforce the students' theoretical knowledge and develop their ability to apply this knowledge to the solution of practical problems. Practicums also prepare them for their MINI and MAJOR PROJECTs and for independent work in their chosen field that promotes creative abilities. Besides they provide Higher Order Cognitive Abilities (HOCAs).						
(i). Practicum is a mandatory semester project work.						
(ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)						
(iii). Allotment of Practicum topics for students:						
o Practicum matrix: In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.						
Course	U24MH101	U24CY102	U24CI103	U24IN104	U24MH105	U24CH106
Student s allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058
	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060
o In week (-1), the class teacher of a section shall collect 10-12 topics for practicum						

from each of the course teachers of that section.

- The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

CIRCULAR

Allotment of Practicum topics to students

Section :

S.No.	Roll number of the student	Practicum topic allotted	Practicum under the course	Course faculty

Note:

1. The students should meet immediately the allotted course faculty for practicum and start working on the practicum with the guidance of course faculty.
2. To complete the Practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and also outside the class work hours during weekdays.
3. The course faculty are advised to guide the allotted students for practicum during the semester course work.

(Signature of class teacher)

- (iv). *To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.*
- (v). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.
- (vi). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.
- (vii). The class teacher shall collect the final marks of practicum of the students allotted to each course teacher and submit them to the CoE.
- (viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course
- (ix). A sample rubrics for assessment and evaluation of practicum is as follows:

Literature survey & Identification of research gaps	10 marks
Working model / process / software package / system developed	30 marks
Report writing (subjected to max of 30% plagiarism)	20 marks
Oral presentation with PPT and viva-voce	20 marks

Video pitch	20 marks
Total	100 marks

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation of Practicum.

- (a) **Practicum Topic:** Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.
- (b) **Working Model:** Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.
- (c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.
 - What was the objective of the practicum assigned?
 - What are the main responsibilities and tasks for practicum?
 - What knowledge and skills from the coursework are applied in the practicum?
 - What new knowledge and skills are acquired during the practicum?
 - In what ways, can the practicum be helpful for the professional career?
 - What gaps are identified in your practicum work?
 - What improvements or changes you suggest for addressing the identified gaps for future work?
- (d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute
- (e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department
- (f) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact
- (g) The student has to register for the Practicum as a supplementary examination in the following cases:

i)	he/she is absent for oral presentation and viva-voce
ii)	he/she fails to submit the report in prescribed format
iii)	he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY (SEA-I/SAA-I)			
Class: B.Tech. I Semester	Branch: Common to all branches		
Course Code:	U24VA109XXXXX	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-2-2	CIE:	100%
Total Number of Teaching Hours:	-	ESE :	-
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i>			
CO1: integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility CO2: interact effectively through written, oral and nonverbal communication with external-world in a professional, sensitive and culturally relevant manner CO3: analyse the issues related to social empowerment / self-accomplishment, demonstrate problem-solving skills, articulate solutions and demonstrate social sensibility CO4: demonstrate the generic competencies in making a well-documented report and an effective oral presentation with PPTs portraying knowledge, skills, qualities acquired through fieldwork/ practice sessions and social impact of the course learning			
Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building generic competencies in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the physical, emotional, cognitive, spiritual and social aspects. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society. It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely SEA (Social Empowerment Activities) and SAA (Self Accomplishment Activities) These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset. - Each SEA/SAA activity is treated as one credit course - Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester. - Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA - To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc., - If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enrol in the forthcoming semesters.			

Monitoring SEA/SAA:

- (a) **Nodal units:** The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA.
- (b) During the semester period, the student has to **acquire requisite knowledge, conduct fieldwork**, acquire skills and propose unique solutions to the real-life problems
- (c) **Knowledge Acquisition & Skilling:**
 - i. Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity
 - ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.
 - iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.
- (d) **Fieldwork:** Fieldwork is an essential component of learning for gaining real-life experiences. In addition to knowledge acquisition & skilling, student has to take up fieldwork on the chosen activity, as part of SEA/SAA course.
 - i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.
 - ii. Fieldwork consists of three phases: preparation, the actual activity and feedback
 - iii. **As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.**
 - iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.
 - v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more
 - vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.
 - vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

(a). **In case of socially relevant problems/ activities of SEA/SAA:**

Eminent personalities/ achievers include district administrative officers, Eminent Social workers / NGOs, other inspiring and great personalities

(b). **In case of Sports / Games and Cultural activities of SEA/SAA:**

Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.

- viii. **For appointment to interact eminent personalities:** Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction
 - ix. On fieldwork, student is expected to demonstrate solid time management, organisational and note taking skills during fieldwork
 - x. **Ethics of fieldwork:** Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged
 - xi. Student is expected to take care of health and Safety practices for fieldwork and travel
 - xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.
 - xiii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practise sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.
 - xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.
 - During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.
- (e) **Demonstration / Presentation and Report:** Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.
- (f) **Flow process for completion of SEA/SAA course:**
- i. **Faculty counsellor approval:** In week (-1), in consultation with faculty

counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal centre. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student

- ii. **Identification of goals and preparation of action plan:** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.
 - iii. **Field work:** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal centre.
 - iv. **Demonstration/ Presentation:** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.
 - v. **Report writing:** After successful demonstration/presentation, student shall write a 2-3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.
- (g) **Assessment & Evaluation:** There shall be *only Continuous Internal Evaluation (CIE) for SEA/SAA*. The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centres and faculty counsellors, consolidate them, and submit the final grades to the examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

Assessment	Maximum marks	Marks to be awarded by

Goal setting, Planning & Knowledge Acquisition	20	Nodal centre
Field work	40	Nodal centre
Demonstration/Presentation	20	Nodal centre
Report submission	20	Faculty counsellor
Total	100	-

Note:

- (a) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.
 - The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.
- (b) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator*.
- (c) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.
- (d) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she
 - a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal centre, **and**
 - b. scores a minimum of 40 marks in the CIE of the course
- (e) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Text / Reference book(s):

For knowledge acquisition, students shall refer to textbooks and web resources relevant to the course selected. Plan for fieldwork/practice sessions in coordination with SEA/SAA coordinator

EXPERT TALK SERIES-I			
Class: B.Tech. I -Semester	Branch: Common to all branches		
Course Code:	U24AE110	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-1-1	CIE Marks:	100%
Total Number of Teaching Hours:	-	ESE Marks :	-
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i>			
CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology CO2: identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement CO3: interact with experts, exhibit confidence, demonstrate improved communication and networking abilities potentially leading to mentorship opportunities, internships, or even future job prospects CO4: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through ETS sessions and impact of the expert talks			
In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important. (a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade. (b) Learning from industry experts with real-world examples, is important to enhance your educational experience. (c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximised if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations. (d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations". But how would you know all this without venturing into the industry? (e) The answer is Industry Expert Talk Series (ETS). Through ETS, we invite industry experts in different fields to deliver talks and interact with students. (f) Through Industry expert talks students get to know so much more that textbooks don't explain. (g) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts. (h) Our competency-focussed curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS			

courses

- (i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.
- (j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.
- (k) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.
- (l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.
- (m) ETS enhances your learning in many ways for global opportunities for your career.
- (n) All in all, learning from industry experts, is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.
- (o) Salient features of ETS are hereunder:
 - (i) ETS is offered from I semester to VI semester.
 - (ii) ETS, in any given semester, is treated as one credit course
 - (iii) Students are required to earn six credits (from I to VI semester)
 - (iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**
 - (v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.
 - (vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs, *duration: 10-15 mins*), on the contents covered in the expert talk.
 - (vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators**.
 - (viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.
 - (ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.
 - (x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks
 - (xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).
- (p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

Quiz score (sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks)	60 marks
Attendance (out of 10 quizzes)	20 marks
Report in prescribed format (max 30% plagiarism)	20 marks
Total	100 marks

- i. **Attendance:** Maximum of 20 marks shall be awarded based on the attendance maintained by the student over a maximum of 10 lectures.

$$\text{Marks for attendance} = \frac{\text{Number of expert talks attended fully}}{10} * 20$$

ii. Supplementary Exam:

- Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE
- The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs , *duration: 2Hrs*) on the content covered in ETS lectures.
- Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE
- Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

Course Articulation Matrix (CAM):		U24AE110: EXPERT TALK SERIES												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24AE110.1	1	1	1	1	1	1	2	1	2	1	2	1	1
CO2	U24AE110.2	1	1	1	1	1	1	2	1	2	1	2	1	1
CO3	U24AE110.3	1	1	1	1	1	1	2	1	2	1	2	1	1
CO4	U24AE110.4	1	1	1	1	1	1	2	1	2	1	2	1	1
U24AE110		1	1	1	1	1	1	2	1	2	1	2	1	1
3-HIGH, 2 -MEDIUM, 1-LOW														

II-Sem Syllabi

(B.Tech CSE(Networks) URR24)

II SEMESTER
Stream-II

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	6	9	3
2	BSC	U24PY202B	Engineering Physics	2	1	2	5	10	4
3	PCC	U24CN203	Computer Architecture and Organization	2	1	-	4	7	3
4	ESC	U24CN204	Data Structures through C	2	1	2	5	10	4
5	ESC	U24EE205B	Basic Electrical Engineering	2	1	2	5	10	4
6	VAC	U24VA206	Environmental Studies	2	-	-	2	4	-
7	ESC	U24AE207	IDEA Lab Makerspace	-	-	2	2	4	1
8	SEC	U24SE208	Programming Skill Development (PSD) Lab - 1	-	-	2	2	4	1
9	ELC	U24EL209	Practicum-2	-	-	-	4	4	1
10	VAC	U24VA210XXXXX	SEA-2 / SAA -2	-	-	-	2	2	1
11	AEC	U24AE211	Expert Talk Series-2	-	-	-	1	1	1
Total:				10	5	12	38	65	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning(will be printed on grade sheet									

Pool - I (Physics)		
S. No.	Course Code	Course Title
1.	U24PY202A	Engineering Physics (for Mechanical Engineering)
2.	U24PY202B	Engineering Physics (Common to CSM, CSD, CSN, CSO & IT)

Pool - II (Basic Electrical & Electronics Engineering)		
S. No.	Course Code	Course Title
1.	U24EE205A	Basic Electrical and Electronics Engineering (for Mechanical Engineering)
2.	U24EE205B	Basic Electrical Engineering (Common to CSM, CSD, CSN, CSO&IT)

MATRIX THEORY AND VECTOR CALCULUS			
Class: B.Tech. II -Semester		Branch: Common to all branches	
Course Code:	U24MH201	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-6-9	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1: analyze eigen value problems using matrix theory CO2: apply basic concepts of multiple integrals in evaluating physical quantities of real-life engineering problems CO3: apply differential operators on vector and scalar point functions CO4: solve line, surface, volume integrals and correlate these with applications of Green, Stoke and Gauss divergence theorems			
UNIT-I			9 Hrs
Matrices: Rank of a Matrix, Elementary transformations of a matrix, Gauss Jordan method of finding the inverse, Normal form of a matrix, Consistency of linear system of equations, System of linear homogenous equations, Eigen values, Eigen vectors, Properties of Eigen values, Cayley Hamilton's theorem, Reduction to diagonal form, Factorization method (LU Decomposition) Applications of Eigen value problems: Stretching of an elastic membrane, Eigenvalue problems arising from Markov processes, Eigenvalue problems arising from population models, Leslie model Self-Learning Topics (SLTs): Review of Matrices [Text 1: topics 2.1, 2.2, 2.3, 2.4, 2.5] PAQ – Normal form [Text 1, topic 2.7(7), Solved problems: 2.26, Practice problems: exercise 2.4 (9,10)] Additional problems on System of homogeneous and non-homogeneous equations [Text 1: topic 2.18, Solved problems: 2.52, Practice problems: exercise 2.10 (13,14)] Additional problems on Eigen values and Eigen vectors [Text 2: topic 8.1, Solved problems: 8.1(1,2), Practice problems: exercise 8.1(4,6)] Nature of Quadratic form [Text 1: topic 2.18, Solved problems: 2.52, Practice problems: exercise 2.10 (13,14)]			
UNIT-II			9 Hrs
Multiple Integrals and Beta, Gamma functions: Double Integrals, change of order of integration, Double Integrals in polar coordinates, Area enclosed by plane curves, Triple integrals, Volumes of solids, Calculation of Mass for a plane lamina, Beta function, Gamma function, Relation between Beta and Gamma functions (without proof). Self-Learning Topics (SLTs): Review of integrals [Text 1: topic Appendix VII (1)] Additional problems on change of order of integration [Text 1: topic 7.2, Solved problems: 7.4, 7.6, Practice problems: exercise 7.1 (9,14)] Centre of gravity of a plane lamina [Text 1: topic 7.10, Solved problems 7.34, 7.35, Practice problems: exercise 7.6 (9,10)] Moment of Inertia of plane lamina [Text 1: topic 7.12(1,2), Solved problems: 7.37, 7.38, Practice problems: exercise 7.7 (1,4)] Additional problems on Volume of solids [Text 1: topic 7.6, Solved problem: 7.21, Practice problems: exercise 7.4 (12,25)]			
UNIT-III			9 Hrs
Vector Calculus and its applications: - Vector Space, Linear dependent and independent vectors, Differentiation of vectors, Curves in space, Tangent, Principal normal, Binormal,			

Curvature, Torsion, Velocity and acceleration, Scalar and vector point functions, Del applied to scalar point functions - Gradient, Geometrical interpretation, Directional derivative, Del applied to vector point functions - Divergence, Curl, Physical interpretation of divergence, Physical interpretation of curl, Del applied twice to point functions, Del applied to products of point functions, Decomposition of vector valued functions

Self-Learning Topics (SLTs): Review of vectors [Text 2: topics 9.1, 9.2, 9.3]

Vector identities [Text 1: topic 8.9, Solved problems: 8.22, 8.23, Practice problems: exercise 8.4 (13,14)]

Additional problems on Directional derivatives [Text 1: topic 8.5(3), Solved problems: 8.13, 8.14, Practice problems: exercise 8.3 (4,6,8,9)]

UNIT-IV

9 Hrs

Integration of vectors:

Line integral, Surfaces-Surface integral, flux across a surface, Green's theorem in the plane (without proof), Stoke's theorem (Relation between line and surface integrals) (without proof), Volume integral, Gauss divergence theorem (Relation between surface and volume integrals) (without proof), irrotational fields, solenoidal fields

Self-Learning Topics (SLTs): Additional problems on Green's theorem [Text 1: topic 8.13, Solved problems: 8.33, 8.35, Practice problems: exercise 8.8 (1,2,4)]

Additional problems on Stoke's theorem [Text 1: topics 8.14, Solved problems: 8.39, 8.40, Practice problems: exercise 8.9 (1,2)]

Additional problems on Gauss Divergence theorem [Text 1: topic 8.16, Solved problems: 8.44, 8.46, Practice problems: exercise 8.10 (1,2)]

Textbook(s):

2. Grewal, B.S., *Higher Engineering Mathematics*, Khanna Publishers, Delhi, 44th edition, 2017
(Chapters 2,7,8)
3. Kreyszig E, *Advanced Engineering Mathematics*, Inc, U.K, John Wiley & sons, 10th edition, 2020 (Chapter 8(8.2))

Reference Book(s):

4. Spiegel M, *Vector Analysis* -Schaum's Series, McGraw Hill, 2nd edition, 2017
5. S.S. Sastry, *Engineering Mathematics, Vol.II*, Prentice Hall of India, 3rd edition, 2014.
6. Gilbert Strang, *Introduction to Linear Algebra*, Wellesley-Cambridge Press, 5th edition

Web and Video link(s):

1. <https://youtu.be/L4crGhtEX14?si=hyjAPgDheJOHxtYZ> : NPTEL Video Lecture on Matrix Analysis with Applications/Dr.S.K.Gupta and Dr.Sanjeev Kumar/IIT Roorkee
2. https://youtu.be/ksS_yOK1vtk?si=CNNA58OluszubPiX: NPTEL Video Lecture on Integral and Vector Calculus./Prof.Hari Shankar Mahato / IIT Kharagpur

Course Articulation Matrix (CAM):			U24MH201 MATRIX THEORY AND VECTOR CALCULUS											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24MH201.1	2	2	1	1	-	-	-	1	1		1	1	1
CO2	U24MH201.2	2	2	1	1	-	-	-	1	1		1	1	1
CO3	U24MH201.3	2	2	1	1	-	-	-	1	1		1	1	1
CO4	U24MH201.4	2	2	1	1	-	-	-	1	1		1	1	1
U24MH201		2	2	1	1	-	-	-	1	1		1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	analyze eigen value problems using matrix theory	SDG4	Quality Education	If the work focuses on mathematical learning, computational methods, or improving higher education and research in mathematics and engineering.
CO2	apply basic concepts of multiple integrals in evaluating physical quantities of real-life engineering problems	SDG9	Industry, Innovation and Infrastructure	Multiple integrals are applied in engineering fields such as fluid mechanics, thermodynamics, and structural analysis to evaluate physical quantities in real-world systems. In Computer Science and Engineering (CSE) and AI & ML, they are used in image processing, computer graphics, data modeling, probability distributions, and optimization techniques.
CO3	apply differential operators on vector and scalar point functions	SDG9	Industry, Innovation and Infrastructure	Applying differential operators on scalar and vector point functions is essential in fluid dynamics, electromagnetism, engineering analysis, and computational modeling. These mathematical tools are widely used in scientific research, technological development, and modern engineering applications.
CO4	solve line, surface, volume integrals and correlate these with applications of Green, Stoke and Gauss divergence theorems	SDG9	Industry, Innovation and Infrastructure	Line, surface, and volume integrals along with Green's, Stoke's, and Gauss divergence theorems are widely used in engineering, fluid mechanics, electromagnetics, and computational science. In Computer Science and Engineering, these concepts are applied in computer graphics, image processing, simulation techniques, artificial intelligence, and data visualization.

ENGINEERING PHYSICS			
Class: B.Tech. II- Semester		Branch:Common to CSM, CSD, CSN, CSO & IT	
Course Code:	U24PY202B	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60%
Total Number of Teaching Hours:	60 Hrs	ESE:	40%
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to, (based on cognitive skills acquired from theory component)</i> CO1: evaluate properties of lasers and optical fibre parameters CO2: calculate the electric field, electric potential, magnetic field and flux density; determine properties of magnetic and superconducting materials CO3: evaluate the energy values of a particle in an infinite potential well and apply the quantum principles in quantum computing CO4: analyze V-I characteristics of semiconductor diodes and suggest their applications; determine resistances of transistor biasing circuits <i>(based on psychomotor skills acquired from laboratory component)</i> CO5: measure diameter of wire and hollow tubes using Vernier callipers and screw gauge CO6: determine the width of a narrow slit and wavelength of laser using diffraction phenomenon and numerical aperture of an optical fiber CO7: calculate the dielectric constant of a material and plot the hysteresis curve of ferromagnetic material CO8: determine forward voltage and currents from V-I characteristics of semiconductor diodes; identify cut-off, saturation and active regions of NPN transistor			
THEORY COMPONENT			
UNIT-I		9 Hrs	
Applied Optics and Lasers: Principles of interference,Diffraction phenomena and applications (qualitative), Difference between conventional light and laser,Basic principles and characteristics of lasers, Absorption,Spontaneous and stimulated emission,Population inversion, Pumping methods, Optical resonator,Types of lasers- Ruby laser, He-Ne laser, Diode laser, Applications of lasers Fiber Optics: Introduction,Total internal reflection,Optical fiber construction,Numerical aperture and acceptance angle,Types of optical fibers - Step index and graded index, Single and multimode,V-number,Power losses in optical fibers - Attenuation, Dispersion, Bending,Fiber optic communication system,Applications of optical fibers -Endoscopy,Fiber optic sensors (temperature and displacement) Self Learning Topics (SLTs): Concept of waveand basic concepts-amplitude, wavelength, frequency, phase, phase angle and general wave equation(Text1: topic1.9),types of waves(Text1: topic 1.10), reflection laws(Text1: topic1.11).			
UNIT-II		9 Hrs	
Electrostatics and Magnetostatics: Electric charges, Coulomb’s law, Electric field, Electrostatic potential, Computation of electric field and electrostatic potential due to point and line charges,Magnetic field, Magnetic flux density, Biot-Savart’s law, Ampere’s law, Faraday’s law and Lenz’s law Magnetic and Superconducting materials: Introduction,Permeability,Magnetization,Susceptibility,Origin of magnetism,Bohr magneton,Ferro, Antiferro and ferri magnetic materials,Hysteresis, Soft and hard magnetic materials and their applications, superconductivity, Meissner effect,Transition temperature,Isotope effect,Type-I and type-II superconductors,High T _c superconductors,Applications of superconductors Self Learning Topics (SLTs): magnetisation, susceptibility& their relations (Text1: topic 41.2), London			

<i>penetration depth (Text1: topics 42.4.7), Solved problems (Text1: Prob 42.9 to 42.14).</i>	
UNIT-III	9 Hrs
Elements of Quantum Mechanics: Wave-particle duality, de-Broglie wavelength, Physical significance of wave function, Schrodinger time-dependent wave equation, Schrodinger time-independent wave equation, Particle in an infinite potential well (one dimension) Introduction to Quantum Computing: Observables and operators, Expectation values, Expectation values in operator notation, Dirac Bra-Ket notation, Superposition principle, Concept of Quantum bits, Classical versus Quantum computing, Quantum parallelism and Quantum entanglement, Applications of quantum computing Self Learning Topics (SLTs): Heisenberg's uncertainty principle (Text1: topics 27.2), Observables and operators (Text1: topics 27.19), Solved problems (Text1: Prob 27.13, Prob 27.17).	
UNIT-IV	9 Hrs
Semiconductor Physics: Classification of solids based on energy band theory-Conductors, Semiconductors and insulators, Intrinsic semiconductor- carrier generation and recombination, Extrinsic semiconductors- n-type and p-type (qualitative) Semiconductor Diodes and Bipolar Junction Transistors (BJTs): Formation of a PN junction, Forward and reverse bias, PN junction diode, Diode current equation, Zener diode, Zener diode as voltage regulator and their V-I characteristics, Light emitting diode (LED), Transistor structure, Representation of NPN and PNP transistors, Transistor action, Transistor configurations- Common base (CB), Common emitter (CE) and Common collector (CC), Corresponding α, β, γ parameters and their relations and transistor as an amplifier Self Learning Topics (SLTs): drift & diffusion current (Text2: topic 4.9), diode current equation (Text2: topic 4.15), Solved problems (Text2: Prob 4.17 to 4.21).	
LABORATORY COMPONENT	
List of Experiments	
1. Linear Measurements using Vernier callipers and screw gauge 2. Determination of slit width using He-Ne laser 3. Determination of wavelength of He-Ne laser using reflection and transmission diffraction grating 4. Determination of dielectric constant of materials using parallel plate capacitor 5. Magnetic hysteresis- B-H curve tracing using CRO 6. Numerical aperture and acceptance angle of an optical fiber 7. Study of V-I characteristics of PN junction diode 8. Study of V-I characteristics of LED 9. Study of common emitter characteristics of NPN transistor 10. Energy band gap of a semiconductor material 11. Determination of thickness of thin sheet using air-wedge method 12. Determination of Planck's constant	
Textbook(s):	
1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, <i>A Text Book of Engineering Physics</i>, S. Chand & Company Ltd, 11th edition, 2018 (Unit-I, II & III- Chapter 5, 6, 27, 41, 42, 44 & 47) 2. S Salivahanan, N Suresh Kumar, <i>Electronic devices and circuits</i>, Mc Graw Hill edition, 2017 (Unit-IV-Chapter 4, 5 & 6) (Unit-IV-Chapter 4, 5 & 6) 3. Michael Nielsen and Isaac Chuang, <i>Quantum Computation and Quantum Information</i>, Cambridge University Press, 2010 (Unit-III-Chapter 1.1, 1.2 & 1.3)	
Reference Book(s):	
1. Neil Gershenfeld, <i>Physics of Information Technology</i>, Cambridge University Press, 1st edition, 2000 2. V. Rajendran, <i>Engineering Physics</i>, McGraw Hill edition, 2013 3. Eleanor Rieffel and Wolfgang Polak, <i>Quantum Computing: A Gentle Introduction</i>, The MIT	

Press Cambridge, Massachusetts London, England, 2011

4. R.K. Gaur and S.L.Gupta, *Engineering Physics*, Dhanpath Rai and Sons, 2013

5. David Halliday, Robert Resnick and S Krane, *Physics Volume I&II*, Wiley India Limited, 5th edition, 2014

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_ph28/preview, NPTEL video lecture on Concepts in Magnetism and Superconductivity by Prof. Arghya Taraphder IIT Kharagpur
2. https://onlinecourses.nptel.ac.in/noc24_lw07/preview, NPTEL video lecture on Introduction to Law on Electricity by Prof. Uday Shankar, IIT Kharagpur
3. https://onlinecourses.nptel.ac.in/noc24_ph45/preview, NPTEL Video Lecture on Introduction to LASER - Course by Prof. M. R. Shenoy, IIT Delhi
4. https://onlinecourses.nptel.ac.in/noc20_ee77/preview, NPTEL Video Lecture on Semiconductor Devices and Circuits By Prof. Sanjiv Sambandan, IISc Bangalore
5. <https://nptel.ac.in/courses/106106232>, NPTEL Video Lecture on Introduction to Quantum Computing: Quantum Algorithms and Qiskit by Prof. Prabha Mandayam, Prof. Anupama Ray, Prof. Sheshashayee Raghunathan, IIT Madras

Laboratory Manual (for laboratory component):

1. *Engineering Physics Laboratory Manual & Record Book*, Department of PS, KITSW
2. A.K.Katiyar, C.K.Pandey, *Engineering Physics Theory and Practical*, Wiley India Pvt. Ltd, 2nd edition, 2017

Course Articulation Matrix (CAM):				U24PY202B- ENGINEERING PHYSICS (common to CSM, CSD, CSN, CSO & IT)										
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	U24PY202B.1	2	1	1	-	-	1	1	1	1	-	1	-	-
CO2	U24PY202B.2	2	1	-	-	-	1	1	1	1	-	1	-	-
CO3	U24PY202B.3	2	1	-	-	-	1	1	1	1	-	1	-	-
CO4	U24PY202B.4	2	1	-	-	-	1	1	1	1	1	1	-	-
CO5	U24PY202B.5	2	1	1	-	1	1	1	1	2	-	1	-	-
CO6	U24PY202B.6	2	1	-	-	1	1	1	1	2	-	1	-	-
CO7	U24PY202B.7	2	1	-	-	1	1	1	1	2	-	1	-	-
CO8	U24PY202B.8	2	1	-	1	1	1	1	1	2	1	1	-	-
U24PY202B		2	1	1	1	1	1	1	1	1.5	1	1	-	-
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	analyse the phenomena of interference, diffraction and polarization, and the working principles and applications of lasers and optical fibres.	SDG 4	Quality Education	Concepts of interference, diffraction, polarization and laser action (spontaneous/stimulated emission, population inversion) build foundational scientific literacy essential for engineering education. This strengthens access to quality STEM learning and nurtures lifelong learning in photonics.
		SDG 9	Industry, Innovation & Infrastructure	Lasers (Ruby, He-Ne, Diode) and optical fibres (step/graded index, fibre-optic communication, endoscopy, fibre sensors) are core technologies behind modern telecommunication and healthcare infrastructure, directly supporting industrial innovation.
CO2	assess the operation and applications of optical fibre, and interpret the formation and characteristics of special diodes through semiconductor physics principles.	SDG 7	Affordable & Clean Energy	Understanding semiconductor band theory, PN junction formation and LED operation underpins the design of energy-efficient solid-state lighting and photodiode-based sensing, supporting affordable and clean-energy solutions.
		SDG 9	Industry, Innovation & Infrastructure	PN junction diodes, LEDs and photodiodes are fundamental building blocks of electronic circuits and optoelectronic devices, forming the basis of innovation in the electronics and communication industry.
CO3	evaluate the magnetic and superconducting properties of materials and justify their use in engineering applications.	SDG 7	Affordable & Clean Energy	Superconductivity, the Meissner effect, and Type-I/Type-II superconductors enable lossless power transmission, magnetic energy storage and high-field magnets, all of which support efficient, clean-energy infrastructure.
		SDG 9	Industry, Innovation & Infrastructure	Soft and hard magnetic materials, magnetic memories and magnetic levitation underpin transformers, data-

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
			re	storage devices and high-speed transport systems, contributing to resilient industrial infrastructure and technological innovation.
CO4	estimate the energy values of a particle in an infinite potential well and apply quantum mechanical principles to understand quantum computing.	SDG 4	Quality Education	Wave-particle duality, the Schrodinger equation and the particle-in-a-box model, together with the basics of quantum computing (qubits, superposition), expose students to cutting-edge STEM concepts, promoting inclusive, high-quality, future-ready technical education.
		SDG 9	Industry, Innovation & Infrastructure	Quantum computing concepts (superposition, entanglement, quantum parallelism) represent frontier computational technology with transformative applications in cryptography, optimization and drug discovery, driving next-generation digital infrastructure.
		SDG 17	Partnerships for the Goals	Quantum computing is an inherently interdisciplinary, global research effort; exposure to open platforms such as Qiskit fosters international academic and industry collaboration needed to achieve shared technological and sustainable-development goals.

COMPUTER ARCHITECTURE AND ORGANIZATION			
Class: B.Tech. II -Semester		Branch: CSE (Networks)	
Course Code:	U24CN203	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-4-7	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1: identify functional units of a computer and compare the different addressing modes of instructions for execution CO2: develop the control sequence for execution of an instruction CO3: solve the problems on pipelining and implement synchronous and asynchronous schemes for transferring data CO4: analyze memory access time to fetch instructions from main memory and basic input/output operations			
UNIT-I			9 Hrs
Basic Structure of Computers: Functional units, basic operational concepts, performance of computer. Instruction Set Architecture: Memory locations and addresses, memory operations, instructions and instruction sequencing, instruction formats, addressing modes, assembly language, and assembler directives. Self Learning Topics (SLTs): Digital computers(Text2:topic 1),Complement of a function(Text2:Topic 1.3)			
UNIT-II			9 Hrs
Basic Processing Unit: Fundamental concepts, instruction execution, hardware components, Instruction fetch and execution steps, control signals, hard-wired control, CISC-style processors Arithmetic: Addition and subtraction of signed numbers, multiplication of unsigned numbers, multiplication of signed numbers, fast multiplication, integer division, floating-point numbers and operations Self Learning Topics(SLTs): Number Representation and Arithmetic Operations(Text1: topic 1.4.1 & 1.4.2),Boolean Algebra(Text2:Topic 1.3)			
UNIT-III			9 Hrs
The Memory System: Basic concepts, semiconductor RAM memories-Internal organization of memory chips, static memories, dynamic RAMs, read-only memories, memory hierarchy, cache memory mapping functions, performance considerations, secondary storage Input-Output Organization: Input-output interface-I/O bus and interface modules, I/O vs memory bus, Isolated vs. memory-mapped I/O, asynchronous data transfer- strobe control, handshaking, asynchronous serial transfer Self Learning Topics(SLTs): Register Transfer Language(Text2:Topic 4.1),Bus and Memory transfers(Text2:Topic 4.3)			
UNIT-IV			9 Hrs
Modes of Transfer: Modes of transfer, priority interrupt, direct memory access, interconnection standards Pipeline and Vector Processing: Parallel processing, pipelining, arithmetic pipeline, instruction pipeline, vector processing Multi Processors: Characteristics of multiprocessors, Interconnection structures Self Learning Topics(SLTs): Common Bus System(Text1:Topic 5.2)			

Textbook(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, Computer Organization and Embedded Systems, 6th ed., New Delhi: McGraw-Hill Education, 2012 (Chapters 1, 2, 5, 7-9)
2. Morris Mano, Digital Design, PHI, 3rd edition, 2003, New Delhi.
3. David B. Kirk and Wen-mei W. Hwu, Programming Massively Parallel Processors A Hands-on Approach, 2nd ed., USA: Morgan Kaufmanns, 2013. (Chapters 1, 2)

Reference Book(s):

1. B. Ram, Sanjay Kumar, Computer Fundamentals: Architecture and Organization, 5th ed., New Delhi: New Age International Publishers, 2018.
2. W. Stallings, Computer Organization and Architecture - Designing for Performance, 7th ed., New Delhi: Pearson Education, 2009.
3. John P. Hayes, Computer Architecture and Organization, 3rd ed., New Delhi: McGraw-Hill Education, 1998.
4. Vincent P. Heuring, Harry F. Jordan, Computer Systems Design and Architecture, 2nd ed., United States: Pearson Education, 2004.

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc20_cs64/preview

Course Articulation Matrix (CAM):					U24CN203- COMPUTER ARCHITECTURE AND ORGANIZATION									
Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN203.1	2	2	2	1	-	1	1	1	-	1	1	1	1
CO2	U24CN203.2	2	2	2	2	-	1	1	1	-	1	1	1	1
CO3	U24CN203.3	2	2	2	2	-	1	1	1	-	1	1	2	1
CO4	U24CN203.4	2	2	2	2	-	1	1	1	-	1	1	2	1
U24CN203		2	2	2	1.8	-	1	1	1	-	1	1	1.5	1

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	identify functional units of a computer and compare the different addressing modes of instructions for execution	SDG4	Quality Education	Develops foundational knowledge and technical competencies essential for engineering education and lifelong learning.
CO2	develop the control sequence for execution of an instruction	SDG4, SDG9	Quality Education; Industry, Innovation and Infrastructure	Enhances students' ability to design and understand processor operations, supporting innovation in computing infrastructure.
CO3	solve the problems on pipelining and implement synchronous and asynchronous schemes for transferring data	SDG9	Industry, Innovation and Infrastructure	Focuses on improving computational efficiency and performance, contributing to technological innovation and resilient digital infrastructure.
CO4	analyze memory access time to fetch instructions from main memory and basic input/output operations	SDG9, SDG12	Industry, Innovation and Infrastructure; Responsible Consumption and Production	Efficient memory and I/O system design optimizes resource utilization and energy efficiency in computing systems.

DATA STRUCTURES THROUGH C			
Class: B.Tech. II -Semester		Branch: CSE (Networks)	
Course Code:	U24CN204	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60%
Total Number of Teaching Hours:	60 Hrs	ESE:	40%
Course Learning Outcomes (COs):			
<i>After completion of this course, the students should be able to, (based on cognitive skills acquired from theory component)</i>			
CO1: analyze and implement array operations by utilizing dynamic memory allocation and evaluating their time and space complexities			
CO2: analyze and implement stack and queue data structures by utilizing array representations and evaluating their applications and operational complexities			
CO3: analyze and implement various types of linked lists by utilizing dynamic memory allocation techniques and evaluating their operational complexities			
CO4: develop various sorting algorithms, analyze their time complexities, and apply hashing techniques with collision resolution methods, comparing their efficiencies			
<i>(based on psychomotor skills acquired from laboratory component)</i>			
CO5: develop and test basic data structures and array operations, including dynamic memory allocation to evaluate their performance and complexity			
CO6: apply the linear data structures such as stacks and queues and perform various operations using LIFO or FIFO order respectively			
CO7: solve problems using various linked list representations for efficiently storing and retrieving the data			
CO8: apply different sorting techniques on unsorted data and sort them in an order, able to store the data using hashing techniques to retrieve the data very effectively			
THEORY COMPONENT			
UNIT-I		9 Hrs	
Data Structures: Basic terminology, Classification of data structures, Applications and operations on data structures, Time and space complexity			
Arrays: Operations on arrays-traversing an array, Inserting an element in an array, Deleting an element from an array, Searching an element using binary search and their complexities,			
Dynamic Memory Allocation: Memory allocation functions, Dynamic memory allocation for single and two dimensional arrays			
Self Learning Topics (SLTs): Three dimensional and n-dimensional arrays (Text1: topics 2.4.3), passing arrays to functions and pointers (Reference1: topics 3.6, 3.7), Practice problems (Text1: Prob 2.3, Reference1: Prob 1, Prob 2, Prob 3, Prob 4)			
UNIT-II		9 Hrs	
Stacks: stacks, Array representation of stacks, Operations on a stack-push and pop, Multiple stacks, Applications of stacks- recursion, Fibonacci series, tower of Hanoi, evaluation of expressions (infix to postfix conversion, evaluation of postfix expression)			
Queues: queues, Array representation of queues, Double ended queues, Circular queues			
Self Learning Topics (SLTs): Infix to prefix (Reference1: topics 7.7.3), priority Queue(Reference1: 8.4.3), Solved problems (Reference1: Prob 7.7.1, Prob 7.7.2), Practice problems (Text1: Prob 4.5, Prob 4.11, Prob 5.7, Prob 5.9)			
UNIT-III		9 Hrs	
Linked Lists: Basic terminologies, Linked list versus arrays, Memory allocation and de-			

allocation for a linked list, Singly linked list, Circular linked list, Doubly linked list, Circular doubly linked list (linked list operations- traversing, searching, inserting, deleting), Representing stack and queue using linked list Self Learning Topics (SLTs): Merging (Text1: topics 3.3), Skiplist (weblink: https://www.geeksforgeeks.org/skip-list/), Deallocation strategy(Text1: topic 3.9), Solved problems (Text1: Prob 3.6.1, Prob 3.6.2), Practice problems (Reference1: Prob 5.5, Prob 5.7, Prob 5.9)	
UNIT-IV	9 Hrs
Sorting Techniques: Selection sort, Insertion Sort, Shell sort and radix sort, Time complexities of sorting Hashing: Hashing techniques, Collision resolution techniques, Closed hashing, Open hashing, Comparison of collision resolution techniques Self Learning Topics (SLTs): Two way insertion sort (Text1: topics 10.3.4), Comparison of sorting techniques(Reference1: topics 14.16) Solved problems (Reference1: Prob 15.5, Prob 15.6, Prob 15.7), Practice problems (Text1: Prob 6.4)	

LABORATORY COMPONENT
List of Experiments
Experiment-I 1. Program to implement initialization of array and perform traversal operations in both the directions 2. Program to implement searching operation on array using Linear Search 3. Program to display the count of occurrences of every number in an array Experiment-II 4. Program to implement searching operation on array using Binary Search 5. Program to implement insertion operation on array 6. Program to implement deletion operations on array Experiment-III 7. Program to implement initialization of arrays and traversal operation with DMA 8. Program to implement matrix addition and subtraction with DMA Experiment-IV 9. Program to implement matrix multiplication with DMA 10. Program to implement stack operations 11. Program to convert infix expression into postfix Experiment-V 12. Program to evaluate given postfix expression 13. Program to define recursive function to solve tower of hanoi puzzle 14. Program to display the Fibonacci series with the help of recursive function 15. Program to implement MultiStack Experiment-VI 16. Program to implement queue operations using arrays 17. Program to implement circular queue operations using arrays 18. Program to implement double ended queue operations using arrays Experiment-VII 19. Program to create single linked list and implement its operations Note:-Linked list Operations: i) traversing ii) inserting iii) deleting iv) searching v) reversing vi) concatenation

Experiment-VIII 20. Program to create circular linked list and implement its operations 21. Program to create double linked list and implement its operations Experiment-IX 22. Program to create circular double linked list and implement its operations Experiment-X 23. Program to implement stack operations using linked list 24. Program to implement queue operations using linked list Experiment-XI 25. Program to implement selection sort 26. Program to implement insertion sort Experiment-XII 27. Program to implement shell sort 28. Program to implement radix sort 29. Program to implement hash table.
Textbook(s): 1. Debasis Samanta, <i>Classic Data Structures</i>, Prentice Hall India, 2nd edition, 2009
Reference Book(s): 1. Reema Thareja, <i>Data Structures Using C</i>, Oxford University Press, 2nd edition, 2014 2. Balagurusamy E, <i>Data Structure Using C</i>, McGraw Hill Education, 1st edition, 2017 3. Richard F. Gilberg and Behrouz A. Forouzan, <i>Data Structures: A Pseudocode Approach with C</i>, Cengage Learning, 2nd Edition, 2007
Web and Video link(s): https://nptel.ac.in/courses/106106130, NPTEL Video Lecture on Programming and Data Structures Dr. N. S. Narayana Swamy, CSE, IIT Madras.
Laboratory Manual (for laboratory component): 1. <i>Data Structures through C Laboratory Manual and Record Book</i>, Department of CSE (AI & ML), KITSW.

Course Articulation Matrix (CAM):						U24CN204 DATA STRUCTURES THROUGH C								
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CN204.1	2	2	2	1	-	-	-	1	-	1	1	2	1
CO2	U24CN204.2	2	2	2	2	-	-	-	1	-	1	2	2	2
CO3	U24CN204.3	2	2	2	2	-	-	-	1	-	1	2	2	2
CO4	U24CN204.4	2	2	2	2	-	-	-	1	-	1	2	2	2
CO5	U24CN204.5	2	2	2	1	-	-	-	1	1	1	1	2	1
CO6	U24CN204.6	2	2	2	2	-	-	-	1	1	1	2	2	2
CO7	U24CN204.7	2	2	2	2	-	-	-	1	1	1	2	2	2
CO8	U24CN204.8	2	2	2	2	-	-	-	1	1	1	2	2	2
U24CN204		2	2	2	1.75	-	-	-	1	1	1	1.75	2	1.75

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	analyze and implement array operations by utilizing dynamic memory allocation and evaluating their time and space complexities	SDG 4	Quality education	Develops foundational computational thinking, programming proficiency, and problem-solving skills essential for quality technical education.
CO2	analyze and implement stack and queue data structures by utilizing array representations and evaluating their applications and operational complexities	SDG 9	Industry, Innovation and Infrastructure	Enhances skills required for designing efficient software systems and digital infrastructure used in industry applications
CO3	analyze and implement various types of linked lists by utilizing dynamic memory allocation techniques and evaluating their operational complexities	SDG 9	Industry, Innovation and Infrastructure	Supports the design of robust and scalable software systems through effective data organization and processing techniques.
CO4	develop various sorting algorithms, analyze their time complexities, and apply hashing techniques with collision resolution methods, comparing their efficiencies	SDG 9	Industry, Innovation and Infrastructure	Promotes technological innovation through the development of optimized algorithms and high-performance computing solutions

BASIC ELECTRICAL ENGINEERING			
Class: B.Tech. II -Semester		Branch: Common to CSM, CSD,CSN.CSO & IT	
Course Code:	U24EE205B	Credits	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE	60 %
Total Number of Teaching Hours:	60 Hrs	ESE	40 %
Course Learning Outcomes (COs):			
After completion of this course, the students should be able to, (based on cognitive skills acquired from theory component)			
CO1: determine voltage, current & power in electrical circuits using network reduction techniques, mesh & nodal analysis			
CO2: apply suitable network theorems to analyze DC circuits			
CO3: determine impedance, voltage, current, and power in 1- Ø AC circuits & determine line and phase quantities in 3- Ø AC circuits			
CO4: select a suitable electrical machine for given applications and determine the energy consumed by a lighting load.			
(based on psychomotor skills acquired from laboratory component)			
CO5: validate mesh and nodal analysis			
CO6: validate network theorems			
CO7: determine the impedance of series RL & RC circuits at various operating frequencies			
CO8: determine the efficiency of a transformer by conducting a load test			
THEORY COMPONENT			
UNIT-I		9 Hrs	
DC circuits: Network elements, Linear & non-linear elements, Active & passive elements, Unilateral & bilateral elements, Ohm's law, Power, Energy, Kirchhoff's laws, Resistances connected in series and parallel, Voltage divider rule & Current divider rule.			
DC Circuit analysis: Source transformation, Star-Delta conversion, Mesh analysis & Nodal analysis (T & π networks only).			
Self-Learning Topics (SLTs): Definitions of charge, current, & voltage (Text1: Topics1.2,), Solved problems (Text1: Prob 3.10,3.11 &3.12), Practice problems (Text1: Chap-3,Prob 4,5,7&8).			
UNIT-II		9 Hrs	
DC network theorems (Independent sources only): Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem (T & π networks only).			
Self-Learning Topics (SLTs): Condition for maximum power transfer(Text1: Topics3.9), Solved problems (Text1: Prob 3.15,3.18,3.23 & 3.25), Practice problems (Text1: Chap-3,Prob 9,10,13 & 14).			
UNIT-III		9 Hrs	
1-Ø AC circuits: R.M.S value, Average value, Peak factor and form factor of a sine wave, Concept of phasor, Phase and phase difference, Rectangular and polar form representation, Sinusoidal steady state analysis of R, L, C, Series RL, RC, RLC circuits, Concept of Reactance, Impedance, Complex power, Real Power, Reactive power and Power factor.			
3- Ø AC circuits: Generation of 3- Ø voltages, Advantages, Disadvantages, Applications of a three-phase system, Voltage & current relationships of line and phase values for balanced star and delta connections.			
Self-Learning Topics (SLTs): Expression for RMS & Average value (Text1: Topic,4.4 & 4.5) Solved problems (Text1: Prob4.10,4.12,4.13 & 4.14), Practice problems (Text1: Chap-4,Prob 8,9,12&12).			
UNIT-IV		9 Hrs	
Electrical Machines & Electrical Lighting (Qualitative treatment):			

Construction, Principle of operation, Characteristics & applications of 1- ϕ transformer, 3- ϕ induction motor, 1- ϕ induction motor and DC motor and Types of DC motor.

Electrical lighting sources and Energy calculations:

Lighting sources-incandescent, Fluorescent, CFL & LED lamps, Elementary calculations for energy consumption.

Self-Learning Topics (SLTs): EMF equation of a Transformer (Text1: Part-II Topic,4.4.2) Solved problems (Text1: Part-II Prob 4.5, 4.6 & 4.7), Practice problems (Text1: Part-II Prob 5.2, 5.3 & 5.4), Practice problems (Text1: Part-II Prob 6, 7 & 8)

LABORATORY COMPONENT

List of Experiments

1. Verification of voltage divider rule and current divider rule
2. Verification of Mesh Analysis
3. Verification of Nodal Analysis
4. Verification of Superposition Theorem
5. Verification of Thevenin's Theorem
6. Verification of Maximum power transfer Theorem
7. Determination of internal parameters of a choke coil
8. Impedance calculations and phasor representation of RL series circuit
9. Impedance calculations and phasor representation of RC series circuit
10. Load test on 1-phase transformer
11. Verification of Kirchoff's laws using PSPICE/MATLAB
12. **Interfacing Sensors with Arduino using TINKER CAD**
 - i. LED blinking
 - ii. IR Sensor
 - iii. Ultrasonic Sensor
 - iv. Voltage Sensor
 - v. Current Sensor
 - vi. Speed Sensor

Textbook(s):

1. K. Uma Rao, *Basic Electrical Engineering*, Pearson Education, Edition,2011

Reference Book(s):

1. B.L.Thereja, A.K.Thereja, *Electrical Technology Vol. I & II*, S.Chand & Company Ltd, Edition, 2005.
2. Edward Hughes, *Electrical & Electronics Technology*, Pearson Education, 10thEdition., 2010.
3. D. P. Kothari and I. J. Nagrath, *Basic Electrical Engineering*, Tata McGraw Hill, Edition, 2010.
4. Chakravarthy A, Sudhipanath and Chandan Kumar, *Basic Electrical Engineering*, Tata McGraw Hill Ltd, 4thEdition, 2013

Web and Video link(s):

<https://nptel.ac.in/courses/108/105/108105112//>, NPTEL Video Lecture on Fundamentals of Electrical Engineering by Prof. Debapriya Das, Professor of EED, IITK Kharagpur.

Laboratory Manual (for laboratory component):

1. *Basic Electrical Engineering Laboratory Manual and Record Book*, Department of EEE, KITSW.

Course Articulation Matrix (CAM):		U24EE205B: BASIC ELECTRICAL ENGINEERING												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24EE205B.1	2	1	-	-	-	-	-	1	1	1	1	1	1
CO2	U24EE205B.2	2	2	-	-	-	-	-	1	1	1	1	1	1
CO3	U24EE205B.3	3	3	1	1	1		1	1	1	1	1	1	1
CO4	U24EE205B.4	3	3	1	1	1	1	1	1	1	1	1	1	1
CO5	U24EE205B.5	2	1	-	-	-	-	-	1	1	1	1	1	1
CO6	U24EE205B.6	2	2	-	-	-	-	-	1	1	1	1	1	1
CO7	U24EE205B.7	3	3	1	1	1		1	1	1	1	1	1	1
CO8	U24EE205B.8	3	3	1	1	1	1	1	1	1	1	1	1	1
U24EE205B		2.5	2.25	1	1	1	1	1	1	1	1	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement (The student should be able to...)	Relevant SDG	SDG Description	Mapping Justification
CO1	Apply network reduction, Kirchhoff's laws, nodal and mesh analysis to determine resistance, voltage, current & power in electrical circuits.	SDG 9	Industry, Innovation and Infrastructure	Mastering fundamental DC circuit analysis techniques (Ohm's law, KVL/KCL, mesh/nodal analysis) is essential for designing reliable and efficient power distribution networks. This foundational knowledge supports the development of resilient industrial infrastructure and fosters innovation in electrical systems.
CO2	Evaluate impedance, voltage, current, and power in 1-Ø AC circuits & select suitable motor for given application.	SDG 7	Affordable and Clean Energy	SDG 7: Analysis of AC circuits (phasors, power factor, RLC analysis) is crucial for optimizing power transmission and distribution, which directly enables reliable and affordable clean energy access. SDG 9: Selecting the appropriate motor (1-Ø IM, DC, Stepper, BLDC) for specific applications like pumps, EVs, and industrial drives improves overall energy efficiency and supports innovation in sustainable automation and infrastructure.
CO3	Evaluate the voltage and current characteristics of PN junction diode and Zener diode.	SDG 9	Industry, Innovation and Infrastructure	Understanding the V-I characteristics of PN junction and Zener diodes is fundamental to modern electronics. This knowledge is critical for designing power supplies, rectifiers, and protection circuits, which are key components in developing innovative industrial electronics and communication systems, thereby driving infrastructure modernization.

CO-SDG Alignment Matrix				
CO	CO Statement (The student should be able to...)	Relevant SDG	SDG Description	Mapping Justification
CO4	Evaluate the voltage and current characteristics of transistors and select suitable sensor for given application.	SDG 7	Affordable and Clean Energy	Evaluating BJT characteristics (CE, CB, CC configurations) is foundational for analog and digital electronics. Furthermore, the ability to select suitable sensors (Thermocouple, RTD, Hall Effect, LDR, Ultrasonic) is crucial for creating smart systems and IoT applications. This directly contributes to industrial innovation and the development of intelligent infrastructure.

ENVIRONMENTAL STUDIES			
Class:B.Tech.IISemester		Branch:Common to ME, CSM, CSD, IT, CSN & CSO	
CourseCode:	U24CY206	Credits:	0
Hours/Week(L-T-P-O-E):	2-0-0-2-4	CIE:	60%
TotalNumberofTeachingHours:	24Hrs	ESE:	40%
Course Learning Outcomes (COs)			
After completion of this course, the students should be able to,			
CO1: identify the natural resources and practice their usage more equitably			
CO2: develop an action plan for sustainable alternatives and conserving biodiversity			
CO3: examine and perceive the solutions for the environmental pollution			
CO4: adapt issues involved in enforcement of environmental legislation and green methodology			
UNIT-I			6Hrs
The Multidisciplinary Nature of Environmental Studies: Definition, Scope and importance			
Natural Resources: Forest Resources-Use and over exploitation of forests, Deforestation, Timber extraction, Mining, Dams and their effects on forests and tribal people, Water Resources-Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water, Mineral Resources-Environmental effects of extracting and using mineral resources, Energy Resources-Renewable and non-renewable energy sources, Use of alternate energy sources			
Self Learning Topics (SLTs): Use and over-utilization of surface and ground water (Text1: unit 2, topic: 2.2.2) world food problems (Text1: unit 2, topic 2.2.2)			
UNIT-II			6Hrs
Ecosystem and Biodiversity:			
Ecosystem: Concepts of an ecosystem, Food chain, Food webs, Ecological pyramids, Energy flow in the ecosystem and ecological succession			
Biodiversity and its Conservation: Introduction, Definition, Genetic, Species and ecosystem diversity, Value of biodiversity, Biodiversity in India, Hot spots of biodiversity, Man-wildlife conflicts, Endangered and endemic species of India, In-situ and Ex-situ conservation			
Self Learning Topics (SLTs): Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)			
UNIT-III			6Hrs
Environmental Pollution:Global issues-Global climatic change, Greenhouse gases, Effects of global warming, Ozone layer depletion			
International Conventions/Protocols: Earth summit, Kyoto protocol, Montreal protocol			
Environmental Pollution-Causes and effects of air, Water, Soil, Marine and noise pollution with case studies			
Solid and Hazardous Waste Management: Introduction, Types, Effects of urban industrial and nuclear waste			
Natural Disaster Management: Introduction to disaster, Management of disaster, Disaster management of flood, earthquake, cyclone and landslides			
Role of information technology in environment and human health			
Self Learning Topics (SLTs): Role of individual in prevention of pollution (Text1: unit 5, topic 5.10)			
UNIT-IV			6Hrs
Social Issues and the Environment: Role of Individual and Society, Water conservation, Rain water harvesting			
Environmental Protection/Control Acts: Air (prevention and control of pollution) act 1981, Forest conservation act (1980 and 1992), Wildlife protection act 1972, Environment protection act 1986, Issues involved in enforcement of environmental legislations			

Green Methodology: Principles of green chemistry, Green methods in electronic production, Impact of electronic waste on public health and environment

The Sustainable Development Goals (SDGs): United Nations Sustainable Development Goals

Self Learning Topics (SLTs): Water (prevention and control of pollution) act 1974 (Text1: unit 6, topics 6.10), Water pollution cess act 1977 (Text1: unit 6, topics 6.11)

Course Articulation Matrix (CAM):					U24CY206 ENVIRONMENTAL STUDIES									
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CY206.1	2	1	2	1	-	2	1	1	1	-	-	-	-
CO2	U24CY206.2	-	-	2	-	-	1	1	1	1	1	-	-	-
CO3	U24CY206.3	1	2	1	-	-	1	1	1	1	1	1	-	-
CO4	U24CY206.4	-	-	1	-	-	1	1	1	1	-	1	-	-
U24CY206		1.50	1.50	1.50	1.00	-	1.25	1.00	1.00	1.00	1.00	1.00	-	-

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	identify the natural resources and practice their usage more equitably	SDG 7 and 13	Affordable and Clean Energy and Climate Action	Natural Resources and their usage creates awareness about conservation and equitable use of natural resources. It promotes sustainable practices that help reduce environmental degradation and climate change impacts.
CO2	develop an action plan for sustainable alternatives and conserving biodiversity	SDG14 and 15	Life below water & Life on Land	Conserving biodiversity focuses on conserving terrestrial, marine and aquatic ecosystems biodiversity through protection of forests, wildlife, and natural habitats. The action plan encourages sustainable land use and restoration of ecosystems, ensuring long-term conservation of biodiversity and environmental stability.
CO3	examine and perceive the solutions for the environmental pollution	SDG3	Good Health and Well-Being	Environmental pollution and its direct impact on human health such as respiratory diseases, waterborne infections, and toxicity-related disorders. It promotes awareness of pollution control measures that reduce exposure to harmful pollutants in air, water, and soil.

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO4	adapt issues involved in enforcement of environmental legislation and green methodology	SDG13	Climate Action	Environmental legislation and green methodology, promotes awareness of environmental legislation and green methodologies that help reduce pollution and greenhouse gas emissions. It encourages effective enforcement of environmental laws to mitigate climate change impacts and ensure sustainable practices.

IDEA LAB MAKERSPACE			
Class: B.Tech.II -Semester		Branch: Common to all branches	
Course Code:	U24AE207	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-2-2-4	CIE :	100%
Total Number of Lab Hours:	36 Hrs	ESE :	-
Course Learning Outcomes (COs): After completion of this course, the students should be able to ...			
CO1: produce wooden joints and intricate articles using carpentry and CNC wood router respectively			
CO2: implement procedures to prepare the mould cavity for sand casting and arc welding joints			
CO3: produce innovative prototypes using laser engraving and 3D printing			
CO4: design and develop systems based on PCB and IoT for given applications			
LABORATORY COMPONENT			
S. No.	Creative Fabrication Technology	List of Experiments	
1.	Carpentry	Prepare a half lap dovetail joint	
2.	CNC Wood Router	Perform wood carving using CNC Wood Router	
3.	Foundry	Prepare a sand mould using single piece pattern	
4.	Welding	Prepare a single V-butt joint on mild steel plates using AC arc welding machine	
5.	Injection Moulding	Prepare a plastic product using Injection moulding machine	
6.	Laser Engraving	Perform key chain by using CO ₂ laser cutting machine	
7.	3D Printing	Prepare a key chain on 3D printer with the given dimensions	
8.		Prepare a Spur Gear on 3D printer with the given dimensions	
9.	Robotics	Perform basic pick-and-place operation using robot	
10.	Printed Circuit Board (PCB)	Design and fabricate a PCB for a given application	
11.	Internet of Things (IoT)	Measure the temperature and humidity by using DHT11 sensor and Arduino UNO	
12.		Create a smart plant watering system using IoT	
Course Project		- Students are required to create an affordable prototype as their course project, based on the knowledge and skills acquired during the course. - Students have to present and submit their prototypes to demonstrate their ability to apply classroom learning practically, showcasing their creativity and technical aptitude.	
Laboratory Manual:			
IDEA Lab Makerspace Laboratory Manual & Record Book (LMRB) prepared by the faculty of department of Mechanical Engineering, KITSW, Revised version 4, August-2024.			

Text/ Reference Book(s):

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy., "*Elements of Workshop Technology*", Media Promoters and publishers Pvt. Ltd, India, Vol-I-2008 & Vol-II-2010
2. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, "*Additive Manufacturing Technologies-3D Printing, Rapid Prototyping, and Direct Digital Manufacturing*" Springer Nature, 2nd Edition 2021
3. R.S. Khandpur, "*Printed Circuit Boards: Design, Fabrication, Assembly and Testing*", New Delhi Tata Mc Graw Hill-2008
4. Sudeep Mishra, Anandarupmukherjee and Arijit Roy, "*Introduction to IoT*", New Delhi: University Cambridge Press, 2021

Course Articulation Matrix (CAM):				U24EE207: IDEA LAB MAKERSPACE										
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24AE207.1	2	2	1	1	2	1	-	1	2	2	1	1	1
CO2	U24AE207.2	2	2	1	1	2	1	-	1	2	2	1	1	1
CO3	U24AE207.3	2	2	1	1	2	1	-	1	2	2	1	1	1
CO4	U24AE207.4	2	2	1	1	2	1	-	1	2	2	1	1	1
U24AE207		2	2	1	1	2	1	-	1	2	2	1	1	1

PROGRAMMING SKILL DEVELOPMENT LAB - 01			
Class: B.Tech. II -Semester		Branch: CSE (Networks)	
Course Code:	U24SE208	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-2-2-4	CIE :	100%
Total Number of Lab Hours:	36 Hrs	ESE :	-
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to ...</i> CO1: develop efficient and optimized C programs to solve a range of moderate to complex problems, demonstrating a strong understanding of programming fundamentals and algorithm design CO2: analyze and debug C programs to identify errors and optimize code performance, employing appropriate debugging techniques and tools CO3: apply advanced programming concepts such as dynamic memory allocation, data structures, and file handling in C to create robust and scalable solutions CO4: design, implement, and test real-world applications in C, simulating industry scenarios and preparing for technical roles in software development and problem-solving			
LABORATORY COMPONENT			
S. No.	List of Experiments		
1.	Programs using input output functions, operators		
2.	Programs using conditional control structures: if, if-else, nested if		
3.	Programs using else if ladder, switch and goto statements		
4.	Programs using iterative statements		
5.	Programs using iterative statements		
6.	Programs on one dimensional array and two-dimensional arrays		
7.	Programs on one dimensional array and two-dimensional arrays		
8.	Programs on String operations and string handling functions		
9.	Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes		
10.	Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes		
11.	Programs using structures, unions, pointers to arrays and pointers to strings		
12.	Programs using array of pointers and pointers to structures		
Text/ Reference Book(s): 5. Balagurusamy.E, <i>Programming in ANSI C</i> , McGraw Hill, 8 th edition, 2022 6. Paul Deitel, Harvey Deitel, <i>C How to Program: With Case Studies Introducing Applications Programming and Systems Programming</i> , Pearson Education Limited, 9 th edition, 2022 7. Brian W. Kernighan and Dennis Ritchie, <i>The C Programming Language</i> , Pearson Education India, 2 nd edition, 2015 8. Reema Thareja, <i>Programming in C</i> , Oxford University Press, 3 rd edition, 2023 9. Yashavant Kanetkar, <i>Let Us C</i> , BPB Publications, 19 th edition, 2022 10. A.K.Sharma, <i>Computer Fundamentals and Programming in C</i> ,Universities Press, 2 nd edition, 2018			

Course Articulation Matrix (CAM):					U24SE208: Programming Skill Development Lab - 01									
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PSO 2
CO1	U24SE208.1	2	2	1	1	1	-	-	1	1	1	1	2	2
CO2	U24SE208.2	2	2	1	1	1	-	-	1	1	1	1	2	2
CO3	U24SE208.3	2	2	1	1	1	-	-	1	1	1	1	2	2
CO4	U24SE208.4	2	2	1	1	1	-	-	1	1	1	1	2	2
U24SE208		2	2	1	1	1	-	-	1	1	1	1	2	2

PRACTICUM-2					
Class: B.Tech. II-Semester		Branch: Common to all branches			
Course Code:	U24EL209	Credits:	1		
Hours/Week (L-T-P-O-E):	0-0-0-4-4	CIE Marks :	100%		
Total Number of Teaching Hours:	-	ESE Marks :	-		
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i> CO1: synthesize literature survey, identify research gaps and define objective & scope of practicum problem CO2: apply knowledge to design & conduct experiments, utilize modern tools for solution of practicum problem and develop working model/ process/ system CO3: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through practicum CO4: create a video pitch on practicum and make an effective oral presentation using PPTs					
Practicum is an independent project carried out by the student during the course period, under the supervision of allotted course faculty. It helps to reinforce the students’ theoretical knowledge and develop their ability to apply this knowledge to the solution of practical problems. Practicums also prepare them for their MINI and MAJOR PROJECTs and for independent work in their chosen field that promotes creative abilities. Besides they provide Higher Order Cognitive Abilities (HOCAs). (i). Practicum is a mandatory semester project work. (ii). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters) (iii). Allotment of Practicum topics for students: o Practicum matrix: In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.					
Course	U24MH201	U24PY202	U24IN203	U24IN204	U24IN205
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047

B24XX008	B24XX018	B24XX028	B24XX038	B24XX048
B24XX009	B24XX019	B24XX029	B24XX039	B24XX049
B24XX010	B24XX020	B24XX030	B24XX040	B24XX050

- In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.
- The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

CIRCULAR

Allotment of Practicum topics to students

Section :

S.No.	Roll number of the student	Practicum topic allotted	Practicum under the course	Course faculty

Note:

1. The students should meet immediately the allotted course faculty for practicum and start working on the practicum with the guidance of course faculty.
2. To complete the Practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and also outside the class work hours during weekdays.
3. The course faculty are advised to guide the allotted students for practicum during the semester course work.

(Signature of class teacher)

- (iv). *To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.*
- (v). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.
- (vi). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.
- (vii). The class teacher shall collect the final marks of practicum of the students allotted to each course teacher and submit them to the CoE.

- (viii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be on knowledge, skills & qualities acquired by the student during the practicum course
- (ix). A sample rubrics for assessment and evaluation of practicum is as follows:

Literature survey & Identification of research gaps	10 marks
Working model / process / software package / system developed	30 marks
Report writing (subjected to max of 30% plagiarism)	20 marks
Oral presentation with PPT and viva-voce	20 marks
Video pitch	20 marks
Total	100 marks

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation of Practicum.

- (a) **Practicum Topic:** Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.
- (b) **Working Model:** Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.
- (c) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.
- What was the objective of the practicum assigned?
 - What are the main responsibilities and tasks for practicum?
 - What knowledge and skills from the coursework are applied in the practicum?
 - What new knowledge and skills are acquired during the practicum?
 - In what ways, can the practicum be helpful for the professional career?
 - What gaps are identified in your practicum work?
 - What improvements or changes you suggest for addressing the identified gaps for future work?
- (d) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute
- (e) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department
- (f) **Video Pitch:** Each student should create a pitch video, which is a video

presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(g) The student has to register for the Practicum as a supplementary examination in the following cases:

- i) he/she is absent for oral presentation and viva-voce
- ii) he/she fails to submit the report in prescribed format
- iii) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY			
Class: B.Tech.II Semester	Branch: Common to all branches		
Course Code:	U24VA210XX	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-2-2	CIE:	100 %
Total Number of Teaching Hours:	-	ESE :	-
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i> CO1: integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility CO2: interact effectively through written, oral and nonverbal communication with external-world in a professional, sensitive and culturally relevant manner CO3: analyse the issues related to social empowerment / self-accomplishment, demonstrate problem-solving skills, articulate solutions and demonstrate social sensibility CO4: demonstrate the generic competencies in making a well-documented report and an effective oral presentation with PPTs portraying knowledge, skills, qualities acquired through fieldwork/ practice sessions and social impact of the course learning			
Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building generic competencies in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the physical, emotional, cognitive, spiritual and social aspects. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society. It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely SEA (Social Empowerment Activities) and SAA (Self Accomplishment Activities) These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset. (a) Each SEA/SAA activity is treated as one credit course (b) Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester. (c) Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA (d) To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc., (e) If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enrol in the forthcoming semesters. Monitoring SEA/SAA: (a) Nodal units: The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA. (b) During the semester period, the student has to acquire requisite knowledge, conduct fieldwork, acquire skills and propose unique solutions to the real-life problems (c) Knowledge Acquisition & Skilling: i. Students have to identify goals, acquire and accumulate knowledge on the			

- chosen SEA/SAA activity
- ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.
 - iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.
- (d) **Fieldwork:** Fieldwork is an essential component of learning for gaining real-life experiences. In addition to knowledge acquisition & skilling, student has to take up fieldwork on the chosen activity, as part of SEA/SAA course.
- i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.
 - ii. Fieldwork consists of three phases: preparation, the actual activity and feedback
 - iii. **As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.**
 - iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.
 - v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more
 - vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.
 - vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**
- Eminent personalities/ Achievers / Renowned personalities:
- (a). **In case of socially relevant problems/ activities of SEA/SAA:** Eminent personalities/ achievers include district administrative officers, Eminent Social workers / NGOs, other inspiring and great personalities
 - (b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/ won state level/national level /international level competitions, other inspiring and great personalities.
- viii. **For appointment to interact eminent personalities:** Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction
 - ix. On fieldwork, student is expected to demonstrate solid time management, organisational and note taking skills during fieldwork
 - x. **Ethics of fieldwork:** Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are

- to be acknowledged
- xi. Student is expected to take care of health and Safety practices for fieldwork and travel
 - xii. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.
 - xiii. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practise sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.
 - xiv. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.
 - During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.
- (e) **Demonstration/ Presentation and Report:** Student after presentation/demonstration of his/her achievements/work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.
- (f) **Flow process for completion of SEA/SAA course:**
- i. **Faculty counsellor approval:** In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal centre. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student
 - ii. **Identification of goals and preparation of action plan:** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.
 - iii. **Field work:** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal centre.
 - iv. **Demonstration/ Presentation:** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.
 - v. **Report writing:** After successful demonstration/presentation, student shall write a 2-3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming

choices into desired actions/outcomes.

- (g) **Assessment & Evaluation:** There shall be *only Continuous Internal Evaluation (CIE)* for SEA/SAA. The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centres and faculty counsellors, consolidate them, and submit the final grades to the examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

Assessment	Maximum marks	Marks to be awarded
Goal setting, Planning & Knowledge Acquisition	20	Nodal centre
Field work	40	Nodal centre
Demonstration/Presentation	20	Nodal centre
Report submission	20	Faculty counsellor
Total	100	-

Note:

- (a) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.
- The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.
- (b) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator*.
- (c) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.
- (d) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she
- a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal centre, **and**
 - b. scores a minimum of 40 marks in the CIE of the course
- (e) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Text/ Reference book(s):

For knowledge acquisition, students shall refer to textbooks and web resources relevant to the course selected. Plan for fieldwork/practice sessions in coordination with SEA/SAA coordinator

EXPERT TALK SERIES-II			
Class: B.Tech. II -Semester	Branch: Common to all branches		
Course Code:	U24AE211	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-1-1	CIE Marks :	100%
Total Number of Teaching Hours:	-	ESE Marks :	-
Course Learning Objectives (LOs): <i>This course will develop students' knowledge in /on...</i> LO1: 21 st century skills needed for industry, current industry trends, challenges and innovations LO2: latest technology in practice and applying knowledge to solve real-world problems LO3: smart work, soft skills, professional etiquette, networking abilities LO4: making a well-documented report portraying the knowledge, skills, qualities acquired and the impact of the learning			
In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important. (a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade. (b) Learning from industry experts with real-world examples, is important to enhance your educational experience. (c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximised if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations. (d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations". But how would you know all this without venturing into the industry? (e) The answer is Industry Expert Talk Series (ETS). Through ETS, we invite industry experts in different fields to deliver talks and interact with students. (f) Through Industry expert talks students get to know so much more that textbooks don't explain. (g) Students have the opportunity to learn from professionals who have achieved success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts. (h) Our competency-focussed curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses (i) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.			

- (j) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.
- (k) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.
- (l) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.
- (m) ETS enhances your learning in many ways for global opportunities for your career.
- (n) All in all, learning from industry experts, is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.
- (o) Salient features of ETS are hereunder:
- (i) ETS is offered from I semester to VI semester.
 - (ii) ETS, in any given semester, is treated as one credit course
 - (iii) Students are required to earn six credits (from I to VI semester)
 - (iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**
 - (v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.
 - (vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs, *duration: 10-15 mins*), on the contents covered in the expert talk.
 - (vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators**.
 - (viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.
 - (ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.
 - (x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks
 - (xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).
- (p) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

Quiz score (<i>sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks</i>)	60 marks
Attendance (<i>out of 10 quizzes</i>)	20 marks
Report in prescribed format (<i>max 30% plagiarism</i>)	20 marks
Total	100 marks

- i. **Attendance:** Maximum of 20 marks shall be awarded based on the attendance maintained by the student over a maximum of 10 lectures.

$$\text{Marks for attendance} = \frac{\text{Number of expert talks attended fully}}{10} * 20$$

ii. Supplementary Exam:

- (a) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE
- (b) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs , duration: 2Hrs) on the content covered in ETS lectures.
- (c) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE
- (d) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

Course Learning Outcomes (COs):

After completion of this course, the students should be able to...

- CO1:** identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology
- CO2:** identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement
- CO3:** interact with experts, exhibit confidence, demonstrate improved communication and networking abilities potentially leading to mentorship opportunities, internships, or even future job prospects
- CO4:** demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through ETS sessions and impact of the expert talks

Courses for exit:

Successful completion of two subjects (6-Credits) during 2-months internship at the institute

OR

Successful completion of two suitable skill based courses (external) to qualify

for Certification A. After First Year: (UG Certificate in CSE(N))

(i) The candidate should pass any two of the following additional courses (ITI Level) during the 2-Months internship at institute

Exit Option to Qualify UG Certificate in CSE(N) : Any Two (02) Courses during the 2 - Months internship									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	PCC	U24CN212X	Computer Networks Fundamentals	2	-	2	-	4	3
2	PCC	U24CN213X	Java Programming	2	-	2	-	4	3
3	PCC	U24CN214X	Fundamentals of DBMS	2	-	2	-	4	3
4	PCC	U24CN215X	Any other course approved by BoS Chair and Dean AA	2	-	2	-	4	3

(OR)

(ii) Any two suitable skill based courses to qualify for Certification.

Exit Option to Qualify UG Certificate in CSE(N) : Any Two (02) Skill based Courses :-									
S. No.	Category	Course Code	Course Title	L	T	P	O	E	C
1	SEC	U24SE212X	Programming with C++ (https://trainings/internshala.com/Cplusplus-course)	-	-	6	-	6	3
2	SEC	U24SE213X	Advance Excel (https://trainings/internshala.com/excel-course)	-	-	6	-	6	3
3	SEC	U24SE214X	CISCO: IT Essentials (offered by CISCO CoE KITSW)	-	-	6	-	6	3
4	SEC	U24SE215X	CISCO CCNA: Introduction to Networks (offered by CISCO CoE KITSW)	-	-	6	-	6	3
5	SEC	U24SE216X	Any other skill based course approved by BoS Chair and Dean AA	-	-	6	-	6	3

COMPUTER NETWORKS FUNDAMENTALS			
Class: B. Tech syllabi of Exit Course for UG certificate in CSE(NETWORKS)		Branch: CSE(Networks)	
Course Code:	U24CN211X	Credits:	4
Hours/Week (L-T-P-O-E):	3-1-0-0-0	CIE Marks (%):	60
Total Number of Teaching Hours:	32 Hrs	ESE Marks (%):	40
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> <i>(based on cognitive skills acquired from theory component)</i> CO1: classify OSI and TCP/IP reference models CO2: examine data link and medium access control protocols CO3: develop routing algorithms and congestion control CO4: make use of Transport and Application Layer protocols in the networks <i>(based on psychomotor skills acquired from laboratory component)</i> CO5: make use of reference models OSI & TCP/IP. CO6: develop error detection mechanism. CO7: construct routing algorithms CO8 : develop required application level network services			
THEORY COMPONENT			
UNIT-I		4 Hrs	
Introduction: Uses of computer networks, Network hardware, Network software Reference models: OSI reference model, TCP /IP reference model, Comparison of OSI and TCP/IP reference model. Introduction to Physical layer: Transmission media, Guided transmission media, Unguided Transmission Media			
UNIT-II		4 Hrs	
Introduction to Data link layer: Data link layer design issues, Error detection and correction Elementary data link protocols: Sliding window protocols IEEE standard 802.3, Switched Ethernet, Fast Ethernet, Gigabit Ethernet, Bluetooth, Data link layer switching			
UNIT-III		4 Hrs	
Introduction to Network layer: Network layer design issues; Routing algorithms, Optimality principle, Shortest path algorithm, Distance vector routing, Network layer in the internet: The IP version 4 protocol, IP addresses, IP version 6			
UNIT-IV		4 Hrs	
Introduction to Transport layer: The transport service, Elements of transport protocols, Connection establishment and release, Internet transport protocols - UDP, Internet transport protocols - TCP Introduction to Application layer, Domain name system (DNS), Electronic mail ,World Wide Web			

LABORATORY COMPONENT

List of Experiments

1. Draw symbols of devices and connectors used in network diagrams and Illustrate network diagram of different network types (LAN, MAN,WAN)
2. Illustrate physical and logical diagrams of a campus network and draw the network diagram of a campus network
3. (a)Identify different Ethernet cable categories and write down the detailed specifications
(b)Identify different devices, tools, connectors used in establishing a physical LAN
4. (a)Configure an IP address on a computer
(b)Establish a LAN network with two computers and check network
5. Develop a socket program to implement date and time display from client to server using TCP
6. Develop a socket program to implement date and time display from client to server using UDP
7. Develop a socket program to implement chat application using TCP
8. Develop a java program to implement sliding window protocol
9. Develop a program for error detection code using CRC-CITT(16-bits)
10. Develop a java program to find subnet mask and networked for given IP address
11. Develop a java program that resolves IP address from a given domainname
Demonstration of Wireshark packet analyzertool (a) Capture Packet (b)Apply filter (c)Analyze Packet

Textbook(s):

1. *Computer Networks*, Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson Education/PHI

Reference Book(S):

1. Jack L. Burbank, *An Introduction to Network Simulator 3*, First Edition, Wiley-Blackwell,2015

Laboratory Manual (for laboratory component):

1. *Computer Networks Laboratory manual*, prepared by the faculty of Dept. of CSE(Networks)

Course Articulation Matrix (CAM):		U24CN211X COMPUTER NETWORKS												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CN211.1	2	2	1	1	-	-	-	-	-	-	1	1	1
CO2	U24CN211.2	2	2	2	1	-	-	-	-	-	-	1	1	1
CO3	U24CN211.3	2	2	2	1	-	-	-	-	-	-	1	1	1
CO4	U24CN211.4	2	2	2	1	-	-	-	-	-	-	1	1	1
CO5	U24CN211.5	2	2	2	1	2	1	-	1	2	2	1	1	1
CO6	U24CN211.6	2	2	2	1	2	1	1	-	2	2	1	1	1
CO7	U24CN211.7	2	2	2	1	2	1	-	-	2	2	1	1	1
CO8	U24CN211.8	2	2	2	1	2	1	1	1	2	2	1	1	1
U24CN211X		2.5	2.25	2.66	1.85	2	0.75	1	1.5	2	2.75	1	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Evaluate OSI and TCP/IP reference models and compare their functionalities	SDG4	Quality Education	Enhancing students understanding of networking fundamentals such as OSI and TCP/IP models, thereby strengthening technical knowledge and lifelong learning skills in communication technologies.
CO2	Analyse various data link layer mechanisms and medium access control protocols to ensure efficient and reliable communication	SDG9	Industry, Innovation and Infrastructure	Study of Data Link Layer and Medium Access Control ensures efficient and reliable data communication, supporting strong and optimized network infrastructure.
CO3	Apply appropriate routing and congestion control algorithms to enhance and optimize network performance	SDG11	Sustainable Cities and Communities	Optimized routing improves smart city networks, traffic systems, and public communication services. digital infrastructure.
CO4	Analyse the different services provided by transport and application layer protocols in network communication	SDG9	Industry, Innovation and Infrastructure	Strengthens understanding of communication services and protocols that enable efficient information exchange and support learning in advanced networking technologies.
CO5	Demonstrate the ability to design and configure small-scale campus networks by understanding network devices, topologies, IP addressing, and system/network administration roles.	SDG9	Industry, Innovation and Infrastructure	Involves designing and configuring network infrastructure using devices, topologies, IP addressing, and administration roles for efficient communication
CO6	Apply socket programming techniques using TCP and UDP protocols to develop Client-server applications such as chat systems, date/time services, and file transfers	SDG9	Industry, Innovation and Infrastructure	Involves building client-server applications using TCP/UDP socket programming for communication services like chat, file transfer, and date/time systems
CO7	develop data link and network layer protocols such as Stop-and-Wait, sliding window, CRC, ARP, RARP, SNMP,	SDG9	Industry, Innovation and Infrastructure	Involves implementing key data link and network layer protocols in Java to strengthen understanding of communication networks and infrastructure

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
	and Distance Vector Routing using Java programming			
CO8	Analyze network behaviour and performance using NS3 and Wireshark tools, focusing on traffic, congestion, and packet-level protocol analysis.	SDG4	Quality Education	enhances practical learning through simulation and analysis tools while improving network efficiency and performance, contributing to technical education and robust communication infrastructure

JAVA PROGRAMMING			
Class: B. Tech syllabi of Exit Course for UG certificate in CSE(NETWORKS)		Branch: CSE(Networks)	
Course Code:	U24CN212X	Credits:	4
Hours/Week (L-T-P-O-E):	3-1-0-0-0	CIE Marks (%):	60
Total Number of Teaching Hours:	32 Hrs	ESE Marks (%):	40
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> <i>(based on cognitive skills acquired from theory component)</i> CO1: choose programming paradigms for developing programs CO2: develop programs using classes, constructors and various string concepts CO3: make use of reusability concepts like inheritance, dynamic method dispatch, interfaces and packages to build java programs CO4: develop programs using streams (I/O), exception handling and multithreading concepts <i>(based on psychomotor skills acquired from laboratory component)</i> CO5: develop java fundamental programs using operators, control structures and arrays CO6: develop java programs using classes, constructors and various string concepts. CO7: make use of reusability concepts like inheritance, dynamic method dispatch, interfaces and packages to build java programs. CO8 : develop java programs using streams (I/O), exception handling and multithreading			
THEORY COMPONENT			
UNIT-I		4 Hrs	
Java Basics: History and evolution of Java, An overview of java, Data types, Variables and arrays, Operators, Control statements Introducing Classes: Structures in C, Class fundamentals, Objects, Methods, Object reference variables			
UNIT-II		4 Hrs	
Classes and Methods: Overloading methods, this keyword, Passing and returning objects, Recursion, Variable length arguments, Constructors, Overloading constructors, Static variables, Static blocks, Static methods, Nested and inner classes, Command line arguments Strings: Exploring String, StringBuffer, StringBuilder and StringTokenizer classes			
UNIT-III		4 Hrs	
nheritance: Inheritance basics, Types of inheritance, super keyword, Method overriding, Abstract classes, final with inheritance, Object class Interfaces: Defining an interface, Implementing interfaces, Nested interfaces, Interfaces can be extended Packages: Packages, Packages and Member Access, Importing packages Using I/O: I/O basics, Reading, Writing and copying files using byte and character streams			

UNIT-IV	4 Hrs
Exception Handling: Fundamentals, Exception types, Uncaught exceptions, Using try and catch, Multiple catch clauses, throw, throws, finally Multithreading: Creating a thread, Creating multiple threads, Synchronization, Interthread communication	
LABORATORY COMPONENT	
List of Experiments	
13. Programs on operators and control structures 14. Programs on arrays and for-each 15. Programs on classes and objects 16. Programs variable length arguments, constructors, garbage collector, inner classes and static concepts 17. Programs on command line arguments and wrapper classes 18. Programs on String, StringBuffer and StringTokenizer classes 19. Programs on Inheritance 20. Programs on abstract classes, Dynamic Method Dispatch and Object Class 21. Programs on interfaces 22. Programs on packages 23. Programs on exception handling 24. Programs on files and multi threading	
<u>Textbook:</u> 1. HerbertSchildt, Java The Complete Reference, 11th ed., New Delhi: McGraw-Hill Education,2019	
<u>Reference Book(S):</u> 1. KathySierra,BertBates,HeadFirstJava,2nd ed., Boston: O`Reilly Publications 2005 2. Uttam K. Roy, Advanced JAVA Programming, England: Oxford Publications,2013. 3. Balaguruswamy, Programming with Java: A Primer, 6th ed., New Delhi: McGraw-Hill Education India Pvt. Ltd, 2019. 4. TanweerAlam, Internet and Java Programming, New Delhi: Khanna Publishing House,2010	
<u>Web and Video link(s):</u> https://onlinecourses.nptel.ac.in/noc24_cs105/preview; NPTEL Video Lecture on Programmingin Java By Prof. Debasis Samanta, IIT Kharagpur.	
<u>Laboratory Manual</u> (for laboratory component): 1. Java Programming, Department of CSN, KITSW	

Course Articulation Matrix (CAM):				U24CN212X JAVA PROGRAMMING										
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CN212.1	2	2	1	1	-	-	-	-	-	-	1	1	1
CO2	U24CN212.2	2	2	2	1	-	-	-	-	-	-	1	1	1
CO3	U24CN212.3	2	2	2	1	-	-	-	-	-	-	1	1	1
CO4	U24CN212.4	2	2	2	1	-	-	-	-	-	-	1	1	1
CO5	U24CN212.5	2	2	2	1	2	1	-	1	2	2	1	1	1
CO6	U24CN212.6	2	2	2	1	2	1	1	-	2	2	1	1	1
CO7	U24CN212.7	2	2	2	1	2	1	-	-	2	2	1	1	1
CO8	U24CN212.8	2	2	2	1	2	1	1	1	2	2	1	1	1
U24CN212		2.5	2.25	2.66	1.85	2	0.75	1	1.5	2	2.75	1	1	1
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Distinguish various programming paradigms and develop java fundamental programs	SDG4	Quality Education	It supports by promoting quality technical education and digital literacy
CO2	Develop java programs using classes, constructors and various string concepts	SDG4	Quality Education	strengthens object-oriented programming skills, which are essential for real-world software development. This enhances employability and job readiness by preparing students for productive employment in the IT sector
CO3	Make use of reusability concepts like inheritance, dynamic method dispatch, interfaces and packages to build java programs	SDG9	Industry, Innovation and Infrastructure	It promotes efficient and reusable code design, which is a key aspect of sustainable software development. Reusability reduces development time and resource consumption
CO4	Develop java programs using I/O, exception handling and multithreading concepts	SDG9	Industry, Innovation and Infrastructure	It deals with building robust, efficient, and reliable applications. Exception handling ensures software reliability, while multithreading improves performance
CO5	Develop and test java	SDG 4	Quality Education	Builds strong programming foundation and problem-solving skills. Enhances technical education and improves student competency in software development.

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
	fundamental programs using operators, control structures and arrays	SDG 8	Decent Work & Economic Growth	Provides employability skills in programming which are essential for IT jobs and economic productivity.
		SDG 9	Industry, Innovation & Infrastructure	Basic coding skills contribute indirectly to software innovation and development infrastructure.
CO6	Develop and test java programs using classes, constructors and various string concepts	SDG 4	Quality Education	Strengthens object-oriented thinking and structured programming knowledge.
		SDG 8	Decent Work & Economic Growth	Prepares students for industry-level coding practices and job readiness.
		SDG 9	Industry, Innovation & Infrastructure	Supports development of modular and scalable software systems used in industries.
CO7	Build java programs on inheritance, dynamic method dispatch, interfaces and packages	SDG 4	Quality Education	Enhances advanced programming skills and conceptual understanding of reusable code.
		SDG 8	Decent Work & Economic Growth	Strongly aligned with industry requirements for scalable and maintainable software development.
		SDG 9	Industry, Innovation & Infrastructure	Enables development of robust applications contributing to innovation.
CO8	Implement and test java programs using I/O, exception handling and multithreading concepts	SDG 4	Quality Education	Develops advanced problem-solving and debugging skills.
		SDG 8	Decent Work & Economic Growth	Prepares students for real-world software development roles requiring concurrency and robustness.
		SDG 9	Industry, Innovation & Infrastructure	Strong contribution to building efficient, scalable, and high-performance systems.

FUNDAMENTALS OF DBMS			
Class: B. Tech syllabi of Exit Course for UG certificate in CSE(NETWORKS)		Branch: CSE(Networks)	
Course Code:	U24CN213	Credits:	3
Hours/Week(L-T-P-O-E):	2-0-2-0-4	CIE Marks(%):	60
Total Number of Teaching Hours:	32Hrs	ESE Marks(%):	40
Course Learning Objectives(LOs): <i>This course will develop students' knowledge in/on...</i> LO1: diverse issues in the design and implementation of a database management system LO2: physical and logical database designs and models LO3: distinct normalization techniques, query optimization techniques LO4: database structure, security, integrity and concurrency control			
THEORY COMPONENT			
UNIT-I		4Hrs	
Introduction: Introduction, Characteristics of database approach, Advantages of using DBMS, When not to use DBMS Database System Concepts and Architecture: Data models, Schemas and Instances, Three- schema architecture and data independence, Database Languages and interfaces, The database system environment, Classification of database management systems The Relational Data Model and its constraints: Relational model concepts, Relational constraints and the relational database schemas, Update operations and dealing with constraint violations			
UNIT-II		4Hrs	
Data Modeling using the Entity-Relationship Model: Using high-level conceptual data models for database design, Entity types, Entity sets, Attributes and keys, Relationships types, Relationship sets, Roles and structural constraints, Weak entity types, ER diagrams Basic SQL: SQL Data definition and data types, Specifying constraints in SQL, Basic retrieval queries in SQL, INSERT, DELETE, and UPDATE statements in SQL			
UNIT-III		4Hrs	
Database Design Theory and Normalization: Informal design guidelines for relation schemas, Functional dependencies, Normal forms on Primary keys, General definitions of second and third normal form, Boyce-Codd Normal Form			
UNIT-IV		4Hrs	
Introduction to Transaction Processing: Introduction to transaction processing, Transaction and system concepts, Desirable properties of a transactions, Characterizing schedules based on recoverability and serializability. Concurrency Control Techniques: Two-Phase locking techniques for concurrency control, Concurrency control based on timestamp ordering			

LABORATORY COMPONENT

1. Design and implement DDL, DML , TCL and DCL commands
2. Design and implement Queries on types of constraints
3. Design and implement Queries using built-in functions of NUMBER, CHARACTER and DATE Data types
4. Design and implement Queries on Data type conversion functions
5. Design and implement Queries on single row functions and operators
6. Design and implement Queries on aggregate functions
7. Design and implement Queries on joins and nested queries
8. Construct SQL statements to create simple, composite indexes, user-defined data types, views, sequences
9. Implementation of sample PL/SQL programs using conditional and iterative statements
10. Implementation of PL/SQL programs using cursors
11. Implementation of PL/SQL programs using parameterized cursors
12. Create PL/SQL programs to handle exceptions

Text book:

1. Ramez Elmasri, Shamakanth, B. Navathe, *Fundamentals of Database Systems*, 7th edition, New Delhi, 2017

Reference Book(S):

1. Raghu RamaKrishnan, Johannes Gehrke, *Database Management Systems*, 4th edition., New Delhi:Mc-Graw Hill, 2014
2. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, *Database System Concepts*, 6th edition., New Delhi: McGraw-Hill,2011

Course Articulation Matrix (CAM):					U24CN213X DATABASE MANAGEMENT SYSTEMS									
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN213X.1	2	1	2	1	-	-	-	-	-	-	1	2	1
CO2	U24CN213X.2	2	1	2	1	-	-	-	-	-	-	1	2	1
CO3	U24CN213X.3	2	1	2	2	-	-	-	-	-	-	1	2	1
CO4	U24CN213X.4	2	1	1	1	-	-	-	-	-	-	1	1	1
CO5	U24CN213X.5	2	1	2	1	1	1	1	-	-	-	1	2	1
CO6	U24CN213X.6	2	1	2	1	1	1	1	-	-	-	1	2	1
CO7	U24CN213X.7	1	1	1	1	1	1	1	-	-	-	1	1	1
CO8	U24CN213X.8	2	1	2	1	1	1	1	-	-	-	1	2	2
U24CN213X		1.87	1	1.75	1.2	1	1	1	-	-	-	1	1.75	1.12

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	design the databases using entity relationship model	SDG4	Quality Education	Provides foundational database knowledge and analytical skills essential for quality education and digital literacy
		SDG9	Industry, Innovation and Infrastructure	ER modeling supports the design of efficient and scalable information systems used in modern infrastructure
CO2	apply queries to manage the data that can efficiently store and retrieve	SDG9	Industry, Innovation and Infrastructure	Database design ensures reliable and scalable systems for industries
		SDG 16	Peace Justice and Strong Institutions	Data integrity and consistency are critical for transparent and accountable systems
CO3	apply normalization techniques to reduce redundancy	SDG 8	Decent Work and Economic Growth	Efficient data handling improves productivity and supports economic activities
		SDG9	Industry, Innovation and Infrastructure	Optimization techniques enhance performance of digital infrastructure
CO4	Transaction processing, concurrency, recovery	SDG9	Industry, Innovation and Infrastructure	Ensures reliable and fault-tolerant systems in industries
		SDG 16	Peace Justice and Strong Institutions	Secure and consistent transaction systems support governance, banking, and public service
CO5	Design ER diagrams and implement SQL queries to create and manipulate data with constraints	SDG 9	Industry, Innovation and Infrastructure	Database design and structured data management support development of reliable and scalable digital infrastructure
CO6	Implement various database objects using SQL queries	SDG 9	Industry, Innovation and Infrastructure	Efficient database objects improve system performance and contribute to robust software and industrial applications
CO7	Implement block structured programming with cursors to manage data traversal and reduce redundancy	SDG 12	Responsible Consumption and Production	Optimizing database performance and reducing redundancy promotes efficient use of computational resources
CO8	Implement stored programs, error handling, and security mechanisms using PL/SQL and triggers	SDG 16	Peace, Justice and Strong Institutions	Ensures secure data handling, integrity, and access control in information systems

III-Sem Syllabi

(B.Tech CSE(Networks) URR24)

III SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures / week					Credits
				L	T	P	O	E	C
1	PCC	U24CN301	Automata Theory and Compiler Design	2	1	-	6	9	3
2	PCC	U24CN302	Operating Systems	2	1	2	5	10	4
3	PCC	U24CN303	Advanced Data Structures	2	1	2	5	10	4
4	PCC	U24CN304	Computer Networks	2	1	-	4	7	3
5	PCC	U24CN305	Object Oriented Programming through Java	2	1	2	5	10	4
6	VAC	U24VA306B	Soft & Interpersonal Skills	-	-	2	2	4	1
7	SEC	U24SE307	Programming Skill Development Lab-02	-	-	2	2	4	1
8	ELC	U24EL308	Practicum-3	-	-	-	4	4	1
9	VAC	U24VA309XXXXX	SEA-3 / SAA -3	-	-	-	2	2	1
10	AEC	U24AE310	Expert Talk Series-3	-	-	-	1	1	1
Total:				10	5	10	36	61	23
Summer/ Inter-sem Bridge Courses (Approved by BoS and Dean,AA): 1 week to 10 days: 1 credit to each Bridge course under additional learning (will be printed on grade sheet)									

@ Dean AA will allot the courses QALR (Stream-I), Soft & Interpersonal Skills (Stream-II), to the branches as per Stream-I and Stream-II.

AUTOMATA THEORY AND COMPILER DESIGN			
Class: B.Tech. III - Semester		Branch: CSE (Networks)	
Course Code:	U24CN301	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-4-7	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to,</i> CO1: apply finite automata to solve basic computational problems CO2: apply regular expressions and context-free grammars for generating languages CO3: evaluate pushdown automata and Turing machines for an efficient language processing system CO4: analyse syntax, intermediate code, and code generation in the development of a compiler			
UNIT-I			9 Hrs
Automata Theory: Introduction to finite automata, Structural representations and the central concepts of automata theory Finite Automata: Deterministic finite automata (DFA), Non-deterministic finite automata (NFA), Finite automata with epsilon transitions, Conversion of NFA with ϵ -transitions to NFA without ϵ -transitions. Conversion of NFA to DFA, Moore and Melay machines, Minimization of DFA Self Learning Topics (SLTs): NFA an application: text search (Text1:Topics:2.4), Minimization of DFA (Text1: Topics: 4.4.3)			
UNIT-II			9 Hrs
Regular Expressions: Introduction, Algebraic laws for regular expressions, From DFA to regular expressions, Conversion of regular expressions to automata, Pumping lemma for regular languages, Closure properties of regular languages Context-Free Grammars (CFG): Definition, Derivations using grammar, Leftmost and rightmost derivations, Parse trees, Ambiguity in grammars and languages, Removal of ambiguity in grammars, Pumping lemma of context-free languages, Simplification of CFG, Chomsky normal form (CNF) Self Learning Topics (SLTs): applications of regular expressions (Text1: Topics: 3.3), applications of pumping lemma (Text1: Topics: 4.1.2)			
UNIT-III			9 Hrs
Push Down Automata (PDA): Definition, Acceptance by final state, Acceptance by empty store, Conversion of CFG to PDA Turing Machines: Introduction, Formal description, Instantaneous description, The language of a Turing machine, Design of basic Turing machine, Undecidability, Post correspondence problem Compiler Design: Language processors, The structure of a compiler Lexical Analysis: The role of the lexical analyzer, Input buffering, Recognition of tokens Self Learning Topics (SLTs): Deterministic pushdown automata (Text1: Topics: 6.4.1), A language that is not recursively enumerable (Text1: Topics: 9.1), Recursive languages (Text1: topics: 9.2.1)			
UNIT-IV			9 Hrs
Syntax Analysis: Introduction, Top-down parsing, Bottom-up parsing, Introduction to LR parsing: simple LR, More powerful LR parsers Intermediate-code Generation: Intermediate languages, Syntax trees, Three-address code Code Generation: Issues in the design of the code generator, Basic blocks and flow graphs, Direct acyclic graphs for basic blocks			

Self Learning Topics (SLTs): *syntax trees (Text 2 :Topics: 4.4), Dag for basic blocks (Text2: Topics: 8.5.1)*

Textbook(s):

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, *Introduction to Automata Theory, Languages, and Computation*, 3rd ed., USA: Pearson Education, 2007
2. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, *Compilers: Principles, Techniques and Tools*, 2nd ed., USA: Pearson Education, 2007

Reference Book(s):

1. Mishra, Chandrashekar, *Theory of Computer Science – Automata languages and computation*, 2nd ed., India: Prentice Hall India Learning Private Limited, 2006
2. Michael Sipser, *An Introduction to the Theory of Computation*, 3rd ed., USA: Cengage Learning 2013
3. Kamala Krithivsan, Rama R, *Introduction to Formal languages Automata Theory and Computation*, 1st ed., India: Pearson education 2013
4. Peter Linz, Jones & Bartlett, *An Introduction to Formal Languages and Automata*, 6th ed., USA: Jones & Bartlett Learning 2017

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc21_cs83/preview, nptel video lecture on theory of computation by prof. raghunathtewari, iitkanpur
2. https://onlinecourses.nptel.ac.in/noc21_cs07/preview, nptel video lecture on compiler design by prof. santanuchattopadhyay, iitkharagpur

Course Articulation Matrix (CAM):				U24CN301 AUTOMATA THEORY AND COMPILER DESIGN										
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CN304.1	2	2	2	2	1	-	-	1	-	1	2	1	1
CO2	U24CN304.2	2	2	2	2	1	-	-	1	-	1	2	1	1
CO3	U24CN304.3	2	2	3	3	1	-	-	1	-	1	3	1	1
CO4	U24CN304.4	2	2	3	3	1	-	-	1	-	1	3	1	1
U24CN304		2	2	2.5	2.5	1			1		1	2.5	1	1
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply finite automata solve basic computational problems	SDG4	Quality Education	Develops fundamental computational thinking and problem-solving skills essential for lifelong learning and quality technical education
CO2	apply regular expressions and context-free grammars for generating languages	SDG4	Quality Education	Enhances theoretical foundations in computer science and strengthens students' analytical and language-design competencies
CO3	evaluate pushdown automata and Turing machines for an efficient language processing system	SDG 4 SDG 9	Quality Education Industry, Innovation and Infrastructure	Builds advanced knowledge in computation models that underpin modern language processing systems, compilers, and innovative computing technologies
CO4	analyse syntax, intermediate code, and code generation in the development of a compiler	SDG8	Decent Work and Economic Growth	Provides industry-relevant skills in compiler construction and software development, fostering innovation and employability in the IT sector

OPERATING SYSTEMS			
Class: B.Tech. III-Semester		Branch: CSE (Networks)	
Course Code:	U24CN302	Credits:	3
Hours/Week (L-T-P-O-E):	2-1-0-4-7	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : use of the operating system services and system calls CO2 : analyze CPU scheduling algorithms based on scheduling criteria, synchronization algorithms based on number of resource allocations CO3 : assess the deadlock problems based on mutual exclusion, hold &wait, no-preemption and circular wait conditions and memory management issues based on page replacement techniques CO4 : evaluate file access and allocation methods based on memory space requirement, disk scheduling algorithms based on tracking time, system protection techniques based on them domains			
UNIT-I			9 Hrs
Introduction: Operating systems fundamentals, Operating-system operations, Process management, Memory management, Input-output management, Secondary storage management, Computing environments System Structures: Operating-system services, System calls, Types of system calls, System programs, Operating-system structure, System boot Self Learning Topics (SLTs): Dual mode and multi-mode operation (Text1: topics 1.5.1), Mobile computing and distributed systems (Text1: topics 1.11.2,1.11. 3), File management and device management (Text1: topics 2.4.2,2.4.3), Hybrid systems (Text1: topics 2.7.5), Threads (Text1: topics 3.1.4), Message-passing systems (Text1: topic 3.4.2)			
UNIT-II			9 Hrs
Process Concept: Process concept, Interprocess communication Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms – first- come first serve Shortest-job-first, Priority, Round-robin Synchronization: Background, The critical-section problem, Peterson’s solution, Synchronization hardware, Mutex locks, Semaphores, Monitors Self Learning Topics (SLTs): Practice problems (Text1: Prob 6.3, 6.16, 6.17), Deadlocks and starvation and priority inversion (Text1: topics 5.6.3, 5.6.4), Implementing a monitor using semaphores (Text1: topic 5.8.3)			
UNIT-III			9 Hrs
Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock Memory Management: Background, Swapping, Contiguous memory allocation, Segmentation, Paging, Structure of page table-hierarchical paging, Hashed page tables, Inverted page tables Virtual-Memory Management: Background, Demand paging, Page replacement, Allocation of frames, Thrashing Self Learning Topics (SLTs): No preemption and circular wait (Text1: topics 7.4.3, 7.4.4), Detection-algorithm usage (Text1: topics 7.6.3), Resource preemption (Text1: topics 7.7.2), Dynamic loading and dynamic linking and shared libraries (Text1: topics 8.1.4, 8.1.5), Practice problems (Text1: Prob 7.3, 7.8, 7.9, 7.22, 7.23), Practice problems (Text1: Prob 9.8, 9.21, 9.30)			

UNIT-IV	9 Hrs
File System: File concept, Access methods, Directory structure, Implementing file systems - Allocation methods, Free space management Mass Storage Structure: Overview of mass storage structure, Disk structure, Disk scheduling, Disk management, Swap-space management System Protection: Goals of protection, Principles of protection, Domain of protection Self Learning Topics (SLTs): Solid state disks and magnetic tapes (Text1: topics 10.1.2, 10.1.3), File types and file structure (Text1: topics 11.1.3, 11.1.4), Practice problems (Text1: Prob 10.11), An Example: UNIX, An example: MULTICS (Text1: topics 14.3.2, 14.3.3)	
Textbook: 1. Abraham Silberschatz , Peter B Galvin, Gerg Gagne, <i>Operating System Concepts</i>, 10th ed., Newyork: Wiley publications, ISBN-978-1-119-32091-3, 2018	
Reference Book(s): 1. EktaWalia, <i>Operating System Concepts</i>, 2nd ed., Delhi: Khanna Publishers, ISBN-10: 9789380016658, ISBN-13: 978-9380016658, 2019 2. Dhananjay M. Dhamdhare, <i>Operating Systems A Concept-Based Approach</i>, 1st ed., Newdelhi: McGraw Hill Education, ISBN-10: 0072957697 ISBN-13: 978-0072957693,2008 3. William Stalling, <i>Operating Systems</i>, Maxwell, McMillan International Editions, ISBN 81-203-1187- 6, 1992	
Web and Video link: https://www.youtube.com/watch?v=jciGlvn7UfM&list=PLyqSpQzTE6M9SYI5RqwFYtFYab94gJpWk;NPTEL Video Lecture on Introduction to Operating Systems By Prof. Chester Rebeiro, IIT Madras	

Course Articulation Matrix (CAM):				U24CN302 OPERATING SYSTEMS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN302.1	2	1	2	1	-	-	-	1	-	-	2	2	2
CO2	U24CN302.2	3	2	2	2	-	-	-	-	-	-	2	2	2
CO3	U24CN302.3	3	2	2	2	2	-	-	-	-	1	2	2	2
CO4	U24CN302.4	2	2	2	1	2	1	-	1	-	1	1	2	2
U24CN302		2.5	1.75	2	1.5	2	1	-	1	-	1	1.75	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Use the operating system services and system calls	SDG 9	Industry, Innovation and Infrastructure	Understanding OS services supports development of efficient software systems and computing infrastructure, contributing to technological innovation
CO2	Analyze CPU scheduling algorithms based on scheduling criteria and synchronization algorithms based on resource allocation	SDG 8	Decent Work and Economic Growth	Efficient CPU scheduling and synchronization improve system performance and productivity in computing environments
CO3	Assess deadlock problems based on conditions and memory management issues using page replacement techniques	SDG 9	Industry, Innovation and Infrastructure	Deadlock handling and memory optimization are critical for reliable and scalable system design
CO4	Evaluate file access and allocation methods, disk scheduling algorithms, and system protection techniques	SDG 16	Peace, Justice and Strong Institutions	System protection techniques ensure secure and reliable computing systems, aligning with strong institutional infrastructure

ADVANCED DATA STRUCTURES			
Class: B.Tech. III-Semester		Branch: CSE (Networks)	
Course Code:	U24CN303	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE :	60 %
Total Number of Teaching Hours:	60 Hrs	ESE :	40 %
Course Learning Outcomes (COs)			
After completion of this course, the students should be able to,			
CO1: Apply the knowledge of binary trees and binary search trees to organise and retrieve the data			
CO2: Apply AVL,red-black trees and B trees and B+ trees to optimize database queries			
CO3: Evaluate interval trees, trie indexing, sorting algorithms, and advanced searching techniques for efficient data organization and retrieval			
CO4: Evaluate graph algorithms and string-matching techniques for solving complex computational and data-processing problems			
(Laboratory Component)			
CO5: implement and test binary trees and binary search trees to organise and retrieve data efficiently			
CO6: implement and test AVL trees and red-black trees to optimise data storage			
CO7: develop and test sorting techniques on unsorted data and searching techniques to retrieve the data effectively			
CO8: develop and test graphs and string manipulation algorithms to organize and retrieve the data			
THEORY COMPONENT			
UNIT-I		9 Hrs	
Trees: Basic terminologies, Definitions and concepts, Representations of binary tree, Operations on a binary tree			
Types of Binary Trees: Expression tree, Binary search tree- Searching a binary search tree, Inserting a node into a binary search tree, Deleting a node from a binary search tree			
Heap Trees: Representation of a heap tree, Operations on a heap tree- Insertion, Deletion			
Threaded binary trees: Representation of threaded binary trees			
Self Learning Topics (SLTs): Formation of binary tree from its traversals (Text1: topic 7.4.3.2), Determining the Height of a Binary Search Tree (Reference1: topic 10.2.4), Practice problems (Text1: Prob 7.5, Reference1: Prob 9.11, Prob 9.12, Prob 9.13)			
UNIT-II		9 Hrs	
Height Balanced Binary Tree: Definition, Adelson-Velsky and Landis (AVL) rotations, Insertion operation			
Red-Black Tree: Definition of a red-black tree, Operation on a red-black tree-Insertion			
Splay Tree: Definition. Operations on splay tree, Splaying operation			
B Trees: B tree indexing, Operations on a B tree- Inserting, Deleting			
B+ Tree Indexing: Searching, Inserting, B tree vs. B+ tree			
Self Learning Topics (SLTs): Huffman's trees (Refernce1: topic 9.5), AVL tree deletion (Text1: topic 7.5.5), Practice problems (Text1: Prob 7.17)			
UNIT-III		9 Hrs	
Interval Tree: Construction of interval trees			
Trie Tree Indexing: Trie structure, Operations on trie, Applications of tree indexing			
Sorting: Heap sort,Quick sort, Merge sort, Bitonic generator sort			
Searching: Fibonacci search, Interpolation search			
Self Learning Topics (SLTs):Linked representation of binomial heap(Reference1: topic 12.2.1), operations of binomial heap(Reference1: topic 12.2.2),Jump search (Reference1: topic 14.3), Hashtree (http://originstamp.com/blog/what-is-a-hash-tree-or-merkle-tree/)			

UNIT-IV	9 Hrs
Graphs: Introduction, Graph terminology, Representation of graphs Application of Graph Structures: Topological sorting, Minimum spanning trees- Prim's algorithm, Kruskal's algorithm; Graphs traversal methods- Breadth first search, Depth first search; Kosaraju's algorithm String Matching Algorithms: Brute force method, Rabin-karp string matching algorithm, Knuth morrispratt (KMP) algorithm, Boyer-moore algorithm Self-Learning Topics (SLTs): Directed graphs (Reference1: topic 13.3.1), practice problems (Reference1: Prob 13.18) String compression -Run Length Encoding (https://www.naukri.com/code360/library/run-length-encoding)	
LABORATORY COMPONENT	
List of Experiments	
- Program to perform following binary tree operations - creation - insertion of a node - traversal using recursion - Program to perform following binary search tree traversal operations without recursion - inorder - preorder - postorder - spiral order - Program to perform following binary search tree operations. - creation - insertion of a node - deletion of a node - Program to implement AVL tree construction - Program to implement search and insert operations on Trie - Program to implement the following sorting techniques. - Heap sort - Quick sort - Program to implement the following sorting techniques. - Merge sort - Bitonic generator sort - Program to implement the following search algorithms. - Fibonacci search - Interpolation search - Program to implement the following - Graph Representations - Topological sort - Program to implement the following graph traversal techniques. - Depth first search - Breadth first search - Program to implement following shortest path algorithms. - Kruskal's algorithm - Prim's algorithm - Program to implement the following string matching algorithms. - Knuth morrispratt algorithm - Boyer-moore algorithm - Rabin-karp algorithm	
<u>Textbook:</u> 1. Debasis Samanta, <i>Classic Data Structures</i>, 2nd ed., New Delhi: Prentice Hall India, 2009 (Chapters 7 to 11)	
<u>Reference Book(s):</u> 1. Reema Thareja, <i>Data Structures Using C</i>, 2nd ed., New Delhi: Oxford University Press, 2014 2. Narasimha Karumanchi, <i>Data Structures and Algorithms Made Easy</i>, 5th ed., Bombay: Careermonk, 2017	

Web and Video link(s):

<https://nptel.ac.in/courses/106102064>; NPTEL Video Lecture on Data Structures and Algorithms
Prof. Naveen Garg, IIT Delhi

<https://nptel.ac.in/courses/106106130>; NPTEL Video Lecture on Programming and Data Structures
Dr. N. S. NarayanaSwamy, CSE, IIT Madras

Laboratory Manual (for laboratory component):

1. *Advanced Data Structures Laboratory Manual and Record Book*, Department of CSE (N), KITSW

Course Articulation Matrix (CAM):					U24CN303 ADVANCED DATA STRUCTURES									
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN303.1	2	2	2	1	1	-	1	1	-	1	1	2	2
CO2	U24CN303.2	2	2	2	1	1	-	1	1	-	1	1	2	2
CO3	U24CN303.3	2	2	2	2	1	-	1	1	-	1	1	2	2
CO4	U24CN303.4	2	2	2	2	1	-	1	1	-	1	1	2	2
CO5	U24CN303.5	1	1	3	2	1	-	1	1	-	1	1	1	1
CO6	U24CN303.6	1	1	3	2	1	-	1	1	-	1	1	1	1
CO7	U24CN303.7	1	1	3	2	1	-	1	1	-	1	1	1	1
CO8	U24CN303.8	1	1	3	2	1	-	1	1	-	1	1	1	1
U24CN303		1.5	1.5	2.5	1.75	1	-	1	1	-	1	1	1.5	1.5

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Apply the knowledge of binary trees and binary search trees to organise and retrieve the data	SDG 9	Industry, Innovation and Infrastructure	Data structures are fundamental to software systems, databases, and digital infrastructure. Contributes to innovation in technology and efficient system design
CO2	Apply AVL, red-black trees and B trees and B+ trees to optimize database queries	SDG 9	Industry, Innovation and Infrastructure	These data structures are widely used in databases, file systems, and large-scale applications. Supports efficient data processing and scalable digital systems. Directly contributes to innovation in computing and IT infrastructure
CO3	Evaluate interval trees, trie indexing, sorting algorithms, and advanced searching techniques for efficient data organization and retrieval	SDG 9	Industry, Innovation and Infrastructure	These techniques are essential for efficient algorithms in real-world systems. Used in databases, search engines, and large-scale application. Contribute to optimized and scalable digital infrastructure

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO4	Evaluate graph algorithms and string-matching techniques for solving complex computational and data-processing problems	SDG 9	Industry, Innovation and Infrastructure	Graphs and spanning trees are widely used in network design, routing, and communication systems. String matching algorithms are key in search engines, cybersecurity, and data processing. Supports efficient and scalable technological infrastructure
CO5	Construct Binary Trees and Binary Search Trees for efficient data storage and retrieval.	SDG9	promotes innovation and strong digital infrastructure	This project improves data efficiency and supports faster, smarter computing systems, aligning with SDG 9 innovation goals.
CO6	Construct AVL Trees and Red-Black Trees to optimize data storage.	SDG9	Sustainable Development Goal 9 focuses on building efficient and innovative digital infrastructure	Improves data structure AVL and Red-Black Trees optimize data storage and retrieval, improving system performance and supporting efficient digital infrastructure.
CO7	Develop and test Sorting Algorithms and Searching Algorithms for efficient data handling.	SDG9	Sustainable Development Goal 9 focuses on innovation and efficient digital infrastructure	Sorting and searching algorithms improve data efficiency, supporting faster and smarter digital systems.
CO8	Develop and test Graph Algorithms and String Manipulation Algorithms for efficient data handling.	SDG9	Sustainable Development Goal 9 focuses on building efficient and innovative digital infrastructure	Graph and string algorithms improve data processing and connectivity, supporting faster and smarter digital systems.

COMPUTER NETWORKS			
Class: B.Tech. III -Semester		Branch: CSE(Networks)	
Course Code:	U24CN304	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60 %
Total Number of Teaching Hours:	60 Hrs	ESE:	40 %
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to, (based on cognitive skills acquired from theory component)</i>			
CO1: evaluate the OSI and TCP/IP reference models in terms of their operational frameworks, layer functionalities, and support for switching infrastructures			
CO2: analyze data link layer mechanisms and medium access control protocols to ensure efficient and reliable communication			
CO3: apply routing and congestion control algorithms to optimize network performance			
CO4: analyze the functionalities and performance of transport and application layer protocols by examining services like connection management, reliability, flow control, and port addressing. <i>(based on psychomotor skills acquired from laboratory component)</i>			
CO5:apply basic UNIX/Linux commands, shell scripting, and text processing tools to perform file management, user operations, and automate system tasks			
CO6: implement and test basic networking concepts including network device identification, topology diagrams, LAN setup, IP configuration, and network connectivity			
CO7:develop socket-based applications using TCP and UDP protocols and simulate key data link and network layer protocols such as CRC, Stop-and-Wait, Sliding Window, and routing			
CO8: simulate and analyze network behaviour using tools like NS3 and Wireshark for understanding packet-level communication, protocol performance, and congestion handling			
THEORY COMPONENT			
UNIT-I		9 Hrs	
Introduction:Uses of computer networks, Types of computer networks, Network technology from local to global , Examples of Networks - WiFi, Network protocols			
Reference Models: OSI reference model, TCP /IP reference model,			
Physical Layer: Transmission media - Guided transmission media, Wireless transmission, Using the Spectrum for transmission, Communication satellites,Multiplexing			
Switching: Circuit and packet switching			
Self-Learning Topics (SLTs): A critique of the OSI model and protocols(Text: Topic 1.6.3), A critique of the TCP/IP reference model and protocols(Text: Topic 1.6.4), Digital modulation(Text: Topic 2.4.3)			
UNIT-II		9 Hrs	
Data Link Layer: Data link layer design issues, Error detection and correction, Elementary data link protocols, Sliding window protocols			
Medium Access Control Sub Layer: Channel allocation problem, ALOHA, Carriers sense multiple access, Collision free protocols, Limited contention protocol, Ethernet-Switched ethernet, Fast Ethernet, Gigabit Ethernet, Data link layer switching, Wireless LANS -802.11 Architecture and protocol stack, 802.11 Physical layer, 802.11 MAC Sublayer protocol, 802.11 Frame structure, Services			
Self-Learning Topics (SLTs):10-Gigabit Ethernet(Text: Topic 4.3.7), 40-and 100-Gigabit Ethernet(Text: Topic 4.3.8),Bluetooth(Text:4.5)Virtual LANs(Text: Topic 4.7.5)			

UNIT-III	9 Hrs
Network Layer: Network layer design issues, Routing algorithms - Optimality principle, shortest path algorithm, Flooding, Distance vector routing, Link state routing, Hierarchical routing, broadcast routing, Multicast routing Traffic Management at Network Layer: Congestion, Approaches to traffic management, Traffic aware routing, Admission control, Traffic throttling, Load shedding Internetworking: How networks differ, Connecting heterogeneous networks, Connecting endpoints across heterogeneous networks, Internetwork routing, Packet fragmentation Network Layer In The Internet: IP version 4 protocol, IP addresses, IP version 6 protocol, Internet control protocols, OSPF – Interior gateway routing protocol, BGP – Exterior gateway routing protocol, Internet multicasting Self-Learning Topics (SLTs):Quality of service and application QOE(Text: Topic 5.4),policy at the network layer(Text: Topic 5.8)	
UNIT-IV	9 Hrs
Transport Layer: Transport services, Primitives, Elements of transport protocols – Addressing, Connection establishment and release, Error control and flow control, Multiplexing, Crash recovery, Congestion control, Internet transport protocols - UDP,TCP Application Layer: Domain Name System (DNS), Electronic mail, World Wide Web Self-Learning Topics (SLTs):Streaming audio and video(Text: Topic 7.4),Content delivery(Text: Topic 7.5)	
LABORATORY COMPONENT	
List of Experiments - Practicing basic UNIX commands: - General Utility Commands: login, cal, date, who, uname, echo, passwd, pwd, exit - File and Directory Related Commands: ls, cd, mkdir, rmdir, cat, cp, rm, mv, wc, comm, diff, split, ln, touch, chmod, chown, chgrp - Filters : (Data Processing Commands):more, head, tail, cut, paste, sort, uniq, nl, tr - Communication Commands: write, mail, talk, finger, news - Pattern Searching Commands: grep, egrep, fgrep - Practicing the following examples: - Display the contents of file (file names starting with 'a' and ending with X) - Copy the contents of directory1 to directory2 - Remove the all .c files from current directory - Merge the three different files into single one - Set given file as read only - Display the details of all users in an order they logged on to system (based on time) who are working on the system - Practicing the Vi editor commands - Write shell script for the following: - To check given number is even or odd - To perform all basic arithmetic operations using switch statement - To accept login name as command line argument and find out at How many terminals the user has logged in - To display IP address configuration details - To store PING status output into a file	

- f) To check port availability, service details, checking IP
[Note: Create script to display 3-Menu options, for selecting any of the operation]
 - g) To fetch and display Data center information from given domain name
4. Do the following related to computer networks:
 - a) Study of system administration, network administration and identify the responsibilities of a network engineer and network administrator
 - b) Draw symbols of devices and connectors used in network diagrams
 - c) Illustrate network diagram of different network topologies
 - d) Illustrate network diagram of different network types (LAN, MAN, WAN)
 - e) Illustrate physical and logical diagrams of a campus network
 5. Building a LAN network and check network connectivity
 - a) Identify different Ethernet cable categories and write down the detailed specifications
 - b) Identify different devices, tools, connectors used in establishing a physical LAN network
 - c) Perform crimping operation for straight through cable and crossover cable
 - d) Configure an IP address on a computer and verify using command
 - e) Create a LAN network using two computers and check network connectivity
 6.
 - a) Study of socket programming and implement a simple socket
 - b) Develop a socket program to implement date and time display from client to server using TCP
 - c) Develop a socket program to implement date and time display from client to server using UDP
 - d) Develop a socket program to implement chat application using TCP
 - e) Develop a program for file transfer using TCP sockets
 7.
 - a) Develop a program for error detection code using CRC
 - b) Develop a program to implement stop and wait protocol
 - c) Develop a program to implement sliding window protocol
 8.
 - a) Develop a program to implement distance vector routing
 - b) Develop a program for simulating ARP and RARP protocols
 9.
 - a) Develop a program to find subnet mask and network id for given IP address
 - b) Develop a program that resolves IP address from a given domain name
 - c) Develop a program for SNMP application
 10. Implementing simulations using NS3
 - a) Study of network simulation tool NS3
 - b) create nodes and connect nodes
 11. Implementing simulations using NS3
 - a) simulate a simple network
 - b) simulate to find number of packets dropped due to congestion
 12. Demonstration of Wireshark packet analyzer tool.
 - a) Capture a HTTP packet

b) View the captured packet c) Apply filters d) Analyze the packet
<u>Textbook:</u> 1. Andrew S. Tanenbaum, David J. Wetherall, Nick Feamster, <i>Computer Networks</i> , 6th ed., London: Pearson Education, ISBN- 978-9356063600, 2023
<u>Reference Book(s):</u> 1. William Stallings, <i>Data and Computer Communications</i> , 10th ed., Pearson Education, ISBN- 9780137561704, 2014 2. BehrouzForouzan, <i>Data Communication and Networking</i> , 5th ed., Tata McGraw Hill, ISBN- 13978-1259064753, 2017 3. Larry L. Peterson, Bruce S. Davie, <i>Computer Networks</i> , 5th ed., Morgan Kaufmann Publishers., ISBN- 978-0123850591, 2011 4. James F.Kurose and Keith W.Ross, <i>Computer Networking a Top-Down Approach</i> , 7th ed., Pearson Education, ISBN- 978-0133594140, 2016
<u>Web and Video link(s):</u> 1. https://www.youtube.com/watch?v=O--rkQNKqls Video Lecture on Computer Networks and Internet Protocol, Multiplication by Prof SoumyaKantiGhosh& Prof SandipChakraborty, NPTEL IIT Kharagpur
<u>Laboratory Manual (for laboratory component):</u> <i>Computer Networks Manual and Record Book</i> , Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):					U24CN304COMPUTER NETWORKS									
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN304.1	3	2	2	1	2	-	1	-	1	1	1	3	2
CO2	U24CN304.2	3	3	3	2	3	-	1	-	1	1	1	3	3
CO3	U24CN304.3	2	3	2	1	3	-	1	-	1	1	2	3	3
CO4	U24CN304.4	2	2	1	1	2	-	1	-	1	1	2	3	2
CO5	U24CN304.5	3	3	2	2	2	-	1	-	1	1	2	3	
CO6	U24CN304.6	3	3	3	2	2	-	1	-	1	1	2	3	2
CO7	U24CN304.7	3	3	2	2	2	-	1	-	1	1	2	3	3
CO8	U24CN304.8	3	2	1	2	2	-	1	-	1	1	2	3	2
U24CN304		2.75	2.62	2	1.62	2.25	-	1	-	1	1	1.75	3	2.12
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Evaluate OSI and TCP/IP reference models and compare their functionalities	SDG4	Quality Education	Enhancing students understanding of networking fundamentals such as OSI and TCP/IP models, thereby strengthening technical knowledge and lifelong learning skills in communication technologies.
CO2	Analyse various data link layer mechanisms and medium access control protocols to ensure efficient and reliable communication	SDG9	Industry, Innovation and Infrastructure	Study of Data Link Layer and Medium Access Control ensures efficient and reliable data communication, supporting strong and optimized network infrastructure.
CO3	Apply appropriate routing and congestion control algorithms to enhance and optimize network performance	SDG11	Sustainable Cities and Communities	Optimized routing improves smart city networks, traffic systems, and public communication services. digital infrastructure.
CO4	Analyse the different services provided by transport and application layer protocols in network communication	SDG9	Industry, Innovation and Infrastructure	Strengthens understanding of communication services and protocols that enable efficient information exchange and support learning in advanced networking technologies.
CO5	Demonstrate the ability to design and configure small-scale campus networks by understanding network devices, topologies, IP addressing, and system/network administration roles.	SDG9	Industry, Innovation and Infrastructure	Involves designing and configuring network infrastructure using devices, topologies, IP addressing, and administration roles for efficient communication
CO6	Apply socket programming techniques using TCP and UDP protocols to develop Client-server applications such as chat systems, date/time services, and file transfers	SDG9	Industry, Innovation and Infrastructure	Involves building client-server applications using TCP/UDP socket programming for communication services like chat, file transfer, and date/time systems
CO7	develop data link and	SDG9	Industry,	Involves implementing key

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
	network layer protocols such as Stop-and-Wait, sliding window, CRC, ARP, RARP, SNMP, and Distance Vector Routing using Java programming		Innovation and Infrastructure	data link and network layer protocols in Java to strengthen understanding of communication networks and infrastructure
CO8	Analyze network behaviour and performance using NS3 and Wireshark tools, focusing on traffic, congestion, and packet-level protocol analysis.	SDG4	Quality Education	enhances practical learning through simulation and analysis tools while improving network efficiency and performance, contributing to technical education and robust communication infrastructure

OBJECT ORIENTED PROGRAMMING THROUGH JAVA			
Class: B.Tech. III -Semester		Branch: CSE(Networks)	
Course Code:	U24CN305	Credits:	4
Hours/Week (L-T-P-O-E):	2-1-2-5-10	CIE:	60 %
Total Number of Teaching Hours:	60 Hrs	ESE:	40 %
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to,</i> <i>(based on cognitive skills acquired from theory component)</i> CO1: distinguish various programming paradigms and develop java fundamental programs CO2: develop java programs using classes, constructors and various string concepts CO3: make use of reusability concepts like inheritance, dynamic method dispatch, interfaces and packages to build java programs CO4: develop java programs using I/O, exception handling and multithreading concepts <i>(based on psychomotor skills acquired from laboratory component)</i> CO5: develop and test java fundamental programs using operators, control structures and arrays CO6: develop and test java programs using classes, constructors and various string concepts CO7: build java programs on inheritance, dynamic method dispatch, interfaces and packages CO8: implement and test java programs using I/O, exception handling and multithreading concepts			
THEORY COMPONENT			
UNIT-I			9 Hrs
Programming Paradigms: Procedural programming, Modular programming, Object oriented programming (OOP), Generic programming Java Basics: The History and evolution of Java, An overview of java, Data types, Variables and arrays, Operators, Control statements Introducing Classes: Class fundamentals, Declaring objects, Object reference variables, Introducing methods <i>Self Learning Topics (SLTs): Lexical Issues like Keywords, identifiers, Literals and comments (TextBook-Chapter 2), Type conversions and casting (TextBook-Chapter 3)</i>			
UNIT-II			9 Hrs
Classes and Methods: Overloading methods, <i>this</i> keyword, Passing and returning objects, Recursion, Variable length arguments, Constructors, Overloading constructors, Garbage collection, Static variables, Static blocks, Static methods, Nested and inner classes, Command line arguments, Wrapper classes Strings: Exploring String, StringBuffer, StringBuilder and StringTokenizer classes <i>Self Learning Topics (SLTs): Overloading Vararg Methods, Varargs and Ambiguity (TextBook-Chapter: 7),Anonymous Inner classes(TextBook-Chapter-25)</i>			
UNIT-III			9 Hrs
Inheritance: Inheritance basics, Types of inheritance, Using <i>super</i> , Method overriding, Order of constructors Execution, Dynamic method dispatch, Abstract classes, <i>final</i> with inheritance, Object class Interfaces: Defining an interface, Implementing interfaces, Nested interfaces, Variables in interfaces, Interfaces can be extended Packages: Defining a package, Packages and Member Access, Importing packages			

Self Learning Topics (SLTs): Accessing implementations through interface references, Default interface methods, Use static methods in an interface, private interface methods(TextBook-Chapter-9)

UNIT-IV

9 Hrs

Using I/O: I/O basics, Reading, Writing and copying files using byte and character streams

Exception Handling: Fundamentals, Exception types, Uncaught exceptions, Using *try* and *catch*, Multiple catch clauses, Nested try statements, *throw*, *throws*, *finally*, Creating your own exception sub classes.

Multithreading: Creating a thread, Creating multiple threads, Thread priorities, Synchronization, Interthread communication

Self Learning Topics (SLTs):*try-with resource, multi catch, chained exception, precise re-throw*(TextBook-Chapter: 10), *Serialization- Writing and reading objects to and from the file-*(TextBook-Chapter-22)

LABORATORY COMPONENT

List of Experiments

1. a) Develop a java program to demonstrate different operators in java
b) Develop a java program to demonstrate control structures
c) Develop a java program to demonstrate *switch* statement
2. a) Develop a java program to read an array and display them using *for-each* control. Finally display the sum of array elements
b) Develop a java program to read a matrix and display whether it is an identity matrix or not. Use *civilizedform* of *break* statement
c) Develop a java program to define a two dimensional (2D) array where each row contains different number of columns. Display the 2D-array using *for-each*
3. a) Develop a java program to demonstrate class concept
b) Develop a java program to demonstrate *this* keyword
c) Develop a java program to demonstrate object reference variable
d) Develop a java program to demonstrate overloading of methods
e) Develop a java program to demonstrate passing and returning objects
4. a) Develop a java program to demonstrate variable length argument (using array and ellipsis notation)
b) Develop a java program to demonstrate constructors and garbage collection
c) Develop a java program to demonstrate nested and inner classes
d) Develop a java program to demonstrate *static* variables, *static* methods, and *static* blocks
5. a) Read at least five strings from command line argument and display them in sorted order
b) Develop a java program to demonstrate wrapper class by reading N number of integers from command line and display their sum
c) Develop a java program to demonstrate wrapper class by reading N floating point numbers from command line and display their average
6. a) Develop a java program to accept a string, count number of vowels and remove all vowels
b) Develop a java program to accept a string, count number of vowels and remove all vowels using *StringBuffer* class
c) Develop a java program to accept a line of text, tokenize the line using *StringTokenizer* class and print the tokens in reverse order

7. a) Develop a java program to demonstrate single level-inheritance
b) Develop a java program to demonstrate multilevel-inheritance using super
c) Develop a java program to demonstrate method overriding
8. a) Develop a java program to demonstrate dynamic method dispatch
b) Develop a java program to demonstrate use of abstract class
c) Develop a java program to demonstrate the use of overriding *equals()* method of an Object class
9. a) Develop a java program to implement interfaces
b) Develop a java program to extend the interfaces
c) Develop a java program to demonstrate implementation of nested interfaces
10. Develop a java program to create a *package*, and demonstrate to import the *package* into any java program (Consider the behavior of all access specifiers)
11. a) Develop a java program to demonstrate *try-catch* block
b) Develop a java program to demonstrate *throw* clause
c) Develop a java program to demonstrate *throws* clause
d) Develop a java program to demonstrate *re-throw* an exception, and *finally* block
12. a) Develop a java program to demonstrate read/write/copy a file using *byte stream*
b) Develop a java program to demonstrate read/write/copy a file using *character stream*
c) Develop a java program to create a thread (using *Thread* class or *Runnable* interface)
d) Develop a java program to demonstrate *synchronization* of threads
e) Develop a java program to demonstrate *Interthreadcommunication*

Textbook:

1. Herbert Schildt, *Java The Complete Reference*, 13th ed., New Delhi: McGraw-Hill Education, 2019

Reference Book(s):

1. Balaguruswamy, *Programming with Java: A Primer*, 7th ed., New Delhi: McGraw-Hill Education India Pvt. Ltd 2019
2. Kathy Sierra, Bert Bates, *Head First Java*, 2nd ed., Boston: O'Reilly Publications, 2005
3. Harvey Deitel, Paul J. Deitel, *Java How to Program*, 11th ed., India: Pearson Publications, 2018

Web and Video link(s):

<https://nptel.ac.in/courses/106105191> NPTEL Video Lecture on Java Programming by Prof. Debasis Samanta, Professor of CSE, IIT Kharagpur.

Laboratory Manual (for laboratory component):

1. *Object Oriented Programming through java Manual and Record Book*, Department of CSE (Networks), KITSW.

Course Articulation Matrix (CAM):					U24CN305: OBJECT ORIENTED PROGRAMMING THROUGH JAVA									
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CN305.1	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	U24CN305.2	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	U24CN305.3	2	2	3	2	1	-	-	-	-	-	1	2	2
CO4	U24CN305.4	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	U24CN305.5	1	1	1	1	1	-	-	1	1	-	1	1	1
CO6	U24CN305.6	1	2	2	2	2	-	-	1	1	-	1	1	1
CO7	U24CN305.7	1	2	3	2	2	-	-	1	1	-	1	2	2
CO8	U24CN305.8	1	2	3	2	2	-	-	1	1	-	1	2	2
U24CN305		1.5	1.87	2.37	1.5	1.62	-	-	1	1	-	1	1.5	1.5

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Distinguish various programming paradigms and develop java fundamental programs	SDG4	Quality Education	It supports by promoting quality technical education and digital literacy
CO2	Develop java programs using classes, constructors and various string concepts	SDG4	Quality Education	strengthens object-oriented programming skills, which are essential for real-world software development. This enhances employability and job readiness by preparing students for productive employment in the IT sector
CO3	Make use of reusability concepts like inheritance, dynamic method dispatch, interfaces and packages to build java programs	SDG9	Industry, Innovation and Infrastructure	It promotes efficient and reusable code design, which is a key aspect of sustainable software development. Reusability reduces development time and resource consumption
CO4	Develop java programs using I/O, exception handling and multithreading concepts	SDG9	Industry, Innovation and Infrastructure	It deals with building robust, efficient, and reliable applications. Exception handling ensures software reliability, while multithreading improves performance
CO5	Develop and test java fundamental programs using operators, control structures and arrays	SDG 4	Quality Education	Builds strong programming foundation and problem-solving skills. Enhances technical education and improves student competency in software development.
		SDG 8	Decent Work & Economic Growth	Provides employability skills in programming which are essential for IT jobs and economic productivity.

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
		SDG 9	Industry, Innovation & Infrastructure	Basic coding skills contribute indirectly to software innovation and development infrastructure.
CO6	Develop and test java programs using classes, constructors and various string concepts	SDG 4	Quality Education	Strengthens object-oriented thinking and structured programming knowledge.
		SDG 8	Decent Work & Economic Growth	Prepares students for industry-level coding practices and job readiness.
		SDG 9	Industry, Innovation & Infrastructure	Supports development of modular and scalable software systems used in industries.
CO7	Build java programs on inheritance, dynamic method dispatch, interfaces and packages	SDG 4	Quality Education	Enhances advanced programming skills and conceptual understanding of reusable code.
		SDG 8	Decent Work & Economic Growth	Strongly aligned with industry requirements for scalable and maintainable software development.
		SDG 9	Industry, Innovation & Infrastructure	Enables development of robust applications contributing to innovation.
CO8	Implement and test java programs using I/O, exception handling and multithreading concepts	SDG 4	Quality Education	Develops advanced problem-solving and debugging skills.
		SDG 8	Decent Work & Economic Growth	Prepares students for real-world software development roles requiring concurrency and robustness.
		SDG 9	Industry, Innovation & Infrastructure	Strong contribution to building efficient, scalable, and high-performance systems.

SOFT AND INTERPERSONAL SKILLS			
Class: B.Tech.III -Semester& IV-Semester		Branch: Common to all Branches	
Course Code:	U24VA306B	Credits:	2
Hours/Week (L-T-P-O-E):	0-0-2-2-4	CIE	100 %
Total Number of Teaching Hours:	24Hrs	ESE	-
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i> CO1: introspect to convert strengths into opportunities, identify weaknesses, and bypass threats CO2: present views on various issues confidently in a group CO3: make effective PPT presentations CO4: prepare a professional resume, communicate effectively to attain better opportunities			
LIST OF ACTIVITIES Activity 1 Activity 2 Activity 3 Activity 4 Activity 5 Activity 6 Activity 7 Activity 8 Activity 9 Activity 10 Reading Comprehension Listening & Observation (Video Source) Group Discussion Presentations through PPTs Self-Introduction JAM Email Etiquette Resume Writing Interview Etiquette “My Career Plan” SWOT Analysis			
Textbook(s): 4. Krishna Mohan, MeeraBenerji, <i>Developing Communications Skills</i> , 1st ed., New Delhi: Mcmillan Publications, 2005			

Course Articulation Matrix (CAM):			U24VA406B SOFT AND INTERPERSONAL SKILLS LABORATORY												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24VA406B .1	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO2	U24VA406B .2	-	-	-	-	-	-	-	2	3	3	-	-	-	-
CO3	U24VA406B .3	-	-	-	-	-	-	-	-	2	3	-	-	-	-
CO4	U24VA406B .4	-	-	-	-	-	-	-	1	2	3	-	-	-	-
U24VA406B		-	-	-	-	-	-	-	1.5	2.25	3	-	-	-	-
3 – HIGH, 2 – MEDIUM, 1 - LOW															

PROGRAMMING SKILL DEVELOPMENT LAB - 02			
Class: B.Tech. III –Semester		Branch: CSE(Networks)	
Course Code:	U24SE307	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-2-2-4	CIE:	100%
Total Number of Lab Hours:	36 Hrs	ESE:	-
Course Learning Outcomes (COs): After completion of this course, the students should be able to ... (based on psychomotor skills acquired from laboratory component): CO1:develop programs on arrays including searching and sorting CO2:develop programs on strings and DMA CO3: develop programs on stacks CO4: develop programs on queues and hashing			
LABORATORY COMPONENT			
Sl.No	List Of Experiments		
1	Implementation of arrays		
2	Implementation of searching techniques		
3	Implementation of sorting techniques		
4	Implementation of string operations		
5	Implementation of string operations		
6	Implementationof dynamic memory allocation function		
7	Implementation of linked list operations using c		
8	Implementation of stacks operationsusing c		
9	Implementation of stacksoperations using c		
10	Implementation of queues operations		
11	Implementation of queuesoperations		
12	Implementationof hashing function		
Textbook: 1.Balagurusamy.E, <i>Programming in ANSI C</i> , 8th ed., 2022			
Reference Book(s): 1. Paul Deitel, Harvey Deitel, C How to Program: With Case Studies <i>Introducing Applications Programming and Systems Programming</i> , Pearson Education Limited, 9th ed., 2022 2. Brian W. Kernighan and Dennis Ritchie, <i>The C Programming Language</i> , Pearson EducationIndia, 2nd ed., 2015 3. Reema Thareja, <i>Programming in C</i> , Oxford University Press, 3rd ed., 2023 4. Yashavant Kanetkar, <i>Let Us C</i> , BPB Publications, 19th ed., 2022 5. A.K.Sharma, <i>Computer Fundamentals and Programming in C</i> , Universities Press, 2nd ed., 2018			

Course Articulation Matrix (CAM):					U24SE307 Programming Skill Development Lab - 02									
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2
CO1	U24SE307.1	2	2	1	1	1	-	-	1	1	-	1	1	2
CO2	U24SE307.2	2	2	1	1	1	-	-	1	1	-	1	1	2
CO3	U24SE307.3	2	2	1	1	1	-	-	1	1	-	1	1	2
CO4	U24SE307.4	2	2	1	1	1	-	-	1	1	-	1	1	2
U24SE307		2	2	1	1	1	-	-	1	1	-	1	1	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

PRACTICUM-3						
Class: B.Tech. III -Semester	Branch: Common to all branches					
Course Code:	U24EL308	Credits:	1			
Hours/Week (L-T-P-O-E):	0-0-0-4-4	CIE Marks :	100%			
Total Number of Teaching Hours:	-	ESE Marks :	-			
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i>						
CO1: synthesize literature survey, identify research gaps and define objective & scope of practicum problem						
CO2: apply knowledge to design & conduct experiments, utilize modern tools for solution of practicum problem and develop working model/ process/ system						
CO3: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through practicum						
CO4: create a video pitch on practicum and make an effective oral presentation using PPTs						
Practicum is an independent project carried out by the student during the course period, under the supervision of allotted course faculty. It helps to reinforce the students’ theoretical knowledge and develop their ability to apply this knowledge to the solution of practical problems. Practicums also prepare them for their MINI and MAJOR PROJECTs and for independent work in their chosen field that promotes creative abilities. Besides they provide Higher Order Cognitive Abilities (HOCAs).						
(x). Practicum is a mandatory semester project work.						
(xi). Practicum is offered as a one credit course. Student has to earn 4 credits (one in each semester from I to IV semesters)						
(xii). Allotment of Practicum topics for students:						
○ Practicum matrix: In week (-1), the class teacher, in consultation with HoD, shall prepare the practicum matrix of the section. The practicum matrix is the allotment of group of students to the different course faculty of the section, as shown below.						
Course	U24IN301	U24IN302	U24IN303	U24IN304	U24IN305	U24IN306
Students allotted to different courses	B24XX001	B24XX011	B24XX021	B24XX031	B24XX041	B24XX051
	B24XX002	B24XX012	B24XX022	B24XX032	B24XX042	B24XX052
	B24XX003	B24XX013	B24XX023	B24XX033	B24XX043	B24XX053
	B24XX004	B24XX014	B24XX024	B24XX034	B24XX044	B24XX054
	B24XX005	B24XX015	B24XX025	B24XX035	B24XX045	B24XX055
	B24XX006	B24XX016	B24XX026	B24XX036	B24XX046	B24XX056
	B24XX007	B24XX017	B24XX027	B24XX037	B24XX047	B24XX057
	B24XX008	B24XX018	B24XX028	B24XX038	B24XX048	B24XX058

	B24XX009	B24XX019	B24XX029	B24XX039	B24XX049	B24XX059
	B24XX010	B24XX020	B24XX030	B24XX040	B24XX050	B24XX060

- In week (-1), the class teacher of a section shall collect 10-12 topics for practicum from each of the course teachers of that section.
- The class teacher, in consultation with HoD shall allot the practicum topics to the students of that section in the following format.

CIRCULAR

Allotment of Practicum topics to students

Section :

No.	Roll number of the student	Practicum topic allotted	Practicum under the course	Course faculty

Note:

4. The students should meet immediately the allotted course faculty for practicum and start working on the practicum with the guidance of course faculty.
5. To complete the Practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and also outside the class work hours during weekdays.
6. The course faculty are advised to guide the allotted students for practicum during the semester course work.

(Signature of class teacher)

- (xiii). *To complete the practicum, the student shall work in laboratories under supervision of allotted course faculty, in the allotted hours in the classwork timetable and outside the class work hours during weekdays.*
- (xiv). There shall be only continuous Internal Evaluation (CIE) for practicum for a maximum of 100 marks.
- (xv). The practicum course faculty shall evaluate & submit the final marks of the allotted students in week (N+1) to the respective class teacher.
- (xvi). The class teacher shall collect the final marks of practicum of the students allotted to each course teacher and submit them to the CoE.
- (xvii). Course faculty shall follow his/her own rubrics for practicum evaluation. Focus shall be

on knowledge, skills & qualities acquired by the student during the practicum course

viii). A sample rubrics for assessment and evaluation of practicum is as follows:

Literature survey & Identification of research gaps	10 marks
Working model / process / software package / system developed	30 marks
Report writing (subjected to max of 30% plagiarism)	20 marks
Oral presentation with PPT and viva-voce	20 marks
Video pitch	20 marks
Total	100 marks

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation of Practicum.

- (h) **Practicum Topic:** Each student shall be allotted a topic for practicum by the course faculty member attached to him/her. Interested students can work on their own title for practicum, but with due approval from course faculty.
- (i) **Working Model:** Each student is required to develop a prototype / process / system/simulation model on the given practicum topic and demonstrate/present, during the allotted time, before the course teacher.
- (j) **Report:** Each student is required to submit a well-documented report on the allotted practicum topic as per the format specified by the course faculty. The student shall include answers to the following questions in the report and ppt presentation.
 - What was the objective of the practicum assigned?
 - What are the main responsibilities and tasks for practicum?
 - What knowledge and skills from the coursework are applied in the practicum?
 - What new knowledge and skills are acquired during the practicum?
 - In what ways, can the practicum be helpful for the professional career?
 - What gaps are identified in your practicum work?
 - What improvements or changes you suggest for addressing the identified gaps for future work?
- (k) **Anti-Plagiarism Check:** The practicum report should clear plagiarism check as per the Anti-Plagiarism policy of the institute
- (l) **Presentation:** Each student should prepare PPT with informative slides and make an effective oral presentation before the course teacher as per the schedule notified by the department
- (m) **Video Pitch:** Each student should create a pitch video, which is a video presentation on his / her Practicum. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include

evidence like videos & pics at the time of implementing the practicum and also key points about his / her business idea / plan (*if any*) and social impact

(n) The student has to register for the Practicum as a supplementary examination in the following cases:

- iv) he/she is absent for oral presentation and viva-voce
- v) he/she fails to submit the report in prescribed format
- vi) he/she fails to fulfill the requirements of Practicum evaluation as per specified guidelines

SOCIAL EMPOWERMENT ACTIVITY / SELF ACCOMPLISHMENT ACTIVITY (SEA-III /SAA-III)			
Class: B.Tech. III Semester	Branch: Common to all branches		
Course Code:	U24VA309XXXXX	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-2-2	CIE:	100%
Total Number of Teaching Hours:	-	ESE :	-
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i> CO1: integrate the five dimensions of physical, emotional, cognitive, spiritual and social aspects in life for holistic development and demonstrate social sensibility CO2: interact effectively through written, oral and nonverbal communication with external-world in a professional, sensitive and culturally relevant manner CO3: analyse the issues related to social empowerment / self-accomplishment, demonstrate problem-solving skills, articulate solutions and demonstrate social sensibility CO4: demonstrate the generic competencies in making a well-documented report and an effective oral presentation with PPTs portraying knowledge, skills, qualities acquired through fieldwork/practice sessions and social impact of the course learning			
Activity Based Liberal Learning about Life, Literature and Culture (ABLL@LLC) is introduced for building generic competencies in students. ABLL is aimed at all dimensional holistic growth of the learner. The holistic development includes the physical, emotional, cognitive, spiritual and social aspects. This is an area which opens the decision-making process, helps the student to develop creativity, an analytical mind, and builds resilience, confidence, hope, well-being and success. This will help student face the world with a greater degree of maturity, stoic and become a wholesome person in the society. It is more than just learning from books to lead a successful life. These activity-based liberal learning courses, which help students to expand their social roles later in life, are offered under two sequels namely SEA (Social Empowerment Activities) and SAA (Self Accomplishment Activities) These SEA/SAA courses also focus on building positive mindset: adopting optimism, acceptance, resilience, gratitude, mindfulness, and integrity in your life will help student develop and maintain a positive mindset. - Each SEA/SAA activity is treated as one credit course - Student must select one activity per semester, through first 04 semesters, from the courses listed under SEA/ SAA, before commencement of the semester. - Students are required to earn minimum 04 credits under SEA/SAA, by completing minimum 02 credits through SEA and minimum 02 credits through SAA - To complete these activities student shall work outside the class work hours, during weekends, holidays, semester breaks, etc., - If a student is not able to attend/ fulfil performance requirements, he/she shall be dropped from the course and shall have to enrol in the forthcoming semesters. Monitoring SEA/SAA: Nodal units: The Student Activity Centre (SAC) and Centre for Innovation Incubation Research and Entrepreneurship (C-i²RE) shall act as nodal units for activities listed under SEA/SAA. - During the semester period, the student has to acquire requisite knowledge, conduct fieldwork, acquire skills and propose unique solutions to the real-life problems Knowledge Acquisition & Skilling: - Students have to identify goals, acquire and accumulate knowledge on the chosen SEA/SAA activity			

- ii. For the activities related to social awareness/issues/challenges that affect society, use the knowledge base, apply relevant skills to analyse the issue and propose unique possible solutions to the social issues/challenges. Practice to acquire necessary skills to seek new opportunities in their personal and professional life.
 - iii. For the activities related to physical fitness, music, dance, fine arts, etc., guided practice sessions under supervision of expert/guru are to be planned and executed to acquire the benchmark skills to be demonstrated.
- (d) **Fieldwork:** Fieldwork is an essential component of learning for gaining real-life experiences. In addition to knowledge acquisition & skilling, student has to take up fieldwork on the chosen activity, as part of SEA/SAA course.
- i. This student-driven Fieldwork allow students to interact with the 'real world'. It is an autonomous learning (self-learning) situation that students are more actively involved during the activity and develop a deeper understanding and develop a more positive attitude.
 - ii. Fieldwork consists of three phases: preparation, the actual activity and feedback
 - iii. **As part of fieldwork, student has to interact with at least two eminent personalities/achievers/renowned persons/inspiring and great personalities related to the activity chosen.**
 - iv. Fieldwork will benefit students for any careers where they need to work with communities of people or which involves analysis of complex processes, especially social and cultural.
 - v. Certain skills are required for effective fieldwork, which include observation, communication, interviewing, problem solving, documentation, and more
 - vi. Other skills important for fieldwork practice include the ability to act in a crisis, to plan, set priorities, mobilize resources, and implement the plan effectively. These skills used in an integrated manner help students solve their problems and to develop one's own leadership style based on the need and culture of the place.
 - vii. **Eminent personalities/achievers/renowned persons/inspiring and great personalities**

Eminent personalities/ Achievers / Renowned personalities:

- (a). **In case of socially relevant problems/ activities of SEA/SAA:** Eminent personalities/ achievers include district administrative officers, Eminent Social workers / NGOs, other inspiring and great personalities
- (b). **In case of Sports / Games and Cultural activities of SEA/SAA:** Eminent coaches/ trainers/gurus, achievers who represented/won state level/national level /international level competitions, other inspiring and great personalities.
- i. **For appointment to interact eminent personalities:** Student is expected to follow email etiquette rules and other appropriate polite communication etiquettes for getting appointment and time for interaction
- ii. On fieldwork, student is expected to demonstrate solid time management, organisational and note taking skills during fieldwork
- iii. **Ethics of fieldwork:** Fieldwork is an educational process with commitment to positive values. All fieldwork should be planned and conducted in a way that is ethical, responsible and safe, for people, students, visited communities, if any, and all other stakeholders. Student is expected to maintain integrity and honesty. Avoid bias and deception. Protect the rights and well-being of people involved in fieldwork. The privacy, confidentiality and respect for the eminent people interacted should be maintained and their time, inputs & guidance are to be acknowledged
- iv. Student is expected to take care of health and Safety practices for fieldwork and

- travel
- v. Student should remember that contrary to a *field trip or company visit*, **the emphasis in fieldwork is on acquiring skills**, and not on casually presenting theory and assessing.
 - vi. For the fieldwork, student shall go with a scientifically designed questionnaire and record the responses during interaction. These response sheets, along with geo-tagged pic of fieldwork (at the time of interaction & practise sessions, if any) shall be appended as annexures in the report to be submitted for course evaluation.
 - vii. **Feedback:** The learnings the student made out of interaction with eminent achievers shall be presented in the report as one of the chapters.
 - During feedback, the central focus is on the elaboration of the students' experience during fieldwork. Therefore, the student should create an end product, such as a demonstration/presentation and report in which they demonstrate a link between their experiences during fieldwork and the underlying theoretical concepts and ideas.
- (e) **Demonstration / Presentation and Report:** Student after presentation/ demonstration of his/her achievements/ work, shall get a certificate from the concerned nodal unit and submit a report, in the prescribed format, to the faculty counsellor for award of grade.
- (f) **Flow process for completion of SEA/SAA course:**
- vi. **Faculty counsellor approval:** In week (-1), in consultation with faculty counsellor, every student shall, identifies minimum of 4 activities listed under SEA/SAA activities, lists their priority and fills the same in ONLINE REGISTRATION FORM FOR SEA/SAA (received in their domain mail id) to Dean, Student Affairs. Dean, Student Affairs shall release the section wise allotment of SEA/SAA courses to students along with the details of supervising faculty of nodal centre. The allotment details shall be shared to the SEA/SAA coordinator and the student through domain mail id of the student
 - vii. **Identification of goals and preparation of action plan:** In week (1), the respective faculty coordinator(s) of nodal centres shall address the students allotted to them to educate them on fixing goals, plan of action for completion and evaluation. In consultation with nodal centre, based on the workflow of the allotted activity, every student shall identify the goals (of activity) & eminent personalities (to be visited during the field trip) and prepare action plan (oriented workflow) for attaining the identified goals.
 - viii. **Field work:** Under the guidance of nodal centre, student shall complete the field work, based on the action plan, with the progress continuously monitored by the faculty counsellor and the nodal centre.
 - ix. **Demonstration/ Presentation:** After completion of field work, student shall demonstrate/present his achievements (knowledge/skills gained during the activity) at the nodal centre in the presence of external experts/senior practitioners of the activity. After successful demonstration/presentation, the nodal centre shall provide a certificate of completion indicating that the student has completed the activity in the stipulated time.
 - x. **Report writing:** After successful demonstration/presentation, student shall write a 2-3-page report and submit the same to the faculty counsellor. The report shall emphasize knowledge, skills and qualities acquired through the SEA/SAA activities. It shall also include the influence of these activities on enhancing confidence, positive change in life, decision making, transforming choices into desired actions/outcomes.
- (g) **Assessment & Evaluation:** There shall be *only Continuous Internal Evaluation (CIE)* for

SEA/SAA. The SEA/SAA activities shall be evaluated at the end of the semester through respective evaluation processes, which shall include field work, presentation/ demonstration, submission of reports on the gathered data/information/ surveys, the details of which have been shown in below table. The department level SEA/SAA coordinator shall collect marks from the nodal centres and faculty counsellors, consolidate them, and submit the final grades to the examination branch, within one week of the last day of instruction. Evaluation of SEA/SAA activities shall be completed as and when students are ready, but not later than week (N+1).

The CIE for SEA/SAA is as follows:

Assessment	Maximum marks	Marks to be awarded
Goal setting, Planning & Knowledge Acquisition	20	Nodal centre
Field work	40	Nodal centre
Demonstration/Presentation	20	Nodal centre
Report submission	20	Faculty counsellor
Total	100	-

Note:

- (f) **Presentation/ Demonstration:** It is mandatory for the student to appear for demonstration and (or) oral presentation oral presentation to qualify for course evaluation. In case of presentation, student should prepare PPT with informative slides including the geo tagged photos of his/her field trips/interactions as per the schedule notified by the nodal centre. In case of demonstration, student must take timeslot from the nodal centre and demonstrate the skills learnt/improved during the allotted timeslot.
 - The necessary arrangements for demonstration shall be looked after the student in consultation with the coordinator with due permission from Head of the department.
- (g) **Report:** Each student is required to submit a well-documented report on the chosen SEA/SAA topic as per the format specified by *department level SEA/SAA coordinator*.
- (h) **Anti-Plagiarism Check:** The SEA/SAA report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.
- (i) **Requirements for passing the course:** A student is deemed to have passed SEA/SAA if he/she
 - a. successfully demonstrates/presents the skills attained at the end of course as per the schedule notified by the nodal centre, **and**
 - b. scores a minimum of 40 marks in the CIE of the course
- (j) **Supplementary examination:** If a student fails in SEA/SAA activity of a particular semester, he must complete the same by enrolling it in the next higher semesters.

Text / Reference book(s):

For knowledge acquisition, students shall refer to textbooks and web resources relevant to the course selected. Plan for fieldwork/practice sessions in coordination with SEA/SAA coordinator

EXPERT TALK SERIES-III			
Class: B.Tech. III -Semester	Branch: Common to all branches		
Course Code:	U24AE310	Credits:	1
Hours/Week (L-T-P-O-E):	0-0-0-1-1	CIE Marks :	100%
Total Number of Teaching Hours:	-	ESE Marks :	-
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i> CO1: identify real-world problems, different career paths, industry requirements, emerging job roles, business practices and exploit new opportunities by staying up-to-date with industry knowledge, trends and technology CO2: identify what 21st century employability-related skills and professional etiquette are must in a range of recruitment situations, what skills are absent in him/her, and demonstrate skill improvement CO3: interact with experts, exhibit confidence, demonstrate improved communication and networking abilities potentially leading to mentorship opportunities, internships, or even future job prospects CO4: demonstrate the generic competencies in making a well-documented report portraying knowledge, skills, qualities acquired through ETS sessions and impact of the expert talks			
In the 21st century, for successful career, degree alone won't suffice. Competencies are much more important. (a) You need to be aware of the real-world problems, industry working style, need to be confident and smart and you also need to know the tricks of the trade. (b) Learning from industry experts with real-world examples, is important to enhance your educational experience. (c) Enhanced graduate employability benefits all stakeholders. To effectively enhance employability and the immediacy of adding value to company/project, it is important that you are aware of what you are learning and its use in the workplace. The cognitive abilities viz., remember, understand, recall, and application of knowledge and other skills acquired in higher education can be maximised if you are clear on the purpose of your developed competencies and how to apply them in a range of complex situations. (d) Graduate employability could be enhanced through fostering lifelong learning, the development of a range of employability-related competencies and increased confidence and capacity in "reflecting on and articulating these capabilities and attributes in a range of recruitment situations". But how would you know all this without venturing into the industry? (a) The answer is Industry Expert Talk Series (ETS). Through ETS, we invite industry experts in different fields to deliver talks and interact with students. (b) Through Industry expert talks students get to know so much more that textbooks don't explain. (c) Students have the opportunity to learn from professionals who have achieved			

success in their respective fields. These speakers often share their personal experiences, case studies, and anecdotes, providing students with real-world examples and perspectives that go beyond theoretical concepts.

- (d) Our competency-focussed curriculum URR24 is designed to contribute greatly to the nurturing and development of each of these facets among students through ETS courses
- (e) ETS helps students gain improved industry engagement for an easier transition into the workplace, broader career progression opportunities and personal development.
- (f) In URR24 curriculum, Expert talk series (ETS) is offered as a course under **ability enhancement category of courses**.
- (g) Through ETS sessions, students get the chance to interact with industry regularly which helps them focus on the needs and requirements of current industry. This will not only enthuse the students with new ideas but also motivate them to understand what kind of 21st century skills are needed in industry and how they need to groom themselves.
- (h) Through ETS sessions, another benefit is that students learn the importance of soft skills like communication, presentation, email etiquettes, corporate grooming and dressing styles. Conversing with successful people is the biggest motivation and students gain in more ways than one through ETS sessions.
- (i) ETS enhances your learning in many ways for global opportunities for your career.
- (j) All in all, learning from industry experts, is a wonderful opportunity for student to getting acquainted with professional etiquette, acquiring professional knowledge, and getting to know the internal workings of an organization.
- (k) Salient features of ETS are hereunder:
 - (i) ETS is offered from I semester to VI semester.
 - (ii) ETS, in any given semester, is treated as one credit course
 - (iii) Students are required to earn six credits (from I to VI semester)
 - (iv) **Head, Centre for i²RE** shall be the **institute level ETS coordinator**
 - (v) Under this course, a minimum of 10 expert talks shall be organized in **online/offline mode** by the parent department / Centre for i²RE.
 - (vi) Each expert talk shall be for a minimum duration of 45 minutes (*but not exceeding 90 minutes*) followed by **online quiz/test** for 10 marks (10 MCQs/FiBs , *duration: 10-15 mins*), on the contents covered in the expert talk.
 - (vii) **The Head C-i²RE** shall share the marks obtained by the students in each of the quizzes / tests to the respective **department ETS coordinators**.
 - (viii) Each student shall attend a minimum of 6 expert talks and attempt the corresponding quizzes/ tests conducted at the end of the talks.
 - (ix) **Report on ETS:** At the end of semester, the student shall submit a well-documented report on the acquired knowledge and skills, in the prescribed format, to the department ETS coordinator.
 - (x) **Evaluation:** There shall be only continuous Internal Evaluation (CIE) for ETS for a maximum of 100 marks
 - (xi) The department ETS coordinator shall, in coordination with institute level ETS coordinator, submit the final scores to the CoE in week (N+1).

(l) The CIE for ETS is as follows:

Rubrics for evaluation of ETS

Quiz score (sum of best 6 quiz scores out of 10 quizzes. Each quiz evaluated for 10 marks)	60 marks
Attendance (out of 10 quizzes)	20 marks
Report in prescribed format (max 30% plagiarism)	20 marks
Total	100 marks

- ii. **Attendance:** Maximum of 20 marks shall be awarded based on the attendance maintained by the student over a maximum of 10 lectures.

$$\text{Marks for attendance} = \frac{\text{Number of expert talks attended fully}}{10} * 20$$

iii. **Supplementary Exam:**

- (a) Student has to register for ETS supplementary examination if he/she scores less than 40 marks in CIE
- (b) The ETS supplementary examination shall be conducted by the parent department, in physical mode, for 100 marks (MCQs/FiBs , duration: 2Hrs) on the content covered in ETS lectures.
- (c) Department ETS coordinator shall, in coordination with the institute level ETS coordinator, conduct the supplementary exam, and submit scores to the CoE
- (d) Exam material/resources for supplementary: Recorded videos of ETS arranged for that semester, which shall be made available on ETS webpage of institute website

IV-Sem Syllabi

(B.Tech CSE(Networks) URR24)

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	BSC	U24MH401D	Discrete Mathematics and Probability, Statistics	2	1	-	3	3
2	PCC	U24CN402	Database Management Systems	2	1	-	3	3
3	PCC	U24CN403	Design and Analysis of Algorithms	2	1	-	3	3
4	PCC	U24CN404	Internetworks and Virtualization	2	1	-	3	3
5	PCC	U24CN405	Python Programming	2	1	-	3	3
6	VAC	U24VA406B	Quantitative Aptitude and Logical Reasoning	2	-	-	2	2
7	SEC	U24SE407	Programming Skill Development Lab - 03 (DAA)			2	2	1
8	PCC	U24CN408	Database Management Systems Laboratory	-	-	2	2	1
9	PCC	U24CN409	Internetworks and Virtualization Laboratory	-	-	2	2	1
10	PCC	U24CN410	Python Programming Laboratory	-	-	2	2	1
11	VAC*	U24CY411*	Environmental Studies*	2*	-	-	2*	-
Total:				12	5	8	25	21

**For Lateral Entry Students Only*

*** Branch Specific Mathematics:**

Branch Specific Mathematics (Pool-4)			
S. No.	Course Code	Course Title	Common to
1.	U24MH401A	Numerical and Statistical Methods	CE
2.	U24MH401B	Applied Mathematics for Mechanical Engineering	ME
3.	U24MH401C	Applied Mathematics	EEE, ECE, ECI
4.	U24MH401D	Discrete Mathematics and Probability, Statistics	CSE, IT, CSN, CSO
5.	U24MH401E	Essential Mathematics and Statistics for Machine learning	CSM
6.	U24MH401F	Essential Mathematics and Statistics for Data science	CSD
7.	U24MH401X	Any other Course approved by BoS chair and Dean AA	-

@ Dean AA will allot the courses QALR (Stream-I), Soft and Interpersonal Skills (Stream-II), to the branches as per Stream-I and Stream-II.

DISCRETE MATHEMATICS AND PROBABILITY STATISTICS			
Class: B.Tech. IV -Semester		Branch: Common to CSE, CSN, CSO & IT	
Course Code:	U24MH401	Credits:	3
Hours/Week (L-T-P-E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : apply fundamentals of logic to solve various engineering problems CO2 : solve different types of enumeration problems and apply them to real-life scenarios CO3 : solve various graph theory problems and apply them to real-world applications CO4 : interpret the data using various statistical measures and probability distributions			
UNIT-I			9 Hrs
Foundation: Sets and operations on sets, Relations, Binary relations, Equivalence relations, Partial order relations, Hasse diagram and lattices, Digraphs, Adjacency matrices of binary relations Fundamentals of Logic: Propositions and connectives, Truth tables, Propositional functions, Logical inferences, First order logic, Predicate calculus and quantified logic Application: Transitive closure of a relation using Warshal's algorithm			
UNIT-II			9 Hrs
Elementary Combinatorics and Recurrence Relations: Basic concepts of permutations and combinations, Enumeration with unlimited repetition and applications, Enumeration with constrained repetitions and applications Generating function of sequences: Coefficients of generating function, Recurrence relations and its applications, Solutions of recurrence relations by method of substitution, Characteristic roots, Solving non-linear recurrence relations Application: Using recurrence relations find the computational complexity of binary search, Towers of Hanoi problem, and Sorting			
UNIT-III			9 Hrs
Graphs: Basic concepts, Isomorphism, Sub graphs, Trees and their properties, Spanning trees, Binary trees, Planner graphs, Euler's formula, Multi graphs and Eulerian circuits, Hamiltonian graphs, Chromatic number, Four color problem Applications: Find the shortest path of a network problem			
UNIT-IV			9 Hrs
Statistics: Correlation, Rank correlation, Regression – Linear regression equations Curve Fitting: Method of least squares –fitting of (i) Straight line (ii) Second degree parabola Probability: Random variables, Discrete and continuous probability distributions, mean and variance of a distribution, Binomial distribution, Poisson distribution, Normal and Exponential distributions Applications: Fitting of Binomial distribution, Poisson distribution to the given real time data			

Textbook(s):														
1. Mott. J.L, Kandel. K and, Baker. T.P., <i>Discrete Mathematics for Computer Scientists</i> , PHI 2/e, New Delhi,1999. (Unit I, Unit II and Unit III) 2. Grewal, B.S., <i>Higher Engineering Mathematics</i> , Khanna Publishers, 44/e, Delhi, 2017. (Unit IV)														
Reference Book(S):														
1. Gupta. S.C and Kapoor. V. K, <i>Fundamentals of Mathematical Statistics</i> , Sultan Chand & Sons, New Delhi, 2020. 2. Tremblay, J, P, Manohar.R <i>Discrete Mathematical Structures with Applications to Computer Science</i> , MGH New York, 1977 3. Zohar Manna., <i>Mathematical Theory of Computation</i> , , MGH, New Delhi 4. C. L. Liu , <i>Elements of Discrete mathematics</i> , 3/e, Tata Mc. Graw Hill,2008														
Web and Video link(s):														
1. https://onlinecourses.nptel.ac.in/noc25_cs26/course : NPTEL Video Lecture on Discrete Mathematics by Prof. Sudarshan Iyengar, IIT Ropar 2. https://onlinecourses.nptel.ac.in/noc25_ma33/preview?user_email=dsreddy.hari@gmail.com : 3. NPTEL Video Lecture on Introduction to Probability Theory and Statistics by Prof. S Dharmaraja, IIT Delhi														

Course Articulation Matrix (CAM):				U24MH401 : DISCRETE MATHEMATICS AND PROBABILITY										
				STATISTICS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24MH401.1	2	2	1	1	-	-	-	1	1	-	1		
CO2	U24MH401.2	2	2	1	1	-	-	-	1	1	-	1		
CO3	U24MH401.3	2	2	1	1	-	-	-	1	1	-	1		
CO4	U24MH401.4	2	2	1	1	-	-	-	1	1	-	1		
U24MH401		2	2	1	1	-	-	-	1	1	-	1		
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply fundamentals of logic to solve various engineering problems	SDG9	Industry, Innovation and Infrastructure	Using logical, analytical, and computational skills (algorithms, systems modelling) is essential for developing new technologies, automation, and AI-driven solutions

CO2	solve different types of enumeration problems and apply them to real-life scenarios	SDG9	Industry, Innovation and Infrastructure	Enumerative combinatorics (counting possibilities) is critical for optimization, efficiency, and resource allocation in industrial and logistical processes
CO3	solve various graph theory problems and apply them to real-world applications	SDG9	Industry, Innovation and Infrastructure	Graph theory is used to model and optimize transportation networks, power grids, and communication systems
CO4	interpret the data using various statistical measures and probability distributions	SDG4 & SDG9	Quality Education & Industry, Innovation and Infrastructure	Interpreting data using statistical measures and probability distributions involves summarizing dataset characteristics using descriptive metrics, determining the underlying distribution that generated the data, and justifying the choice by mapping the data type to the appropriate theoretical probability model

DATABASE MANAGEMENT SYSTEMS			
Class:B. Tech. IV – Semester		Branch:CSE(Networks)	
Course Code:	U24CN402	Credits:	4
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: design the databases using entity relationship model CO2 : apply queries to manage the data that can efficiently store and retrieve CO3: apply normalization techniques to reduce redundancy CO4: apply locking techniques for concurrent transactions to recover the database failures			
UNIT-I			9 Hrs
Databases and Database Users: Introduction, Characteristics of the database approach, the database system environment, Advantages of using a DBMS Database System Concepts and Architecture: Data models, Schemas and instances, Three- schema architecture and data independence, Classification of database management systems Data Modelling using the Entity-Relationship (ER) Model: High-level conceptual Data models for database design, Features of ER-Model, ER diagrams, The Enhanced Entity-Relationship (EER) Model, NO SQL			
UNIT-II			9 Hrs
The Relational Data Model, Relational Database Constraints: Relational model concepts, Relational constraints and the Relational database schemas, Update operations and dealing with constraint violations Basic Structured Query Language (SQL): SQL Data definition and data types, specifying constraints in SQL, Basic retrieval queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL Relational Database Design by ER-to-Relational Mapping: Relational database design using ER-to-Relational mapping, EER-to-Relational mapping			
UNIT-III			9 Hrs
The Relational Algebra and Relational Calculus: Basic relational algebra operations, Examples of queries in relational algebra, The tuple relational calculus Database Design Theory and Normalization: Informal design guidelines for relation schemas, Functional dependencies, Normal forms based on primary keys, General definitions of second and third normal forms, Boyce-Codd normal form Multivalued dependency and fourth normal form, Join dependencies and fifth normal Query Processing and Optimization: Translating SQL queries into relational algebra, Using heuristics in query optimization			

UNIT-IV	9 Hrs
Introduction to Transaction Processing Concepts and Theory: Introduction to transaction processing, Transaction and system concepts, Desirable properties of transactions, Characterizing Schedules Based on Serializability	
Concurrency Control Techniques: Two-Phase Locking techniques for concurrency control, Concurrency control based on Timestamp Ordering	
Database Recovery Techniques: Recovery concepts, NO-UNDO/REDO Recovery Based on deferred update, Recovery techniques based on immediate update, Shadow paging	
Textbook: 1. Ramez Elmasri and Shamkanth B. Navathe, <i>Fundamentals of Database Systems</i>, Pearson Education, 6th ed., 2010	
Reference Book(s): 1. Raghu Ramakrishnan and Johannes Gehrke, <i>Database Management Systems</i>, McGraw-Hill Education, 3rd ed., 2002 2. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, <i>Database System Concepts</i> McGraw-Hill Education, 3rd ed., 1997 3. Thomas Connolly and Carolyn Begg, <i>Database Systems</i>, Pearson Education, 3rd ed., 2003	
Web and Video link: https://onlinecourses.nptel.ac.in/noc22_cs91/preview NPTEL Video Lecture: Data Base Management System by Prof. Partha Pratim Das, Prof. Samiran Chattopadhyay, IIT Kharagpur	

Course Articulation Matrix (CAM):				U24CN402: DATABASE MANAGEMENT SYSTEMS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN402.1	2	1	2	1	-	-	-	1	1	-	1	2	1
CO2	U24CN402.2	2	1	2	1	-	-	-	1	1	-	1	2	1
CO3	U24CN402.3	2	1	2	2	-	-	-	1	1	-	1	2	1
CO4	U24CN402.4	2	1	1	1	-	-	-	1	1	-	1	1	1
U24CN402		2	1	1.75	1.25	-	-	-	1	1	-	1	1.75	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	design the databases using entity relationship model	SDG4	Quality Education	Provides foundational database knowledge and analytical skills essential for quality education and digital literacy

		SDG9	Industry, Innovation and Infrastructure	ER modeling supports the design of efficient and scalable information systems used in modern infrastructure
CO2	apply queries to manage the data that can efficiently store and retrieve	SDG9	Industry, Innovation and Infrastructure	Database design ensures reliable and scalable systems for industries
		SDG 16	Peace Justice and Strong Institutions	Data integrity and consistency are critical for transparent and accountable systems
CO3	apply normalization techniques to reduce redundancy	SDG 8	Decent Work and Economic Growth	Efficient data handling improves productivity and supports economic activities
		SDG9	Industry, Innovation and Infrastructure	Optimization techniques enhance performance of digital infrastructure
CO4	Transaction processing, concurrency, recovery	SDG9	Industry, Innovation and Infrastructure	Ensures reliable and fault-tolerant systems in industries
		SDG 16	Peace Justice and Strong Institutions	Secure and consistent transaction systems support governance, banking, and public service

DESIGN AND ANALYSIS OF ALGORITHMS			
Class: B. Tech. IV – Semester		Branch: CSE (Networks)	
Course Code:	U24CN403	Credits:	4
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : apply divide and conquer strategy for searching and sorting techniques with performance CO2 : analyze 0/1 Knapsack problem, optimal merge pattern and single source shortest path algorithms using greedy method and N-Queen problem, graph colouring problem using backtracking method CO3 : design of algorithms using dynamic programming approach to find the shortest path CO4 : analyze and categorize NP-Hard and NP-Complete problems for the classes of P and NP			
UNIT-I			9 Hrs
Introduction: Algorithm analysis, Performance analysis, Space complexity and time complexity, Big 'O' notation, Omega notation, Theta notation, Different mathematical approaches for solving time complexity of algorithms Sets and Disjoint Set Union: Introduction, Union, Find operations Divide and Conquer: General method, Binary search, Merge sort, Quick sort, Strassen's matrix multiplication			
UNIT-II			9 Hrs
Greedy Method: General method, Knapsack problem, Job sequencing with deadlines, Optimal storage on tapes, Optimal merge patterns, Single source shortest paths Backtracking: General method, N-Queens problem, Sum of subsets, Graph coloring problem			
UNIT-III			9 Hrs
Dynamic Programming Concepts: General method, Multistage graphs, All pairs shortest paths, Single source shortest paths Applications in Optimization Problems: Optimal binary search trees, String editing, 0/1 Knapsack problem, Reliability design problem, Travelling sales person problem			
UNIT-IV			9 Hrs
Branch and Bound: General method, Least cost (LC) search, The 15-puzzle problem, Control abstractions for LC search, 0/1 Knapsack problem, Travelling salesperson problem NP Hard and NP Complete Problems: Basic concepts, Nondeterministic algorithms, The classes NP-hard and NP-complete; COOK's theorem; NP-hard graph problems – Clique decision problem, Node cover decision problem, Traveling sales person decision problem			

Textbook:

1. E. Horowitz, S. Sahni, S. Rajasekaran, *Fundamentals of Computer Algorithms*, 2nd ed. Hyderabad, (Chapters 1 to 12)

Reference Book(s):

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, *Introduction to Algorithms*, 3rd ed., Prentice-Hall of India, New Delhi, 2010
2. Gajendra Sharma, *Design and Analysis of Algorithms*, 4th ed., Rajput: Khanna Publishing, 2019
3. S. Sridhar, *Design and Analysis of Algorithms*, 3rd ed., UK: Oxford University Press, India, 2015

Web and Video link:

https://onlinecourses.nptel.ac.in/noc19_cs47/preview; NPTEL Video Lecture on Design and analysis of algorithms by Prof. Madhavan Mukund Director Chennai Mathematical Institute H1, SIPCOT IT Park, Siruseri, Kelambakkam 603 103, INDIA

Course Articulation Matrix (CAM):				U24CN403: DESIGN AND ANALYSIS OF ALGORITHMS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN403.1	3	3	2	2	1	-	-	1	1	1	-	2	1
CO2	U24CN403.2	3	3	3	2	1	-	-	1	1	1	-	2	1
CO3	U24CN403.3	3	3	3	2	1	-	-	1	1	1	-	2	1
CO4	U24CN403.4	2	2	2	2	1	-	-	1	1	1	-	2	1
U24CN403		2.75	2.75	2.5	2	1	-	-	1	1	1	-	2	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply divide and conquer strategy for searching and sorting techniques with performance	SDG9	Industry, Innovation and Infrastructure	Efficient divide and conquer algorithms improve computational performance in large-scale systems such as databases, search engines, and network infrastructure, enabling scalable and innovative solutions
CO2	analyze 0/1 Knapsack problem, optimal merge pattern and single source shortest path algorithms using greedy method and N-Queen problem, graph colouring problem using backtracking method	SDG8	Decent Work and Economic Growth	Optimization and resource allocation problems help improve decision-making in logistics, scheduling, and business operations, supporting productivity and economic growth
CO3	design of algorithms using dynamic programming approach to find the shortest path	SDG11	Sustainable Cities and Communities	Dynamic programming techniques are used in route optimization, traffic management, and urban planning systems, contributing to efficient and sustainable city infrastructure
CO4	analyze and categorize NP-Hard and NP-Complete problems for the classes of P and NP	SDG4	Quality Education	Understanding computational complexity enhances problem-solving skills and theoretical knowledge, strengthening advanced education and research in computer science

INTERNETWORKS AND VIRTUALIZATION			
Class: B. Tech. IV – Semester		Branch: CSE (Networks)	
Course Code:	U24CN404	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: demonstrate the fundamental concepts, architecture, and addressing mechanisms used in computer networks and internetworking CO2: analyze communication protocols, packet delivery mechanisms, and control techniques used for reliable data transmission in networks CO3: apply routing concepts, algorithms, and networking protocols to establish and manage communication between interconnected networks CO4: evaluate network virtualization, address translation, and network management techniques for secure and efficient network administration			
UNIT-I			9 Hrs
Introduction And Overview: The motivation for internetworking, The TCP/IP internet, internet services, History and scope, IAB, RFC, Internet growth, New version of IP, IPv4 and IPv6 relationship, IPv6 migration, Dual stack systems Internetworking Concept and Architectural Model: Introduction, IPv4 and IPv6 relationship, IPv6 migration, Dual stack systems, Application-level interconnection, Network-level interconnection, Properties of internet, Internet architecture, Interconnection of multiple networks with IP routers, The user 's view Internet Addressing: Universal host identifiers, IPv4-Classfull addressing scheme, Dotted decimal notation used with IPv4, IPv4 Subnet addressing, Fixed length subnets, Variable length subnets, classless addressing scheme, address blocks and CIDR slash notation, IPv6-Addressing scheme, Colon hexadecimal notation, Address space assignment, Embedding IPv4 address in IPv6 for transition			
UNIT-II			9 Hrs
Mapping Internet Address to Physical Address: Introduction, Address resolution problem, Types of hardware addresses, Address Resolution Protocol (ARP)- Cache, Refinements, Implementation, Encapsulation and identification, Message format, Automatic ARP cache revalidation, Reverse Address resolution protocol (RARP), Proxy ARP Internet Protocol Connectionless Datagram Delivery: Purpose and importance, The IP datagram, Datagram: Type of service and differentiated services, Encapsulation, Size, Network MTU, Fragmentation, Reassembly, Header fields, Time to live, Hop limit Internet Protocol Error and Control Messages (ICMP): Introduction, ICMP, Message delivery, Conceptual layering, Message format, ICMP message types used with IPv4& IPv6, Testing destination reachability and status, Echo request and reply message format			

UNIT-III	9 Hrs
Routing Architecture: Introduction, Origin of forwarding tables, Forwarding with partial information, original internet architecture and cores, Peer back bones, Automatic route Propagation and a FIB, Distance-Vector (Bellman-Ford) routing, Link state (SPF) Routing Routing Among Autonomous Systems: Introduction, Scope of route update protocol, Autonomous system concept, Exterior gateway protocols and reachability, Border Gateway Protocol (BGP)- Characteristics, Functionality and message types, Message header, OPEN message, UPDATE message Routing Within an Autonomous System: Introduction, Static Vs Dynamic routes, Routing information Protocol (RIP), Slow convergence problem, RIP message format, Fields in a RIP message, RIP for IPv6 (RIPng), Open Shortest Path First (OSPF)- OSPFv2 Message formats, OSPFv3 to support IPv6	
UNIT-IV	9 Hrs
Network Virtualization: Virtualization, Virtual Private Network (VPN), VPN Tunnelling and IP-in-IP Encapsulation, VPN Addressing and Forwarding, Network Address Translation (NAT), Translation table creation, Variant of NAT, Interaction between NAT and ICMP, Interaction between NAT and Applications, Overlay networks Network Management: Introduction, The level of management protocols, Architectural model, Protocol framework, Examples of MIB variables, Structure of management information, Structure and representation of MIB object names, MIB changes and additions for IPv6, Simple network management protocol (SNMP), SNMP Message format, Formal definitions using ASN.1, An example encoded SNMP message, Security in SNMPv3	
<u>Textbook:</u> 1. Douglas. E. Comer, <i>Internetworking with TCP/IP Vol I: Principles, Protocols, and Architecture</i>, 6th ed., United States of America: Pearson Education, 2014	
<u>Reference Book(s):</u> 1. James F. Kurose, Keith W. Ross, <i>Computer networking, A Top Down approach</i>, 6th ed., United States of America: Pearson Education, 2013 2. Shah, Ambawade, Mehra, Agarwal, <i>Advanced Computer Networks</i>, revised., New Delhi, Dream tech, Press, 2011	
<u>Web and Video link(s):</u> 1. https://onlinecourses.nptel.ac.in/noc22_ee116/preview; NPTEL Video Lecture on <i>Advance Computer Networks</i> by Dr. Shanmughaneeti, National Institute of Technical Teachers Training, NIITR 2. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs35; NPTEL Video Lecture on <i>Computer Networks and Internet protocol</i> by Dr. Prof. Soumya Kanti Ghosh, Prof. Sandip Chakraborty, IIT Kharagpur	

Course Articulation Matrix (CAM):				U24CN404: INTERNETWORKS AND VIRTUALIZATION										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN404.1	3	2	-	-	1	-	-	-	-	-	1	3	2
CO2	U24CN404.2	3	3	1	2	1	-	-	-	-	-	1	3	3
CO3	U24CN404.3	3	3	3	2	3	-	-	1	1	-	1	3	3
CO4	U24CN404.4	2	2	3	2	3	1	1	1	1	-	1	2	3
U24CN404		2.75	2.5	2.33	2	2	1	1	1	1	-	1	2.75	2.75
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	demonstrate the fundamental concepts, architecture, and addressing mechanisms used in computer networks and internetworking	SDG 4	Quality Education	Understanding networking fundamentals develops technical competency and digital literacy, enabling students to acquire industry-relevant knowledge and lifelong learning skills required for the modern information society
CO2	analyze communication protocols, packet delivery mechanisms, and control techniques used for reliable data transmission in networks	SDG 9	Industry, Innovation and Infrastructure	Analysis of network protocols and transmission mechanisms helps students understand the design of robust communication infrastructures that support innovation, industrial automation, and digital transformation
CO3	apply routing concepts, algorithms, and networking protocols to establish and manage communication between interconnected networks	SDG 9	Industry, Innovation and Infrastructure	Routing and internetworking technologies form the backbone of modern digital infrastructure. Applying these concepts contributes to the development of scalable, reliable, and efficient network systems that support industrial and societal connectivity
CO4	evaluate network virtualization, address translation, and network management techniques for secure and efficient network administration	SDG 9	Industry, Innovation and Infrastructure	Network virtualization and management technologies improve resource utilization, reduce hardware dependency, optimize energy consumption, and enable secure, sustainable, and cost-effective deployment of networking services
		SDG 12	Responsible Consumption and Production	

PYTHON PROGRAMMING			
Class: B. Tech. IV – Semester		Branch: CSE (Networks)	
Course Code:	U24CN405	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : apply syntax, control statements, operators and functions for writing basic python programs CO2 : design programs using collections, namespaces, packages, strings and regular expressions CO3 : develop python programs using object oriented programming principles, files & database handling mechanisms CO4 : build visualization graphs with Matplotlib and adapt packages like Numpy, Pandas for statistical analysis and data handling			
UNIT-I			9 Hrs
Introduction: Features of python, The future of python, Writing and executing python programs Python Preliminaries: Literal constants, Variables and identifiers, Data types, Input operation, Comments, Reserved words, Indentation, Operators, Expressions in python, Type conversion Decision Control Statements: Selection/Conditional branching statements, Loop structures/ iterative statements, Nested loop, the continue statement, the pass statement, the else statement used with loops Functions: Function definition, Function call, Variable scope and lifetime, the return statement, Advances in defining in functions, Lambda functions, Recursive functions			
UNIT-II			9 Hrs
Python Strings: String operations, String formatting operator, Built-in string methods and functions, slice operation, ord() and Chr() functions, in and not in operators, Comparing strings, Regular expressions and meta characters Data Structures: Lists, Tuple, Sets, Dictionaries Modules and Packages: The import statement, Naming modules ,dir()function, Packages in Python Standard library modules , globals() and locals() reload()			
UNIT-III			9 Hrs
Python Object Oriented Programming: Classes and objects, The __init__ () method, The self-parameter, Class variables and object variables, Public and private data members, Private methods, Calling a class method from another class method, Built-in class attributes, Class methods, Static methods, Inheritance and Polymorphism Error and Exception handling: Introduction to errors and exceptions, Handling exceptions, Multiple except blocks, Built-in and user-defined exceptions, The finally block File Handling: Opening and closing files, Reading and writing files, File positions, Renaming and deleting files, Directory methods Database Connectivity: SQLite, Creating a database table, Insert and retrieve data from database			

UNIT-IV	9 Hrs
NumPy: The basics of NumPy arrays, Array Shape, Array Reshape, Array Iterating, Join, Split, Array filter Data Manipulation with Pandas: Introduction to Pandas, Installation and importing Pandas, Pandas data structures(Series,Dataframes), reading data from CSV file, data indexing and selection, data cleaning, data analysis, combining datasets, aggregation and grouping Data Visualization Using Matplotlib: Introduction to Matplotlib, Pyplot, Plotting, Markers, Line, Labels, Grid, Subplot, Scatter, Bars, Histograms, Pie charts	
Textbook(s): 1. Reema Thareja, Python Programming using problem solving approach, 1st ed., New Delhi: Oxford University Press, 2017. (Chapter 1 to 7) 2. Jake VanderPlas, Python Data Science Handbook- Essential Tools for Working with Data, 1st ed., California: O'Reilly Media Inc., 2016. (Chapter 2 to 4)	
Reference Book(s): 1. Dr.Charles R. Severance, Python for Everybody-Exploring Data Using Python, 1st ed., USA: open book, 2016 2. David Beazley, Python Cookbook, 3rd ed., California: O'Reilly Media, Inc., 2013 3. Caleb Hattingh, 20 Python Libraries You Aren't Using (But Should), 2nd ed., California: O'Reilly Media Inc., 2016 4. Magnus Lie Hetland, Beginning: from Novice to Professional, 3rd ed., New York City: A press, 2005	
Web and Video link(s): 1. https://onlinecourses.nptel.ac.in/noc23_cs99/ NPTEL Video Lecture on Python For Data Science by By Prof. Ragunathan Rengasamy, IIT Madras 2. https://onlinecourses.nptel.ac.in/noc25_cs17/ NPTEL Video Lecture on Data Analytics with Python By Prof. A Ramesh, IIT Roorkee 3. https://onlinecourses.nptel.ac.in/noc25_cs69/ NPTEL Video Lecture on The Joy of Computing using Python By Prof. Sudarshan Iyengar , IIT Ropar	

Course Articulation Matrix (CAM):				U24CN405 : PYTHON PROGRAMMING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN405.1	1	1	1	1	2	1	-	1	1	-	1	2	1
CO2	U24CN405.2	1	1	2	1	2	1	-	1	1	-	1	2	1
CO3	U24CN405.3	2	2	2	2	3	1	-	1	1	-	1	2	2
CO4	U24CN405.4	2	2	2	2	3	1	-	1	1	-	1	2	2
U24CN405		1.5	1.5	1.75	1.5	2.5	1	-	1	1	-	1	2	1.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Apply syntax, control statements, operators and functions for writing basic python programs	SDG4	Quality Education	Students develop fundamental programming skills that form the basis for computational thinking and problem-solving. These skills contribute to digital literacy and support the development of educational tools and learning applications, thereby enhancing access to quality education
CO2	Apply modules, packages and stings regular expressions and data structures to solve problems using python	SDG9	Industry, Innovation and Infrastructure	Advanced Python features like modules, regular expressions, and data structures help build scalable and efficient software solutions, supporting innovation in industries such as automation, data processing, and digital infrastructure development
CO3	develop python programs using object oriented programming principles, Exception handling, files & database handling mechanisms	SDG11	Sustainable Cities and Communities	Robust software systems developed using OOP, file handling, and databases enable smart city applications such as traffic management, resource allocation, and urban data systems, contributing to sustainable and efficient communities
CO4	build visualization graphs with Matplotlib and adapt packages like Numpy, Pandas for statistical analysis& data visualization	SDG9	Industry, Innovation and Infrastructure	Data analysis and visualization tools like NumPy, Pandas, and Matplotlib support data-driven decision-making in industries, research, and infrastructure planning, promoting innovation and efficient resource utilization

QUANTITATIVE APTITUDE AND LOGICAL REASONING			
Class: B.Tech. IV -Semester		Branch: Common to all Branches	
Course Code:	U24VA406A	Credits:	2
Hours/Week (L-T-P-O-E):	2-0-0-2-4	CIE	60 %
Total Number of Teaching Hours:	24 Hrs	ESE	40 %
Course Learning Objectives (LOs): <i>This course will develop students' knowledge in /on...</i> LO1: quantitative aptitude & problem-solving skills LO2: computation of abstract quantitative information LO3: application of basic mathematics skills & critical thinking to draw conclusions LO4: evaluation of validity & possible biases in arguments presented in authentic contexts			
UNIT-I			6 Hrs
Quantitative Aptitude-I: Number system, Averages, Percentages, Ratios & proportions, Time, Speed & distance, Time and work			
UNIT-II			6 Hrs
Quantitative Aptitude-II: Simple interest, Compound interest, Profit & loss, Ages, Permutations & Combinations, Probability			
UNIT-III			6 Hrs
Logical Reasoning-I: Series completion, Analogy, Coding and decoding, Blood relations, Number, Ranking & Time sequence test, Linear & Circular arrangements			
UNIT-IV			6 Hrs
Logical Reasoning-II: Data sufficiency, Logical Venn diagram, Syllogisms, Statement & Arguments, Statement & Assumptions, Direction sense test			
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to...</i> CO1: apply arithmetic concepts such as averages, percentages, ratios, and time-based calculations to solve real-life quantitative problems CO2: analyze and solve problems involving financial, arithmetic and probability using structured quantitative methods CO3: identify patterns and apply deductive reasoning to solve series, coding-decoding, and arrangement-based logical problems CO4: evaluate logical statements, assess validity, and draw conclusions using tools like syllogisms, Venn diagrams, and argument analysis			
Note: Students should go through the QALR course supplementary material made available on online learning platform - Contents covered in class shall be practiced through the material available on the online learning platform. At home practice problems and practice tests shall be made available on the online learning platform - Tutorial classes shall be conducted on the online learning platform and hence students shall attend the tutorial classes with laptop/tab - All assessments shall be conducted through online learning platform			

Textbook(s):

1. **R S Agarwal**, *Quantitative Aptitude for Competitive Examinations*, 3rd ed., New Delhi: S. Chand Publications, 2019. (Chapters 1,6,7,8,10,11,12,15,17,21,22,30,31 - for Unit I & II)
2. **R S Agarwal**, *A Modern Approach to Verbal and Non-Verbal Reasoning*, 3rd ed., New Delhi: S. Chand Publications, 2019. (Chapters Section I: 1,3,4,5,6,8,16, Section II: 2,3 - for Unit III & IV)

Reference Book(s):

1. **Dinesh Khattar**, *Quantitative Aptitude for Competitive Examinations*, 1st ed., New Delhi: Pearson India, 2019.
2. **Nishit K Sinha**, *Reasoning for Competitive Examinations*, 1st ed., New Delhi: Pearson India, 2019.
3. **R. N. Thakur**, *General Intelligence and Reasoning*, 1st ed., New Delhi: McGraw Hill Education, 2017.

Course Articulation Matrix (CAM):		U24VA406:A QUANTITATIVE APTITUDE AND LOGICAL REASONING												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24VA406A.1	1	2	-	1	-	-	-	-	-	-	1	1	-
CO2	U24VA406A.2	1	2	-	1	-	-	-	-	-	-	1	1	-
CO3	U24VA406A.3	-	1	-	2	-	2	-	-	-	-	1	1	-
CO4	U24VA406A.4	-	1	-	2	-	2	-	-	-	-	1	1	-
U24VA406A		1	1.5	-	1.5	-	2	-	-	-	-	1	1	-
3 - HIGH, 2 - MEDIUM, 1 - LOW														

PROGRAMMING SKILL DEVELOPMENT LAB-3			
Class: B.Tech. IV-Semester		Branch:CSE(Networks)	
Course Code:	U24SE407	Credits:	1
Hours/Week (L-T-P-E):	0-0-2-4	CIE:	100%
Total Number of Lab Hours:	36 Hrs	ESE:	-
Course Learning Outcomes (COs): After completion of this course, the students should be able to ... CO1: implement programs on operators and control structures. CO2: develop programs using arrays, strings, exception handling and multithreading CO3: build programs using binary trees, binary search trees. CO4: develop programs using spanning trees, searching, sorting.			
LABORATORY COMPONENT			
Sl.NO	List of Experiments		
1	Implementation of operators and data types using java.		
2	Implementation of control statements using java.		
3	Implementation of loops using java.		
4	Implementation of simple arrays and strings using java.		
5	Implementation of arrays and strings using java.		
6	Implementation of functions and recursion using java.		
7	Implementation of exceptions using java.		
8	Implementation of multithreading using java.		
9	Implementation of binary tree using java.		
10	Implementation of binary search tree using java.		
11	Implementation of spanning tree using java.		
12	Implementation of searching and sorting using java.		
Textbook(s): 1. Herbert Schildt, <i>Java The Complete Reference</i> , 9th ed.,New Delhi: McGraw-Hill Education India Pvt. Ltd, 2014 2. Debasis Samanta, <i>Classic Data Structures</i> , 2nd ed., New Delhi: Prentice Hall India, 2009 (Chapters 3 to 8, 10, 11)			
Reference Book(s): 1. Kathy Sierra and Bert Bates, <i>Head First Java</i> , 2nd ed.,Boston: O'Reilly Publications, 2013 2. Uttam K. Roy, <i>Advanced JAVA Programming</i> , 1st ed.England: Oxford Publication, 2013 3.Balaguruswamy , <i>Programming with Java : A Primer</i> ,6th ed., New Delhi: McGraw-Hill Education India Pvt. Ltd, 2019 4. Tanweer Alam , <i>Internet and Java Programming</i> ,1st ed.,New Delhi: Khanna Publishing House,2010 5. Reema Thareja, <i>Data Structures Using C</i> , 2nd ed., Noida: Oxford University Press, 2014 6. E Balagurusamy, <i>Data Structure Using C</i> , 1st ed. New Delhi: McGraw Hill Education, 2017 7. Richard F. Gilberg and Behrouz A. Forouzan, <i>Data Structures: A Pseudo code Approach with C</i> , 2nd ed., Noida: Cengage Learning, 2007 8.Yashavant P. Kanetkar, <i>Data Structure Through C</i> , 2nd ed., New Delhi: BPB Publications, 2003			

Course Articulation Matrix (CAM):				U24SE407: PROGRAMMING SKILL DEVELOPMENT LAB-3										
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24SE407.1	1	1	1	1	-	-	-	1	1	-	1	1	2
CO2	U24SE407.2	2	2	2	1	-	-	-	1	1	-	1	1	2
CO3	U24SE407.3	2	2	2	1	-	-	-	1	1	-	1	1	2
CO4	U24SE407.4	2	2	2	1	-	-	-	1	1	-	1	1	2
U24SE407		1.75	1.75	1.75	1	-	-	-	1	1	-	1	1	2

DATABASE MANAGEMENT SYSTEMS LABORATORY			
Class: B. Tech. IV – Semester		Branch:CSE(NETWORKS)	
Course Code:	U24CN408	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: design entity relationship diagrams, implement SQL queries to create and manipulate data in Database by enforcing constraints			
CO2 : implement various database objects using SQL Queries			
CO3: implement block structured programming with cursors to enable traversal over the records of the database redundancy and maintain the performance of database			
CO4: implement pre-compiled stored programs, run-time errors checking ,database objects collection in PL/SQL high-level security using triggers			
Experiment-1			
1. Design Entity relationship diagrams of a database			
Experiment-2			
2. Queries on Data definition language (DDL), Data manipulation Language (DML), Transaction control language (TCL) and Data control language (DCL) commands			
Experiment-3			
3. Queries on column level and table level constraints			
Experiment-4			
4. Queries using built-in functions of NUMBER, CHARACTER, DATE datatypes			
Experiment-5			
5. Queries on single row functions and operators and aggregate functions			
Experiment-6			
6. Queries on joins and nested queries			
Experiment-7			
7. Write SQL statements to create simple, composite indexes, user defined data types, views, sequences			
Experiment-8			
8. Write sample PL/SQL programs using conditional and iterative statements			
Experiment-9			
9. Write PL/SQL programs using cursors and parameterized cursors			
Experiment-10			
10. Write PL/SQL programs to handle exceptions			
Experiment-11			
11. Write PL/SQL programs using stored procedures and functions			
Experiment-12			

12. Write PL/SQL programs for creating Triggers

Textbook:

1. Ramez Elmasri and Shamkanth B. Navathe, *Fundamentals of Database Systems*, Pearson Education, 6th ed., 2010

Reference Book(s):

1. Raghu Ramakrishnan and Johannes Gehrke, *Database Management Systems*, McGraw-Hill Education, 3rd ed., 2002
2. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, *Database System Concepts* McGraw-Hill Education, 3rd ed., 1997
3. Thomas Connolly and Carolyn Begg, *Database Systems*, Pearson Education, 3rd ed., 2003

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc22_ee116/preview; NPTEL Video Lecture on Dital Image Processing by Prof. Prabir Kumar Biaswas, Professor of EEE, IIT Kharagpur

Laboratory Manual:

Database Management Systems Laboratory Manual and Record Book, Department of CSE(Networks), KITSW

Course Articulation Matrix (CAM):				U24CN408 : DATABASE MANAGEMENT SYSTEMS LAB										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN408.1	2	1	2	1	1	-	-	1	1	-	1	2	1
CO2	U24CN408.2	2	1	2	1	1	-	-	1	1	-	1	2	1
CO3	U24CN408.3	1	1	1	1	1	-	-	1	1	-	1	1	1
CO4	U24CN408.4	2	1	2	1	1	-	-	1	1	-	1	2	2
U24CN408		1.75	1	1.75	1	1	-	-	1	1	-	1	1.75	1.25
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Design ER diagrams and implement SQL queries to create and manipulate data with constraints	SDG 9	Industry, Innovation and Infrastructure	Database design and structured data management support development of reliable and scalable digital infrastructure
CO2	Implement various database objects using SQL queries	SDG 9	Industry, Innovation and Infrastructure	Efficient database objects improve system performance and contribute to robust software and industrial applications

CO3	Implement block structured programming with cursors to manage data traversal and reduce redundancy	SDG 12	Responsible Consumption and Production	Optimizing database performance and reducing redundancy promotes efficient use of computational resources
CO4	Implement stored programs, error handling, and security mechanisms using PL/SQL and triggers	SDG 16	Peace, Justice and Strong Institutions	Ensures secure data handling, integrity, and access control in information systems

INTERNETWORKS AND VIRTUALIZATION LABORATORY			
Class: B. Tech. IV – Semester		Branch: CSE (Networks)	
Course Code:	U24CN409	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs)			
<i>After completion of this course, the students should be able to,</i>			
CO1: install, configure, and utilize network simulation tools to create and analyze basic network topologies and communication processes CO2: configure IP addressing schemes, networking devices, and diagnostic utilities to establish and troubleshoot network connectivity in LAN environments CO3: design, implement, and evaluate routing solutions using static and dynamic routing protocols for communication across interconnected networks CO4: implement and analyze advanced networking services including VPN, NAT, SNMP, ARP, ICMP, and protocol data units (PDUs) to ensure secure, efficient, and manageable network operations			
Experiment-1 (UNIT-I)			
1. a) Installing and configuring network simulation tool—Cisco Packet Tracer b) Explore Packet Tracer tool Real-Time mode c) Explore physical and logical workspace			
Experiment-2 (UNIT-I)			
1. a) Identifying different networking devices Hub, Switch, Router b) Configure IPv4 address on a computer (IP, Subnet, Gateway, Primary DNS, Secondary DNS) c) Implement basic network commands (1) Ping (2) Traceroute (3) nslookup (4) Pathping			
Experiment-3 (UNIT-I)			
1. Design a simple LAN network with two PCs PC1 and PC2, connect with a switch and check network connectivity between PC1 and PC2			
Experiment-4 (UNIT-I)			
1. Visualize and analyze a PDU in a network with Packet Tracer			
Experiment-5 (UNIT-II)			
1. ARP analysis over a device connected to internet.			
Experiment-6 (UNIT-II)			
1. Design a network and analyze ICMP message			
Experiment-7 (UNIT-III)			
1. Design and configure a network with static route.			
Experiment-8 (UNIT-III)			
1. Design and configure a network using DVRPRIP			
Experiment-9 (UNIT-III)			
1. Design and configure a network using OSPF link state routing protocol			

Experiment-10 (UNIT-IV)
1. Design and configure a VPN using Cisco Packet Tracer or Wireshark
Experiment-11 (UNIT-IV)
1. Design and configure a NAT network using Cisco Packet Tracer
Experiment-12 (UNIT-IV)
1. Analyze SNMP messages in a network using Cisco Packet Tracer
Textbook:
1. Douglas. E. Comer, Internetworking with TCP/IP Vol I: Principles, Protocols, and Architecture, 6th ed., United States of America: Pearson Education, 2014
Reference Book(s):
1. James F. Kurose, Keith W. Ross, Computer networking, A Top Down approach, 6th ed., United States of America: Pearson Education, 2013
2. Shah, Ambawade, Mehra, Agarwal, Advanced Computer Networks, revised., New Delhi, Dream tech, Press,2011
Laboratory Manual:
<i>Internetworks and Virtualization Laboratory Manual, Department of CSE (Networks), KITSW</i>

Course Articulation Matrix (CAM):				U24CN409: INTERNETWORKS AND VIRTUALIZATION LABORATORY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN409.1	3	2	1	2	3	-	-	-	-	-	1	3	2
CO2	U24CN409.2	3	3	2	2	3	-	-	1	1	-	1	3	3
CO3	U24CN409.3	3	3	3	3	3	-	-	1	1	-	1	3	3
CO4	U24CN409.4	3	3	3	3	3	1	1	1	1	-	1	2	3
U24CN409		3	2.75	2.25	2.5	3	1	1	1	1	-	1	2.75	2.75
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	install, configure, and utilize network simulation tools to create and analyze basic network topologies and communication processes	SDG 4 & SDG 9	Quality Education Industry, Innovation & Infrastructure	The use of network simulation tools such as Cisco Packet Tracer provides practical and technology-enabled learning opportunities, strengthening students' understanding of networking concepts and enhancing digital competencies required in professional environments. It promotes experiential learning and skill development aligned with quality technical education. Simulation of network infrastructures enables students to understand the design and operation of communication systems that support modern industrial and technological innovations.

CO2	configure IP addressing schemes, networking devices, and diagnostic utilities to establish and troubleshoot network connectivity in LAN environments	SDG 4 SDG 9	Quality Education Industry, Innovation & Infrastructure	Hands-on implementation of networking concepts enhances technical proficiency, problem-solving abilities, and industry-readiness among students Network configuration and troubleshooting skills contribute to the development and maintenance of reliable communication infrastructure. These competencies support efficient operation of digital systems essential for industrial growth and technological advancement
CO3	design, implement, and evaluate routing solutions using static and dynamic routing protocols for communication across interconnected networks	SDG 4 SDG 9	Quality Education Industry, Innovation & Infrastructure	The practical application of routing concepts strengthens analytical and design skills necessary for lifelong professional development. Routing technologies form the backbone of modern communication networks. Designing and evaluating routing solutions develops the expertise required to build scalable, resilient, and efficient network infrastructures that support digital transformation and innovation
CO4	implement and analyze advanced networking services including VPN, NAT, SNMP, ARP, ICMP, and protocol data units (PDUs) to ensure secure, efficient, and manageable network operations	SDG 4 SDG 9 SDG 12 SDG 16	Quality Education Industry, Innovation & Infrastructure Responsible Consumption & Production Peace, Justice & Strong Institutions	Develops practical networking knowledge, digital skills, and professional competencies through hands-on laboratory activities Advanced networking services improve the efficiency, scalability, and reliability of communication infrastructures. The implementation of secure networking technologies supports innovation and robust digital ecosystems Technologies such as VPNs, NAT, and network management services optimize network resource utilization, reduce unnecessary hardware requirements, and improve operational efficiency, thereby promoting sustainable use of technological resources Secure communication mechanisms and network management practices contribute to information security, data privacy, and trustworthy digital systems, which are essential for secure institutions and responsible governance in the digital age.

PYTHON PROGRAMMING LABORATORY			
Class: B. Tech. IV – Semester		Branch: CSE (Networks)	
Course Code:	U24CN410	Credits:	1
Hours/Week (L-T-P- E):	2-1-0-2	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : develop and test python programs using operators, type conversion, control statements & functions			
CO2 : implement Python concepts including namespaces, packages, string handling methods, regular expressions, and data structures			
CO3 : develop reliable Python applications by integrating object-oriented constructs, file handling, database operations, and exception handling techniques			
CO4 : apply Python-based libraries such as Matplotlib for data visualization and NumPy & Pandas for efficient data manipulation and analysis			
Experiment-1 (UNIT-I)			
1. Demonstrate the setup and basic usage of Python by completing the following tasks - Installation of Python and verifying PATH environment variable - Running instructions in Interactive interpreter and a python script - Executing instructions in Python Interactive Interpreter - Running python scripts in Command Prompt - Running python scripts in IDLE - Write a program to demonstrate importance of indentations - raise indentation error and correct it - Write a program to take input text as command line argument and display it on screen			
Experiment-2 (UNIT-I)			
2. Develop a series of Python programs to perform basic mathematical and logical operations using conditional statements, loops, and command line arguments - Write a program that takes 2 numbers as command line arguments and print its sum - Write a program to check whether the given number is even or odd - Write a program to calculate GCD of 2 numbers - Write a program to find Exponentiation (Power) of a number - Write a program to find given year is leap year or not - Write a program to develop a simple calculator			
Experiment-3 (UNIT-I)			
3. Design and implement a series of Python programs that demonstrate the use of loops, recursion, and control structures to solve basic mathematical problems. Perform the following tasks: - Write a program to find the Factorial of a given number - Write a program to evaluate the Fibonacci series for a given number <u>n</u> - Write a program to demonstrate tuple, set and related functions - Write a program to demonstrate dictionaries			

e) Write a program to find the Armstrong for a given number f) Write a program to find sum of N numbers g) Write a program to take a number as input, and print countdown from that number to zero (use while loop) h) Write a program to find circulating π values
Experiment-4 (UNIT-II)
4. Demonstrate the concept of modular programming in Python by implementing and using modules and packages. a) Write a program to implement a module using import statement (Use python source file as a Module and implement import statement another python source files) b) Write a program to implement from, import statement c) Write a program to implement dir() function d) Write a program to demonstrate packages in python
Experiment-5 (UNIT-II)
5. Write a Python program to perform various string operations and manipulations
Experiment-6 (UNIT-II)
6. Develop a Python program to demonstrate various string operations and list manipulations using functions and built-in methods
Experiment-7 (UNIT-III)
7. Write Python programs to explore and demonstrate the use of advanced data types and pattern matching a) Write a program to demonstrate tuple, set and related functions b) Write a program to demonstrate dictionaries c) Write a program to demonstrate RegEx functions d) Write a program to demonstrate regular expressions using Meta characters
Experiment-8 (UNIT-III)
8. Develop Python programs to demonstrate object-oriented programming concepts and file handling operations a) Demonstrate the creation and usage of classes and objects b) Show the difference and usage of class methods and static methods c) Implement inheritance to show how one class can derive from another d) Perform file handling operations using python
Experiment-9 (UNIT-III)
9. Write Python programs to demonstrate database connectivity using SQLite a) Install and verify SQLite Connector for Python b) Install and verify SQLite Connector for Python c) Install and verify SQLite Connector for Python d) To connect check SQLite Database connectivity e) To retrieve and display data from a table f) To insert data into a table g) To delete rows in a table

Experiment-10 (UNIT-IV)
10. Write a Python program to demonstrate the basic functionalities of NumPy
Experiment-11 (UNIT-IV)
11. Write a Python program to demonstrate basic operations using the Pandas library
Experiment-12 (UNIT-IV)
12. Write a Python program to demonstrate basic plotting using the Matplotlib library
Textbook(s):
1. Reema Thareja, Python Programming using problem solving approach, 1st ed., New Delhi: Oxford University Press, 2017. (Chapter 1 to 7) 2. Jake VanderPlas, Python Data Science Handbook- Essential Tools for Working with Data, 1st ed., California: O'Reilly Media Inc., 2016. (Chapter 2 to 4)
Reference Book(s):
1. Dr.Charles R. Severance, Python for Everybody-Exploring Data Using Python, 1st ed., USA: open book, 2016 2. David Beazley, Python Cookbook, 3rd ed., California: O'Reilly Media, Inc., 2013 3. Caleb Hattingh, 20 Python Libraries You Aren't Using (But Should), 2nd ed., California: O'Reilly Media Inc., 2016 4. Magnus Lie Hetland, Beginning: from Novice to Professional, 3rd ed., New York City: A press, 2005
Web and Video link(s):
https://onlinecourses.nptel.ac.in/noc23_cs99/ NPTEL Video Lecture on Python For Data Science by By Prof. Ragunathan Rengasamy, IIT Madras
Laboratory Manual (for laboratory component):
<i>Python programming Laboratory Manual, Department of CSE (Networks), KITSW</i>

Course Articulation Matrix (CAM):				U24CN410: PYTHON PROGRAMMING LABORATORY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN410.1	2	2	2	2	2	1	-	2	1	-	1	2	2
CO2	U24CN410.2	2	2	2	2	2	1	-	2	1	-	1	2	2
CO3	U24CN410.3	2	2	2	2	3	1	-	2	1	-	1	2	2
CO4	U24CN410.4	2	2	2	2	3	1	-	2	1	-	1	2	2
U24CN410		2	2	2	2	2.4	1	-	2	1	-	1	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	develop and test python programs using operators, control statements & functions	SDG3	Good Health and Well-being	Programming fundamentals enable the development of basic healthcare applications such as patient record systems, health monitoring tools, and diagnostic support systems, contributing to improved healthcare services and well-being
CO2	Implement Python concepts including namespaces, packages, string handling methods, regular expressions, and data structures	SDG9	Industry, Innovation and Infrastructure	Core programming concepts and efficient data structures support the development of scalable and optimized software systems, fostering innovation and digital infrastructure in industries
CO3	develop reliable Python applications by integrating object-oriented constructs, file handling, database operations, and exception handling techniques	SDG11	Sustainable Cities and Communities	Robust application development supports smart city solutions such as traffic management, waste management, and public service systems, improving sustainability, safety, and urban living standards
CO4	Apply python based libraries like Matplotlib for data visualization and numpys & pandas for efficient data manipulation and analysis	SDG9	Industry, Innovation and Infrastructure	Data analysis and visualization enable informed decision-making, predictive analysis and optimization in industrial processes, thereby enhancing innovation, efficiency, and technological advancement

ENVIRONMENTAL STUDIES			
Class:B.Tech.IV Semester		Branch: Common to all branches	
CourseCode:	U24CH411	Credits:	0
Hours/Week(L-T-P-E):	2-0-0-2	CIE:	60%
TotalNumberofTeachingHours:	24Hrs	ESE:	40%
Course Learning Outcomes(COs): <i>After completion of this course, the student should be able to,</i> CO1: identify the natural resources and practice their usage more equitably CO2: develop an action plan for sustainable alternatives and conserving biodiversity CO3: examine and perceive the solutions for the environmental pollution CO4: adapt issues involved in enforcement of environmental legislation and green methodology			
UNIT-I			6Hrs
The Multidisciplinary Nature of Environmental Studies: Definition, Scope and importance Natural Resources: Forest Resources-Use and over exploitation of forests, Deforestation, Timber extraction, Mining, Dams and their effects on forests and tribal people, Water Resources-Use and over-utilization of surface and ground water, Floods, Drought, Conflicts over water, Mineral Resources-Environmental effects of extracting and using mineral resources, Energy Resources-Renewable and non-renewable energy sources, Use of alternate energy sources Self Learning Topics (SLTs): Use and over-utilization of surface and ground water (Text1: unit 2, topic 2.2.2) world food problems (Text1: unit 2, topic 2.2.2)			
UNIT-II			6Hrs
Ecosystem and Biodiversity: Ecosystem: Concepts of an ecosystem, Food chain, Food webs, Ecological pyramids, Energy flow in the ecosystem and ecological succession Biodiversity and its Conservation: Introduction, Definition, Genetic, Species and ecosystem diversity, Value of biodiversity, Biodiversity in India, Hot spots of biodiversity, Man-wildlife conflicts, Endangered and endemic species of India, In-situ and Ex-situ conservation Self Learning Topics (SLTs): Introduction and definition of biodiversity (Text1: unit 4, topic 4.1)			
UNIT-III			6Hrs
Environmental Pollution: Global issues-Global climatic change, Greenhouse gases, Effects of global warming, Ozone layer depletion International Conventions/Protocols: Earth summit, Kyoto protocol, Montreal protocol Environmental Pollution- Causes and effects of air, Water, Soil, Marine and noise pollution with case studies Solid and Hazardous Waste Management: Introduction, Types, Effects of urban industrial and nuclear waste Natural Disaster Management: Introduction to disaster, Management of disaster, Disaster management of flood, earthquake, cyclone and landslides Role of information technology in environment and human health Self Learning Topics (SLTs): Role of individual in prevention of pollution (Text1: unit 5, topic 5.10)			

UNIT-IV	6Hrs
Social Issues and the Environment: Role of Individual and Society, Water conservation, Rain water harvesting Environmental Protection/Control Acts: Air (prevention and control of pollution) act 1981, Forest conservation act (1980 and 1992), Wildlife protection act 1972, Environment protection act 1986, Issues involved in enforcement of environmental legislations Green Methodology: Principles of green chemistry, Green methods in electronic production, Impact of electronic waste on public health and environment The Sustainable Development Goals (SDGs): United Nations Sustainable Development Goals Self Learning Topics (SLTs): Water (prevention and control of pollution) act 1974 (Text1: unit 6, topics 6.10), Water pollution cess act 1977 (Text1: unit 6, topics 6.11)	
Textbook(s): 1. Erach Bharucha, <i>Text Book of Environmental Studies for Under Graduate Courses</i>, 2nd Edn., Universities Press (India) Pvt. Ltd, 2013	
Reference Book(s): 1. Y. Anjaneyulu, <i>Introduction to Environmental Science</i>, B.S. Publications, 2004. 2. Gilbert M. Masters, <i>Introduction to Environmental Engineering & Science</i>, 3rd Edn., Prentice Hall of India, 1991 3. Anubha Kaushik, C.P. Kaushik, <i>Environmental Studies</i>, 4th Edn., New Age International Publishers, 2014 4. R. Rajagopalan, <i>Environmental Studies from crisis to cure</i>, Oxford University Press, 2nd Edn., 2011	
Web and Video link(s): 1. https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ch27/ videolecture on renewable energy resources by Prof. Vaibhav. V. Goud and Dr. R. Anandalakshmi, Dept. Of Chemical Engineering, Guwahati. 2. https://sdgs.un.org/goals, UN's webpage on 17 sustainable Development Goals 3. https://onlinecourses.nptel.ac.in/noc23_hs57/preview United nations Sustainable Development Goals	

Course Articulation Matrix (CAM):					U24CH411: ENVIRONMENTAL STUDIES									
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CH411.1	2	1	2	1	-	2	1	1	1	-	-	-	-
CO2	U24CH411.2	-	-	2	-	-	1	1	1	1	1	-	-	-
CO3	U24CH411.3	1	2	1	-	-	1	1	1	1	1	1	-	-
CO4	U24CH411.4	-	-	1	-	-	1	1	1	1	-	1	-	-
U24CH411		1.50	1.50	1.50	1.00	-	1.25	1.00	1.00	1.00	1.00	1.00	-	-

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	identify the natural resources and practice their usage more equitably	SDG 12	Responsible Consumption and Production;	Promotes sustainable management and efficient utilization of natural resources, ensuring equitable access for present and future generations
		SDG 6	Clean Water and Sanitation	
CO2	develop an action plan for sustainable alternatives and conserving biodiversity	SDG 15	Life on Land	Focuses on biodiversity conservation, ecosystem restoration, and adopting sustainable practices to mitigate environmental degradation and climate change impacts
		SDG 13	Climate Action	
CO3	examine and perceive the solutions for the environmental pollution	SDG 3	Good Health and Well-being Clean	Addresses pollution control measures to improve public health, environmental quality, and sustainable urban development
		SDG 11	Sustainable Cities and Communities	
		SDG 6	Water and Sanitation	
CO4	adapt issues involved in enforcement of environmental legislation and green methodology	SDG 16	Peace, Justice and Strong Institutions	Emphasizes environmental governance, implementation of environmental laws, and adoption of green technologies and sustainable production methods
		SDG 12	Responsible Consumption and Production	

Courses for exit:

Successful completion of two subjects (6-Credits) during 2-months internship at the institute

OR

Successful completion of two suitable skill based courses (external) to qualify for Certification

A. After Second Year: (UG Diploma in CSE(N))

The candidate should pass any two of the following additional courses (Diploma Level) during the 2-Months internship at institute

Exit Option to Qualify UG Diploma in CSE(N) : Any Two (02) Courses during the 2 - Months internship								
S. No.	Category	Course Code	Course Title	L	T	P	E	C
1	PCC	U24CN412X	Artificial Intelligence and Machine Learning	2	-	-	4	3
2	PCC	U24CN413X	Cryptography and Network Security	2	-	-	4	3
3	PCC	U24CN414X	Internet of Things	2	-	-	4	3
5	PCC	U24CN415X	Any other course approved by BoS Chair and Dean AA	2	-	-	4	3

(OR)

Any two suitable skill based courses to qualify for Diploma.

Exit Option to Qualify UG Diploma in CSE(N) : Any Two (02) Skill based Courses -:								
S. No.	Category	Course Code	Course Title	L	T	P	E	C
1	SEC	U24SE410X	Drone Pilot Reference: https://agnipathvayu.cdac.in	-	-	-	6	3
2	SEC	U24SE411X	CISCO: Switching Routing and Wirelss Essentials Reference: Offered by CISCO CoE, KITSW	-	-	-	6	3
3	SEC	U24SE412X	Graphic Design Reference: https://trainings.internshala.com/graphic-design-course	-	-	-	6	3
4	SEC	U24SE413X	Andrioid App Development Reference: https://trainings.internshala.com/android-course/	-	-	-	6	3
5	SEC	U24SE414X	Any other skill based course approved by BoS Chair and DeanAA	-	-	-	6	3

B. Tech Honours with Research:

Students opting for B. Tech Honours with Research, shall undergo a 2-Month Mandatory Research Internship-I (5 Credits) at respective department during the summer vacation after IV

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING			
Class: B. Tech syllabi of Exit Course for UG Diploma in CSE(NETWORKS)		Branch:CSE(Networks)	
Course Code:	U24CN412X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE:	60%
Total Number of Teaching Hours:	32 Hrs	ESE:	40%
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to, (based on cognitive skills acquired from theory component)</i> CO1: understand basic AI concepts, intelligent agents and game playing CO2:apply supervised and algorithms with data preprocessing CO3: apply unsupervised algorithms, ensemble methods and dimensionality reduction CO4: analyze artificial neural networks and deep neural networks <i>(based on psychomotor skills acquired from laboratory component)</i> CO5:apply data preprocessing techniques CO6: implement supervised learning algorithms (Linear Regression, Logistic Regression) CO7:implement unsupervised learning algorithms (KNN, Naive Bayes and SVM) CO8: implement K-Means and PCA			
THEORY COMPONENT			
UNIT-I		4 Hrs	
Introduction to Artificial Intelligence: History, Evolution, and applications Types of AI: Narrow, General, Strong AI Intelligent agents: Structure of AI, Learning agent Game Playing: Minimax algorithm and Alpha-Beta pruning			
UNIT-II		4 Hrs	
Introduction to Machine Learning: Relationship between AI, ML, and DL Types of Learning: Supervised, Unsupervised, Reinforcement (intro only) Supervised Learning Algorithms: Linear regression, Logistic regression, K-Nearest Neighbours (KNN), Decision trees Model Evaluation: Confusion matrix, Accuracy, Precision, Recall, F1 score, ROC curve and AUC			
UNIT-III		4 Hrs	
Unsupervised Learning: K-Means clustering, Hierarchical clustering Dimensionality Reduction: Principal Component Analysis (PCA), Linear Discriminant Analysis (LDA) Ensemble Learning: boosting, bagging, random forests			
UNIT-IV		9 Hrs	
Artificial neural networks: Perceptron model, Activation functions (ReLU, Sigmoid, Tanh), Forward and backward propagation Deep Neural Networks: Multi-layer Perceptrons (MLPs), error propagation,Reinforcement learning overview, example scenarios, Markov decision processes, value functions, SARSA, Q-learning, applications of reinforcement learning			
LABORATORY COMPONENT			
List of Experiments			
1. Handle missing values using mean, median, and mode imputation techniques in a dataset. 2. Apply one-hot encoding and label encoding to categorical features in a dataset. 3. Perform feature scaling using normalization and standardization techniques on a dataset. 4. Implement Simple Linear Regression to predict a target variable (e.g., house prices or sales			

prediction). - Implement Multiple Linear Regression for predicting a target variable using multiple input features. - Implement Logistic Regression for binary classification (e.g., email spam detection or disease prediction). - Implement K-Nearest Neighbors (KNN) algorithm for classification using the Iris dataset. - Implement Naïve Bayes algorithm for text classification (e.g., spam vs. non-spam email classification). - Implement Support Vector Machine (SVM) with linear and RBF kernels for classification tasks. - Implement Decision Tree and Random Forest algorithms for classification and compare their performance. - Implement K-Means Clustering on an unlabeled dataset (e.g., customer segmentation) and analyze cluster formation. - Apply Principal Component Analysis (PCA) for dimensionality reduction and visualize the transformed dataset.
Text Book(s): - Stuart Russell and Peter Norvig, <i>Artificial Intelligence: A Modern Approach</i>, 3rd Edition, Pearson, 2010 (<i>Chapter 1 to 8</i>) - Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, <i>Machine Learning</i>, Pearson, 2nd edition, 2020, New Delhi. (<i>Chapters 1 to 11</i>)
Reference Book(s): - Ethem Alpaydin, <i>Introduction to Machine Learning</i>, MIT Press, 4th edition, 2020, Massachusetts. - Kathy Sierra, Bert Bates, <i>Head First Java</i>, O'Reilly Publications, 2nd edition, 2005, Boston. - Harvey Aurélien Géron, <i>Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow</i>, O'Reilly Media, 2nd edition, 2019, California. - Shai Shalev-Shwartz and Shai Ben-David, <i>Understanding Machine Learning: From Theory to Algorithms</i>, Cambridge University Press, 1st edition, 2014, New York
Web and Video link(s): https://onlinecourses.nptel.ac.in/noc19_cs53NPTEL Video Lecture on Machine Learning by Prof. Bala Ravindran, Professor of CSE, IIT Madras.
Laboratory Manual (for laboratory component): <i>Artificial Intelligence & Machine Learning Manual and Record Book</i>, Department of CSN, KITSW.

Course Articulation Matrix (CAM):					U24CN412X: ARTIFICIAL INTELLIGENCE & MACHINE LEARNING									
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CN412X.1	2	2	2	-	1	-	-	-	-	-	1	1	1
CO2	U24CN412X.2	2	2	2	1	2	-	-	1	-	-	1	1	1
CO3	U24CN412X.3	2	2	3	2	2	-	-	-	-	-	1	2	2
CO4	U24CN412X.4	2	2	3	2	2	-	-	1	-	-	1	2	2
CO5	U24CN412X.5	2	2	1	1	2	-	-	1	1	-	1	1	1
CO6	U24CN412X.6	2	2	2	2	2	-	-	1	1	-	1	1	1
CO7	U24CN412X.7	2	2	3	2	2	-	-	1	1	-	1	2	2
CO8	U24CN412X.8	2	2	3	2	2	-	-	1	1	-	1	2	2
U24CN412X		2	2	2.37	1.5	1.87	-	-	1	1	-	1	1.5	1.5

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	understand basic AI concepts, intelligent agents, and game playing.	SDG 4	Quality Education	Builds foundational AI literacy, equipping learners with conceptual knowledge essential for inclusive, technology-driven quality education.
CO2	apply supervised learning algorithms with data preprocessing techniques.	SDG 9	Industry, Innovation and Infrastructure	Enables application of data-driven techniques that foster innovative, technology-based solutions supporting resilient industrial and digital infrastructure.
CO3	apply unsupervised learning algorithms, ensemble methods, and dimensionality reduction techniques.	SDG 9	Industry, Innovation and Infrastructure	Advances analytical capability for handling complex datasets, fostering innovation in intelligent systems and industrial data processing.
CO4	analyze artificial neural networks and deep neural networks.	SDG 9	Industry, Innovation and Infrastructure	Develops expertise in deep learning architectures that drive technological innovation and modernization of intelligent infrastructure systems.
CO5	apply data preprocessing techniques.	SDG 12	Responsible Consumption and Production	Promotes efficient, accurate handling of data resources, supporting responsible and optimized use of information in production of reliable models.
CO6	implement supervised learning algorithms (Linear Regression and Logistic Regression).	SDG 8	Decent Work and Economic Growth	Equips learners with practical predictive modeling skills that enhance employability and support data-driven economic decision-making.
CO7	implement machine learning algorithms (KNN, Naïve Bayes, and SVM).	SDG 3	Good Health and Well-being	Develops classification skills applicable to healthcare diagnostics and disease prediction, supporting improved health outcomes and well-being.
CO8	implement K-Means clustering and Principal Component Analysis (PCA).	SDG 11	Sustainable Cities and Communities	Enables pattern discovery and data simplification useful for urban data analytics, supporting smarter and more sustainable community planning.

CRYPTOGRAPHY AND NETWORK SECURITY			
Class: B. Tech syllabi of Exit Course for UG Diploma inCSE(NETWORKS)		Branch: CSE(Networks)	
Course Code:	U24CN413X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE:	60
Total Number of Teaching Hours:	32 Hrs.	ESE:	40
Course Learning Outcomes (COs)			
After completion of this course, the students should be able to, <i>(based on cognitive skills acquired from theory component)</i>			
CO1: illustrate the basic concepts of security, services, attacks, and mathematical concepts required for various cryptographic algorithms			
CO2: compare symmetric and asymmetric cryptosystems			
CO3: design and develop various security algorithms to achieve data integrity			
CO4: analyze security requirements in networks and internet-based communication <i>(based on psychomotor skills acquired from laboratory component)</i>			
CO5: implement mathematical hard problems, usage of appropriate parameters			
CO6: develop algorithms to implement symmetric ciphers			
CO7: develop security protocols using data encryption standard			
CO8 : analyse internet security protocols for security using modern tools			
THEORY COMPONENT			
UNIT-I		4 Hrs	
Introduction: Computer and Network Security Concepts, Security attacks, services, and mechanisms			
Number Theory: Divisibility and the Division algorithm, Modular arithmetic, Prime Numbers, Integer Factorization, Euclidean algorithm, Extended Euclidean Algorithm			
UNIT-II		4 Hrs	
Symmetric Ciphers: classical encryption techniques, Block cipher & Stream Cipher, DES and AES			
Asymmetric Ciphers: Pubic key cryptography, RSA, Diffie-Hellman, Elgamal and Elliptic Curve Arithmetic and Cryptography			
UNIT-III		4 Hrs	
Cryptographic Data Integrity Algorithms: Hash function, Applications of hash function, requirements, and security of Hash function. Secure Hash Algorithm			
Key Management and Distribution: Symmetric Key Distribution using Symmetric & Asymmetric encryption			
UNIT-IV		4 Hrs	
Network and Internet Security: Network access control and cloud security. Transport level security, Wireless network security, E-mail Security			
IP Security: Overview, Encapsulating Security Payload, Authentication Header, Combining Security Associations, Internet Key Exchange			
LABORATORY COMPONENT			
List of Experiments			
1. Write a program to implement the Euclidean algorithm			
2. Write a program to implement the Extended Euclidean algorithm			

3. Write a program to implement Caesar Cipher
4. Write a program to implement the Hill Cipher
5. Write a program to implement the Playfair cipher
6. Write a program to implement the Vigenere Cipher
7. Write a program to implement a one-time pad
8. Write a program to implement the DES algorithm
9. Write a program to implement RSA
10. Implement and analyze DES using CRYPTOOL

Textbook:

1. William Stallings, *Cryptography and Network Security: Principles and Practice*, 7th ed. Pearson Education, 2018

Reference Books:

1. Menezes, P.C. van Oorschot, S.A. Vanstone: *Handbook of Applied Cryptography*: CRC Press, 1996
2. Abhijit Das and C.E.Veni Madhavan, *Public-key Cryptography: Theory and Practice*

Laboratory Manual (for laboratory component):

1. *Cryptography and Network Security Laboratory manual*, prepared by the faculty of Dept. of CSE (Networks)

Course Articulation Matrix (CAM):				U24CN413X CRYPTOGRAPHY AND NETWORK SECURITY										
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CN413X.1	2	2	1	1	-	-	-	-	-	-	-	1	1
CO2	U24CN413X.2	2	2	2	1	-	-	-	-	-	-	-	1	1
CO3	U24CN413X.3	2	2	2	1	-	-	-	-	-	-	-	1	1
CO4	U24CN413X.4	2	2	2	1	-	-	-	-	-	-	-	1	1
CO5	U24CN413X.5	2	2	2	1	2	1	1	1	2	1	2	1	1
CO6	U24CN413X.6	2	2	2	1	2	1	1	1	2	1	2	1	1
CO7	U24CN413X.7	2	2	2	1	2	1	1	1	2	1	2	1	1
CO8	U24CN413X.8	2	2	2	1	2	1	1	1	2	1	2	1	1
U24CN413X		2	2	1.85	1	1	0.5	0.5	0.5	1	0.5	1	1	1

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	demonstrate security concepts, attacks, and services along with OSI security architecture and apply number theory concepts like modular arithmetic	SDG 9	Industry, Innovation and Infrastructure	Understanding security architecture and mathematical foundations of cryptography helps in building secure digital communication systems and reliable network infrastructure, supporting innovation in information security technologies

	and theorems			
CO2	apply symmetric and asymmetric cryptographic techniques including DES, AES, and RSA	SDG 9	Industry, Innovation and Infrastructure	Cryptographic algorithms and secure communication techniques are essential for protecting modern industrial networks, e-commerce systems, banking applications, and digital infrastructure from cyber threats
CO3	apply cryptographic hash functions, MAC, HMAC, and digital signatures, authentication protocols and key management techniques like Kerberos and X.509	SDG 16	Peace, Justice and Strong Institutions	Authentication, integrity verification, and digital signature mechanisms ensure secure access control, trustworthy digital transactions, and protection of sensitive information in governance, organizations, and institutional systems
CO4	apply network security protocols such as IPSec, SSL/TLS, email security and implement firewall mechanisms for system protection	SDG 9	Industry, Innovation and Infrastructure	Network security protocols, malware protection, and firewall technologies strengthen cybersecurity infrastructure by ensuring secure communication, safe internet services, and protection against cyberattacks in digital environments
CO5	apply fundamental bitwise logic and number theory algorithms	SDG 4	Quality Education	Students acquire fundamental engineering knowledge and mathematical logic essential for advanced technical skill sets
CO6	analyse symmetric/asymmetric cryptographic algorithms	SDG 9	Industry, Innovation, and Infrastructure	Implementing modern encryption algorithms (AES, RSA) is crucial for building secure and resilient industrial digital infrastructures
CO7	build SHA-512 hashing for data integrity and utilize Cryp Tool for practical analysis of encryption algorithms	SDG 16	Peace, Justice, and Strong Institutions	Data integrity through hashing and digital signatures ensures the accountability and security of institutional data and legal documentation
CO8	analyse network security protocols like SSL and perform vulnerability assessments using Nmap, Snort, and Advanced IP Scanner	SDG 9	Industry, Innovation, and Infrastructure	Vulnerability assessments and intrusion detection (IDS) are vital for protecting critical network infrastructure from cyber threats

INTERNET OF THINGS			
Class: B. Tech syllabi of Exit Course for UG Diploma inCSE(NETWORKS)		Branch:CSE(Networks)	
Course Code:	U24CN414X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE Marks (%):	60
Total Number of Teaching Hours:	32 Hrs	ESE Marks (%):	40
Course Learning Outcomes (COs)			
After completion of this course, the students should be able to, (based on cognitive skills acquired from theory component)			
CO1: identify sensors, actuators and IoT boards in real time environment			
CO2: make use of syntax of i/o functions for problem solving			
CO3: compare analog, and digital communications with Arduino			
CO4: design a real time application using sensors, actuators and Arduino board (based on psychomotor skills acquired from laboratory component)			
CO5: develop arduino programming for problem solving			
CO6: develop arduino programming with LED, button and switch			
CO7: interpret analog and digital communications with arduino			
CO8: develop arduino programming for connecting sensors and actuators to control the applications			
THEORY COMPONENT			
UNIT-I		4 Hrs	
Introduction: Introduction to IoT, Evolution of IoT, challenges and applications, IoT versus M2M and IoT versus CPS, Sensors: characteristics, Deviations, Types-scalar, Multimedia, Hybrid and virtual, Actuators: Types-Hydraulic, Pneumatics, Electric, Thermal or Magnetic, Mechanical			
Classificationof IoT boards:Microcontroller boards,Single board controller, System on chipboard			
UNIT-II		4 Hrs	
Programming with Arduino: Introduction to Arduino, String objects; Time, I/O function, Display, Random numbers, GPIO, Controlling LEDs-Blinking led without delay, Connecting an external led,Working with buttons-Connecting a button, Button with no resistor			
UNIT-III		4 Hrs	
Analog and Digital Communication with Arduino:Interfacing LCD character display, UART protocol			
I2C Communication: I2C protocol, SPI Communication: SPI protocol, SD card interfacing			
UNIT-IV		4 Hrs	
Integration of Sensors with Arduino: Interfacing with potentiometer, Temperature sensor, Detecting motion using PIR sensor, Measuring distance using infrared and ultrasonic sensor			
Integration of Actuators with Arduino: DC motor, Servo motor, Stepper motor			
LABORATORY COMPONENT			
List of Experiments			
1. Introduction of Arduino IDE,writean Arduino program to demonstrate all the statements and functions			

- Write an Arduino program to demonstrate if statements, switch case, loops and arrays - Write an Arduino program to demonstrate string object, timebased functions, digital and analog I/O functions. - Write an Arduino program to demonstrate light an LED with button and 7-segement display - Write an Arduino program to demonstrate I2C and SPI communication protocol - Write an Arduino program for interfacing with potentiometer and temperature sensor - Write an Arduino program for interfacing with PIR sensor and infrared and ultrasonic sensor - Write an Arduino program for interfacing with DC motor
Textbook(s): [1] Sudeep Mishra, Anandarupmukherjee and Arijit Roy, <i>Introduction to IoT</i>, New Delhi: University Cambridge Press, 2021. (Chapter 4) [2] Cornel Amariei, <i>Arduino Development Cook Book</i>, Birmingham: Packt Publishing Ltd., 2015. (Chapter 2-6)
Reference Book(S): [1] ArshdeepBahga and Vijay Madiseti, <i>Internet of Things: A Hands-On Approach</i>, Hyderabad: University Press, 2015. [2] Marco Schwartz, <i>Internet of Things with ESP8266</i>, Birmingham: Packt Publishing Ltd., 2016. [3] Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, <i>Internet of things With Raspberry Pi and Arduino</i>, Boca Raton: CRC Press, Taylor & Francis Group, 2020. [4] Brian Evans, <i>Beginning Arduino Programming</i>, New York: Apress, 2011.
Web and Video link(s): https://onlinecourses.nptel.ac.in/noc24_cs115/ ; NPTEL Video Lecture on Fundamentals of Internet of Things by Prof. Sudip Misra, Professor of CSE, IIT Kharagpur.
Laboratory Manual (for laboratory component): 1. <i>Internet of Things laboratory manual</i>, Department of CSE(N), KITSW

Course Articulation Matrix (CAM):			U24CN414X INTERNET OF THINGS											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24CN413X.1	2	2	2	2	1	1	1	1	-	2	-	2	2
CO2	U24CN413X.2	2	2	2	2	1	1	1	1	-	2	-	2	2
CO3	U24CN413X.3	2	2	2	2	1	1	1	1	-	2	-	2	2
CO4	U24CN413X.4	2	2	2	2	1	1	1	1	-	2	-	3	3
CO5	U24CN413X.5	2	2	2	2	1	1	1	1	-	1	2	2	2
CO6	U24CN413X.6	2	2	2	2	1	1	1	1	-	1	2	2	2
CO7	U24CN413X.7	2	2	2	2	1	1	1	1	-	2	2	2	3
CO8	U24CN413X.8	2	2	2	2	1	1	1	1	-	2	2	2	3
U24CN413X		2	2	2	2	2	1	1	1	1	-	1.75	1	2.12

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	identify sensors, actuators and IoT boards in real time environment	SDG 9	Industry, Innovation and Infrastructure	Introduces IoT hardware used in modern industrial and smart infrastructure applications.
CO2	Make use of syntax of I/O functions for problem solving	SDG4	Quality Education	Develops programming and computational thinking skills essential for engineering education.
CO3	Compare analog and digital communications with Arduino	SDG9	Industry, Innovation and Infrastructure	Builds knowledge of communication technologies used in automation and IoT systems.
CO4	Design a real-time application using sensors, actuators and Arduino board	SDG9	Industry, Innovation and Infrastructure	Enables development of smart systems such as smart homes, smart traffic, environmental monitoring, and industrial automation.
		SDG11	Sustainable Cities and Communities	
CO5	develop arduino programming for problem solving	SDG 4	Quality Education	Enhances practical programming and engineering problem-solving skills.
CO6	develop arduino programming with LED, button and switch	SDG 4	Quality Education	Provides hands-on learning and embedded system programming skills.
CO7	interpret analog and digital communications with arduino	SDG9	Industry, Innovation and Infrastructure	Supports understanding of embedded communication systems used in Industry 4.0.
CO8	Develop Arduino programming for connecting sensors and actuators to control applications	SDG9	Industry, Innovation and Infrastructure	Facilitates smart automation, energy-efficient systems, smart agriculture, and intelligent infrastructure.
		SDG11	Sustainable Cities and Communities	
		SDG7	Affordable and Clean Energy	

V-Sem Syllabi

(B.Tech CSE(Networks) URR24)

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	OEC	U24OE501X-SDG	Open Elective -SDG	2	1	-	3	3
2	PCC	U24CN502	FullStack Development	2	1	-	3	3
3	PCC	U24CN503	Internet of Things	2	1	-	3	3
4	PCC	U24CN504	Artificial Intelligence and Machine Learning	2	1	-	3	3
5	PCC	U24CN505	Network Automation	2	1	-	3	3
6	IKSC	U24IK506B	Essence of Indian Traditional Knowledge	2	-	-	2	2
7	SEC	U24CN507	FullStack Development Laboratory	-	-	2	2	1
8	PCC	U24CN508	Internet of Things Laboratory	-	-	2	2	1
9	PCC	U24CN509	Artificial Intelligence and Machine Learning Laboratory	-	-	2	2	1
10	ELC	U24CN510	Seminar	-	-	2	2	1
Total:				12	5	8	25	21
Additional Learning@: Maximum credits allowed for Honours/Minor				-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	26

Pool - XVI Sustainable Development Goals Basket (OE - SDGB)		
S. No.	Course Code	Course Title
1.	U24OE501A-SDG	Cloud Computing (Offered by CSE Department)
2.	U24OE501B-SDG	AI Ethics (Offered by CSE (AI & ML) Department)
3.	U24OE501C-SDG	Sustainable AI (Offered by CSE (AI & ML) Department)
4.	U24OE501D-SDG	Any other course approved by BoS Chair and Dean AA

CLOUD COMPUTING			
Class: B. Tech. V- Semester		Branch: CSE(Networks)	
Course Code:	U24OEX501A-SDG	Credits:	3
Hours/Week (L-T-P- E):	3-1-0-4	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) After completion of this course, the students should be able to,			
CO1 : design enterprise-level applications in hosted cloud environments using Software as a Service (SaaS) model.			
CO2 : analyze virtual cloud resources for deploying and executing applications using virtual machines.			
CO3 : apply cloud service models such as SaaS, PaaS and IaaS using cloud platforms including Microsoft Azure, Google App Engine and Amazon Web Services.			
CO4 : apply cloud economics, security mechanisms and resource management techniques to mitigate risks and support further study and research in cloud computing.			
UNIT-I			9 Hrs
Principles of Parallel and Distributed Computing: Eras of computing, parallel vs distributed computing, elements of parallel computing, elements of distributed computing, technologies for distributed computing. Introduction: Cloud computing at a glance, historical developments, building cloud computing environment, computing platforms and technologies.			
UNIT-II			9 Hrs
Cloud Computing Architecture: Introduction, cloud reference model, types of cloud, economics of cloud, open challenges. Virtualization: Introduction, characteristics of virtualized environments, taxonomy of virtualization techniques, virtualization and cloud computing, pros and cons of virtualization, technology examples.			
UNIT-III			9 Hrs
Data Intensive Computing: Introduction, data intensive computing, technologies for data intensive computing. Cloud Platform in Industry: Amazon Web Services, Google App Engine, Microsoft Azure. Cloud Applications: Scientific applications - ECG analysis in the cloud, business and consumer applications - CRM and ERP.			
UNIT-IV			9 Hrs
Advanced Topics in Cloud Computing: Federated clouds/InterCloud characterization and definition, cloud federation stack, aspects of interest, technologies for cloud federation. Cloud Security: Security top concern for cloud users, cloud security risks, privacy and privacy impact assessment, trust, cloud data encryption, security of database services, operating system security, virtual machine security, security of virtualization, security risks posed by shared images, security risks posed by a management operating system, mobile devices and cloud security.			
Textbook(s): 1. Rajkumar Buyya, Christian Vecchiola, Thamarai Selvi, <i>Mastering Cloud Computing</i> , McGraw Hill Education, 2 nd edition, 2024, New Delhi. 2. Dan C. Marinescu, <i>Cloud Computing Theory and Practice</i> , Elsevier, 2nd edition, 2018, Cambridge. (Chapter No. 1, 3, 7, 10)			

Reference Book(s):

1. Thomas Erl and Eric Barceló Monroy, *Cloud Computing: Concepts, Technology, Security, and Architecture*, Pearson, 2nd Edition, 2024, Boston.
2. Dr. Kumar Saurabh, *Cloud Computing: Architecting Next-Gen Transformation Paradigms*, Wiley India Private Limited, 4th edition, 2018, New Delhi.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs55

NPTEL Video Lecture on Cloud Computing by Prof. Soumya Kanti Ghosh, Professor of CSE, IIT Kharagpur.

Course Articulation Matrix (CAM):					U24OE501A-SD: CLOUD COMPUTING									
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE501A-SDG.1	2	2	2	1	2	-	-	1	-	1	-	2	2
CO2	U24OE501A-SDG.2	2	2	2	1	2	-	-	1	-	1	-	2	2
CO3	U24OE501A-SDG.3	2	2	2	2	2	1	1	1	1	1	1	2	2
CO4	U24OE501A-SDG.4	2	2	2	2	2	1	1	1	1	1	1	2	2
U24OE501A-SDG		2	2	2	1.5	2	1	1	1	1	1	1	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO	CO Statement The student should be able to...	Relevant SDG	SDG Description	Mapping Justification
CO1	design enterprise-level applications in hosted cloud environments using Software as a Service (SaaS) model	SDG9	Industry, Innovation and Infrastructure	SaaS-based enterprise applications support scalable digital infrastructure and promote innovation by enabling organizations to deploy cloud-hosted solutions efficiently.
CO2	analyze virtual cloud resources for deploying and executing applications using virtual machines	SDG9	Industry, Innovation and Infrastructure	Virtual machines and cloud resources form the foundation of modern IT infrastructure, enabling flexible, scalable and reliable application deployment.
CO3	apply cloud service models such as SaaS, PaaS and IaaS using cloud platforms including Microsoft Azure, Google App Engine and Amazon Web Services	SDG9	Industry, Innovation and Infrastructure	Cloud service models and platforms support digital transformation, improve productivity, create cloud-based innovation opportunities and contribute to employability.
CO4	apply cloud economics, security mechanisms and resource management techniques to mitigate risks and support further study and research in cloud computing	SDG8	Decent Work and Economic Growth	Cloud economics, security and resource management strengthen students' technical knowledge and research readiness, supporting lifelong learning and advanced study in cloud computing.

AI ETHICS			
Class: B.Tech. V-Semester		Branch: CSE(Networks)	
CourseCode:	U24OE501B-SDG	Credits:	3
Hours/Week(L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: understand and apply the fundamental concepts of Artificial Intelligence to explain key ethical issues, ethical approaches, and the significance of AI ethics in modern society CO2: analyze ethical issues in Artificial Intelligence from the perspectives of policy, regulation, philosophy of technology, and real-world case studies CO3: apply ethical frameworks and methods in applied ethics to identify, interpret, and evaluate ethical challenges arising from AI systems CO4: analyze human values, intelligence, and human nature in the context of AI systems, and assess the boundaries between humans and intelligent machines			
UNIT-I			9 Hrs
Introduction: What is Artificial Intelligence, Why AI Ethics is so exciting?, Bottom-Up and Top-Down approaches to AI Ethics, The boundaries and limitations of ethics, Developing ethical autonomy The Rise of AI Ethics: Ethical questions in AI currently receiving attention, Same or different? What's special about AI Ethics? Common themes and varieties of questions in AI Ethics, Ethical questions in AI currently receiving attention			
UNIT-II			9 Hrs
AI Policy and Regulatory Standards: AI Ethics, Law, Policy, Regulation, Ethics guidance Case Study - An indigenous AI report AI, Philosophy of Technology, and Ethics: Comparing AI to humans, Case Study - Attributing agency to humans and to AI, A brief introduction to the philosophy of technology, Technology and attitudes towards nature, The implicit values of technology, Communication through new technologies			
UNIT-III			9 Hrs
Methods in Applied Ethics: A simple account of methods in Applied Ethics, The challenges from AI for methodology in Applied Ethics, Common assumptions about the nature of ethics and their influence on methodology in Applied Ethics Methodology in Applied Ethics: The stories we tell, Introduction to ethical narratives in AI, Stories about AI systems			
UNIT-IV			9 Hrs
Humans and Intelligent Machines- Underlying Values: The nature and value of intelligence, Values underlying the use of data Human Nature : Self, Reason, Boundaries, Philosophical perspectives- The Divided Self and notions of the Higher Self, Reason or Emotion?, The boundaries of Human nature, Boundaries and limits, Is human nature Perfectible?, Myths and origin stories about human nature			

Textbook(s):

1. P.Boddington, *AI Ethics*, 1st edition, Cham, Switzerland: Springer International Publishing, 2017.(Chapter 1 to 5)

ReferenceBook(s):

1. P.Boddington, *Artificial Intelligence: Foundations, Theory, and Algorithms*, Cham, Switzerland: Springer Nature, 2023
2. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 4th edition, Hoboken, NJ, USA: Pearson, 2021

WebandVideo link(s):

https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_cs132, NPTEL Video Lecture on **Responsible & Safe AI Systems** by Prof. Ponnurangam Kumaraguru, Prof.Balaraman Ravindran, Prof. Arun Rajkumar | IIIT Hyderabad, IIT Madras

Course Articulation Matrix (CAM):				U24OE501B-SDG : AI ETHICS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE501B-SDG.1	2	2	2	2	1	1	1	1	1	-	2	2	1
CO2	U24OE501B-SDG.2	2	2	3	2	1	1	1	1	1	-	2	3	1
CO3	U24OE501B-SDG.3	2	2	2	2	1	1	1	1	1	-	2	3	1
CO4	U24OE501B-SDG.4	2	2	3	3	1	1	1	1	1	-	2	3	1
U24OE501B-SDG		2	2	2.5	2.25	1	1	1	1	1	-	2	2.75	1
3-HIGH,2-MEDIUM,1-LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	understand and apply the fundamental concepts of artificial intelligence to explain key ethical issues, approaches, and the significance of AI ethics in modern society	SDG4	Quality Education	AI ethics improves critical thinking and awareness about responsible technology use, strengthening quality education and informed learning in emerging technologies
CO2	analyze ethical issues in AI through the perspectives of policy, regulation, philosophy of technology, and real-world case studies	SDG16	Peace, Justice and Strong Institutions	Studying AI governance, law, and policy supports ethical decision-making, transparency, and responsible institutional frameworks for trustworthy AI systems
CO3	apply ethical frameworks and methods in applied ethics to identify, interpret, and evaluate ethical challenges arising from AI systems	SDG9	Industry, Innovation and Infrastructure	Ethical analysis methods help design safer and more responsible AI systems, promoting innovation with accountability in technological development
CO4	analyze human values, intelligence, and human nature in the context of AI systems, and assess the boundaries between humans and intelligent machines	SDG3	Good Health and Well-being	Understanding human-centered AI and value alignment supports safer AI applications in healthcare, psychology, and human well-being systems

SUSTAINABLE AI			
Class: B.Tech. V-Semester		Branch: CSE(Networks)	
Course Code:	U24OE501C-SD	Credits:	3
Hours/Week(L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: analyze the role of sustainability and Artificial Intelligence, resource efficiency and consumption, and climate awareness in addressing environmental challenges CO2: analyze the energy consumption and environmental impacts of artificial intelligence models CO3: apply optimization techniques for resource-efficient deployment of artificial intelligence systems. CO4: analyze sustainable Artificial Intelligence applications and emerging trends across various domains to identify their impacts, opportunities, and challenges			
UNIT-I			9 Hrs
Sustainability and Artificial Intelligence: Scope of sustainability and sustainable development goals, Artificial intelligence- The new electricity?, Sustainability x AI, A green path to sustainable AI Generative AI Foundations: Introduction to GenAI& representation Learning, Auto encoders, Large language models, Multimodal generative models and data modalities Quantifying the Efficiency of Deep Learning: AI Waste, Resource Consumption of Deep Learning, Resource Efficiency and Climate Awareness, Carbon Footprint of AI, Estimating the Carbon Footprint of AI Models			
UNIT-II			9 Hrs
Data Parsimony: The cost of data, Dataset curation, Active learning for dataset creation, Learning with pruned datasets, Learning with compressed data, Data and dataset compression Automating Model Selection: Hyper parameter optimization, Neural architecture search, Model selection in the era of foundational models, Model selection automated			
UNIT-III			9 Hrs
Training Efficiency: Training costs of AI models, Transfer learning, training compressed neural networks, Quantization, Efficient training techniques Lean Inference: Lifetime cost of an AI model, Achieving lean inference, Deploying models, Lean and efficient inference Hardware Considerations: Environmental cost of AI hardware, Hardware scaling laws of AI, The alchemy of creating AI, Improving the resource efficiency of AI hardware, Hardware optimization for sustainable AI			
UNIT-IV			9 Hrs
A Recipe for Sustainable AI: Introduction and sustainability across the AI lifecycle, Technical debt of machine learning, Environmental debt of AI, Operationalizing sustainable AI, Green MLOps Toward Sustainable AI: Rebound effects and AI, Economic sustainability of AI, Social sustainability of AI, Sustainable AI principles impact of sustainable AI			

Textbook:

1. Raghavendra Selvan, "Sustainable AI Tools for Moving Toward Green AI", First Edition, O'Reilly Media, October 2025

ReferenceBook(s):

1. Aboul Ella Hassanien, Roheet Bhatnagar, and Ashraf, *Artificial Intelligence for Sustainable Development: Theory, Practice and Future Applications*, Springer Nature, Computational Intelligence, Volume 912, September 2021, New Delhi
2. Mohammad Dastbaz, Colin Pattinson, Babak Akhgar, *Green Information Technology A Sustainable Approach*, Morgan Kaufmann 1st Edition, March 3, 2015

Web and Video link(s):

1. https://onlinecourses-archive.nptel.ac.in/noc18_ce08,NPTEL *VideoLecture on Sustainable Engineering Concepts And Life Cycle Analysis* by Prof. Brajesh Kr. Dubey, IIT Kharagpur

Course Articulation Matrix (CAM):				U24OE501C-SDG: SUSTAINABLE AI										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE501C-SDG.1	1	2	1	1	1	-	1	1	1	1	1	1	1
CO2	U24OE501C-SDG.2	1	2	2	2	1	-	1	1	1	1	1	1	1
CO3	U24OE501C-SDG.3	1	2	2	2	1	-	1	1	2	1	1	1	1
CO4	U24OE501C-SDG.4	1	2	1	1	1	-	1	1	2	1	1	1	1
U24OE501C-SDG		1	2	1.5	1.5	1	-	1	1	1.5	1	1	1	1
3-HIGH,2-MEDIUM,1-LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO 1	analyze the role of sustainability & AI, resource efficiency and consumption, and climate awareness in addressing environmental challenges	SDG4, SDG13	Quality Education, Climate Action	Provide the knowledge about the principles of bio inspired computing and natural intelligence to improve the quality of understanding and study by observing nature and derive the solutions
CO 2	Analyze energy consumption and environmental impacts of AI models	SDG7, SDG9	Affordable and Clean Energy, Industry, Innovation and Infrastructure	The algorithms developed can be used for helping the industry to improve the infrastructure by optimizing various situations with a large number of parameters
CO 3	apply optimization techniques for resource-efficient AI deployment	SDG16	Peace, Justice and Strong Institutions	The solutions developed are useful in finding the Improved infrastructure in the smart city environment like self-driving cars with swarm intelligence solutions
CO 4	analyze sustainable AI applications and emerging trends across various domains to identify their impacts, opportunities, and challenges	SDG11, SDG12, SDG13	Sustainable Cities and Communities, Responsible Consumption and Production, Climate Action	Smart applications like Smart Greenhouse improve sustainable agriculture

FULLSTACK DEVELOPMENT			
Class: B. Tech. V - Semester		Branch: CSE (Networks)	
Course Code:	U24CN502	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : apply the fundamentals of web application development to design and develop structured, responsive web pages using HTML5, CSS3, and Bootstrap CO2 : develop interactive client-side web applications using JavaScript, DOM manipulation, ES6 features, and browser storage techniques CO3 : develop server-side web applications using Node.js and Express.js, and explain the MERN stack architecture and application flow CO4 : design and integrate full-stack web applications using React.js, MongoDB, and Node.js/Express.js for frontend, backend, and database communication			
UNIT-I			9 Hrs
Basics of Web Applications: Introduction to Web Applications , Client-Server Architecture, Frontend, Backend and Database, Static vs Dynamic Websites, HTTP and HTTPS, URL HTML: Introduction to HTML5, Structure of HTML Document, Text Formatting, Lists, Tables, Hyperlinks, Images, Forms and Input Controls, Semantic Elements CSS: Introduction to CSS, Types of CSS (Inline, Internal, External), Selectors, Colors, Box Model, Flexbox Basics, Responsive Design Basics, Media Queries Bootstrap: Introduction to Bootstrap, Bootstrap Grid System, Tables, Forms, Buttons, Cards, Navigation Bar			
UNIT-II			9 Hrs
JavaScript Basics Introduction to JavaScript, Variables, Data Types, Operators , Conditional Statements , Loops, Functions, Arrays, Objects DOM Manipulation Introduction to DOM, Selecting Elements, Event Handling, Form Validation using JavaScript Advanced JavaScript Concepts ES6 Features, Let, Const, Arrow Functions, Template Literals, Destructuring, Spread and Rest Operators, Promises, Async and Await – JSON Basics ,Local Storage and Session Storage			
UNIT-III			9 Hrs
Introduction to MERN Stack Overview of MERN Stack, Role of MongoDB, Express.js, React.js and Node.js , Full Stack Application Flow, REST API Concept Node.js Introduction to Node.js, Installation and Setup , Node.js Architecture, Modules - File System Module, Path Module, HTTP Module, Node Package Management Express.js Introduction to Express.js, Express Application Setup – Routing, Middleware, Request and Response Objects			

UNIT-IV	9 Hrs
MongoDB CRUD Operations, Query Operators, Schema Design Basics, Connecting MongoDB with Node.js and Express.js React.js Components, Functional Components, JSX, Props and State, Event Handling, Forms in React, Conditional Rendering, Lists and Keys , Hooks (useState, useEffect) Full Stack Integration Connecting React Frontend with Node.js + Express Backend, API Calls using Fetch/ Axios, MongoDB Integration, Authentication Basics, Deployment Overview	
Textbook(S): 1. Terry Felke-Morris, <i>Web Development and Design Foundations with HTML5</i>, Pearson, 9th edition, 2018, New York. (Chapters 1 to 8) 2. Jennifer Niederst Robbins, <i>Learning Web Design: A Beginner's Guide to HTML, CSS, JavaScript, and Web Graphics</i>, O'Reilly Media, 5th edition, 2018, California. (Chapters 1 to 12)	
Reference Book(S): 1. Marijn Haverbeke, <i>Eloquent JavaScript</i>, No Starch Press, 3rd edition, 2018, San Francisco. (Chapters 1 to 15) 2. Kristina Chodorow, <i>MongoDB: The Definitive Guide</i>, O'Reilly Media, 2nd edition, 2013, California. (Chapters 1 to 6) 3. Alex Banks and Eve Porcello, <i>Learning React: Functional Web Development with React and Redux</i>, O'Reilly Media, 2nd edition, 2020, California. (Chapters 1 to 10)	
Web and Video link(S): https://www.youtube.com/live/YLpCPo0FDtE?si=IKtEtseBsWgnuCil	

Course Articulation Matrix (CAM):				U24CN502 : FULL STACK DEVELOPMENT											
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	
CO1	U24CN502.1	3	2	2	1	3	-	-	-	-	1	-	3	2	
CO2	U24CN502.2	3	3	3	2	3	-	-	-	1	1	-	3	3	
CO3	U24CN502.3	3	3	3	2	3	-	-	-	1	2	1	3	3	
CO4	U24CN502.4	3	3	3	2	3	-	-	-	2	2	1	3	3	
U24CN502		3.0	2.75	2.75	1.75	3.0	-	-	-	1.0	1.50	0.50	3.0	2.75	
3 - HIGH, 2 - MEDIUM, 1 - LOW															

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply the fundamentals of web application development to design and develop structured, responsive web pages using HTML5, CSS3, and Bootstrap	SDG 9	Industry, Innovation and Infrastructure	Knowledge of modern web technologies enables students to build responsive and scalable web applications, contributing to digital infrastructure and technological innovation
CO2	develop interactive client-side web applications using JavaScript, DOM manipulation, ES6 features, and browser storage techniques	SDG 4	Quality Education	Developing interactive web applications enhances programming proficiency, digital literacy, and practical software development skills required for quality education and lifelong learning
CO3	develop server-side web applications using Node.js and Express.js, and explain the MERN stack architecture and application flow	SDG 9	Industry, Innovation and Infrastructure	Server-side application development and REST-based architectures support the creation of secure, scalable, and innovative software systems for modern digital industries
CO4	design and integrate full-stack web applications using React.js, MongoDB, and Node.js/Express.js for frontend, backend, and database communication	SDG 11	Sustainable Cities and Communities	Integrated full-stack applications enable the development of accessible digital services that support smart governance, sustainable communities, and efficient public service delivery

INTERNET OF THINGS			
Class: B. Tech. V- Semester		Branch: CSE(Networks)	
Course Code:	U24CN503	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : build IoT-based solutions using sensors, actuators, and IoT hardware platforms by understanding the fundamentals and architecture of the Internet of Things (IoT) CO2 : demonstrate basic elements of Arduino, digital and analog I/O functions, LED and button interfacing, and NodeMCU programming CO3 : build real-time control and monitoring applications by integrating sensors and actuators with Arduino/NodeMCU CO4 : apply feature extraction and classification techniques for processing and analyzing IoT sensor data in intelligent applications			
UNIT-I			9 Hrs
Internet of Things (IoT): Introduction, Evolution of IoT, IoT Architectures - drivers behind new network architectures, OneM2M IoT standardized architecture, IoT World Forum (IoTWF) standardized architecture, A Simplified IoT architecture, Core IoT Functional stack, IoT data management and compute stack Sensors: Definition, Characteristics, deviations, Types and considerations Actuators: Definition, Types, Characteristics Classification of IoT boards: Microcontroller boards, Single board controller, System on chipboard			
UNIT-II			9 Hrs
IoT Connectivity Technologies: Overview, IEEE 802.15.4- 802.15 standards, Zigbee-Overview, Physical layer and Media Access Control(MAC) Layer, Protocol stack, Addressing modes and packet structure, Topology, Security, Long Range (LoRa)-Physical layer, Media Access Control (MAC) layer and topology, Z-Wave, RFID, NFC, Wi-Fi, Bluetooth IoT Communication Technologies: Constrained nodes, Constrained networks, Types of constrained devices, Low power and lossy networks			
UNIT-III			9 Hrs
Data Protocols: Message Queue Telemetry Transport(MQTT)-Publish-Subscribe Architecture, Packet structure and communication format; Message Queue Telemetry Transport -Sensor Networks (MQTT-SN)-Architecture, Topology; Constrained Application Protocol(COAP) - Architecture, Message formats; Advanced Message Queuing Protocol(AMQP), Extensible Messaging and Presence Protocol(XMPP), Simple Object Access Protocol(SOAP), Representational State Transfer(REST), WebSocket Discovery protocols: Physical web, Multicast Domain Name System (MDNS), Universal plug and play(UPnP)			
UNIT-IV			9 Hrs
Infrastructure Protocols : Internet Protocols version6(IPv6), Lightweight On-demand Ad- hoc distance vector Routing protocol - Next Generation(LOADng), Routing Protocols for Low-power(RPL), IPv6 over Low-Power Wireless Personal Area Networks (6LoWPAN), Quick UDP Internet Connections (QUIC), Micro Internet protocols(μIP), Nano Internet Protocols (NanoIP), Content-Centric Networking(CCN) Case Study: Smart Green House			

Textbook(s):

1. Sudip Misra, Anandarup Mukherjee, Arljit Roy, *Introduction to IoT*, New Delhi: Cambridge University Press ,2020(chapter 7,8)
2. Cornel Amariei, *Arduino Development Cook Book*, Birmingham: Packet Publishing Ltd., 2015(chapter 2,6)

Reference Book(s):

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Hyderabad: University Press, 2015
2. Marco Schwartz, *Internet of Things with ESP8266*, Birmingham: Packt Publishing Ltd., 2016
3. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, *Internet of things With Raspberry Pi and Arduino*, Boca Raton: CRC Press, Taylor & Francis Group,2020
4. Brian Evans, *Beginning Arduino Programming*, New York: Apress, 2011

Web and Video link(s):

<https://nptel.ac.in/courses/106105191> NPTEL Video Lecture on internet of things Prof. Supidmistra, Professor of CSE, IIT Kharagpur

Course Articulation Matrix (CAM):				U24CN503: INTERNET OF THINGS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN503.1	2	2	1	1	2	-	-	1	-	-	-	2	2
CO2	U24CN503.2	2	2	2	1	2	-	-	1	1	-	-	2	2
CO3	U24CN503.3	2	2	2	2	2	-	-	1	1	-	-	2	2
CO4	U24CN503.4	2	2	2	2	2	-	-	1	2	-	1	2	2
U24CN503		2	2	1.75	1.5	2	-	-	1	1.33	-	1	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	build IoT-based solutions using sensors, actuators, and IoT hardware platforms by understanding the fundamentals and architecture of the Internet of Things (IoT)	SDG 9	Industry, Innovation and Infrastructure	IoT fundamentals and hardware platforms support the development of smart infrastructure, industrial automation, and innovative connected systems
CO2	demonstrate Arduino programming, I/O functions, LED/button interfacing, and Node MCU operations	SDG4	Quality Education	Learning Arduino and Node MCU programming enhances technical skills, practical knowledge, and hands-on learning in emerging IoT technologies
CO3	Build real-time control and monitoring applications by integrating sensors and actuators with Arduino/Node MCU	SDG11	Sustainable Cities and Communities	Sensor and actuator integration enables smart monitoring and automation systems used in smart homes, traffic management, environmental monitoring, and sustainable urban development
CO4	apply feature extraction and classification techniques for intelligent IoT data analysis	SDG9	Industry, Innovation and Infrastructure	Feature extraction and classification techniques support intelligent IoT systems, industrial automation, predictive analytics, and AI-driven innovations

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING			
Class: B. Tech. V – Semester		Branch: CSE (Networks)	
Course Code:	U24CN504	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : apply AI fundamentals, intelligent agent concepts, and search algorithms (BFS, DFS, and A*) to solve problem-solving tasks CO2 : build machine learning solutions by implementing the ML pipeline and applying data preprocessing and model evaluation techniques CO3 : apply supervised and unsupervised learning algorithms for classification, regression, clustering, and association tasks CO4 : design and evaluate ensemble models and neural networks including deep learning techniques			
UNIT-I			9 Hrs
Introduction to Artificial Intelligence: Definition and scope of AI, History and Evolution of AI, Applications of AI, Types of AI Intelligent Agents: Structure of intelligent agents, Types of agent programs, Environment types Problem Solving in AI: Problem formulation—states, actions, goal test and path cost, Uninformed Search strategies—Breadth First Search (BFS) and Depth First Search (DFS), Informed Search—Greedy Best-First Search and A* Search, heuristic functions, admissibility and consistency Game Playing: Alpha-Beta Prunings			
UNIT-II			9 Hrs
Introduction to Machine Learning: Definition and scope, difference between AI and ML, types of machine learning, applications of each type ,Machine Learning Pipeline Data Preprocessing: Data cleaning, data normalization and standardization, Feature encoding, Feature selection techniques Types of Models: Predictive Models, Descriptive Models Training a Model: Training and Testing Data, Model Parameters, Hyperparameters Overfitting and Underfitting, Bias-Variance Trade-off Model Evaluation Techniques: K-fold Cross-Validation, Bootstrap Sampling Performance Metrics: Classification – Accuracy, Precision, Recall, F1-Score; Regression – Root Mean Square Error (RMSE) Regularization Techniques: Ridge Regression, Lasso Regression			
UNIT-III			9 Hrs
Supervised Learning: Regression: Concept of regression, Simple Linear Regression, Multiple Linear Regression Classification: Concept of classification, Logistic regression, k-Nearest Neighbour (kNN), Decision Tree , Support Vector Machines (SVM), Naïve Bayes classifier Unsupervised Learning: Concept of unsupervised learning, clustering techniques – K-Means Clustering Dimensionality Reduction: Principal Component Analysis (PCA)			
UNIT-IV			9 Hrs
Ensemble Learning: Concept of ensemble learning, Bagging, Boosting, Stacking, Random forests, Different ways to combine classifiers			

Artificial Neural Network: Biological inspiration, Artificial neuron, McCulloch-Pitts neuron, Perceptron model, Perceptron learning rule, Activation functions, Multi-layer Perceptron (MLP) architecture, Backpropagation, Chain rule of differentiation, Gradient descent optimization, Learning rate

Reinforcement Learning: Basic concepts, Markov Decision Process (MDP), Q-learning, Applications

Textbook(s):

1. Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 3rd Edition, Pearson, 2010 (*Chapter 1 to 8*)
2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, *Machine Learning*, Pearson, 2nd edition, 2020, New Delhi(*Chapters 1 to 11*)

Reference Book(s):

1. Tom M. Mitchell, *Machine Learning*, McGraw-Hill, 1st edition, 1997, New York
2. Stuart J. Russell, Peter Norvig, *Artificial Intelligence: A Modern Approach*, Pearson Education, 4th edition, 2020, New Delhi
3. Ethem Alpaydin, *Machine Learning*, PHI Learning, 3rd edition, 2014, New Delhi
4. Andreas C. Müller, Sarah Guido, *Introduction to Machine Learning with Python*, O'Reilly Media, 1st edition, 2016, Sebastopol

Web and Video link(s):

1. <https://nptel.ac.in/courses/106106139> NPTEL Video Lecture on Artificial Intelligence by Prof. Deepak Khemani, Department of Computer Science and Engineering, IIT Madras
2. <https://nptel.ac.in/courses/106105152> NPTEL Video Lecture on Introduction to Machine Learning by Prof. Balaraman Ravindran, Department of Computer Science and Engineering, IIT Madras

Course Articulation Matrix (CAM):				U24CN504 : ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2
CO1	U24CN504.1	1	2	2	1	-	-	1	-	1	-	-	2	2
CO2	U24CN504.2	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	U24CN504.3	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	U24CN504.4	2	2	3	3	-	-	1	-	1	-	2	2	2
U24CN504		1.75	2	2.25	1.75	-	-	1	-	1	-	2	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply AI fundamentals, intelligent agent concepts, and search algorithms (BFS, DFS, and A*) to solve problem-solving tasks	SDG9	Industry, Innovation and Infrastructure	AI-based problem-solving and intelligent agent systems support automation and optimization in industrial and infrastructure applications
CO2	build machine learning solutions by implementing the ML pipeline and applying data preprocessing and model evaluation techniques	SDG4	Quality Education	Machine learning enables intelligent educational systems and data-driven learning methods, improving education quality
CO3	apply supervised and unsupervised learning algorithms for classification, regression, clustering, and association tasks	SDG9	Industry, Innovation and Infrastructure	ML algorithms enable predictive analytics and automation in industrial and infrastructure applications
CO4	design and evaluate ensemble models and neural networks including deep learning techniques	SDG3	Good Health and Well-being	Deep learning and neural networks support healthcare applications such as disease prediction and diagnostics

NETWORK AUTOMATION			
Class: B. Tech. V – Semester		Branch: CSE (Networks)	
Course Code:	U24CN505	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : examine linux distributions for network automation and programmability CO2 : create python scripts and modules to automate networks CO3 : develop data models with YAML, XML, JSON, YANG to exchange data between network devices CO4 : design automated networks using network API's and analyze networks using automation tools			
UNIT-I			9 Hrs
Network industry trends: The rise of Software Defined Networking, Open Flow Technologies and trends in SDN: Open Flow, Network Functions Virtualization, Virtual Switching, Network Virtualization, Device APIs, Network Automation, Bare metal Switching, Data center network fabrics, SD-WAN, controller networking Network Automation: Why Network Automation, Network Automation tasks, Evolving management plane from SNMP to device APIs, Network Automation in SDN Era LINUX: Examining Linux in Network Automation context, Linux distributions, Networking in Linux			
UNIT-II			9 Hrs
Python in a Network Context: Should Network Engineers learn to code, Using python interactive interpreter, Data Types, Understanding Containment, Loops, Using python Functions, Working with files Python Programming: Creating python programs, Understanding shebang, migrating code from python interpreter to python script, working with python modules, passing arguments into python script Packages: Using pip and installing python packages			
UNIT-III			9 Hrs
Data Formats: Introduction to Data format, Types of data Data Models: YAML-Reviewing YAML basics, working with YAML in python, Data Models in YAML, XML- Reviewing XML Basics, Using XSD for Data Models, transforming XML with XSLT, JSON-Reviewing JSON Basics, working with JSON in python, Using JSON schema for Data Models, YANG- overview, taking a deeper dive into YANG Network Configuration Templates: Rise of modern template languages, Value of templates in network automation JINJA: Jinja for network configuration templates, Dynamically inserting data, Rendering a Jinja template, Conditions and loops, Jinja filters, Template creation			
UNIT-IV			9 Hrs
Network APIs: HTTP-Based APIs: restful, non-restful. NETCONF-overview, protocol stack, Exploring Network APIs- HTTP-Based APIs: CURL, Postman Automating Using Network APIs: Using python requests Library, CISCO-NX API, Using python ncclient library, Using netmiko Automation Tools: Reviewing Automation tools, ANSIBLE- Overview, Understanding how Ansible works, SALT- Overview, Architecture, STACKSTORM- Event-Driven automation, concepts, Architecture			

Textbook:

1. Jasen Edelman, Scott.S Lowe & Matt Oswalt, *Network Programmability and Automation*, O'REILLY publishers, February 2018 First Edition (Chapters: 1,2,3,4,5,6,7)

Reference Book:

1. Abhishek Ratan, *Practical Network Automation*, Packt publishers, 2018 Second Edition

Course Articulation Matrix (CAM):				U24CN505 : NETWORK AUTOMATION										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN505.1	2	2	2	1	2	-	-	1	1	1	-	2	2
CO2	U24CN505.2	2	2	2	2	1	-	-	1	1	1	-	2	2
CO3	U24CN505.3	2	2	3	3	2	-	-	1	1	1	-	2	3
CO4	U24CN505.4	2	3	2	3	3	-	-	1	1	1	-	2	3
U24CN505		2	2.2 5	2.2 5	2.2	2	-	-	1	1	1	-	2	2.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Examine linux distributions for network automation and programmability	SDG 9	Industry, Innovation and Infrastructure	Linux-based network automation supports modern digital infrastructure, scalable networking, and innovative IT operations used in smart industries and communication systems detection
CO2	Create python scripts and modules to automate networks	SDG 4	Quality Education	Developing programming and automation skills enhances technical competency, digital literacy, and industry-relevant education aligned with modern engineering practices
CO3	Develop data models with YAML, YAMS, JSON, YANG to exchange data between network devices	SDG 9	Industry, Innovation and Infrastructure	Standardized data models improve interoperability, reliability, and efficiency of communication infrastructure and intelligent network systems
CO4	design automated networks using network API's and analyze networks using automation tools	SDG 9	Industry, Innovation and Infrastructure	API-driven automation and intelligent network management enable resilient, scalable, and innovative digital infrastructure for enterprises and smart services

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE			
Class: B.Tech. V Semester	Branch: V SEM (CE, ME, IT, CSN, CSM, CSO, CSD)		
Course Code:	U24IK506B	Credits:	2
Hours/Week (L-T-P-E):	2-0-0-2	CIE:	60%
Total Number of Teaching Hours:	24 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : summarize the basic structure of Vedas, Upavedas, Vedanga, Upanga CO2 : explain Vedas as principal source of knowledge for scientific inventions CO3 : describe different yogasanas, breathing techniques, chakras, meditation and their benefits CO4 : discuss the benefits of yoga as an effective tool for management of human crisis			
UNIT-I			6 Hrs
Basic Structure of Indian Knowledge System: Introduction, Vedas – origin, classification, structure, Rig Veda, Sama Veda, Yajur Veda, Atharva Veda, UpaVedas – DhanurVeda, SthapatVeda, GandharvaVeda, AyurVeda, Vedanga – Shiksha, Chanda, Vyakarna, Nirukta, Kalpa, Jyothisha, Upanga – Dharmashastra, Mimamsa, Tarkashastra, Purana			
UNIT-II			6 Hrs
Modern Science and Indian Knowledge System: Introduction, Vedas as basis for modern science, architectural developments, medicine and its relevance, mathematical sciences in Vedas, space and military related developments, chemical sciences			
UNIT-III			6 Hrs
Yoga and Holistic Health Care: Healthy mind in healthy body, yoga: definition, types, yoga to keep fit: diet, yoga asanas, fundamentals, breathing techniques in Patanjali yoga tradition, pranayama, chakras, meditation, benefits of yoga – physical health, emotional health, prevention of disease, reducing or alleviating symptoms of problems			
UNIT-IV			6 Hrs
Case Studies – Yoga Practice: Yoga as an effective tool for management of human crisis – depression, self-concept & mental health, yoga for stress management, yoga: a way to cure for insomnia Requisite: Yoga practice sessions are to be conducted for all students taking this course by the time they complete Unit 1 and Unit 2			
Textbook(s): 1. Sathish Chandra Chatterjee, Dhirendramohan Datta, <i>An Introduction to Indian Philosophy</i>, New Delhi: Rupa Publications Pvt. Ltd. (Chapter 2, 3) 2. Priyadarshan Ray, S.N. Sen, <i>The Cultural Heritage of India</i>, Vol. 6, Science and Technology, Kolkata: The Ramakrishna Mission Institute of Culture 3. <i>Yoga Sutra of Patanjali</i>, Kolkata: Ramakrishna Mission 4. RN Jha, <i>Science of Consciousness Psychotherapy and Yoga Practices</i>, New Delhi: Vidyanidhi Prakasham, 2016 (Chapter 4, 5, 6, 7, 8)			

Reference Book:

- Swami Jitatmananda, *Holistic Science and Vedanta*, Mumbai: Bharatiya Vidya Bhavan (Chapter 2, 3).

Web and Video link:

- NPTEL courses on Indian Philosophy, Yoga and Vedic Sciences available at <https://onlinecourses.nptel.ac.in>

Course Articulation Matrix (CAM):				U26IK506B : ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE											
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	U24IK506B.1	-	-	-	-	-	1	-	2	1	1	-	-	-	-
CO2	U24IK506B.2	-	-	-	-	-	1	1	2	1	1	-	-	-	-
CO3	U24IK506B.3	-	-	-	-	-	1	-	2	2	1	-	2	-	-
CO4	U24IK506B.4	-	-	-	-	-	1	1	2	2	1	-	2	-	-
U24IK506B		-	-	-	-	-	1	1	2	1.5	1	-	2	-	-
3 - HIGH, 2 - MEDIUM, 1 - LOW															

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	summarize the basic structure of Vedas, Upavedas, Vedanga, Upanga	SDG4	Quality Education	Understanding the foundational structure of Indian knowledge systems supports holistic education, critical thinking, and cultural literacy, contributing to quality and inclusive education
CO2	explain Vedas as principal source of knowledge for scientific inventions	SDG9	Industry, Innovation and Infrastructure	Recognizing Vedic contributions to science and technology highlights indigenous innovation in areas such as mathematics, architecture and medicine, inspiring modern sustainable technological development
CO3	describe different yogasanas, breathing techniques, chakras, meditation and their benefits	SDG3	Good Health and Well-being	Knowledge of yoga, pranayama, and meditation directly promotes physical health, mental well-being, and disease prevention, supporting the SDG goal of ensuring healthy lives for all
CO4	discuss the benefits of yoga as an effective tool for management of human crisis	SDG3	Good Health and Well-being	Understanding yoga as a therapeutic tool for depression, stress, and insomnia contributes to mental health management and holistic wellness, aligning with SDG3 targets on mental health

FULLSTACK DEVELOPMENT LABORATORY			
Class: B. Tech. V – Semester		Branch: CSE (Networks)	
Course Code:	U24CN507	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1: design and develop responsive web pages using HTML5, CSS3, and Bootstrap by applying web design principles CO2: develop interactive client-side web applications using JavaScript, DOM manipulation, ES6 features, and browser storage techniques CO3: develop server-side web applications using Node.js, Express.js, and MongoDB for backend processing and database management CO4: build and integrate full-stack web applications using React.js, Node.js, Express.js, and MongoDB following modern MERN stack development practices			
Experiment-1 (UNIT-I)			
HTML Basics 1. Create a basic HTML webpage using headings, paragraphs, lists, and comments 2. Design a webpage using hyperlinks, images, and tables 3. webpages using semantic HTML elements			
Experiment-2 (UNIT-I)			
HTML Forms and Semantic Elements 1. Design a student registration form using HTML5 form controls 2. Implement form validation using HTML attributes 3. Create a responsive webpage containing forms and multimedia elements			
Experiment-3 (UNIT-I)			
CSS Fundamentals 1. Apply Inline, Internal, and External CSS 2. Design webpages using CSS selectors, colors, and the Box Model 3. Create responsive layouts using Flexbox and Media Queries			
Experiment-4 (UNIT-I)			
Bootstrap 1. Design responsive webpages using the Bootstrap Grid System 2. Create Bootstrap forms, tables, buttons, and cards 3. Develop a responsive navigation bar using Bootstrap			
Experiment-5 (UNIT-II)			
JavaScript Fundamentals 1. Write JavaScript programs using variables, operators, conditional statements, loops 2. Implement functions, arrays, and objects 3. Develop programs using basic JavaScript events			
Experiment-6 (UNIT-II)			
DOM Manipulation and ES6 1. Perform DOM element selection and modification 2. Implement event handling and client-side form validation 3. Develop programs using ES6 features (let, const, arrow functions, template literals)			

Experiment-7 (UNIT-II)
Modern JavaScript 1. Implement programs using promises, async, and await 2. Parse and manipulate JSON data 3. Store and retrieve data using Local Storage and Session Storage
Experiment-8 (UNIT-III)
Node.js 1. Install and configure Node.js 2. Develop a simple HTTP server using Node.js 3. Demonstrate the use of File System, Path, and HTTP modules
Experiment-9 (UNIT-III)
Express.js 1. Create an Express.js application 2. Implement routing and middleware 3. Handle client requests and responses using Express.js
Experiment-10 (UNIT-IV)
MongoDB 1. Create collections and perform CRUD operations 2. Execute queries using MongoDB query operators 3. Connect MongoDB with Node.js and Express.js
Experiment-11 (UNIT-IV)
React.js 1. Create React applications using functional components 2. Implement JSX, Props, State, and Event Handling 3. Develop applications using Hooks (useState and useEffect)
Experiment-12 (UNIT-IV)
Full Stack Integration 1. Connect the React frontend with the Express.js backend 2. Integrate MongoDB with the backend application 3. Build and deploy a simple MERN-based full-stack web application using Fetch/ Axios
Textbook(S): 1. Jon Duckett, HTML and CSS: Design and Build Websites, Wiley Publications, 1st edition, 2011, Indianapolis. (Chapters 1 to 15) 2. Ethan Brown, Web Development with Node and Express, O'Reilly Media, 2nd edition, 2019, California. (Chapters 1 to 10)
Reference Book(S): 1. Jon Duckett, JavaScript and JQuery: Interactive Front-End Web Development, Wiley Publications, 1st edition, 2014, Indianapolis. (Chapters 1 to 12) 2. Alex Banks and Eve Porcello, Learning React: Functional Web Development with React and Redux, O'Reilly Media, 2nd edition, 2020, California. (Chapters 1 to 12) 3. David Flanagan, JavaScript: The Definitive Guide, O'Reilly Media, 7th edition, 2020, California. (Chapters 1 to 20)
Web and Video link(S): https://youtu.be/bWACo_pvKxg?si=HqvJFieulNxNaii3
Laboratory Manual: <i>Full Stack Development Laboratory Manual, Department of CSE (Networks), KITSW</i>

Course Articulation Matrix (CAM):				U24CN507 : FULL STACK DEVELOPMENT LABORATORY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN507.1	3	2	3	1	3	-	-	-	2	1	1	3	2
CO2	U24CN507.2	3	3	3	2	3	-	-	-	2	1	1	3	3
CO3	U24CN507.3	3	3	3	2	3	1	-	-	2	2	2	3	3
CO4	U24CN507.4	3	3	3	2	3	1	1	-	3	2	2	3	3
U24CN507		3.0	2.75	3.0	1.75	3.0	0.50	0.25	-	2.25	1.50	1.50	3.0	2.75
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Design and develop responsive web pages using HTML5, CSS3, and Bootstrap by applying web design principles	SDG 9	Industry, Innovation and Infrastructure	Developing responsive web interfaces using modern web technologies promotes digital infrastructure and supports innovation in web application development
CO2	Develop interactive client-side web applications using JavaScript, DOM manipulation, ES6 features, and browser storage techniques	SDG 4	Quality Education	Practical implementation of modern JavaScript technologies enhances programming skills, digital literacy, and lifelong learning through hands-on software development
CO3	Develop server-side web applications using Node.js, Express.js, and MongoDB for backend processing and database management	SDG 9	Industry, Innovation and Infrastructure	Backend application development using industry-standard technologies strengthens students' ability to build scalable and reliable software solutions for digital transformation
CO4	Build and integrate full-stack web applications using React.js, Node.js, Express.js, and MongoDB following modern MERN stack development practices	SDG 11	Sustainable Cities and Communities	Full-stack application development enables the creation of smart, scalable, and accessible digital services that support sustainable communities and e-governance initiatives

INTERNET OF THINGS LABORATORY			
Class: B. Tech. V - Semester		Branch: CSE (Networks)	
Course Code:	U24CN508	Credits:	1
Hours/Week (L-T-P-E):	0-0-2-2	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : identify the basics of IoT, sensors, actuators and IoT boards in real time environment			
CO2 : make use of Arduino IDE, i/o functions for problem solving			
CO3 : demonstrate analog and digital communications with Arduino			
CO4 : design a real time application using sensors, actuators and Arduino board compare			
List of Experiments			
Experiment-1 (UNIT-I)			
1. Introduction of Arduino IDE, setup () and loop (), serial.begin(), serial.print() functions			
Experiment-2 (UNIT-I)			
1. Write an arduino program to demonstrate data types, variables and operators, if statements, loops and arrays			
Experiment-3 (UNIT-I)			
1. Write an Arduino program to demonstrate light an LED and Button			
Experiment-4 (UNIT-II)			
1. Write an Arduino program to demonstrate 7-segment display			
Experiment-5 (UNIT-II)			
1. Write an Arduino program to demonstrate temperature sensor			
Experiment-6 (UNIT-II)			
1. Demonstrate interfacing of PIR sensor and buzzer			
Experiment-7 (UNIT-III)			
1. Demonstrate interfacing of infrared and ultrasonic sensor			
Experiment-8 (UNIT-III)			
1. Demonstrate interfacing of potentiometer			
Experiment-9 (UNIT-III)			
1. Demonstrate interfacing of DC motor, servo motor and stepper motor			
Experiment-10 (UNIT-IV)			
1. Demonstrate I2C communication protocol			
Experiment-11 (UNIT-IV)			
1. Demonstrate SPI communication protocol			
Experiment-12 (UNIT-IV)			
1. Demonstrate UART communication protocol			

Textbook(s):

1. Sudip Misra, Anandarup Mukherjee, Arljit Roy, *Introduction to IoT*, New Delhi: Cambridge University Press ,2020(chapter7,8)
2. Cornel Amariei, *Arduino Development CookBook*, Birmingham: Packet Publishing Ltd., 2015(Chapter 2-6)

Reference Book(s):

1. Arshdeep Bahga and Vijay Madisetti, *Internet of Things: A Hands-On Approach*, Hyderabad: University Press, 2015
2. Marco Schwartz, *Internet of Things with ESP8266*, Birmingham: Packt Publishing Ltd., 2016
3. Rajesh Singh, Anita Gehlot, Lovi Raj Gupta, Bhupendra Singh, Mahendra Swain, *Internet of things With Raspberry Pi and Arduino*, Boca Raton: CRC Press, Taylor & Francis Group,2020
4. Brian Evans, *Beginning Arduino Programming*, New York: Apress, 2011

Laboratory Manual:

1. Internet of things *Manual and Record Book*, Department of CSN, KITSW

Course Articulation Matrix (CAM):				U24CN509: INTERNET OF THINGS LABORATORY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN508.1	2	1	-	-	1	-	-	-	-	-	-	2	2
CO2	U24CN508.2	2	2	1	1	2	-	-	-	1	-	-	2	2
CO3	U24CN508.3	2	2	2	1	2	-	-	-	-	-	-	2	2
CO4	U24CN508.4	2	2	2	2	2	-	-	-	1	-	-	2	2
U24CN508		2	1.75	1.67	1.33	1.75	-	-	-	1.5	-	-	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	identify the basics of IoT, sensors, actuators, and IoT boards in real-time environments	SDG9	Industry, Innovation and Infrastructure	Understanding IoT fundamentals enables development of smart infrastructure systems such as industrial automation, smart devices, and connected networks, promoting innovation and technological advancement
CO2	make use of Arduino IDE and I/O functions for problem solving	SDG4	Quality Education	Hands-on use of Arduino and embedded systems enhances practical learning, technical skills, and problem-solving abilities, supporting quality education through experiential and skill-based learning

CO3	demonstrate analog and digital communications with Arduino	SDG9	Industry, Innovation and Infrastructure	Knowledge of communication techniques supports reliable data transmission in IoT systems, enabling efficient industrial communication, smart monitoring systems, and infrastructure development
CO4	design a real-time application using sensors, actuators, and Arduino boards	SDG11	Sustainable Cities and Communities	Designing IoT-based real-time applications enables smart city solutions such as traffic control, energy management, and environmental monitoring, contributing to sustainable and efficient urban development

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY			
Class: B. Tech. V – Semester		Branch: CSE (Networks)	
Course Code:	U24CN509	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : implement AI search algorithms including BFS, DFS, and A* and apply intelligent agent concepts to problem-solving CO2 : implement machine learning pipeline including data preprocessing, feature engineering, and model evaluation techniques CO3 : apply supervised and unsupervised learning algorithms including classification, regression, clustering, and association techniques to real-world datasets CO4 : design, implement, and evaluate ensemble models and neural network architectures for intelligent system development			
List of Experiments			
Experiment-1 (UNIT-I)			
Dataset: Simulated network topology (nodes = routers, edges = links) - Develop a program to load/create a network graph dataset and represent it using adjacency list - Develop a program to apply BFS and DFS to traverse the network and compare traversal order			
Experiment-2 (UNIT-I)			
Dataset: Weighted network graph (link cost, delay) - Develop a program to apply A* algorithm to find the optimal path between nodes in a network - Develop a program to compare results with Dijkstra’s algorithm and analyze path cost differences			
Experiment-3 (UNIT-I)			
Dataset: Game tree / network decision tree dataset - Develop a program to implement Minimax algorithm for intelligent decision-making in a network scenario - Develop a program to apply Alpha-Beta Pruning and compare execution efficiency with standard Minimax			
Experiment-4 (UNIT-II)			
Dataset: KDD Cup 99 / NSL-KDD / CICIDS dataset - Develop a single program to handle missing values, duplicates, and outliers in the network dataset - Develop a program to apply normalization and standardization techniques on the preprocessed dataset			
Experiment-5 (UNIT-II)			
Dataset: NSL-KDD / CICIDS network intrusion dataset - Develop a program to extract features such as protocol, service, duration, and bytes from the network dataset - Develop a program to apply label encoding and one-hot encoding; perform feature selection			

Experiment-6 (UNIT-II)
Dataset: Preprocessed network intrusion dataset
1. Develop a program to perform train-test split (70:30 / 80:20) on the network dataset 2. Develop a program to visualize the dataset and compute the feature correlation matrix
Experiment-7 (UNIT-III)
Dataset: Network performance dataset (delay, throughput)
1. Develop a program to apply Linear Regression to predict network delay and throughput 2. Develop a program to evaluate the model using RMSE and interpret the results
Experiment-8 (UNIT-III)
Dataset: NSL-KDD / CICIDS network intrusion dataset
1. Develop a program to apply Logistic Regression for binary attack classification on the network dataset 2. Develop a program to implement k-Nearest Neighbour (kNN) classifier and compare accuracy, precision, recall, and F1-score
Experiment-9 (UNIT-III)
Dataset: Network traffic dataset
1. Develop a program to apply K-Means clustering to group network traffic patterns 2. Develop a program to detect anomalies (intrusions) using cluster deviation analysis
Experiment-10 (UNIT-IV)
Dataset: Network intrusion dataset
1. Develop a program to implement Random Forest classifier for network intrusion detection 2. Develop a program to demonstrate the impact of Bagging and Boosting on classification accuracy
Experiment-11 (UNIT-IV)
Dataset: Network attack dataset (NSL-KDD / CICIDS)
1. Develop a program to apply SVM for network attack classification 2. Develop a program to evaluate classification performance using confusion matrix, precision, recall, and F1-score
Experiment-12 (UNIT-IV)
Dataset: Network intrusion dataset
1. Develop a program to implement Perceptron model 2. Develop a program to implement Multi-Layer Perceptron (MLP) and compare performance with single-layer Perceptron
<u>Textbook(S):</u>
1. Stuart Russell and Peter Norvig, <i>Artificial Intelligence: A Modern Approach</i>, 3rd Edition, Pearson, 2010 (<i>Chapter 1 to 8</i>) 2. Saikat Dutt, Subramanian Chandramouli, Amit Kumar Das, <i>Machine Learning</i>, Pearson, 2nd edition, 2020, New Delhi. (<i>Chapters 1 to 11</i>)
<u>Reference Book(S):</u>
1. Tom M. Mitchell, <i>Machine Learning</i>, McGraw-Hill, 1st edition, 1997, New York 2. Stuart J. Russell, Peter Norvig, <i>Artificial Intelligence: A Modern Approach</i>, Pearson Education, 4th edition, 2020, New Delhi

3. Ethem Alpaydin, <i>Machine Learning</i> , PHI Learning, 3 rd edition, 2014, New Delhi
4. Andreas C. Müller, Sarah Guido, <i>Introduction to Machine Learning with Python</i> , O'Reilly Media, 1 st edition, 2016, Sebastopol
Web and Video link(s):
1. https://nptel.ac.in/courses/106106139 ; NPTEL Video Lecture on Artificial Intelligence by Prof. Deepak Khemani, Department of Computer Science and Engineering, IIT Madras
2. https://nptel.ac.in/courses/106105152 NPTEL Video Lecture on Introduction to Machine Learning by Prof. Balaraman Ravindran, Department of Computer Science and Engineering, IIT Madras
Laboratory Manual:
<i>Artificial Intelligence and Machine Learning Laboratory Manual</i> , Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):				U24CN508 : ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LABORATORY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN509.1	1	2	2	1	2	1	1	1	1	1	1	2	2
CO2	U24CN509.2	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	U24CN509.3	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	U24CN509.4	2	2	3	3	-	-	1	-	1	-	2	2	2
U24CN509		1.75	2	2.25	1.75	-	-	1	-	1	-	1.75	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	implement AI search algorithms including BFS, DFS, and A* and apply intelligent agent concepts to problem-solving	SDG9	Industry, Innovation and Infrastructure	AI-based problem-solving and intelligent agent systems support automation and optimization in industrial and infrastructure applications
CO2	implement machine learning pipeline including data preprocessing, feature engineering, and model evaluation techniques	SDG4	Quality Education	Machine learning enables intelligent educational systems and data-driven learning methods, improving education quality
CO3	apply supervised and unsupervised learning algorithms for classification, regression, clustering, and association tasks	SDG9	Industry, Innovation and Infrastructure	ML algorithms enable predictive analytics and automation in industrial and infrastructure applications
CO4	design and evaluate ensemble models and neural networks including deep learning techniques	SDG3	Good Health and Well-being	Deep learning and neural networks support healthcare applications such as disease prediction and diagnostics

SEMINAR			
Class: B. Tech. V – Semester		Branch: CSE (Networks)	
Course Code:	U24CN510	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60%
Total Number of Teaching Hours:	-	ESE:	40%

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,

CO1: select current topics in their engineering discipline & allied areas from peer reviewed journals/ technical magazines/ conference proceedings

CO2: demonstrate the skills for performing literature survey, identify gaps, analyze the technical content and prepare a well-documented seminar report

CO3: create informative PPT and demonstrate communication skills through effective oral presentation showing knowledge on the subject & sensitivity towards social impact of the seminar topic

CO4: write a “seminar paper” in scientific journal style & format from the prepared seminar report

Student has to take up independent topic on innovative ideas, to solve common problems using their knowledge relevant to courses offered in their program of study, which would supplement and complement the program assigned to each student.

Seminar Guidelines:

1. The HoD shall constitute a Department Seminar Evaluation Committee (DSEC)
2. DSEC shall allot a faculty supervisor to each student for guiding on (i) selection of topic (ii) literature survey and work to be carried out (iii) preparing a report in proper format and (iv) effective seminar presentation
3. There shall be only Continuous Internal Evaluation (CIE) for seminar
4. The CIE for seminar is as follows:

Assessment	Weightage
Seminar Supervisor Assessment	20%
Seminar Report	30%
Seminar Paper	20%
DSEC Assessment: Oral presentation with PPT and viva-voce	30%
Total Weightage:	100%

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation

- (a) Seminar Topic: The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals / Technical Magazines on the topics of potential interest
- (b) Report: Each student is required to submit a well-documented report on the chosen seminar topic as per the format specified by DSEC.
- (c) Anti-Plagiarism Check: The seminar report should clear plagiarism check as per the Anti-Plagiarism policy of the institute.
- (d) Presentation: Each student should prepare PPT with informative slides and make an effective oral presentation before the DSEC as per the schedule notified by the department
- (e) The student has to register for the Seminar as supplementary examination in the following cases:

- i) he/she is absent for oral presentation and viva-voce

- ii) he/she fails to submit the report in prescribed format
- iii) he/she fails to fulfill the requirements of seminar evaluation as per specified guidelines
- (f) (i) The CoE shall send a list of students registered for supplementary to the HoD concerned
- ii) The DSEC, duly constituted by the HoD, shall conduct seminar evaluation and send the award list to the CoE within the stipulated time

Course Articulation Matrix(CAM):							U24CN510: SEMINAR								
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24CN510.1	1	1	-	1	1	-	1	2	2	2	1	2	1	1
CO2	U24CN510.2	1	1	-	-	-	-	-	2	2	2	-	2	1	1
CO3	U24CN510.3	-	-	-	-	-	-	1	2	2	2	-	2	1	1
CO4	U24CN510.4	-	-	-	-	-	-	-	2	2	2	-	2	1	1
U24CN510		1	1	-	1	1	-	1	2	2	2	1	2	1	1

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	select current topics in their engineering discipline and allied areas from peer-reviewed journals, technical magazines, and conference proceedings.	SDG 4	Quality Education	Promotes lifelong learning, awareness of emerging technologies, and acquisition of current knowledge through scholarly resources.
CO2	demonstrate the skills for performing literature survey, identifying gaps, analyzing technical content, and preparing a well-documented seminar report.	SDG 9	Industry, Innovation and Infrastructure	Encourages research aptitude, critical thinking, innovation, and technical documentation skills essential for technological advancement.
CO3	construct programs on single source shortest path, multistage graph and all pairs shortest path using dynamic programming technique	SDG11	Sustainable Cities and Communities	Enhances communication and knowledge-sharing skills while fostering awareness of the societal impact of engineering solutions.
CO4	write a seminar paper in scientific journal style and format from the prepared seminar report.	SDG 4 SDG 9	Quality Education, Industry, Innovation and Infrastructure	Develops scientific writing, research dissemination, and professional documentation skills that support innovation and knowledge transfer.

VI-Sem Syllabi

(B.Tech CSE(Networks) URR24)

VI SEMESTER (STREAM-II)

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	OEC	U24OE601X-SEB	OE- S&E Basket	2	1	-	3	3
2	PEC	U24CN602X	PE-I/MOOCs-I	2	1	-	3	3
3	PCC	U24CN603	Software Engineering	2	1	-	3	3
4	PCC	U24CN604	DevOps	2	1	-	3	3
5	PCC	U24CN605	Cryptography and Network Security	2	1	-	3	3
6	IKSC	U24IK606A	UHV-II	2	-	-	2	2
7	HSMC	U24MH607	Technical English	-	-	2	2	1
8	PCC	U24CN608	DevOps Laboratory	-	-	2	2	1
9	PCC	U24CN609	Cryptography and Network Security Laboratory	-	-	2	2	1
10	ELC	U24CN610	Mini Project	-	-	2	2	1
Total:				12	5	8	25	21
Additional Learning@: Maximum credits allowed for Honours/Minor				-	-	-	-	5
Total credits for Honours/Minor students:				-	-	-	-	26

Open Elective-I OE S&EB (Startups & Entrepreneurship)		
S. No.	Course Code	Course Title
1.	U24OE601A-SEB	Design Thinking
2.	U24OE601B-SEB	Innovative Product Design and Development
3.	U24OE601C-SEB	Entrepreneurship
4.	U24OE601D-SEB	Design Studio
5.	U24OE601E-SEB	Any other course approved by BoS Chair and Dean AA

Program Elective - I		
S. No.	Course Code	Course Title
1.	U24CN602A	Fundamentals of Cyber Security and Tools
2.	U24CN602B	Fog and Edge Computing
3.	U24CN602C	Deep Learning
4.	U24CN602D	Statistical Fundamentals
5.	U24CN602E	Any other course approved by BoS Chair and Dean AA

DESIGN THINKING			
Class: B Tech – VI -Semester		Branch: Common to All	
Course Code:	U24OE601A- SE&B	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs)			
After completion of this course, the students should be able to...			
CO1 : identify customer segments and needs, assess customer-problem fit using Jobs-to-be-Done (JTBD) and customer persona frameworks			
CO2 : analyze market opportunities and competitive dynamics, estimate business feasibility and build prototypes/MVPs for validating innovative solutions			
CO3 : develop a Lean Canvas for a start-up venture by integrating value proposition, customer segments, revenue streams, key metrics and growth strategies			
CO4 : evaluate funding and team-building strategies and develop a scalable, investment-ready venture proposal through financial planning, validation and professional pitching			
UNIT-I		9 Hrs	
Identify and Analyze Real-world Problems: The macro industry view, Problem identification & segment assembly, Customer identification & needs validation, Assess 'jobs-to-be-done' (JTBD) for a customer segment, Develop customer persona, Validate customer-problem fit, pivot/refine customer-problem fit for feasibility, Examine ideation techniques			
UNIT-II		9 Hrs	
Solution Idea Generation & MVP: Opportunity & Competition Mapping, Prototype Development & Minimum Viable Product (MVP), Identify Global Competitors, Review Industry Trends and Estimate Market Size (TAM), Introduction to Financial Planning, Overview of Prototypes & MVP, Build an initial Prototype, Prototypes for Early Validation, Map your Relative Position in the Market, Estimate Opportunity Size			
UNIT-III		9 Hrs	
Market Feasibility & Business Modeling: Lean canvas assembly, Marketing & go-to-market (GTM) strategy, Examine revenue models, Review and organize lean canvas, Build LC for your start-up, Build LC for your start-up, Understand marketing and sales, Recommend a GTM approach, Map a sales process, Building an initial team			
UNIT-IV		9 Hrs	
Financial Management, Team Scale & Final Pitch: Funding pathways & scaling orientation, Validation & venture presentation/collaboration, Deep dive into financial planning, Analyse the path to profitability, Understand bootstrapping & funding options, Finding co-founders and mentors, Thinking beyond the prototype - Scale opportunity & orientation, Final milestone - Venture idea feasibility presentation			
Textbook:			
1. Chandramouli Subramanian & Thiyagarajan p, Sankaran V, Design Thinking: A Hands-on Approach, University Press (India) Pvt. Ltd., 1 st Edn, 2025, Hyderabad			

Reference Book(s):

1. Andrew Pressman, Design Thinking: A Guide to Creative Problem Solving for Everyone, Routledge, Taylor & Francis Group, 7th Edn, 2019, New York
2. George E Dieter and Linda C Schmidt, Engineering Design, McGraw-Hill Education, 13th Edn, 2020, New Delhi
3. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperBusiness, 7th Edn, 2009, New York
4. Karl T Ulrich, Steven D Eppinger, and Maria C Yang, Product Design and Development, McGraw-Hill Education, 2020, New Delhi
5. Tom Kelley and David Kelley, Creative Confidence: Unleashing the Creative Potential Within Us All, Crown Business, 2013, New York
6. Idris Mootee, Design Thinking for Strategic Innovation, John Wiley & Sons, 1st Edn, 2013, New Jersey

Web and Video link(s):

<https://nptel.ac.in/courses/110106124>, NPTEL Video Lecture on Design Thinking - A Primer by Prof Ashwin Mahalingam & Prof Bala Ramadurai, IIT Madras

Course Articulation Matrix (CAM):		U24OE601A: SE&B - DESIGN THINKING												
CO		PO 1	PO2	PO 3	PO 4	PO5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PSO1	PS O2
CO1	U24OE601A.1	2	2	1	1	1	1	1	1	1	1	1	1	1
CO2	.U24OE601A2	1	2	2	2	1	1	1	1	1	1	1	1	1
CO3	U24OE601A.3	1	2	3	2	2	1	1	1	1	1	1	1	1
CO4	U24OE601A.4	1	1	3	2	2	2	1	2	2	2	2	1	1
U24OE601A		1.25	1.75	2.25	1.75	1.5	1.25	1	1.25	1.25	1.25	1.25	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

Course Outcome and SDG Goal Mapping				
CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	identify customer segments and needs, assess customer-problem fit using jobs-to-be-done (jtbd) and customer persona frameworks	SDG 4	Quality Education	Develops critical thinking, problem identification, customer-centric analysis, and innovation-oriented learning skills
		SDG 8	Decent Work and Economic Growth	Encourages entrepreneurial thinking and identification of real-world problems that can lead to sustainable economic opportunities
CO2	analyze market opportunities and competitive dynamics, estimate business feasibility and build prototypes/mvps for validating innovative solutions	SDG 9	Industry, Innovation and Infrastructure	Promotes innovation, technology-driven problem solving, and development of viable products and services
		SDG 12	Responsible Consumption and Production	Encourages efficient use of resources through prototype validation and iterative product development before large-scale implementation
CO3	develop a lean canvas for a start-up venture by integrating value proposition, customer segments, revenue streams, key metrics and growth strategies	SDG 8	Decent Work and Economic Growth	Supports entrepreneurship, start-up creation, employment generation, and sustainable business development
		SDG 9	Industry, Innovation and Infrastructure	Encourages business model innovation and the translation of creative ideas into scalable ventures
CO4	evaluate funding and team-building strategies and develop a scalable, investment-ready venture proposal through financial planning, validation and professional pitching	SDG 8	Decent Work and Economic Growth	Enhances entrepreneurial competencies, venture sustainability, and economic value creation
		SDG 17	Partnerships for the Goals	Promotes collaboration among founders, mentors, investors, and stakeholders for successful venture development
		SDG 9	Industry, Innovation and Infrastructure	Facilitates scaling of innovative solutions and commercialization of technology-driven ideas

INNOVATIVE PRODUCT DESIGN & DEVELOPMENT			
Class: B. Tech. – VI -Semester		Branch: Common to All	
Course Code:	U24OE601B-SE&B	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to...</i>			
CO1 create the systematic lifecycle of engineering design from customer requirements to technical specifications			
CO2 choose principles of industrial design, materials science, and ergonomics to optimize product usability			
CO3 implement the advanced rapid prototyping tools to compress the product development cycle			
CO4 design and build prototype performance using structural validation, risk analysis, and engineering metrics			
UNIT-I			9 Hrs
Introduction to product design engineering: Translating user needs into product design specifications (PDS), Quality function deployment (QFD) and the house of quality framework, Functional decomposition and physical architecture mapping, Regulatory compliance, standards, and safety considerations in product architecture			
UNIT-II			9 Hrs
Principles of Industrial Design (ID): Human-centered design and ergonomics (anthropometry), Visual hierarchy, form generation, and product aesthetics, Material selection frameworks (structural, thermal, electrical properties) and manufacturing process mapping (DFM/DFA: Design for manufacturing and assembly), Design semantics and user-interface touchpoints			
UNIT-III			9 Hrs
Prototyping strategies: proof-of-concept vs alpha/beta prototypes: Additive manufacturing (3D Printing: FDM, SLA, SLS) and subtractive techniques (CNC machining), Rapid tooling, silicone molding, and vacuum forming, Digital prototyping- Computer-aided design (CAD) modeling, assembly verification, and finite element simulations, Virtual and augmented reality (VR/AR) workflows for product spatial validation			
UNIT-IV			9 Hrs
Design of Experiments (DoE) for physical/digital prototypes: Robust design testing and failure analysis, Cost modeling, Bill of Materials (BOM) management, and engineering change orders (ECO), Sustainable engineering: Design for Environment (DFE) and lifecycle evaluation, Preparing the product blueprint for production scaling and supply chain onboarding			
Textbook: 1. Karl T Ulrich and Steven D Eppinger, Product Design and Development, Tata McGraw-Hill, 10th Edn, 2012, New Delhi			
Reference Book(s): 1. Devdas Shetty, Product Design for Engineers, Cengage Learning, 9 th Edn, 2015, Boston 2. AK Chitale and RC Gupta, Product Design and Manufacturing, PHI Learning, 2013, 13 th Edn, New Delhi 3. Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Pearson Education, 2001, New Delhi 4. Benjamin W Niebel and Alan B Draper, Product Design & Process Engineering, McGraw-			

Hill, 1974, New York

5. Paul Trott, Innovation Management and New Product Development, Pearson Education, 2016, Harlow

Web and Video link(s):

<https://nptel.ac.in/courses/112107217>, NPTEL Video Lecture on Product Design and Development by Prof Inderdeep Singh, Professor of Mechanical and Industrial Engineering, IIT Roorkee

Course Articulation Matrix (CAM):		U24OE601B - Innovative Product Design & Development												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO 2
CO1	U24OE601B.1	2	2	1	1	1	1	-	1	1	-	1	1	1
CO2	U24OE601B.2	1	2	2	2	1	1	1	1	1	-	1	1	1
CO3	U24OE601B.3	1	2	3	2	2	1	1	1	1	1	1	1	1
CO4	U24OE601B.4	1	1	3	2	2	2	1	2	2	2	2	1	1
U24OE601B		1.25	1.75	2.25	1.75	1.5	1.25	1	1.25	1.25	1.5	1.25	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	create the systematic lifecycle of engineering design from customer requirements to technical specifications	SDG 4	Quality Education	Promotes creative learning, problem-solving, and innovation skills among students
		SDG 9	Industry, Innovation and Infrastructure	Encourages innovative thinking for solving engineering and societal challenges
CO2	choose principles of industrial design, materials science, and ergonomics to optimize product usability	SDG 3	Good Health and Well-being	Human-centered design improves usability, safety, and user well-being
		SDG 11	Sustainable Cities and Communities	Supports identification of sustainable and community-oriented solutions
CO3	implement the advanced rapid prototyping tools to compress the product development cycle	SDG 9	Industry, Innovation and Infrastructure	Promotes innovation, product development, and technological advancement
		SDG 12	Responsible Consumption and Production	Encourages efficient resource utilization and sustainable product development
CO4	design and build prototype performance using structural validation, risk analysis, and engineering metrics	SDG 8	Decent Work and Economic Growth	Supports entrepreneurship, innovation-driven business models, and employability skills
		SDG 9	Industry, Innovation and Infrastructure	Encourages development of practical and scalable engineering solutions
		SDG 17	Partnerships for the Goals	Promotes teamwork, interdisciplinary collaboration, and stakeholder interaction

ENTREPRENEURSHIP			
Class: B. Tech. –VI -Semester		Branch: Common to All	
Course Code:	U24OE601C	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to...</i> CO1: develop an entrepreneurial mindset and create scalable business concepts through the analysis of opportunities and evaluation of business feasibility CO2: analyze and validate customer needs, market demands, and pain points using structured customer discovery techniques CO3: create students with practical knowledge of business modeling, unit economics, and venture monetization CO4: build a clear roadmap for executing, legally safeguarding, and pitching a new venture			
UNIT-I		9 Hrs	
Introduction to Entrepreneurship: definitions, characteristics, and the evolution of an entrepreneurial ecosystem, Myths vs. Realities of starting up, Types of entrepreneurship (Social, Tech, Lifestyle, and Corporate), Developing an entrepreneurial mindset: risk-taking, resilience, self-efficacy, and dealing with failure, Identifying personal strengths and alignment with venture archetypes.			
UNIT-II		9 Hrs	
Deep-dive Problem Identification: moving from generic ideas to systemic problems, Root-cause analysis, stakeholder mapping, and ecosystem friction points, Customer Discovery methodology: conducting ethnographic interviews, building user personas, and mapping customer archetypes, Validating market pain points vs. "nice-to-have" solutions, Value Proposition Canvas framework.			
UNIT-III		9 Hrs	
Designing the business architecture: Introduction to the Lean Canvas and Business Model Canvas (BMC), Revenue streams, pricing strategies, and cost structures, Fundamentals of Unit Economics: Customer Acquisition Cost (CAC), Lifetime Value (LTV), and break-even analysis, Competitor analysis and establishing a Sustainable Competitive Advantage (Moat), Basics of bootstrapping vs. external funding.			
UNIT-IV		9 Hrs	
Building the Go-To-Market (GTM) strategy: marketing channels, sales funnels, and early user acquisition, Basics of business registration, legal structures (LLP, Pvt Ltd), and intellectual property (IP) awareness, Building an early founding team, equity splitting models, and culture, Final capstone venture pitch preparation: structuring an investor pitch deck.			
Textbook(s): 1. Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd, Entrepreneurship, McGraw-Hill Education, 1st Edn, 2020, New Delhi.			
Reference Book(S): 1. Poornima M. Charantimath, Entrepreneurship Development and Small Business Enterprises, Pearson Education, 5th Edn, 2018, New Delhi. 2. Bruce R. Barringer and R. Duane Ireland, Entrepreneurship: Successfully Launching New Ventures, Pearson, 4th Edn, 2019, New Delhi.			

3. Eric Ries, The Lean Startup: How Today's Entrepreneurs Use Continuous Innovation, Crown Business, 2011, New York.
4. S. S. Khanka, Entrepreneurship Development, S. Chand & Company, 2010, New Delhi.
5. Peter Thiel, Zero to One: Notes on Startups, or How to Build the Future, Crown Business, 2014, New York.

Web and Video link(s):

<https://nptel.ac.in/courses/110105067>, NPTEL Video Lecture on Entrepreneurship Essentials by Prof. Rajeev Roy, Entrepreneurship Development Cell, IIT Kharagpur.

Course Articulation Matrix (CAM):		U24OE605C - ENTREPRENEURSHIP												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO 7	PO 8	PO 9	PO 10	PO1 1	PS O1	PSO 2
CO1	U24OE601C.1	2	2	1	1	1	1	-	1	1	-	1	1	1
CO2	U24OE601C.2	1	2	2	2	1	1	1	1	1	-	1	1	1
CO3	U24OE601C.3	1	2	3	2	2	1	1	1	1	1	1	1	1
CO4	U24OE601C.4	1	1	3	2	2	2	1	2	2	2	2	1	1
U24OE601C		1.25	1.75	2.25	1.75	1.5	1.25	1	1.25	1.25	1.5	1.25	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	develop an entrepreneurial mindset and create scalable business concepts through the analysis of opportunities and evaluation of business feasibility	SDG 4	Quality Education	Enhances entrepreneurial learning by fostering creativity, critical thinking, and practical problem-solving skills.
		SDG 9	Industry, Innovation and Infrastructure	Promotes innovation and entrepreneurship by encouraging the development of scalable ventures that contribute to industrial and technological growth.
CO2	analyze and validate customer needs, market demands, and pain points using structured customer discovery techniques	SDG 3	Good Health and Well-being	Facilitates the identification and validation of healthcare-related needs, leading to more user-centric and impactful well-being solutions.
		SDG 11	Sustainable Cities and Communities	Supports the development of community-focused innovations by understanding urban challenges and designing solutions aligned with citizens' needs
CO3	create students with practical knowledge of business modeling, unit economics, and venture monetization	SDG 9	Industry, Innovation and Infrastructure	Strengthens innovation ecosystems by enabling the commercialization and scaling of technology-driven ventures.
		SDG 12	Responsible Consumption and Production	Encourages sustainable business practices by integrating resource efficiency, value creation, and responsible production principles into venture planning
CO4	build a clear roadmap for executing, legally safeguarding, and pitching a new venture	SDG 8	Decent Work and Economic Growth	Promotes entrepreneurship and job creation by enabling the successful launch and growth of innovative ventures.
		SDG 9	Industry, Innovation and Infrastructure	Supports innovation-driven enterprises by facilitating the protection, development, and scaling of new technologies and business models
		SDG 17	Partnerships for the Goals	Encourages collaboration with investors, industry partners, mentors, and institutions to strengthen venture growth and impact.

DESIGN STUDIO			
Class: B. Tech. –VI -Semester		Branch: Common to All	
Course Code:	U24OE601D	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to...</i> CO1 : deconstruct ambiguous real-world problems into rigorous R&D challenges using patent search and prior-art techniques CO2 : apply system-level architecture and feasibility models to design technical solutions CO3 : build and synthesize functional high-fidelity prototypes / MVPs leveraging modern engineering tools CO4 : validate engineering assumptions via stakeholder co-creation and design an institutional go-to-market plan			
UNIT-I			9 Hrs
Foundations of R&D-led entrepreneurship , Identifying deep-tech and high-impact industry problems, Advanced root-cause analysis, Literature review, patent landscaping, and prior art search, Defining the innovation thesis and scientific/technological core, Drafting the initial Product design brief			
UNIT-II			9 Hrs
Translating insights into technical concepts , Systematic brainstorming and TRIZ (Theory of inventive problem solving) basics, Technology readiness level (TRL) mapping, Engineering/architectural design and system topology, Value proposition design and business-technical feasibility modeling, The "Napkin Pitch" for technical solutions			
UNIT-III			9 Hrs
Rapid prototyping paradigms (Software/Hardware/Service) , Formulating the minimum viable product (MVP) core feature matrix, Materials selection and agile development sprints, UI/UX wireframing or hardware schematics, Functional architecture implementation, Risk assessment and failure mode effects analysis (FMEA)			
UNIT-IV			9 Hrs
Surface key engineering and market assumptions , Empirical testing protocols, simulation, and data collection, Customer co-creation loops and iterative engineering, Feedback analysis from key industry stakeholders, Creating the product "On-Ramp" strategy (Go-To-Market roadmap, Pilot launch framework, and IP Protection)			
Textbook(s): 1. Brian Sullivan, The Design Studio Method: Creative Problem Solving with UX Sketching, Routledge, 2015, New York			
Reference Book(s): 1. Elizabeth Boling, James Benedict Brown, Colin M Gray, and Derek Jones, Studio Properties: A Field Guide to Design Education, Yale Press, 2021, New Haven 2. Charles Eastman, W Michael McCracken, and Wendy Newstetter, Design Knowing and Learning: Cognition in Design Education, Elsevier, 2001, Oxford 3. Donald A Schön, Educating the Reflective Practitioner: Toward a New Design for Teaching and Learning in the Professions, Jossey-Bass, 17th Edn, 1987, San Francisco 4. Jerzy Wojtowicz, Virtual Design Studio, Hong Kong University Press, 8 th Edn, 1995, Hong Kong			

5. Lois Hetland and Ellen Winner, Studio Thinking: The Real Benefits of Visual Arts Education, Teachers College Press, 12th Edn, 2007, New York

Web and Video link(s):

<https://nptelacin/courses/124105003>, NPTEL Video Lecture on Understanding Design by Prof Prasad Onkar, Department of Design, IIT Hyderabad

Course Articulation Matrix (CAM):		U24OE601D - DESIGN STUDIO												
CO		PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO2
CO1	U24OE601D.1	2	2	1	1	1	1	1	1	1	1	1	1	1
CO2	U24OE601D.2	1	2	2	2	1	1	1	1	1	1	1	1	1
CO3	U24OE601D.3	1	2	3	2	2	1	1	1	1	1	1	1	1
CO4	U24OE601D.4	1	1	3	2	2	2	1	2	2	2	2	1	1
U24OE601D		1.25	1.75	2.25	1.75	1.5	1.25	1	1.25	1.25	1.25	125	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	Course Outcome	Mapped SDGs		Justification
CO1	deconstruct ambiguous real-world problems into rigorous R&D challenges using patent search and prior-art techniques	SDG 4	Quality Education	Promotes experiential and innovation-based learning by equipping learners with problem-solving, research, and intellectual property skills essential for the 21st century
		SDG 9	Industry, Innovation and Infrastructure	Fosters innovation capacity by encouraging the development of novel technologies, strengthening industry-oriented research, and supporting sustainable technological advancement
CO2	apply system-level architecture and feasibility models to design technical solutions	SDG 3	Good Health and Well-being	Supports the design of reliable healthcare technologies and systems that enhance accessibility, efficiency, and overall well-being
		SDG 11	Sustainable Cities and Communities	Facilitates the creation of smart, resilient, and resource-efficient infrastructure solutions that improve urban sustainability and quality of life
CO3	build and synthesize functional high-fidelity prototypes / MVPs leveraging modern engineering tools	SDG 9	Industry, Innovation and Infrastructure	Promotes technological innovation and strengthens engineering capabilities by accelerating product development and industry-relevant solutions
		SDG 12	Responsible Consumption and Production	Encourages efficient resource utilization, iterative design, and sustainable product development practices that minimize waste and optimize production processes
CO4	validate engineering assumptions via stakeholder co-creation and design an institutional go-to-market plan	SDG 8	Decent Work and Economic Growth	Supports entrepreneurship, innovation-driven employment, and sustainable economic growth through market-oriented solution development
		SDG 9	Industry, Innovation and Infrastructure	Strengthens industry-academia innovation ecosystems by facilitating the translation of validated technologies into scalable solutions
		SDG 17	Partnerships for the Goals	Encourages collaboration among academia, industry, government, and end users to co-create impactful and sustainable innovations

FUNDAMENTALS OF CYBER SECURITY TOOLS			
Class: B Tech VI – Semester		Branch: CSE (Networks)	
Course Code:	U18IN602A	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: understand cyber security fundamentals, threats, vulnerabilities, and system protection mechanisms CO2: analyse network security monitoring and defence mechanisms for secure communication CO3: apply vulnerability assessment and security auditing techniques for protecting computing systems CO4: identify IoT security challenges and recommend suitable cyber defence strategies			
UNIT-I			9 Hrs
Introduction to Cyber Security: Introduction to cyber security, Information security principles, CIA Triad, Threats and vulnerabilities Cyber Attacks and Access Control: Types of cyberattacks, Authentication and authorization, Access control mechanisms Malware and Risk Management: Malware fundamentals, Security policies, Risk management concepts Operating System and Linux Security: Operating system security basics, Linux fundamentals for security administration, Basic security administration practices			
UNIT-II			9 Hrs
Network Security Fundamentals: Network security fundamentals, Secure communication concepts, Domain Name System (DNS) security basics Firewalls and Intrusion Detection: Firewalls and packet filtering, Intrusion detection and prevention Systems VPN and Wireless Security: Virtual Private Networks (VPNs), Wireless network protection techniques Network Monitoring and Analysis: Network traffic analysis, Log monitoring and event analysis			
UNIT-III			9 Hrs
Vulnerability Assessment: Vulnerability assessment concepts, Security auditing techniques Secure System Configuration: Secure system configuration, Patch management techniques Web and Password Security: Web application basics, Secure password policies Backup and Endpoint Security: Data backup and recovery mechanisms, Endpoint security concepts, Cloud security fundamentals			
UNIT-IV			9 Hrs
Fundamentals of IoT Security: Introduction to IoT security, IoT Architecture and security challenges Secure IoT Communication: Secure IoT communication protocols, Sensor and embedded device security Device Authentication and Privacy: Smart device authentication, IoT Data privacy and protection, Mobile device security Cyber Defence and Governance: Cyber defence strategies, Incident response and security best practices, Security governance and cyber laws			

Textbook(s):

1. Charles J Brooks, Christopher Grow, Philip Craig and Donald Short, *Cyber Security Essentials*, 2nd ed, Wiley, 2023 (Chapters 1 to 12)
2. William Stallings and Lawrie Brown, *Computer Security: Principles and Practice*, 5th ed, Pearson Education, 2024 (Chapters 1 to 11, 14 to 18)
3. Michael E Whitman and Herbert J. Mattord, *Principles of Information Security*, 7th ed, Cengage Learning, 2022 (Chapters 1 to 10)
4. William Stallings, *Network Security Essentials: Applications and Standards*, 7th ed, Pearson Education, 2021 (Chapters 1 to 9)
5. Occupy The Web, *Linux Basics for Hackers*, No Starch Press, 2018 (Chapters 1 to 9)

Reference Book(s):

1. Shon Harris and Fernando Maymi, *CISSP All-in-One Exam Guide*, 9th ed, McGraw-Hill Education, 2021
2. David Kim and Michael G Solomon, *Fundamentals of Information Systems Security*, 4th ed, Jones & Bartlett Learning, 2021
3. Brian Russell and Drew Van Duren, *Practical Internet of Things Security*, 2nd ed, Packt Publishing, 2023
4. Fei Hu, *Security and Privacy in Internet of Things (IoT): Models, Algorithms and Implementations*, CRC Press, 2021
5. James Turnbull, *The Logstash Book*, Turnbull Press, 2019

Web and Video link(s):

1. <https://nptelacin/courses/106106248>: NPTEL Video Lecture on Cyber Security and Privacy, by Prof Saji K Mathew, IIT Madras
2. <https://nptelacin/courses/106104467>: NPTEL Video Lecture on Practical Cyber Security for Cyber Security Practitioners, by Prof Sandeep K Shukla IIT Kanpur
3. <https://nptelacin/courses/129106894>: NPTEL Video Lecture on Internet Crimes and Cyber Security, by Prof KVK Santhy Prof B Md Irfan, NALSAR University of Law

Course Articulation Matrix (CAM):			U24IN602A : FUNDAMENTALS OF CYBER SECURITY TOOLS											
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN602A.1	3	2	2	2	2	1	-	-	-	-	-	1	2
CO2	U24IN602A.2	3	3	2	2	3	1	-	-	-	-	-	1	2
CO3	U24IN602A.3	3	2	2	2	3	2	1	-	1	-	-	1	2
CO4	U24IN602A.4	3	2	2	2	2	2	1	-	1	-	-	1	3
U24IN602A		3	2.25	2	2	2.5	1.5	1	-	1	-	-	1	2.25
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	understand cyber security fundamentals, threats, vulnerabilities, and system protection mechanisms	SDG 9	Industry, Innovation and Infrastructure	Cyber security fundamentals support the development of secure digital infrastructure and reliable computing systems for modern industries and communication networks
CO2	analyse network security monitoring and defence mechanisms for secure communication	SDG 9	Industry, Innovation and Infrastructure	Network security and defense mechanisms improve resilience and protection of communication infrastructure against cyber threats and attacks
CO3	apply vulnerability assessment and security auditing techniques for protecting computing systems	SDG 16	Peace, Justice and Strong Institutions	Vulnerability assessment and security auditing ensure digital trust, cybercrime prevention, and protection of institutional information systems
CO4	identify security challenges and recommend suitable cyber defense strategies	SDG 9	Industry, Innovation and Infrastructure	Cyber defense strategies support secure smart systems, connected devices, and reliable digital infrastructure for future technologies

FOG AND EDGE COMPUTING			
Class: B. Tech. VIII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN602B	Credits:	3
Hours/Week (L-T-P- E):	3-0-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : Understand the fundamental concepts, architectures, and differences among Cloud, Fog, and Edge Computing paradigms.			
CO2 : Analyze resource management, optimization challenges, and communication protocols in Fog and Edge computing environments.			
CO3 : Apply Fog and Edge computing techniques for IoT, 5G networks, data management, and real-time distributed applications.			
CO4 : Design and evaluate Edge/Fog-based solutions for practical applications such as video analytics, mobile offloading, augmented reality, and smart systems.			
UNIT-I			9 Hrs
Fundamentals of Fog and Edge Computing: Introduction to Fog Computing, Limitations of Cloud Computing, Differences between Cloud and Fog Computing, Advantages of Fog Computing, Business Models, Fog Architecture, Origins of Edge Computing, Edge Computing Architecture, Opportunities and Challenges			
UNIT-II			9 Hrs
Resource Management and IoT Integration: Taxonomy and Characteristics, Resource Management Challenges, Optimization Challenges, Programming Paradigms, Fog Protocols, IoT and Fog Integration, Data Management and Analysis in Fog Computing, Research Challenges and Directions			
UNIT-III			9 Hrs
5G, Edge Devices and Distributed Systems: Management and Orchestration of Network Slices in 5G, Fog-Edge-Cloud Integration, Edge Support for Low-End IoT Nodes, Edge Support for Higher-Capability Devices, Distributed Learning with Edge/Fog Computing, Case Studies			
UNIT-IV			9 Hrs
Applications of Fog and Edge Computing: Mobile Offloading, Edge Helping the Cloud, Edge for Augmented Reality, Data Processing on the Edge, Video Analytics on the Edge, Smart City Applications, Real-Time Edge Applications, Edge Computing Applications			
<u>Textbook(s):</u> 1. <i>Fog and Edge Computing: Principles and Paradigms</i> – Rajkumar Buyya & Satish Narayana Srirama 2. <i>Fog/Edge Computing for Security, Privacy and Applications</i> – Wei Chang & Jie Wu			
<u>Reference Book(S):</u> 1. <i>Cloud Computing: A Hands-on Approach</i> – Arshdeep Bahga & Vijay Madisetti 2. <i>Internet of Things – From Research and Innovation to Market Deployment</i> – Ovidiu Vermesan & Peter Friess			
<u>Web and Video link(s):</u> https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_cs66 ; NPTEL Video Lecture on Edge Computing by Prof. Rajiv Misra, IIT patna.			

Course Articulation Matrix (CAM):				U24CN602B : FOG AND EDGE COMPUTING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN602B.1	3	1	-	-	1	-	-	-	-	-	2	2	1
CO2	U24CN602B.2	3	3	1	2	2	-	-	-	-	-	2	3	2
CO3	U24CN602B.3	3	2	2	2	3	1	-	1	-	-	2	3	3
CO4	U24CN602B.4	2	2	3	2	3	1	1	1	1	1	2	3	3
U24CN602B		2.75	2	1.5	1.5	2.25	0.5	0.25	0.5	0.25	0.25	2	2.75	2.25
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Understand the fundamental concepts, architectures, and differences among Cloud, Fog, and Edge Computing paradigms.	SDG 9	Industry, Innovation and Infrastructure	Fog and Edge Computing technologies support modern digital infrastructure, intelligent networking, and innovative computing platforms for smart industries and services.
CO2	Analyze resource management, optimization challenges, and communication protocols in Fog and Edge computing environments.	SDG 9	Industry, Innovation and Infrastructure	Efficient resource management and optimization contribute to scalable, resilient, and sustainable computing infrastructures in industrial and communication systems.
CO3	Apply Fog and Edge computing techniques for IoT, 5G networks, data management, and real-time distributed applications.	SDG 11	Sustainable Cities and Communities	IoT-enabled Fog and Edge systems support smart city applications such as intelligent transportation, smart healthcare, environmental monitoring, and urban automation.
CO4	Design and evaluate Edge/Fog-based solutions for practical applications such as video analytics, mobile offloading, augmented reality, and smart systems.	SDG 9	Industry, Innovation and Infrastructure	Development of intelligent Edge/Fog applications promotes technological innovation, efficient computing, and advanced real-time services for modern industries and communities.

DEEP LEARNING			
Class: B Tech VI – Semester		Branch: CSE (Networks)	
Course Code:	U24IN602C	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs)			
After completion of this course, the students should be able to,			
CO1 : apply advanced optimization, regularization, and training strategies to improve deep neural network performance			
CO2 : Analyze transfer learning and representation learning models for advanced computer vision applications			
CO3 : analyze and implement graph-based and multimodal deep learning models for IoT and intelligent systems			
CO4 : analyze efficient, compressed, and explainable deep learning models on edge and embedded devices			
UNIT-I			9 Hrs
Introduction: Review of deep neural networks, Weight initialization techniques (Xavier, He Initialization), Activation functions (ReLU, Leaky-ReLU, ELU, GELU, Swish), Batch normalization and layer normalization, Dropout and regularization techniques, Learning rate scheduling, Hyperparameter tuning, Loss Functions, Model evaluation metrics, Training best practices			
UNIT-II			9 Hrs
Deep Learning Optimization and Representation Learning: Gradient descent variants, Momentum , RMSProp, Adam , AdamW, Learning Rate Warm-up, Transfer learning, Fine-tuning strategies, Feature extraction, Self-Supervised learning, Contrastive learning, Metric learning, Siamese networks			
UNIT-III			9 Hrs
Graph Deep Learning and Advanced Vision Models: Introduction to Graph data, Graph neural networks (GNN), Graph convolutional networks (GCN), Graph attention networks (GAT), GraphSAGE, Knowledge graph embeddings, Deep learning for IoT networks, Multi-modal deep learning, Vision transformers			
UNIT-IV			9 Hrs
Explainable AI, Edge AI and Model Deployment: Explainable AI (XAI), Model interpretability, SHAP, LIME, Model compression, Quantization, Pruning, Knowledge distillation, Edge AI, TinyML, TensorFlow lite, ONNX Runtime, Deployment on embedded devices, Case studies in IoT			
Textbook(s):			
1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, <i>Deep Learning</i> , 1 st edition, MIT Press, 2017(<i>Chapters 1 ,6 to 12</i>)			
2. Michael Nielsen, <i>Neural Networks and Deep Learning</i> , Determination Press, 1 st edition, 2013			
3. François Chollet, <i>Deep Learning with Python</i> , 2nd Edition, Manning Publications, 2021			
4. Aurélien Géron, <i>Hands-On Machine Learning with Scikit-Learn, Keras& TensorFlow</i> , 3rd Edition, O'Reilly Media, 2023			
Reference Book(s):			
1. Deng & Yu, <i>Deep Learning: Methods and Applications</i> , 1 st edition, Now Publisher, USA, 2013			
2. Antonio Gulli, Amita Kapoor, Sujit Pal, <i>Deep Learning with TensorFlow 20 and Keras</i> , 2 nd edition, Mumbai: Packt, 2019			
3. Sebastian Raschka, Vahid Mirjalili - <i>Python Machine Learning</i> , 2 nd edition, Mumbai: Packt, 2019			

Web and Video link(s):

https://onlinecoursesnptelacin/noc20_cs62/preview, NPTEL Video Lecture on Deep Learning by Prof Prabir Kumar Biaswas, Professor of EEE, IIT Kharagpur

Course Articulation Matrix (CAM):				U24IN602C: DEEP LEARNING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN602C.1	2	2	2	1	2	1	1	1	1	1	1	2	2
CO2	U24AI602C.2	2	2	1	2	2	1	1	1	1	1	1	2	2
CO3	U24AI602C.3	2	2	1	2	2	1	1	1	1	1	1	2	2
CO4	U24AI602C.4	2	2	2	3	2	1	1	1	1	1	1	2	2
U24IN602A		2	2	1.5	2	2	1	1	1	1	1	1	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply deep learning fundamentals and regularization techniques for tuning model performance	SDG9	Industry, Innovation and Infrastructure	Deep learning fundamentals and optimization techniques enable the development of efficient and scalable AI models, supporting innovation in industrial applications and intelligent systems
CO2	build and analyze convolutional neural network models for image recognition	SDG3	Good Health and Well-being	CNN-based image recognition is widely used in medical imaging applications such as disease diagnosis and detection, improving healthcare quality and early intervention
CO3	apply recurrent and recursive neural network architectures for handling long-term dependencies	SDG9	Industry, Innovation and Infrastructure	RNN and advanced architectures support applications like speech recognition, predictive analytics, and automation systems, contributing to technological advancement and smart infrastructure
CO4	build deep learning models for computer vision, speech, and natural language processing applications	SDG11	Sustainable Cities and Communities	Deep learning applications such as smart surveillance, traffic management, and intelligent communication systems contribute to building safer, efficient, and sustainable urban environments

STATISTICAL FUNDAMENTALS			
Class: B.Tech. VI-Semester		Branch: CSE(Networks)	
CourseCode:	U24IN602D	Credits:	3
Hours/Week(L-T-P-E):	2-1-0-3	CIE:	60 %
Total Number of Teaching Hours:	36 Hrs	ESE:	40 %
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: apply linear algebra and multivariate calculus concepts to solve real-world situations CO2 : analyze the data using various statistical measures and probability distributions CO3 : apply exact sampling distributions in testing of hypothesis CO4 : analyze dimensionality reduction with PCA and optimize the function using various methods of optimization			
UNIT-I			9 Hrs
Linear algebra: Introduction to vectors, Vector space and subspace, Linear combination and span, Linear independence and dependence, Basis vectors, Linear transformations, Null space and range of linear map and Rank-nullity theorem Matrix decompositions: LU decomposition, Gram Schmidt process, QR decomposition, Singular value decomposition and properties, Norms and Matrix approximations Multivariate calculus: Partial differentiation and gradient, Jacobian matrix, Gradients of matrices, Hessian matrix, Convex sets, Convex functions and multivariate Taylor series			
UNIT-II			9 Hrs
Probability: Basic rules and axioms, Dependent and independent events, Conditional probability, Baye's theorem Random variables: Discrete and continuous random variables, Expectation and variance Distributions: Binomial, Poisson and Normal distributions Joint probability distributions: Joint probability mass and density function, Marginal probability mass and density functions and Covariance			
UNIT-III			9 Hrs
Statistics: Measures of Central tendency, Measures of dispersion, Skewness, Kurtosis, Correlation coefficient of correlation, Linear regression, Curve fitting and method of least squares Sampling: Types of Sampling, Population, Sample, Parameter, Statistics, Sampling distribution of means (σ -known) and estimation Test of hypothesis: Procedure for testing of hypothesis, Test of significance of a single mean and difference of means-Large samples, Test of significance of a single Mean and difference of means-small samples, Paired sample t-test, F-test, F-test for equality of population variances, Chi square test, Chi-square test for goodness of fit and One-way ANOVA			
UNIT-IV			9 Hrs
Dimensionality Reduction with Principal Component Analysis: Problem setting, Maximum variance perspective, Projection perspective, Eigenvector computation and low-rank approximations, PCA in high dimensions, Key Steps of PCA in practice and latent variable Perspective Optimization: Optimization problem, Unconstrained optimization and constrained optimization Unconstrained optimization: Gradient Descent method, Conjugate gradient method and Newton's method, Penalty function method Constrained optimization: Lagrange's method and Kuhn-Tucker conditions			

Textbook(s):

1. SC Gupta VK Kapoor, *Fundamentals of Mathematical Statistics*, 10th ed, New Delhi: Sultan Chand & Sons Educational Publishers, 2010
2. Marc Peter Deisenroth, A Aldo Faisal, and Cheng Soon Ong, *Mathematics for Machine Learning*, 1st ed, UK: Cambridge University Press, 2020
3. Bernard Kolman and David R Hill, *Introductory linear algebra an applied first course*, London, UK: Pearson Education
4. SSRao, *Engineering Optimization theory and practice*, 4th ed, Hoboken, New Jersey John Wiley & Sons, Inc, 2009

Reference Book(s):

1. G Strang, *Introduction to Linear Algebra*, 6th ed, MA, USA: Wellesley-Cambridge Press, 2023
2. BLS Prakasa Rao, *A first course in Probability and statistics*, 1st ed, Singapore: World Scientific Publishing Co Pvt Ltd, 2009
3. S P Gupta, *Statistical Methods*, 46th ed, New Delhi: Sultan Chand & Sons, 2021
4. JCPant, *Introduction to Optimization (Operations Research)*, 7th ed, New Delhi: Jain Brothers, 2008

Web and Video link(s):

1. https://www.youtube.com/watch?v=JO9jNe6BemE&list=PLLy_2iUCG87D1CXFxE-SxCFZUiJzQ3IvE:
NPTEL Video Lecture on ESSENTIAL MATHEMATICS FOR MACHINE LEARNING/Prof SK Gupta and Prof Sanjeev kumar /IIT Roorkee
2. <https://www.youtube.com/watch?v=r1sLCDA-kNY&list=PL46B9EA2CFEB51241>:
NPTEL Video Lecture on Introduction to the Theory of Probability/Prof M Chakraborty /IIT Kharagpur

Course Articulation Matrix (CAM):			U24IN602D: STATISTICAL FUNDAMENTALS											
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24IN602D.1	2	2	1	1	-	-	-	1	1	-	1	2	1
CO2	U24IN602D.2	2	2	1	1	-	-	-	1	1	-	1	2	1
CO3	U24IN602D.3	2	2	1	1	-	-	-	1	1	-	1	2	1
CO4	U24IN602D.4	2	2	1	1	-	-	-	1	1	-	1	2	1
U24IN602D		2	2	1	1	-	-	-	1	1	-	1	2	1

CO-SDG Alignment Matrix				
CO	Course Outcome	Relevant SDG(s)	SDG Description	Justification
CO1	apply linear algebra and multivariate calculus concepts to solve real-world situations	SDG 4, SDG 9	Quality Education, Industry, Innovation and Infrastructure	Develops strong mathematical foundations and analytical skills required for solving engineering problems and fostering innovation
CO2	analyze the data using various statistical measures and probability distributions	SDG 4, SDG 9, SDG 17	Quality Education, Industry, Innovation and Infrastructure, Partnerships for the Goals	Enables data-driven analysis and decision-making, supporting research, industrial applications, and collaborative data sharing
CO3	apply exact sampling distributions in testing of hypothesis	SDG 3 , SDG 4, SDG 9	Good Health and Well-being, Quality Education, Industry, Innovation and Infrastructure	Statistical hypothesis testing supports evidence-based decision-making in healthcare, research, quality control, and engineering
CO4	analyze dimensionality reduction with pca and optimize the function using various methods of optimization	SDG 9, SDG 11, SDG 12	Industry, Innovation and Infrastructure, Sustainable Cities and Communities, Responsible Consumption and Production	Optimization and dimensionality reduction improve the efficiency of AI, IoT, and industrial systems, enabling sustainable resource utilization

SOFTWARE ENGINEERING			
Class: B. Tech. VI – Semester		Branch: CSE(Networks)	
Course Code:	U24CN603	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1: apply the appropriate software model for implement the given real time application CO2 : develop different types of software designs and patterns CO3: apply an appropriate testing method for a given software CO4: apply metrics to assess the quality of software and analyse the risk management in project scheduling			
UNIT-I			9 Hrs
Software Engineering Concepts: The changing nature of software, Software application domains, Legacy software, Software myths, Software engineering layered technology, A process framework, The capability maturity model integration (CMMI), Agile software Process Models: Prescriptive process models, RAD model, Specialized process models, Unified process model, Personal and team process models Agile Development: Agility and the cost of change, Agile process, Extreme programming, Other agile process models Software Engineering Practices:(Principles that Guide the Practice) Communication principles, Planning principles, Modeling principles, Construction principles, Deployment principles			
UNIT-II			9 Hrs
Requirements Engineering Tasks: Requirements analysis and modeling strategies, User requirement, System requirement, Software requirements document Design Engineering: Design within the context of software engineering, Design process, Design concepts, The design model Architectural Design: Software architecture, Architectural genres, Architectural styles, Architectural design, Assessing alternative architectures, Designing class based components, Conducting component level design, Design for WebApps, Designing traditional components			
UNIT-III			9 Hrs
User Interface Design: The golden rules, User interface analysis and design, Interface analysis, Interface design steps, WebApp and mobile interface design Testing Strategies: Software testing fundamentals, Test strategies for conventional software, Test strategies for object-oriented software, Validation testing, System testing, The art of Debugging, White box testing, Basis path testing, Control structure testing, Black box testing Testing Web Applications: Testing concepts for webapps, The testing process, Content testing,			

User interface testing, Component-level testing, Navigation testing, Configuration testing, Security testing, Performance testing	
UNIT-IV	9 Hrs
Product Metrics: Measures, Metrics and indicators, Metrics for the requirements model, Metrics for the design model, Metrics for source code, Metrics for testing, Metrics for maintenance	
Process and Project Metrics: Metrics in the process and project domains, Software measurement, Metrics for software quality, Integrating metrics within the software process, The W5HH principle	
Project Scheduling: Project scheduling, Scheduling for WebApps projects, Earned value analysis	
Risk Management: Reactive versus Proactive risk strategies, Software risks, Risk identification, Risk projection, Risk refinement, RMMM plan	
<u>Textbook:</u>	
1. Roger S. Pressman and Bruce R. Maxim, <i>Software Engineering: A Practitioner’s Approach</i> , 8th ed., New Delhi: McGraw Hill, 2019	
<u>Reference Book(s):</u>	
1. Ian Sommerville, <i>Software Engineering</i> , 10th ed., Delhi: Pearson Education, 2016	
2. Deepak Jain, <i>Software Engineering: Principles and Practices</i> , 3rd ed., Delhi: Oxford University Press, 2008	
3. Pankaj Jalote, <i>Software Engineering: A Precise Approach</i> , New Delhi: Wiley India, 2010	
4. Waman S. Jawadekar, <i>Software Engineering: A Primer</i> , New Delhi: Tata McGraw Hill, 2008	

Course Articulation Matrix (CAM):			U24CN603: SOFTWARE ENGINEERING											
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN603.1	1	2	2	1	-	-	1	-	1	-	-	2	2
CO2	U24CN603.2	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	U24CN603.3	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	U24CN603.4	2	2	3	3	-	-	1	-	1	-	2	2	2
U24CN603		1.7 5	2	2.2 5	1.7 5	-	-	1	-	1	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to ...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Apply the appropriate software model for implementing a given real-time application	SDG9	Industry, Innovation and Infrastructure	Selecting suitable software development models (e.g., Agile, Waterfall) supports the development of innovative and reliable software systems, contributing to technological advancement & industrial growth
CO2	Develop different types of software designs and patterns	SDG4	Quality Education	Designing software systems using patterns enhances problem-solving and learning skills, enabling students to develop structured, maintainable solutions aligned with modern educational practices
CO2	Develop different types of software designs and patterns	SDG9	Industry, Innovation and Infrastructure	Software design and architectural patterns contribute to building scalable and efficient digital infrastructure, supporting innovation in software industries
CO3	Apply an appropriate testing method for a given software	SDG3	Good Health and Well-being)	software testing ensures reliability and safety of applications, especially in healthcare and critical systems, thereby supporting well-being and reducing risks caused by software failures
CO3	Apply an appropriate testing method for a given software	SDG9	Industry, Innovation and Infrastructure	Effective testing improves software quality and system robustness, contributing to dependable digital infrastructure and innovation
CO4	Apply metrics to assess the quality of software and analyze risk management in project scheduling	SDG8	Decent Work and Economic Growth)	Software quality metrics and risk management improve project efficiency, reduce failures, and enhance productivity in software industries, supporting economic growth
CO4	Apply metrics to assess the quality of software and analyze risk management in project scheduling	SDG9	Industry, Innovation and Infrastructure	Applying metrics and risk analysis ensures development of reliable, scalable systems and effective project execution, strengthening technological infrastructure

DEVOPS			
Class: B. Tech. VI – Semester		Branch: CSE (Networks)	
Course Code:	U24CN604	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: apply version control concepts using Git and remote repository management using GitHub for collaborative software development workflows CO2 : build automation and project management using Apache Maven, Gradle, and npm CO3 : implement containerization and orchestration using Docker and Kubernetes CO4 : design and implement CI/CD pipelines using Jenkins by integrating automation scripts and deployment strategies			
UNIT-I			9 Hrs
DevOps Fundamentals: Introduction, Evolution-Software Development Life Cycle (SDLC) vs Agile Methodology, DevOps lifecycle and practices, Challenges and Applications Version Control System (VCS): Introduction, Types, Git-Introduction, Features, architecture and workflow, Basic commands Git Branching: Basic Branching and Merging, Branch Management, Branching Workflows, Remote Branches, Rebasing Remote Repositories: Introduction, Types, GitHub- Introduction, Creating GitHub repository			
UNIT-II			9 Hrs
LINUX Basic and Admin: Learning the shell, Navigation, Manipulating files and directories, Working with commands, Permissions, Processes, Introduction to Shell Scripting Introduction to Build Automation: Need for Build Automation, Maven-Introduction, architecture, Lifecycle, Project Management-Project Object Model (POM) ,Understanding pom.xml ,Maven coordinates, Executing Maven builds ,Maven Plugins and Dependency Management, Other build tools-Introduction to Gradle and npm			
UNIT-III			9 Hrs
Docker: Introduction, Architecture, Containers vs. Virtual Machines, Basic Workflow, Components Docker Images: Building Custom Images, Image Tagging, Pushing Images to Docker Hub Dockerfile: Instructions, Writing Dockerfile, Building custom images Docker Compose: Key Benefits, The docker-compose.yml File, Basic Commands, Networking, Troubleshooting and Debugging Basics of Kubernetes: Introduction to Kubernetes, Architecture, and Components of Kubernetes			
UNIT-IV			9 Hrs
Continuous Integration and Continuous Deployment Concepts: Continuous Integration vs Continuous Delivery vs Deployment, Importance of automation Jenkins Overview: Introduction to Jenkins, Jenkins architecture, Jenkins Setup: Installation (Windows / Docker), Dashboard & configuration, Plugins management Jenkins Pipelines: Freestyle project, Pipeline as Code (Jenkinsfile), Build triggers (poll SCM, webhook)			
Textbook(s): 1. Kim G, Humble J, Debois P, Willis J, Forsgren N. The DevOps handbook: How to create world-class agility, reliability, & security in technology organizations. It Revolution; 2021 Nov 30 2. Scott Chacon,Ben Straub,everything you need to know about git, Pro Git;2025 Dec 12 Casciaro M,Mammino L. Node. js Design Patterns.Packet Publishing Ltd; 2016 Jul 18			

3. Bobby Iliev, Introduction to Docker; 2024 August 19
4. Aman Pathak, Mastering Jenkins the complete CI/CD and DevOps guide;2025
Reference Book(s):
1. Forsgren N, Humble J, Kim G. Accelerate: The science of lean software and devops: Building and scaling high performing technology organizations. IT Revolution; 2018 Mar 27
2. Nickoloff J, Kuenzli S. Docker in action. Simon and Schuster; 2019 Oct 28
The Linux Command Line Complete introduction by William Shotts
Web and Video link(s):
https://www.youtube.com/playlist?list=PL9ooVrP1hQOE5ZDJJsnEXZ2upwK7aTYiX
https://www.youtube.com/watch?v=Ou9j73aWgyE

Course Articulation Matrix (CAM):				U24CN604 : DEVOPS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN604.1	3	2	2	1	2	1	1	-	1	-	1	2	2
CO2	U24CN604.2	3	2	2	2	3	1	1	-	1	-	1	2	2
CO3	U24CN604.3	3	2	2	2	3	1	1	-	1	-	1	2	2
CO4	U24CN604.4	3	2	2	2	3	1	1	-	1	-	1	2	2
U24CN604		3	2	2	1.25	2.75	1	1	-	1	-	1	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply version control concepts using Git and remote repository management using GitHub for collaborative software development workflows	SDG 4	Ensure inclusive and equitable quality education and promote lifelong learning	The course introduces version control and collaborative development practices using Git and GitHub , equipping students with industry-relevant skills and promoting continuous learning aligned with modern software development workflows
CO2	build automation and project management using Apache Maven , Gradle , and npm	SDG 9	Build resilient infrastructure and foster innovation	The use of build automation tools (Maven, npm) and Node.js scripting enables efficient software development workflows and supports scalable and innovative digital infrastructure
CO3	implement containerization and orchestration using Docker and Kubernetes	SDG 9	Build resilient infrastructure and promote sustainable industrialization	Containerization and orchestration using Docker and Kubernetes enable scalable, reliable, and efficient deployment of applications, forming the backbone of modern cloud infrastructure
CO4	design and implement CI/CD pipelines using Jenkins by integrating Node.js applications, automation scripts, and deployment strategies	SDG 8	Promote sustained, inclusive economic growth and productive employment	CI/CD automation using Jenkins enhances software delivery efficiency, reduces manual effort, and improves productivity, contributing to modern digital workforce practices and economic growth

CRYPTOGRAPHY AND NETWORK SECURITY			
Class: B. Tech. VI – Semester		Branch: CSE (Networks)	
Course Code:	U24CN605	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: demonstrate security concepts, attacks, and services along with OSI security architecture and apply number theory concepts like modular arithmetic and theorems CO2: apply symmetric and asymmetric cryptographic techniques including DES, AES, and RSA CO3: apply cryptographic hash functions, MAC, HMAC, and digital signatures, authentication protocols and key management techniques like Kerberos and X.509 CO4: apply network security protocols such as IPSec, SSL/TLS, email security and implement firewall mechanisms for system protection			
UNIT-I			9 Hrs
Introduction: OSI security architecture, Security attacks, Security services, Security mechanisms, Model for network security Number Theory: Prime numbers, Modular arithmetic, Fermat's theorem, Euler's theorem, Discrete logarithms, Euclidean algorithm, Extended Euclidean algorithm			
UNIT-II			9 Hrs
Symmetric Ciphers: Classical encryption techniques, Substitution techniques, Transposition techniques, Steganography, Block cipher & Stream Cipher, Block cipher design principles, Block cipher modes of operation, DES, Strength of DES and AES structure, AES transformation functions, AES key expansion Asymmetric Ciphers: Public key cryptography, RSA, Diffie-Hellman, Elliptic curve arithmetic and cryptography			
UNIT-III			9 Hrs
Cryptographic Hash Functions: Applications of cryptographic hash function, Two simple hash functions, Secure Hash Algorithm (SHA) Message Authentication Codes (MAC): MAC Authentication requirements, MAC functions, security of MAC, HMAC Authentication Protocols: Kerberos, Digital signature, Schnorr digital signature scheme, Key Management and Distribution: Symmetric key distribution using symmetric & asymmetric encryption, Distribution of public keys, X.509 certificates			
UNIT-IV			9 Hrs
Email Security: Pretty Good Privacy (PGP), S/MIME IP Security: IP Security Overview, Security Policies, Mechanism, Encapsulating Security Payload, Authentication header, Combining security associations Transport Layer Security: Web security considerations, Secure Socket Layer (SSL), Transport Layer Security (TLS) Malicious Software: Types of Malwares, Viruses and Worms, Propagation infected content virus, Counter measures of virus Firewalls: Need for Firewalls, Firewall characteristics, Types of Firewalls			

Textbook:

1. William Stallings, *Cryptography and Network Security Principles and Practice*, 7th ed., Pearson Education, 2018(Chapters 1 to 7, 9 to 20)

Reference Book(s):

1. Behrouz A. Forouzan, & Debdeep Mukhopadhyay (2015). *Cryptography and Network Security* (3rd ed.). McGraw-Hill
2. Atul Kahate (2013). *Cryptography and Network Security* (3rd ed.). McGraw-Hill
3. William Diffie, & Martin Hellman (1976). New directions in cryptography. *IEEE Transactions on Information Theory*

Web and Video link:

<https://nptel.ac.in/courses/106105162>; NPTEL Video Lecture on Cryptography and Network Security, by Prof. Sourav Mukhopadhyay, Professor of Mathematics, IIT Kharagpur

Course Articulation Matrix (CAM):				U24CN605: CRYPTOGRAPHY AND NETWORK SECURITY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN605.1	3	2	2	2	2	-	-	-	-	-	1	2	1
CO2	U24CN605.2	3	3	2	2	2	-	-	-	-	-	1	2	2
CO3	U24CN605.3	3	2	2	2	3	1	-	1	-	-	1	2	2
CO4	U24CN605.4	3	2	2	2	2	2	-	1	-	-	1	2	2
U24CN605		3	2.25	2	2	2.25	1.5		1			1	2	1.75
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	demonstrate security concepts, attacks, and services along with OSI security architecture and apply number theory concepts like modular arithmetic and theorems	SDG 9	Industry, Innovation and Infrastructure	Understanding security architecture and mathematical foundations of cryptography helps in building secure digital communication systems and reliable network infrastructure, supporting innovation in information security technologies
CO2	apply symmetric and asymmetric cryptographic techniques including DES, AES, and RSA	SDG 9	Industry, Innovation and Infrastructure	Cryptographic algorithms and secure communication techniques are essential for protecting modern industrial networks, e-commerce systems, banking applications, and digital infrastructure from cyber threats
CO3	apply cryptographic hash functions, MAC, HMAC, and digital signatures, authentication protocols and key management techniques like Kerberos and X.509	SDG 16	Peace, Justice and Strong Institutions	Authentication, integrity verification, and digital signature mechanisms ensure secure access control, trustworthy digital transactions, and protection of sensitive information in governance, organizations, and institutional systems
CO4	apply network security protocols such as IPSec, SSL/TLS, email security and implement firewall mechanisms for system protection	SDG 9	Industry, Innovation and Infrastructure	Network security protocols, malware protection, and firewall technologies strengthen cybersecurity infrastructure by ensuring secure communication, safe internet services, and protection against cyberattacks in digital environments

UNIVERSAL HUMAN VALUES - II			
Class: B. Tech. VI – Semester		Branch: All Branches	
Course Code:	U24IK606A	Credits:	1
Hours/Week (L-T-P- E):	2-0-0-2	CIE:	60%
Total Number of Teaching Hours:	24 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: describe harmony within the individual by understanding the distinct roles of the self and the body CO2: analyze values in human relationships and apply the principles of justice, mutual happiness, and harmony in family and society CO3: explain the interconnectedness of nature and existence and evaluate the concept of coexistence and mutual fulfilment among all orders of nature CO4: apply professional ethics and sustainable practices in engineering and professional activities for societal and environmental well-being			
UNIT-I			6 Hrs
Course Introduction - Need, Basic guidelines, Content and Process for value education Self-exploration: Natural acceptance and Experiential validation, Basic human aspirations, Right understanding, Relationship and Physical facility, fulfilment of aspirations, Understanding happiness and prosperity, Harmony at various levels Understanding Harmony in the Human Being: Harmony in myself, Understanding human being, Understanding the harmony of self with the body, Harmony in self, Health, Program for self and health			
UNIT-II			6 Hrs
Understanding Harmony in the Family: Harmony in human - human Relationship, Understanding values in human-human relationship, Meaning of Justice (universal values in relationships), Mutual happiness Understanding Harmony in the Society: Harmony in the society, Visualizing a universal harmonious order in society- Undivided society, Universal order- from family to world family			
UNIT-III			6 Hrs
Understanding Harmony in the Nature: Whole existence as coexistence, Understanding the harmony in the Nature, Interconnectedness and mutual fulfilment among the four orders of nature, Recyclability and Self-regulation in nature Understanding Harmony in the Existence: Understanding existence as co-existence of mutually interacting units in all- pervasive space, Holistic perception of harmony at all levels of existence			
UNIT-IV			6 Hrs
Professional Ethics: People friendly and eco-friendly production systems, Appropriate technologies and management patterns Case Studies: Case studies of typical holistic technologies, Management models and production systems			
Textbook: 1. R. R. Gaur, R. Sangal and G. P. Bagaria, <i>Human Values and Professional Ethics</i> , New Delhi Excel Books, 2010			

Reference Book(s):

1. A.Nagaraj, *Jeevan Vidya: Ek Parichaya*, Raipur: Jeevan Vidya Prakashan, Amar kantik, 2018
2. A.N.Tripathi, *Human Values*, New Age International Publisher, 3rded., NewDelhi, 2019
3. M.Govindrajran, S.Natrajan & V.S.Senthil Kumar, *Engineering Ethics (includes Human Values)*, PHI Learning Pvt Ltd, 12thed., Haryana, 2011
4. Jayshree Suresh, B S Raghavan, *Human Values & Professional Ethics*, 4thed., S.Chand & Co. Ltd., New Delhi, 2012

AdditionalResources:

1. A set of DVDs containing- Video of Teachers "Orientation Program-PPTs of Lectures and Practice Sessions (*Audio-visual material for use in the practice sessions*)

Web and Video link(s):

1. <https://fdp-siaicte-indiaorg/UHVII.php>

Course Articulation Matrix					U24IK606B UNIVERSAL HUMAN VALUES - II									
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IK606B.1	2	1	-	-	-	1	-	3	-	-	-	1	1
CO2	U24IK606B.2	1	2	-	-	-	3	-	3	2	2	-	1	1
CO3	U24IK606B.3	1	2	-	-	-	2	3	2	-	-	-	1	1
CO4	U24IK606B.4	1	2	-	-	-	3	3	3	2	2	3	1	1
U24IK606B		1.25	1.75	-	-	-	2.25	3	2.75	2	2	3	1	1

CO-SDG Alignment Matrix				
CO	CO Statement	Relevant SDG	SDG Description	Mapping Justification
CO1	The student should be able to... describe harmony within the individual by understanding the distinct roles of the self and the body	SDG 4	Quality Education	Develops self-awareness, values, ethical thinking, and holistic education for responsible citizenship
CO2	analyze values in human relationships and apply the principles of justice, mutual happiness, and harmony in family and society	SDG 16	Peace, Justice and Strong Institutions	Promotes justice, mutual respect, harmonious relationships, and peaceful societies
CO3	explain the interconnectedness of nature and existence and evaluate the concept of coexistence and mutual fulfillment among all orders of nature	SDG 13, SDG 15	Climate Action, Life on Land	Enhances understanding of ecological balance, coexistence, environmental sustainability, and conservation
CO4	apply professional ethics and sustainable practices in engineering and professional activities for societal and environmental well-being	SDG 9, SDG 12	Industry, Innovation and Infrastructure, Responsible Consumption and Production	Encourages ethical professional practices, sustainable technologies, and environmentally responsible production systems

TECHNICAL ENGLISH			
Class: B.Tech. VI-Semesters		Branch: Common to all Branches	
CourseCode:	U24MH607	Credits:	1
Hours/Week(L-T-P-E):	0-0-2-2	CIE:	100%
Total Number of Teaching Hours:	24Hrs	ESE:	-
Course Learning Outcomes(COs) <i>After completion of this course, the students should be able to,</i>			
CO1: develop effective listening, speaking, reading, and writing skills by understanding native-speaker conversations and expressing ideas clearly and confidently using appropriate vocabulary, while maintaining fluency, coherence, and accurate pronunciation			
CO2: enhance communication and professional writing skills through podcast comprehension, group discussions, resume writing, and email writing			
CO3: develop the ability to comprehend reading texts and conversations of both native and non-native speakers, interpret visual information, and produce clear and well-structured technical reports			
CO4: develop the ability to perform effectively in interviews and deliver presentations with clarity of speech and appropriate pronunciation and accent			
Activity-1			2hrs
Phonetic Foundations, Authentic Audio-Visual Comprehension & Vocabulary Enhancement: Speech Sounds- Phonemes (Vowels and consonant sounds), word stress, syllables - their role and importance in spoken English Authentic Audio-Visual Comprehension: Movie Clips - Screening of a short native-speaker clip - context comprehension, focus attention on accent features and key expressions, Vocabulary: Word Formation-Prefixes-Suffixes Activity: Practice pronunciation through Read-Record-Reflect, analyze audio-visual content for comprehension and expression usage			
Activity- 2			2hrs
Story Narration, Writing Skills and Vocabulary Enhancement- Narrative structure (beginning, build-up, climax, conclusion), Cohesive devices, Voice modulation & expression Writing: Principles of Paragraph Writing- Importance of Coherence in Writing-Cause and Effect Paragraphs Vocabulary: Synonyms and antonyms Activity: Narrate structured stories with peer interaction, Read-Record-Reflect storytelling activity for pronunciation and expression enhancement, Write a coherent cause and effect paragraph, Vocabulary practice exercises on synonyms and antonyms			
Activity - 3			2hrs
Reading Comprehension, Vocabulary Enhancement & Elocution Skills- Reading Comprehension: Main idea identification, interpretation, critical analysis Vocabulary Enhancement: One-word substitutes, Elocution- Speech delivery skills (organisation, voice modulation, fluency, pronunciation, and audience engagement) Activity: Read and analyze passages for comprehension and critical interpretation, Read-Record-Reflect activity for improving reading fluency and pronunciation, Vocabulary exercises on one-word substitutes, and deliver a short speech with emphasis on clarity, confidence, and effective expression			

Activity- 4	2hrs
Think-Pair-Share Conversation (Podcast-Based), Vocabulary Enhancement: Introduction to authentic spoken English through podcasts, listening for gist and specific information, and note-taking Think-Pair-Share strategy, use of linking words and expressing agreement/disagreement politely Vocabulary Enhancement: Idioms in context and usage Activity: Listen to podcasts for comprehension and note-making, Think-Pair-Share discussions to exchange ideas and respond confidently, Speak-Record-Reflect activity for improving speaking fluency, pronunciation, and expression	
Activity-5	2 hrs
Group Discussion, Vocabulary Enhancement: GD format and roles, rules of participation, Vocabulary – Word Pairs, commonly confused words Activity: Engage in group discussions focusing on clear expression and interaction and word pair exercises	
Activity -6	2 hrs
Reading Comprehension, Visual Interpretation & Vocabulary Enhancement: Skimming and scanning, identifying main and supporting ideas, distinguishing fact and opinion Visual Interpretation: Interpreting visual cues, logical sequence Vocabulary: Phrasal Verbs: separable and inseparable forms, and contextual usage Activity: Engage in reading comprehension tasks for critical analysis, describe pictures ,Speak-Record-Reflect activity for improving fluency, pronunciation, and expression, and phrasal verbs practice exercises	
Activity-7	2 hrs
Motivational Speeches, Presentation Skills & Vocabulary Enhancement: identifying central theme and tone, note-taking, Narrative techniques Presentation – Speak to Inspire- topic selection, structure (introduction–body–conclusion), Vocabulary Enhancement – Collocations- Introduction to collocations, types of collocations, and contextual usage Activity: Listen to motivational speeches for comprehension and analysis, deliver a 3–5-minute inspirational presentation, Speak–Record–Replay activity for improving fluency, pronunciation, and expression, and collocations practice exercises	
Activity-8	2 hrs
Writing & Vocabulary Enhancement: Professional Resume Writing techniques, Action verbs in resume writing, Letter of Application, E-mail Etiquette – vocabulary: Jumbled sentences Activity: Prepare a professional resume using an appropriate format and action verbs, write a letter of application and formal e-mail following etiquette and jumbled sentence exercises	
Activity-9	2 hrs
Reading Comprehension, Newspaper Reading & Vocabulary Enhancement: Intensive reading , Extensive reading, Newspaper reading:5W1H method, Summarization, vocabulary building Activity: Reading comprehension exercises, Summarizing news content, discussion of current events, Speak–Record–Replay activity for improving fluency, pronunciation and expression Vocabulary building through contextual usage from news articles	
Activity-10	2 hrs
PowerPoint Presentations: Concept and purpose of presentations, layout and structure (title, introduction–body–conclusion), slide design elements, visual aids, common mistakes to avoid	

Activity: Design and present a poster or PowerPoint presentation on a given topic, Speak-Record-Replay activity for improving fluency, pronunciation and expression, peer interaction and feedback sessions	
Activity-11	2hrs
Essay Writing, Vocabulary Enhancement - Concept and Types of Essays, Essay structure (introduction-body-conclusion), paragraph coherence, clarity and objectivity, Sentence completion with correct word/Group alternative word/group Activity: Write essays on given topics focusing on structure, coherence, and clarity Sentence completion practice exercises	
Activity-12	2hrs
Mock Interview - Technical & HR: Introduction to mock interviews: Purpose and importance, types of interviews, interview etiquette, self-introduction, common HR questions, self-assessment Activity: Mock interview with appropriate dress code Record and review own performance, Feedback session	
Textbook(s): 1. Arun Sharma & Meenakshi Upadhyay, "<i>Verbal Ability and Reading Comprehension for CAT & Other Management Examinations</i>", 8th Edition, McGraw Hill Education (India) Private Ltd, Chennai, 2018 2. Meenashki Raman & Sangeethe Sharma, "<i>Technical Communication: Principles and Practice</i>, 3rd Edition, New Delhi, New York: Oxford University Press, 2004	
Reference Book(s): 1. Nishit K Sinha, "<i>Verbal Ability and Reading Comprehension for the CAT</i>", 3rd Edition Pearson India Education Services Pvt Ltd, Chennai 2. Harper Collins, "<i>Collins COBUILD English Grammar</i>" Third Edition, Harper Collins Publishers Ltd 3. Jerald J. Alfred, Charles T. Brusaw and Walter E Oliu, "<i>Handbook for Technical Writing</i>" 12th Edition, Macmillan 4. R.S. Agarwal, "<i>A modern Approach to Verbal and Non-Verbal Reasoning</i>" Revised edition 2025, Chand Publishing, India	
Web and Video link(s): 1. Learn/Practice English with MOVIES (Lesson#1) Title: The Incredibles : https://www.youtube.com/watch?v=5SfQhkMsUFk&list=PLA7INLNvxTzig5dqfGl8DGbLOvUI08yXg&index=2 2. Learn English with wreck-it ralph: https://www.youtube.com/watch?v=wVhG59zh4uQ&list=PLA7INLNvxTzig5dqfGl8DGbLOvUI08yXg&index=4 3. The Pursuit of Happiness (2006): Most Powerful Moments!: https://www.youtube.com/watch?v=TkD1QvjKlqU 4. Podcast by Raul John "Inside the Mind of India's AI Kid" Business Today https://www.youtube.com/watch?v=biCrllhZrC4 5. Podcast by Sudha Murthy-So What If I Lost the Battle, I Lived the War The Ranveer Show https://www.youtube.com/watch?v=KwXtalUuhLc 6. Motivational Talk by Gour Gopal Das, SLEEPLESS Nights for Overnight SUCCESS https://www.youtube.com/watch?v=YyCXp_E4sMU Motivational Talk by Admiral McRaven's Speech for Your Day, "5 Minutes to Start Your Day Right! - MORNING MOTIVATION" https://www.youtube.com/watch?v=b-Pn0yXL9y8	

Course Articulation Matrix (CAM):				U24MH607 : TECHNICAL ENGLISH										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24MH607.1	-	-	-	-	-	-	-	-	2	-	2	1	1
CO2	U24MH607.2	-	-	-	-	-	-	-	2	2	-	2	1	1
CO3	U24MH607.3	-	-	-	-	-	-	-	-	2	-	2	1	1
CO4	U24MH607.4	-	-	-	-	-	-	-	2	2	-	2	1	1
U24MH607		-	-	-	-	-	-	-	1	2	-	2	1	1
3-HIGH,2 -MEDIUM,1-LOW														

CO	CO Statement – <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Develop effective listening, speaking, reading, and writing skills by understanding native-speaker conversations and expressing ideas clearly and confidently using appropriate vocabulary, while maintaining fluency, coherence, and accurate pronunciation	SDG 4	Quality Education	As it develops effective communication and language proficiency skills that enhance learners' ability to communicate confidently and effectively, thereby promoting quality and inclusive education
CO2	Enhance communication and professional writing skills through podcast comprehension, group discussions, resume writing, and email writing	SDG 4	Quality Education	It strengthens professional communication and writing competencies required for lifelong learning and employability, contributing to quality education and skill development
CO3	Develop the ability to comprehend reading texts and conversations of both native and non-native speakers, interpret visual information, and produce clear and well-structured technical report	SDG 4, SDG 9	Quality Education, Industry, Innovation and Infrastructure	By improving comprehension and technical writing skills and with SDG-9 by enabling students to prepare structured technical reports that support innovation, research, and professional communication in engineering and industry
CO4	Develop the ability to perform effectively in interviews and deliver presentations with clarity of speech and appropriate pronunciation and accent	SDG 4, SDG 8	Quality Education, Decent Work and Economic Growth	This aligns with SDG-4 by enhancing communication and presentation skills and with SDG-8 by improving employability, interview performance, and professional competencies necessary for decent work and career growth

DEVOPS LABORATORY			
Class: B. Tech. VI - Semester		Branch: CSN (Networks)	
Course Code:	U24CN608	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : implement version control and remote repository management using Git and GitHub			
CO2 : develop build automation scripts and manage dependencies using maven and build tools			
CO3 : implement containerization and deployment using Docker and Kubernetes			
CO4 : design and implement CI/CD pipelines integrating Node.js applications using Jenkins			
Experiment-1 (Unit-I)			
1. Install and configure Git on the system and perform basic Git operations such as init , add , commit , log , and tracking file changes			
Experiment-2 (Unit-I)			
2.Create branches and perform branch management operations such as branch creation, switching, merging, and deletion using Git			
Experiment-3 (Unit-I)			
3.Connect the local Git repository with a remote repository on GitHub and perform remote operations such as push, pull, and clone			
Experiment-4 (Unit-II)			
4(a)Perform basic Linux commands for file and directory management, navigation, and viewing system information			
4(b)Manage files, directories, permissions, and processes using intermediate Linux administration commands in Linux			
Experiment-5 (Unit-II)			
5(a).Create and execute shell scripts using Bash scripting concepts such as variables, conditional statements, loops, and functions in Bash			
5(b).Configure and manage cron jobs for task scheduling and automation in Linux using the crontab utility			
Experiment-6 (Unit-II)			
6(a).Create, manage, and build Java applications using Project Object Model (POM), Maven coordinates, dependencies, plugins, and project execution features in Apache Maven			
6(b). Install and configure npm and understand package management concepts in Node.js			
Experiment-7 (Unit-III)			
7.Install and configure Docker and work with Docker images by pulling, creating, tagging, and pushing images to Docker Hub			
Experiment-8 (Unit-III)			
8(a).Create and build custom Docker images using Dockerfile instructions and container configuration in Docker			
8(b).Create and build custom Docker images using Dockerfile instructions and container configuration in Docker			

Experiment-9 (Unit-III)
9(a)Configure and manage multi-container applications using Docker Compose, networking, and troubleshooting commands in Docker Compose
9(b)Install and configure a Kubernetes cluster and create basic Pod configurations using YAML files
Experiment-10 (Unit-IV)
10(a).Install and configure Jenkins on Linux and explore the Jenkins dashboard, system configuration, and plugin management features
10(b).Integrate GitHub and Docker with Jenkins to automate source code retrieval, image building, and deployment processes
Experiment-11 (Unit-IV)
11. Create and execute Freestyle projects in Jenkins for automated build and testing processes
Experiment-12 (Unit-IV)
12(a). Develop and execute CI/CD pipelines using Jenkinsfile and Pipeline as Code concepts in Jenkins
12(b).Configure build triggers such as Poll SCM and Webhooks for automated project execution in Jenkins
Textbook(s):
1. Scott Chacon,Ben Straub, <i>everything you need to know about git</i> , Pro Git;2025 Dec 12
2. Casciaro M,Mammino L. <i>Node. js Design Patterns</i> .Packet Publishing Ltd; 2016 Jul 18
3. Bobby Iliev, <i>Introduction to Docker</i> ; 2024 August 19
4. Aman Pathak, <i>Mastering Jenkins the complete CI/CD and DevOps guide</i> ;2025
Reference Book(s):
1.Iriarte Koroliova EW. <i>MERN Quick Start Guide: Build Web Applications with MongoDB, Express.js, React, and Node</i> . Packt Publishing; 2018. ISBN: 978-1787281080
2. Ravindran A. <i>Django Design Patterns and Best Practices</i> . 2nd ed. Packt Publishing; 2018. ISBN: 978-1788831345
Web and Video link(s):
1. https://www.youtube.com/playlist?list=PL9ooVrP1hQOE5ZDJJsnEXZ2upwK7aTYiX
2. https://www.youtube.com/watch?v=Ou9j73aWgyE
Laboratory Manual (for laboratory component):
Computer Networks Manual and Record Book, Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):				U24CN608 : DEVOPS LABORATORY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN608.1	2	2	2	1	3	2	1	1	1	-	2	2	2
CO2	U24CN608.2	3	2	2	2	3	2	1	1	1	-	2	2	2
CO3	U24CN608.3	3	2	2	2	3	2	1	2	2	-	2	2	2
CO4	U24CN608.4	3	3	2	2	3	2	1	2	2	-	2	2	2
U24CN608		2.75	2.25	2	1.75	3	2	1	1.5	1.5	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Implement version control and remote repository management using Git and GitHub	SDG4	Quality Education	The course introduces version control and collaborative development practices using Git and GitHub, equipping students with industry-relevant skills and promoting continuous learning aligned with modern software development workflows
CO2	Develop build automation scripts and manage dependencies using maven and build tools	SDG9	Industry, Innovation and Infrastructure	Node.js automation and dependency management enable efficient software development workflows, supporting scalable and innovative digital infrastructure
CO3	implement containerization and deployment using Docker and Kubernetes	SDG9	Industry, Innovation and Infrastructure	Containerization and orchestration technologies support scalable, reliable, and efficient deployment of applications in modern cloud infrastructure
CO4	Design and implement CI/CD pipelines integrating Node.js applications using Jenkins	SDG8	Decent Work and Economic Growth	CI/CD automation improves productivity, reduces manual effort, and enhances software delivery efficiency, contributing to modern digital workforce practices

CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY			
Class: B. Tech. VI – Semester		Branch: CSE(Networks)	
Course Code:	U24CN609	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60%
Total Number of Teaching Hours:	36hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: apply fundamental bitwise operations and number theory algorithms, including Euclidean and extended Euclidean methods, to solve modular arithmetic problems			
CO2: analyse classical and modern cryptographic techniques like DES, AES, and RSA, while facilitating secure Diffie Hellman key exchanges			
CO3: build data integrity through SHA-512 implementation and utilize Cryptool for the practical analysis and simulation of encryption algorithms			
CO4: analyse network security protocols like SSL and perform vulnerability assessments using tools like Nmap, SNORT, and Advanced Ip Scanner			
Experiment-1 (UNIT-I)			
1(a).Write a program that contains a string (char pointer) with a value \Hello World'. The program should XOR each character in this string with 0 and displays the result 1(b).Write a program that contains a string (char pointer) with a value \Hello World'. The program should AND, OR and XOR each character in this string with 127 and display the result			
Experiment-2 (UNIT-I)			
2.Write a program to implement the Euclidean algorithm			
Experiment-3 (UNIT-I)			
3.Write a program to implement the Extended Euclidean algorithm			
Experiment-4 (UNIT-II)			
4(a).Write a program to implement Hill Cipher 4(b).Write a program to implement Playfair cipher 4(c).Write a program to implement Verman Cipher			
Experiment-5 (UNIT-II)			
5(a).Write a program to implement Vignere Cipher 5(b).Write a program to implement DES algorithm 5(c).Write a program to implement the AES algorithm			
Experiment-6 (UNIT-II)			
6(a).Write a program to implement RSA 6(b).Write a program to implement Diffie - Hellman key exchange			
Experiment-7 (UNIT-III)			
7(a).Write a program to implement SHA – 512 7(b).Introduction to cryptography software tool: CRYPTOOOL			
Experiment-8 (UNT-III)			
8(a)Implement and analyse DES using CRYPTOOOL 8(b).Implement and analyse AES using CRYPTOOOL			

Experiment-9 (UNIT-III)
9(a).Implement and analyse RSA using CRYPTOOL 9(b).Write a program to implement HMAC
Experiment-10 (UNIT-IV)
10(a).Write a program to implement SSL connection 10(b).Demonstrate IP address scanning in a network to identify active hosts, using GUI tool (Advanced IP Scanner) 10(c).Write a program to implement port scan of a device in a network and identify the open port 10(d).Demonstrate port scanning in a network using a GUI tool (Advanced Port Scanner) and identify open ports
Experiment-11 (UNIT-IV)
11.Demonstrate the following using security scanner GUI tool (nmap or zenmap): (a)Find the active hosts in a network (b)Find the operating system version of a remote system (c)write complete details of a remote system (d)Demonstrate software firewall rules to allow or block ports of a computer
Experiment-12 (UNIT-IV)
12.Demonstrate intrusion detection system (IDS) using a GUI tool (SNORT)
Textbook: William Stallings, <i>Cryptography and Network Security Principles and Practice</i> , 7th ed., Pearson Education, 2018
Reference Book(S): 1.Behrouz A. Forouzan, & Debdeep Mukhopadhyay (2015). <i>Cryptography and Network Security</i> (3rd ed.). McGraw-Hill 2.Atul Kahate (2013). <i>Cryptography and Network Security</i> (3rd ed.). McGraw-Hill William Diffie, & Martin Hellman (1976) New directions in cryptography. <i>IEEE Transactions on Information Theory</i>
Web and Video link(s): https://nptel.ac.in/courses/106105162 ; NPTEL Video Lecture on Cryptography and Network Security, by Prof. Sourav Mukhopadhyay, Professor of Mathematics, IIT Kharagpur
Laboratory Manual: Cryptography and Network Security Laboratory Manual, Dept. of CSE(N), KITS Warangal

Course Articulation Matrix (CAM):				U24CN609 : CRYPTOGRAPHY AND NETWORK SECURITY LABORATORY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN609.1	3	2	2	1	2	-	-	-	1	1	1	2	1
CO2	U24CN609.2	3	3	3	2	2	-	-	-	1	1	1	2	2
CO3	U24CN609.3	3	2	2	2	3	1	-	1	1	1	1	2	2
CO4	U24CN609.4	3	3	2	3	3	2	-	1	1	1	1	2	3
U24CN609		3	2.5	2.25	2	2.5	1.5	-	1	1	1	1	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	apply fundamental bitwise logic and number theory algorithms	SDG 4	Quality Education	Students acquire fundamental engineering knowledge and mathematical logic essential for advanced technical skill sets
CO2	analyse symmetric/asymmetric cryptographic algorithms	SDG 9	Industry, Innovation, and Infrastructure	Implementing modern encryption algorithms (AES, RSA) is crucial for building secure and resilient industrial digital infrastructures
CO3	build SHA-512 hashing for data integrity and utilize Cryp Tool for practical analysis of encryption algorithms	SDG 16	Peace, Justice, and Strong Institutions	Data integrity through hashing and digital signatures ensures the accountability and security of institutional data and legal documentation
CO4	analyse network security protocols like SSL and perform vulnerability assessments using Nmap, Snort, and Advanced IP Scanner	SDG 9	Industry, Innovation, and Infrastructure	Vulnerability assessments and intrusion detection (IDS) are vital for protecting critical network infrastructure from cyber threats

MINI PROJECT

Class: B. Tech. VI - Semester		Branch: CSE(Networks)	
Course Code:	U24CN610	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60%
Total Number of Teaching Hours:	-	ESE:	40%

Course Learning Outcomes (COs):

After completion of this course, the students should be able to,
 apply knowledge to practice to design & conduct experiments and utilize modern tools for developing working models / process / system leading to innovation & entrepreneurship
 demonstrate the competencies to perform literature survey, identify gaps, analyze the problem and prepare a well-documented Mini project report
 make an effective oral presentation through informative PPTs, showing knowledge on the subject & sensitivity towards social impact of the Mini project
 write a "Mini project paper" in scientific journal style & format from the prepared Mini project report and create a video pitch on Mini project

Student has to take up independent mini project on innovative ideas, innovative solutions to common problems using their knowledge relevant to courses offered in their program of study, which would supplement and complement the program assigned to each student.

Guidelines:

The HoD shall constitute a *Department Mini Project Evaluation Committee (DMPEC)*

DMPEC shall allot a faculty supervisor to each student for guiding on (i) selection of topic (ii) literature survey and work to be carried out (iii) preparing a report in proper format and (iv) effective mini project oral presentation

There shall be only continuous Internal Evaluation (CIE) for miniproject

The CIE for mini project is as follows:

Assessment	Weightage
Mini Project Supervisor Assessment	15%
Working model / process / software package / system developed	20%
Mini Project report	15%
Mini Project paper	10%
Video pitch	10%
DMPEC Assessment: Oral presentation with PPT and viva-voce	15%
SDG Alignment	5%
Research Alignment	10%
Total Weightage:	100%

Note: It is mandatory for the student to appear for oral presentation and viva-voce to qualify for course evaluation

Mini Project Topic: The topic should be interesting and conducive to discussion. Topics may be found by looking through recent issues of peer reviewed Journals / Technical Magazines on the topics of potential interest

Working Model: Each student is requested to develop a working model / process / system on the chosen work and demonstrate before the *DMPEC* as per the dates specified by *DMPEC*

Report: Each student is required to submit a well-documented report on the chosen seminar topic as per the format specified by *DMPEC*

Anti-Plagiarism Check: The seminar report should clear plagiarism check as per the Anti-Plagiarism policy of the institute

Presentation: Each student should prepare PPT with informative slides and make an effective oral presentation before the *DMPEC* as per the schedule notified by the department

Video Pitch: Each student should create a pitch video, which is a video presentation on his / her mini project. Video pitch should be no longer than 5 minutes by keeping the pitch concise and to the point, which shall also include key points about his / her business idea / plan (*if any*) and social impact

The student has to register for the Mini project as supplementary examination in the following cases:

- he/she is absent for oral presentation and viva-voce
- he/she fails to submit the report in prescribed format
- he/she fails to fulfill the requirements of Mini project evaluation as per specified guidelines

The CoE shall send a list of students registered for supplementary to the HoD concerned

The DSEC, duly constituted by the HoD, shall conduct Mini project evaluation and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):				U24CN610 Mini Project										
CO		PO 1	PO 2	PO 3	PO4	PO5	PO 6	PO7	PO8	PO9	PO1 0	PO1 1	PSO 1	PSO 2
CO1	U24CN610.1	3	3	2	3	3	2	1	2	1	2	2	2	1
CO2	U24CN610.2	2	2	2	3	2	1	1	1	2	1	3	1	1
CO3	U24CN610.3	1	1	1	1	2	2	1	2	3	1	2	1	1
CO4	U24CN610.4	1	2	1	2	2	1	2	1	3	1	2	1	1
U24CN610		1.75	2	1.5	2.25	2.25	1.5	1.25	1.52	2.25	1.25	2.25	1.25	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement (The student should be able to...)	Relevant SDG	SDG Description	Mapping Justification
CO1	apply knowledge to practice to design & conduct experiments and utilize modern tools for developing working models / process / system leading to innovation & entrepreneurship	SDG 9	Industry, Innovation and Infrastructure	Mini projects involve the design and development of innovative ECE solutions such as IoT systems, embedded systems, communication networks, VLSI applications, and intelligent electronic devices. These activities promote technological innovation, entrepreneurship, and sustainable industrial infrastructure.
CO2	demonstrate the competencies to perform literature survey, identify gaps, analyze the problem and prepare a well-documented Mini project report	SDG 4	Quality Education	Literature review, problem analysis, technical documentation, and independent learning enhance research skills, critical thinking, and lifelong learning capabilities, thereby supporting quality technical education and knowledge creation.
CO3	make an effective oral presentation through informative PPTs, showing knowledge on the subject & sensitivity towards social impact of the Mini project	SDG 11	Sustainable Cities and Communities	Presentation and discussion of ECE-based solutions for smart cities, intelligent transportation systems, environmental monitoring, public safety, healthcare technologies, and digital connectivity contribute to sustainable and inclusive community development.
CO4	write a "Mini project paper" in scientific journal style & format from the prepared Mini project report and create a video pitch on Mini project	SDG 12	Responsible Consumption and Production	Scientific reporting and dissemination of project outcomes promote responsible innovation, ethical publication practices, efficient utilization of resources, and sustainable technology development.

Bridge Courses for exit:

Successful completion of two subjects (6-Credits) during 2-months internship at the institute

OR

Successful completion of two suitable skill based courses (external) to qualify for Certification

C. After Third Year: (B. Voc. in CSE (Networks))

- (ii) The candidate should pass any two of the following additional courses (Degree Level) during the 2-Months internship at institute

Exit Option to Qualify B. Voc in CSE (Networks) : Any Two (02) Courses during the 2 - Months internship								
S. No.	Category	Course Code	Course Title	L	T	P	E	C
1	PCC	U24CN611X	Blockchain Technologies	2	-	2	4	3
2	PCC	U24CN612X	Ethical Hacking	2	-	2	4	3
3	PCC	U24CN613X	Fundamentals of Quantum Computing	2	-	2	4	3
4	PCC	U24CN614X	Any other course approved by BoS Chair and Dean AA	2	-	2	4	3

(OR)

- (ii) Any two suitable skill based courses to qualify for B. Voc in CSE (AI & ML) Degree.

Exit Option to Qualify B. Voc in CSE (Networks) : Any Two (02) Skill based Courses -:								
S. No.	Category	Course Code	Course Title	L	T	P	E	C
1	SEC	U24SE611X	Software Testing Tools and Selenium Reference: https://www.careerpedia.co/softwa-re-testing-course-hyderabad	-	-	6	6	3
2	SEC	U24SE612X	Digital Marketing Reference: https://trainings.internshala.com/digital-marketing-course	-	-	6	6	3
3	SEC	U24SE613X	CISCO: Enterprise Networking, Security & Automation Reference: Offered by CISCO CoE, KITSW	-	-	6	6	3
4	SEC	U24SE614X	Business Analytics Reference: https://trainings.internshala.com/business-analytics-course	-	-	6	6	3
5	SEC	U24SE615X	Any other skill based course approved by BoS Chair and Dean AA	-	-	6	6	3

(Note to HoDs on PCC: Under PCC the departments shall plan appropriate courses upto 6th semester covering GATE syllabus).

BLOCKCHAIN TECHNOLOGIES			
Class: B. Tech syllabi of Exit Course for B.Voc. certificate in CSE(NETWORKS)		Branch: CSE(Networks)	
Course Code:	U24CN611X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE Marks (%):	60
Total Number of Teaching Hours:	32 Hrs	ESE Marks (%):	40
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to, (based on cognitive skills acquired from theory component)</i> CO1: Distinguish blockchain types and consensus algorithms. CO2: Explain Bitcoin, blockchain transactions, and cryptocurrencies. CO3: Understand smart contracts, Ethereum, and DApps. CO4: Compare Hyperledger Fabric and Corda frameworks. <i>(based on psychomotor skills acquired from laboratory component)</i> CO5: Develop blockchain blocks and Merkle Trees. CO6: Implement blockchain mining and consensus mechanisms. CO7: Create cryptocurrency wallets, ERC-20 tokens, and smart contracts. CO8: Develop DApps and blockchain-based applications.			
THEORY COMPONENT			
UNIT-I		4 Hrs	
Introduction to Blockchain: History of blockchain, electronic cash, generic elements Structure and Working of Blockchain: Blocks, hashing, linking, architecture, features, benefits and limitations Types of Blockchain: Public, Private, Consortium, Tokenized, Token-less CAP Theorem: Concept and intuition Consensus Mechanisms: Introduction and types			
UNIT-II		4 Hrs	
Foundations of Bitcoin: Introduction to Bitcoin, Digital keys, addresses, and Basic cryptography (hashing, digital signatures), Bitcoin transactions (inputs, outputs, UTXO) Blockchain and Network: Structure of blockchain (blocks, hashing, Merkle tree), Mining and Proof-of-Work,Bitcoin network (nodes, P2P architecture), Transaction lifecycle (creation → validation → confirmation)			
UNIT-III		4 Hrs	
Smart Contracts Fundamentals: History of smart contracts, Definition and characteristics, Ricardian contracts, Applications of smart contracts Ethereum: Introduction to Ethereum, Ethereum vs Bitcoin, Ethereum – bird’s eye view, Ethereum accounts (EOA and Contract accounts), Ether, Gas and transaction fees Smart Contract Development: Programming languages for Ethereum, Solidity language (basics) Structure of smart contracts Decentralized Applications and Web3: Introduction to DAO, Introduction to DApps, Web3 introduction			
UNIT-IV		4 Hrs	
Enterprise Blockchain Platforms: Introduction to enterprise blockchains, Overview of Hyperledger Hyperledger projects (Fabric – basic idea), Hyperledger architecture (reference model – concept) Corda: Introduction to Corda, Architecture and components and Corda development			

environment

Introduction to alternative Blockchain Platforms: Ripple, Quorum, Multichain, Rootstock, BigchainDB, Storj, Tezos

LABORATORY COMPONENT

List of Experiments

1. Write a program to create a Merkle Tree and generate the root hash for a set of transactions.
2. Write a program to create a blockchain block containing block number, timestamp, transaction data, previous hash, and current hash.
3. Write a program to implement a simple blockchain and validate the integrity of the blockchain.
4. Write a Solidity program to create and deploy an ERC-20 token smart contract on an Ethereum test network.
5. Write a Java program to implement Merkle Tree construction and verify transaction integrity using hash values.
6. Write a Java program to implement blockchain mining using the Proof-of-Work consensus mechanism.
7. Write a Java program to implement peer-to-peer communication among blockchain nodes for transaction sharing.
8. Write a program to create a cryptocurrency wallet using public and private key generation techniques.
9. Write a Solidity program to develop and deploy a smart contract for secure asset transfer and transaction management.
10. Write a program to develop a decentralized application (DApp) using Web3.js and Ethereum smart contracts.
11. Write a program to implement and compare Proof-of-Work (PoW) and Proof-of-Stake (PoS) consensus algorithms.
12. Write a blockchain-based application for secure voting, certificate verification, or supply chain management.

Textbook(s):

1. Bashir, I. (2023). *Mastering Blockchain: Inner workings of blockchain, from cryptography and decentralized identities to DeFi, NFTs and Web3* (4th ed.). Packt Publishing.

Reference Book(S):

1. Joseph Bonneau et al., *Blockchain Technology: From Theory to Practice*, Springer, 1st Edition, 2022. (Chapters 1–8)
2. Brenn Hill, Samanyu Chopra, Paul Valencourt, *Blockchain Quick Reference*, Packt Publishing, 2018. (Chapters 1–6)
Kumar Saurabh, Ashutosh Saxena, *Blockchain Technology: Concepts and Applications*, Wiley, 2020. (Chapters 1–9).

Web and Video link(s):

<https://in.video.search.yahoo.com/search/video?fr=mcafee&p=NPTEL+BLOCKCHAIN+TECHNOLOGIES+VIDEO&type=E210IN885G0#id=2&vid=0d4dce47729f5f0dcca1ea877588f56&action=click>

Laboratory Manual (for laboratory component):

1. *Fundamentals of Blockchain Technologies laboratory manual*, Department of CSE(N), KITSW

Course Articulation Matrix (CAM):			U24CN611X:BLOCKCHAIN TECHNOLOGIES													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	U24CN611X.1	2	2	2	2	2	1	1	1	-	1	-	2	2	2	2
CO2	U24CN611X.2	2	2	2	2	2	1	1	1	-	1	-	2	2	2	2
CO3	U24CN611X.3	2	2	2	2	2	1	1	1	-	1	-	2	2	3	2
CO4	U24CN611X.4	2	2	2	2	2	1	1	1	-	1	-	2	2	3	2
CO5	U24CN611X.5	2	2	2	2	2	1	1	1	-	1	-	1	2	2	2
CO6	U24CN611X.6	2	2	2	2	2	1	1	1	-	1	-	1	2	2	2
CO7	U24CN611X.7	2	2	2	2	2	1	1	1	-	1	-	2	2	3	2
CO8	U24CN611X.8	2	2	2	2	2	1	1	1	-	1	-	2	2	3	2
U24CN611X		2	2	2	2	2	1	1	1	-	1	-	1.75	2	2.5	2
3 - HIGH, 2 - MEDIUM, 1 - LOW																

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Distinguish different types of blockchains and consensus algorithms based on their characteristics and use cases.	SDG 9	Industry, Innovation and Infrastructure	Understanding blockchain types and consensus mechanisms builds foundational knowledge for developing secure, decentralized digital infrastructure essential for innovation.
CO2	Understand the working of Bitcoin, its network, transactions, and explore alternative cryptocurrencies.	SDG 9	Industry, Innovation and Infrastructure	Bitcoin and cryptocurrencies introduce decentralized financial systems, enabling innovative digital payment infrastructures that enhance financial inclusion and technological advancement.
CO3	Understand smart contracts, Ethereum architecture, and the development of decentralized applications using blockchain.	SDG 3	Good Health and Well-being	Smart contracts and decentralized applications enable secure healthcare systems such as electronic records and telemedicine platforms, improving healthcare accessibility.
CO4	Compare Hyperledger Fabric and Corda blockchain frameworks.	SDG 9	Industry, Innovation and Infrastructure	Enterprise blockchain frameworks such as Hyperledger Fabric and Corda support scalable, secure industrial applications, strengthening digital infrastructure across supply chain and finance.
CO5	Develop blockchain blocks and Merkle Trees.	SDG 9	Industry, Innovation and	Constructing blocks and Merkle Trees builds core technical competence in secure data structures that underpin resilient,

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
			Infrastructure	tamper-proof digital infrastructure.
CO6	Implement blockchain mining and consensus mechanisms.	SDG 7	Affordable and Clean Energy	Implementing and evaluating consensus mechanisms fosters awareness of energy-efficient alternatives to mining, promoting sustainable and responsible energy use in computing.
CO7	Create cryptocurrency wallets, ERC-20 tokens, and smart contracts.	SDG 8	Decent Work and Economic Growth	Developing wallets, tokens, and smart contracts builds practical skills in decentralized finance, fostering entrepreneurship and growth in the digital economy.
CO8	Develop DApps and blockchain-based applications.	SDG 11	Sustainable Cities and Communities	Building decentralized applications enables transparent, tamper-proof solutions for governance, supply chain tracking, and civic services that support sustainable community management.

ETHICAL HACKING			
Class: B. Tech syllabi of Exit Course for B.Voc. certificate in CSE(NETWORKS)		Branch: CSE(Networks)	
Course Code:	U24CN612X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE Marks (%):	60
Total Number of Teaching Hours:	32 Hrs	ESE Marks (%):	40
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to, (based on cognitive skills acquired from theory component)</i> CO1: analyze security vulnerabilities, security models and phases of penetration testing frameworks CO2: analyze various cyber attacks and security threats in business and network environments CO3: apply reconnaissance, enumeration and exploitation techniques using ethical hacking tools CO4: evaluate penetration testing results and recommend suitable mitigation and defense mechanisms <i>(based on psychomotor skills acquired from laboratory component)</i> CO5: understand the relationship between risk analysis, security architecture, and ethical hacking in protecting organizational information assets CO6: analyze ethical reconnaissance using publicly available information and authorized scanning techniques CO7: demonstrate reconnaissance and OSINT to gather information about authorized targets CO8: analyze cyber attack case studies and propose effective remedies to improve organizational security			
THEORY COMPONENT			
UNIT-I			4 Hrs
Introduction: Hacking impacts, The hacker-Type of hacker, Script kiddies Framework: Planning the test, Sound operations, Reconnaissance, Enumeration, Vulnerability analysis, Exploitation, Final analysis, Deliverable, Integration Information Security Models: Computer security, Network security, Service security, Application security, Security architecture Information Security Program: The process of information security, Component parts of information security programs, Risk analysis and ethical hacking			
UNIT-II			4 Hrs
The Business Perspective: Business objectives, Security policy, Previous test results, Business challenges Planning for a Controlled Attack: Inherent limitations, Imposed limitations, Timing is everything, Attack type, Source point, Required knowledge, Multi-phased attacks, Teaming and attack structure, Engagement planner, The right security consultant, The tester, logistics, Intermediates, Law enforcement			
UNIT-III			4 Hrs
Reconnaissance: Social engineering, Physical security, Internet reconnaissance Preparing for a Hack: Technical preparation, Managing the engagement Enumeration: Enumeration techniques, Soft objective, Looking around or attack, Elements of enumeration, Preparing for the next phase Exploitation: Intuitive testing, Evasion, Threads and groups, Operating systems, Password			

crackers, Rootkits, Applications, Wardialing, Network, Services and areas of concern	
UNIT-IV	4 Hrs
Deliverable: The deliverable, The document, Overall structure, Aligning findings, Presentation Integration: Integrating the results, Integration summary, Mitigation, Defense planning, Incident management, Security policy, Conclusion Case study: various attacks scenarios and their remedies	
LABORATORY COMPONENT	
List of Experiments 1. Perform reconnaissance and enumeration on an authorized target to identify network information, open ports, and running services. 2. Identify security vulnerabilities in an authorized test system using a vulnerability scanner. 3. Perform a basic risk analysis and recommend suitable information security controls for an organization. 4. Analyze an organization's business objectives and evaluate how its security policy supports those objectives. 5. Prepare a professional penetration testing engagement plan for an authorized target environment. 6. Design a structured ethical hacking engagement incorporating team roles, attack phases, logistics, and legal considerations. 7. Perform passive and active reconnaissance on an authorized target using Open-Source Intelligence (OSINT) and network discovery tools. 8. Enumerate network services and identify system resources on an authorized host. 9. Validate identified vulnerabilities in an authorized laboratory environment and prepare a mitigation report. 10. Prepare a comprehensive penetration testing report based on the findings of a simulated security assessment. 11. Integrate penetration testing findings into an organization's security improvement strategy. 12. Analyze real-world cyber attack scenarios and recommend appropriate preventive and corrective measures.	
Textbook: 1. James S. Tiller, <i>The Ethical Hack: A Framework for Business Value Penetration Testing</i>, Auerbach Publications, 1st edition, 2019, New York	
Reference Book(S): 1. Michael Simpson, Kent Backman, James Corley, <i>Hands-On Ethical Hacking and Network Defense</i>, Cengage Learning, 2nd edition, 2005, New York. 2. Patrick Engebreston, <i>The Basics of Hacking and Penetration testing</i>, Syngress Publishers, , 2011, New York. 3. EC-Council, <i>Ethical Hacking and Counter measures: Attack Phases</i>, Course Technology Press, 2016, New York. 4. Hein Smith, Hilary Morrison, <i>ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking</i>, Kindle Edition, 2018, New York.	
Web and Video link(s): https://nptel.ac.in/courses/106105217 ; NPTEL Video Lecture on Ethical Hacking by Prof.	

Laboratory Manual (for laboratory component):

- 1.
- Ethical Hacking laboratory manual*
- , Department of CSE(N), KITSW

Course Articulation Matrix (CAM):		U24CN612X: ETHICAL HACKING													
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	U24CN612X.1	3	2	2	1	2	-	-	-	-	-	-	2	1	2
CO2	U24CN612X.2	2	3	2	2	2	-	-	1	-	-	2	2	1	2
CO3	U24CN612X.3	2	3	3	2	3	-	-	-	1	1	-	2	2	2
CO4	U24CN612X.4	2	3	3	3	2	-	-	2	1	2	2	3	2	2
CO5	U24CN612X.5	2	3	2	1	2	1	-	1	-	-	-	2	2	2
CO6	U24CN612X.6	2	3	2	2	2	-	-	1	-	1	1	2	2	2
CO7	U24CN612X.7	2	3	2	2	2	1	-	2	-	1	-	2	2	3
CO8	U24CN612X.8	2	3	3	3	3	-	-	2	2	2	1	3	2	3
U24CN612X		2.12	2.87	2.37	2	2.25	1	-	1.5	1.33	1.4	1.5	2.25	1.75	2.5
3 - HIGH, 2 - MEDIUM, 1 - LOW															

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Distinguish different types of blockchains and consensus algorithms based on their characteristics and use cases.	SDG 9	Industry, Innovation and Infrastructure	Supports the development of secure digital infrastructure by enabling students to understand security frameworks, identify vulnerabilities, and improve information system resilience.
CO2	Understand the working of Bitcoin, its network, transactions, and explore alternative cryptocurrencies.	SDG 8	Decent Work and Economic Growth	Helps students understand cybersecurity risks affecting modern businesses and prepares them to contribute to secure and sustainable digital workplaces.
CO3	Understand smart contracts, Ethereum architecture, and the development of decentralized applications using blockchain.	SDG 4	Quality Education	Provides practical, skill-based cybersecurity education and develops technical competencies required for professional cybersecurity roles.
CO4	Compare Hyperledger Fabric and Corda blockchain frameworks.	SDG 16	Peace, Justice and Strong Institutions	Promotes responsible cybersecurity practices, protection of digital assets, ethical vulnerability management, and stronger security governance.
CO5	understand the relationship between risk analysis, security architecture, and ethical hacking in protecting organizational information assets	SDG 9	Industry, Innovation and Infrastructure	Enhances secure digital infrastructure by developing skills in cybersecurity testing, vulnerability identification, and protection of information systems.

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO6	analyze ethical reconnaissance using publicly available information and authorized scanning techniques	SDG 8	Decent Work and Economic Growth	Supports secure business operations, risk-aware decision-making, and development of cybersecurity professionals for a safer digital economy.
CO7	demonstrate reconnaissance and OSINT to gather information about authorized targets	SDG 16	Peace, Justice and Strong Institutions	Promotes responsible cybersecurity practices, data protection, ethical technology use, and stronger institutional security frameworks.
CO8	analyze cyber attack case studies and propose effective remedies to improve organizational security	SDG 4	Quality Education	Develops cybersecurity knowledge, analytical skills, and practical competencies required for lifelong learning and professional development.

FUNDAMENTALS OF QUANTUM COMPUTING			
Class: B. Tech syllabi of Exit Course for B.Voc. certificate in CSE(NETWORKS)		Branch:CSN	
Course Code:	U24CN613X	Credits:	3
Hours/Week (L-T-P-O-E):	2-0-2-0-4	CIE Marks (%):	60
Total Number of Teaching Hours:	32 Hrs	ESE Marks (%):	40
Course Learning Outcomes (LOs): <i>This course will develop students' knowledge in /on...</i> <i>(based on cognitive skills acquired from theory component)</i> CO1: understand the fundamentals of classical and quantum computing principles, qubits, superposition, and measurement CO2: apply quantum gates, circuits, and quantum programming techniques using open-source quantum simulators and frameworks CO3: analyze entanglement, quantum protocols, and quantum algorithms for computational problem solving CO4: analyze the performance and limitations of quantum computing systems, error correction methods, and real-world quantum applications <i>(based on psychomotor skills acquired from laboratory component)</i> CO5: understand qubits, superposition, and measurement using quantum simulators CO6: apply quantum gates and develop quantum circuits using Qiskit tools CO7: analyze quantum entanglement, teleportation, and quantum algorithms experimentally CO8: analyze practical aspects of quantum programming, error correction, and quantum applications			
THEORY COMPONENT			
UNIT-I		4 Hrs	
Foundations of Classical and Quantum Computing - Introduction to computation,Classical bits and binary systems,Logic gates and reversible computation,Introduction to quantum computing,Qubits and quantum states,Superposition,Complex numbers in quantum computing,Quantum measurement,Bloch sphere representation			
UNIT-II		4 Hrs	
Quantum Programming Frameworks and Basic Quantum Gates - Introduction to Quantum Programming, Overview of Qiskit and PennyLane, Installation and development environment setup, Quantum circuit creation using Qiskit, Basic quantum gates:, Pauli-X Gate, Pauli-Y Gate, Pauli-Z Gate, Hadamard Gate, Phase Gate, CNOT Gate, Quantum circuit visualization, Quantum measurement and simulation, Running circuits on IBM Quantum Simulator, Introduction to hybrid quantum-classical programming using PennyLane			
UNIT-III		4 Hrs	
Quantum Circuits and Quantum Information - Multi-qubit systems, Tensor products, Bell states, Entanglement, Controlled gates (CNOT, Toffoli), Quantum teleportation, Superdense coding, BB84 Protocol, Quantum Fourier Transform			
UNIT-IV		4 Hrs	
Quantum Algorithms and Applications- Deutsch Algorithm, Deutsch-Jozsa Algorithm, Grover's Search Algorithm, Introduction to Shor's Algorithm, Quantum Error Correction, Noise and Decoherence, Applications of Quantum Computing:, Cryptography, Optimization, AI/ML, Healthcare			

LABORATORY COMPONENT	
Experiment-1 Binary Representation and Classical Logic Simulation 1. Binary number representation 2. Logic gate implementation using Python 3. Truth table generation for AND, OR, NOT, XOR gates	
Experiment-2 Introduction to Qubits and Superposition 1. Representation of qubits 2. Bloch sphere visualization 3. Superposition using Hadamard gate	
Experiment-3 Quantum Measurement 1. Measurement in quantum circuits 2. Probability analysis of qubit states 3. Simulation using Quirk/Qiskit	
Experiment-4 Introduction to Qiskit 1. Installation and setup of Qiskit 2. Creating first quantum circuit 3. Running circuits on simulator	
Experiment-5 Basic Quantum Gates using Qiskit 1. Implementation of Pauli-X gate 2. Implementation of Pauli-Y and Z gates 3. Hadamard gate implementation	
Experiment-6 Introduction to PennyLane 1. PennyLane environment setup 2. Simple hybrid quantum-classical circuit 3. Quantum circuit visualization using PennyLane	

Course Articulation Matrix (CAM):		U24CN613X: FUNDAMENTALS OF QUANTUM COMPUTING												
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO1	PSO2
CO1	U24CN613X.1	3	2	1	1	1	-	1	-	1	-	2	2	3
CO2	U24CN613X.2	3	3	2	2	1	-	1	-	1	-	2	2	3
CO3	U24CN613X.3	3	3	2	3	2	-	1	-	1	-	2	2	3
CO4	U24CN613X.4	2	3	2	3	2	-	1	-	1	-	2	2	2
CO5	U24CN613X.5	3	2	1	1	2	1	1	1	1	1	2	1	3
CO6	U24CN613X.6	3	3	3	2	3	1	1	2	1	1	2	2	3
CO7	U24CN613X.7	3	3	2	3	3	1	1	2	1	1	2	2	3
CO8	U24CN613X.8	2	3	2	3	3	1	1	2	1	1	3	2	2
U24IN613X		2.75	2.75	1.875	2.25	2.125	0.5	1	0.875	1	0.5	2.125	1.875	2.75
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	understand the fundamentals of classical and quantum computing principles, qubits, superposition, and measurement	SDG 4, SDG 9	Quality Education, Industry, Innovation and Infrastructure	Provides quality education in emerging quantum technologies and establishes a strong theoretical foundation that supports innovation and advanced computing research.
CO2	apply quantum gates, circuits, and quantum programming techniques using open-source quantum simulators and frameworks	SDG 8, SDG 9,	Decent Work and Economic Growth, Industry, Innovation and Infrastructure	Develops practical quantum programming skills using collaborative open-source platforms (e.g., Qiskit), enhancing employability, promoting technological innovation, and encouraging global knowledge sharing.
CO3	analyze entanglement, quantum protocols, and quantum algorithms for computational problem solving	SDG 4, SDG 9	Quality Education, Industry, Innovation and Infrastructure	Strengthens analytical and problem-solving skills in advanced quantum algorithms, contributing to innovation and research in next-generation computing technologies.
CO4	analyze the performance and limitations of quantum computing systems, error correction methods, and real-world quantum applications	SDG 9, SDG 12	Decent Work and Economic Growth, Responsible Consumption and Production	Enables evaluation of reliable and efficient quantum computing systems while promoting sustainable use of computational resources and preparing graduates for emerging technology industries.
CO5	understand qubits, superposition, and measurement using quantum simulators	SDG 4, SDG 9	Quality Education, Industry, Innovation and Infrastructure	Promotes experiential learning through quantum simulation tools, improving conceptual understanding and supporting innovation in quantum education.
CO6	apply quantum gates and develop quantum circuits using Qiskit tools	SDG 4, SDG 8, SDG 9, SDG 17	Decent Work and Economic Growth	Enhances hands-on technical competency using industry-standard open-source tools, improving career readiness and fostering collaboration in quantum software development.
CO7	analyze quantum entanglement, teleportation, and quantum algorithms experimentally	SDG 4, SDG 9	Quality Education, Industry, Innovation and Infrastructure	Encourages experimental learning and research in quantum information science, supporting innovation and scientific advancement.
CO8	analyze practical aspects of quantum programming, error correction, and quantum applications	SDG 4, SDG 9, SDG 12	Quality Education, Industry, Innovation and Infrastructure, Responsible Consumption and Production	Integrates practical quantum computing, sustainable and reliable computing practices, industry-oriented skills, and collaborative use of open-source quantum ecosystems.

VII-Sem Syllabi

(B.Tech CSE(Networks) URR24)

VII SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	
1	OEC	U24OE701X-MB	OE-Management Basket	2	1	-	3	3
2	PEC	U24CN702X	PE-II/MOOCs-II	2	1	-	3	3
3	PCC	U24CN703	Software Defined Networking	2	1	-	3	3
4	PCC	U24CN704	Quantum Computing	2	1	-	3	3
5	PCC	U24CN705	Mobile Application Development Lab Laboratory	-	-	2	2	1
6	ELC	U24CN706	Internship Evaluation*	-	-	2	2	1
7	ELC	U24CN707	Major Project, Phase-1/ Industrial Internship-1	-	-	8	8	4
Total:				8	4	12	24	18
Additional Learning®: Maximum credits allowed for Honours/Minor				-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	22

Pool -XVII Management Courses Basket (OE-MB)		
S. No.	Course Code	Course Title
1.	U24OE701A-MB	Managerial Economics and Accountancy
2.	U24OE701B-MB	Engineering Finance
3.	U24OE701C-MB	Organizational Behaviour
4.	U24OE701D-MB	E-Commerce and Digital Marketing
5.	U24OE701E-MB	Any other course approved by BoS Chair and Dean AA

Professional Elective-II		
S. No.	Course Code	Course Title
1.	U24CN702A	Block chain Technologies
2.	U24CN702B	High Performance Computing
3.	U24CN702C	Computer Vision and Image Processing
4.	U24CN702D	Principles of Data Science
5.	U24CN702E	Any other course approved by BoS Chair and Dean AA

MANAGEMENT ECONOMICS AND ACCOUNTANCY			
Class: B. Tech. VII Semester		Branch:CSE,ECE,ECI,EEE/ CSN,CSO,CSM,CSD,IT,CE,ME	
Course Code:	U24OE701A-MB	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs)			
After completion of this course, the students should be able to,			
CO1 : comprehend the basic concepts of management, functions of management			
CO2 : distinguish between micro & macroeconomics & forms of business organizations			
CO3 : pass journal entries & post them into ledgers, prepare profit & loss accounts and assesses the financial position through the balance sheet			
CO4 : evaluate financial statements with a the help of various ratios and reveal the financial health of the organization			
UNIT-I		9 Hrs	
Introduction to Management: Concept of Management, Features of Management, Importance of Management, Nature andScope of Management, Fayol’s Administrative Management,Taylor’s Scientific Management			
Functions of Management: Planning- Concept of Planning, Nature of Planning, Importance of Planning, Planning Process, Types of Planning, Organizing- Concept of Organizing, Organization Structure- line and staff,Advantages of Organizing, Staffing - Meaning, Functions ofHuman Resources Management, Directing- Elements of Directing- Supervision, Leadership- Nature, Motivation - Nature, Types, Communication- Process, Types, Barriers to effective communication,			
Co-ordination- Definition, Steps to achieve effective coordination, Controlling- Definition, Process			
UNIT-II		9 Hrs	
Economics: Meaning and definition, Scope, Micro and Macro Economics, Methods of Economics			
Forms of Business Organization: Sole Proprietor ship, Partnership firm - Types of Partners, Limited Liability Partnership (LLP), Joint Stock Company - Features, Types, Merits and demerits, Cooperative society			
UNIT-III		9 Hrs	
Introduction to Financial Accounting: Accounting concepts and conventions, Double Entry System and Book Keeping, Overview of accounting cycle, Journal-meaning, Journalizing, Ledger - Meaning, Ledger posting, Balancing, Cash book (Single column), Preparation of Trial balance			
Final Accounts: Trading Account, profit and loss account and Balance Sheet with simple adjustments			
UNIT-IV		9 Hrs	
Financial Statement Analysis: Introduction to Financial Statement Analysis, Ratio Analysis, Introduction, Types of Ratios, Analysis and Interpretation of Liquidity Ratios, Profitability ratios, Activity Ratios, and Capital structure Ratios (simple problems)			
Textbook(s):			
1. L.M.Prasad, <i>Principles and Practices of Management</i> , Sultan Chand & Sons Educational Publishers, 11 th edition2025, New Delhi (Part -I to Part-VI)			
2. D. N. Dwivedi, <i>Engineering Economics: Text & Cases</i> , Vikas Publishing, 5th edition, 2014 (Chapter-3)			
3. R. Narayana Swamy, <i>Financial Accounting – A Managerial Perspective</i> , Prentice Hall of India, 7 th edition, 2023, New Delhi(Chapter VI)			

Reference Book(s):

1. Harold Koontz and Heinz Weihrich, Essentials of Management, 6th ed New Delhi: Tata Mc Graw Hill Publications, 2015
2. Maheshwari, S N, & Maheshwari, S K (2024) Financial Accounting (7th ed) Vikas Publishing House Pvt Ltd, 2024

Web and Video link(s):

1. https://onlinecoursesnptelacin/e-learning/preview/noc25_mg52
2. https://onlinecoursesnptelacin/e-learning/preview/noc25_ec10

Course Articulation Matrix (CAM):					MANAGEMENT ECONOMICS AND ACCOUNTANCY									
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24MB701A-MB.1	-	3	3	2	-	2	2	3	3	3	3	1	1
CO2	U24MB701A-MB.2	-	2	2	1	-	2	3	3	3	3	3	1	1
CO3	U24MB701A-MB.3	-	1	2	1	-	2	3	2	3	3	3	1	1
CO4	U24MB701A-MB.4	-	2	2	2	-	1	2	2	3	3	3	1	1
		-	2	2.25	1.5	-	1.75	2.5	2.5	3	3	3	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	comprehend the basic concepts of management	SDG 4	Quality Education	Understanding the management concepts and managerial function will help the students to take effective and efficient decisions and able to solve work place problems
CO2	distinguish between micro & macro-economics & forms of business organizations	SDG 8	Decent Work and Economic Growth	Economics concepts will help to promote sustained, inclusive and sustainable economic growth, and different forms of organizations will provide knowledge about creating full and productive employment and decent work for all
CO3	pass journal entries & post them into ledgers, prepare profit & loss accounts and assesses the financial position through the balance sheet	SDG 17	Partnerships for the goals	accounting concepts and conventions will promote a universal, rules-based, open, non-discriminatory and equitable application of
CO4	evaluate financial statements with a the help of various ratios and reveal the financial health of the organization	SDG 8	Decent Work and Economic Growth	Evaluating financial statements through ratio analysis reveals the financial health of an organization, enabling better decision-making, efficient resource utilization, and sustainable growth

ENGINEERING FINANCE			
Class: B.Tech. VII-Semester		Branch: CSE, ECE, ECI, EEE/CSN, CSO, CSM, CSD, IT, CE, and ME	
Course Code:	U24OE701B-MB	Credits:	3
Hours/Week (L-T-P-E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) After completion of this course, the students should be able to, CO1: explain fundamentals of engineering finance, financial management objectives, ethics, and time value of money concept CO2: apply capital budgeting techniques including inflation adjusted Net Present Value/Internal Rate Return for project evaluation and selection CO3: analyse various cost concepts and determine breakeven point for make or buy decisions in engineering projects CO4: evaluate asset replacement decisions and apply depreciation methods to determine the economic life and value of engineering assets			
UNIT-I			9 Hrs
Fundamentals of Engineering Finance: Engineering Finance – Meaning, Definition, and Scope, Role of Finance in Engineering – Importance for engineers in decision making and cost control, Ethics in Engineering Finance – Transparency, Cost estimation honesty, Avoidance of financial conflicts of interest, Financial Management – Meaning, Functions, Objectives (profit maximization v/s wealth maximization), Sources of Finance, Time value of Money			
UNIT-II			9 Hrs
Investment Decisions: Investment Decisions- Types of Investment projects, Investment evaluation criteria, Methods of capital budgeting – Discounted cash flow techniques v/s non discounted cash flow techniques, Inflation adjusted NPV and IRR, Comparison and selection of mutually exclusive engineering projects			
UNIT-III			9 Hrs
Cost-Volume-Profit Analysis: Cost concepts- Fixed, Variable, Marginal, Sunk, Opportunity costs, Direct and Indirect costs, Breakeven analysis – Meaning, Assumptions, Graphical and Mathematical determination of breakeven point, Make or buy decisions using breakeven analysis, Application of breakeven analysis in engineering projects			
UNIT-IV			9 Hrs
Replacement Decisions and Valuation of engineering assets: Replacement analysis – Meaning, Need, Defender v/s Challenger concept, Economic service life, Valuation of equipment's and physical assets -Depreciation definition, Depreciation fund, Methods of depreciation - straight line, Declining balance, Sum of the years-digits, Sinking fund and Service output method, Application of depreciation methods on equipment's and physical asset with the passage of time			
Textbook(s): 1. M..Y. Khan and P. K. Jain, <i>Financial Management</i>, Tata Mc.Graw Hill 5th edition, ISBN:978-0-07-065614-7 (Unit-I in part 1 of section 1,2&3 and Unit-II in part 3 of 9&10) 2. R. Panneerselvam, <i>Engineering Economics</i>, PHI Learning 2nd edition, ISBN:978-81-203-4837-0 (Unit-III in Chapter 1&16 and Unit-IV in Chapter 8& 9)			
Reference Book(s): 1. F.K. Crundwell, <i>Finance for Engineers: Evaluation and Funding of Capital Projects</i>, Springer London Ltd., Atlantic Publishers and Distributors (P) Ltd, ISBN: 978-1849967082, 2010 2. Robert L. Kosowski, Salih N. Neftci, <i>Principles of financial engineering</i>, Academic press,			

Atlantic Publishers and Distributors (P) Ltd 3rd edition, ISBN: 978-0123869685, 2014

3. D. N. Dwivedi, *Engineering Economics: Text & Cases*, Vikas Publishing, 5th edition, ISBN: 9788126510887, 2014
4. Prasanna Chandhra, *Financial Management: Theory and Practice*, Tata Mc Graw Hill Education (India) private limited, ISBN-10: 93-392-1225-8, 2015
5. Chan S Park, *Fundamentals of Engineering Economics*, Pearson Education 3rd edition, ISBN: 978-9352864379, 2017
6. Chatterjee Partha Sheikh Salim, *Engineering Economy & Financial Management*, Himalaya Publishing House, ISBN: 978-9350247389, 2011

Course Articulation Matrix (CAM):						U24OE701B: ENGINEERING FINANCE								
CO		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2
CO1	U24OE701B-MB	2	3	2	2	2	2	2	2	-	2	2	1	1
CO2	U24OE701B-MB	2	3	2	2	2	2	2	2	-	2	3	1	1
CO3	U24OE701B-MB	2	3	2	2	2	2	2	2	-	2	2	1	1
CO4	U24OE701B-MB	2	3	2	2	2	2	2	2	-	2	2	1	1
		2	3	2	2	2	2	2	2	-	2	2.25	1	1
3-HIGH, 2-MEDIUM, 1-LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	explain fundamentals of engineering finance, financial management objectives, ethics, and time value of money concept	SDG 4 And SDG 16	Quality Education and Peace, Justice and Strong Institutions	Promotes financial literacy, ethical decision-making, and professional responsibility essential for quality education and transparent institutional practices
CO2	apply capital budgeting techniques including inflation adjusted npv/irr for project evaluation and selection	SDG 8 And SDG 9	Decent Work and Economic Growth And Industry, Innovation and Infrastructure	Supports economically viable investment decisions, efficient resource allocation, industrial growth, and sustainable infrastructure development
CO3	analyse various cost concepts and determine breakeven point for make or buy decisions in engineering projects	SDG 9 And SDG 12	Industry, Innovation and Infrastructure and Responsible Consumption and Production	Encourages cost efficiency, optimized production planning, and responsible utilization of resources in engineering and industrial projects
CO4	evaluate asset replacement decisions and apply depreciation methods to determine the economic life and value of engineering assets	SDG 8 And SDG 12	Decent Work and Economic Growth and Responsible Consumption and Production	Promotes sustainable asset management, economic efficiency, lifecycle optimization, and responsible use of engineering resources

ORGANIZATIONAL BEHAVIOUR			
Class: B. Tech. VII – Semester		Branch: CSE,ECE,ECI,EEE/ CSN,CSO,CSM,CSD,IT,CE,ME	
Course Code:	U24OE701C-MB	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: evaluate the fundamentals, importance, influencing factors, and communication processes of Organizational Behaviour CO2: analyse individual behaviour including personality, perception, learning, attitudes, emotions, stress, and motivation CO3: examine group behaviour, team effectiveness, conflict management, leadership, power, politics, and group dynamics in organizational settings CO4: evaluate organizational structure, culture, innovation, change, organizational effectiveness, quality of work life, and international organizational behaviour			
UNIT-I			9 Hrs
Introduction: Foundations of organizational behavior, Concept, Importance, Factors influencing organizational behavior, Challenges and opportunities for organization behavior, Managerial perspective of OB, Communication-Process-channels-communication barriers , Measures to overcome barriers			
UNIT-II			9 Hrs
Individual Behavior: Individual in the organization, Nature of man, Models of man, Personality-Stages of development of personality, Perception-Factors influencing perception, Learning-Theories of Learning-Cognitive Learning Theory, Behaviourist Learning Theory, Attitudes-Formation of attitudes, Personality and emotions, Managing emotions and stress in organizations, Motivation- Motivation theories-Maslow's Needs Hierarchy Theory and Herzberg's Two-Factor Theory			
UNIT-III			9 Hrs
Group decision making: Groups in organization, Basic group concepts, Groups vs Teams, Understanding work teams-Types of teams, Creating effective teams, Conflicts-Types of conflicts, Strategies for resolution of conflicts in groups Group dynamics: Group dynamics, Leadership-Leadership types and managerial effectiveness, Trust and leadership, Power and politics, Basis of power, Organizational politics			
UNIT-IV			9 Hrs
Organization structure: Organization structure, Size and design, Organizational culture, Organizational change-Resistance to change, Organizational stress- Factors contribute to stress, Coping strategies, Stress and performance, Organizational effectiveness-concepts, Quality of work life-concepts, International organizational behavior-concepts			
Textbook(s): 1. Stephen P Robbins, Timothy A Judge & Neharika Vohra, <i>Organizational Behavior</i>, Pearson India, 18th edition, 2022, New Delhi (Chapter I to IV) 2. K Aswathappa, <i>Organizational Behaviour</i>, Himalaya Publishing House, 14th edition, 2021, Mumbai (Chapter I to IV)			
Reference Book(s): 1. Fred Luthans, <i>Organizational Behavior</i>, <u>McGraw Hill Education</u>, 13th edition, 2020, New York 2. Uma Sekaran, <i>Organizational Behavior: Text and Cases</i>, <u>McGraw Hill Education</u>, 2nd edition, 2019, New Delhi			

3. S. S. Khanka, *Organizational Behavior*, S Chand Publishing, 11th edition, 2021, New Delhi

Web and Video link(s):

1. Harvard Business Review – Organizational Behavior Articles and Videos, Web resources and expert videos on leadership, teamwork, communication, conflict management, and organizational effectiveness

Course Articulation Matrix (CAM):				U24OE701C-MB ORGANIZATIONAL BEHAVIOUR										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE701C-MB	2	-	-	-	-	-	-	2	2	-	-	1	1
CO2	U24OE701C-MB	-	3	-	-	-	-	2	--	-	-	3	1	1
CO3	U24OE701C-MB	-	2	-	-	-	-	-	2	2	2	-	1	1
CO4	U24OE701C-MB	-	-	2	-	-	2	-	-	-	2	2	1	1
U24OE701C-MB		2	2.5	2	-	-	2	2	2	2	2	2.5	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	explain the fundamentals, importance, influencing factors, and communication processes of organizational behaviour	SDG 4	Quality Education	Understanding organizational behaviour and communication processes helps students develop professional knowledge, communication, and workplace learning skills
CO2	analyse individual behaviour including personality, perception, learning, attitudes, emotions, stress, and motivation	SDG 3	Good Health and Well-being	Analysing emotions, stress, motivation, and attitudes promotes mental well-being, self-management, and healthy work practices
CO3	examine group behaviour, team effectiveness, conflict management, leadership, power, politics, and group dynamics in organizational settings	SDG 16	Peace, Justice and Strong Institutions	Studying leadership, conflict management, teamwork, and group dynamics supports inclusive, cooperative, and effective organizational practices
CO4	evaluate organizational structure, culture, innovation, change, organizational effectiveness, quality of work life, and international organizational behaviour	SDG 8	Decent Work and Economic Growth	Evaluating organizational culture, innovation, quality of work life, and change management supports productive employment and sustainable organizational growth

E-COMMERCE & DIGITAL MARKETING			
Class: B. Tech. VII – Semester		Branch: CSE,ECE,ECI,EEE/ CSN,CSO,CSM,CSD,IT,CE,ME	
Course Code:	U24OE701D-MB	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs)			
<i>After completion of this course, the students should be able to,</i>			
CO1: interpret the concepts, scope, types, functions, framework, opportunities, and limitations of E-Commerce, and analyse its role in modern business and electronic transactions			
CO2: analyze e-payment systems, e-finance operations, e-banking, e-trading, and the legal framework governing e-commerce transactions			
CO3: evaluate digital marketing practices, emerging trends, and consumer behaviour in the online environment			
CO4: determine digital marketing channels and design effective online marketing plans			
UNIT-I			9 Hrs
Introduction to E-Commerce: E-commerce – introduction, Definition, Scope, Evolution, internet commerce vs e-commerce, Electronic commerce market, E-commerce industry framework, Trade cycle in e-commerce, electronic data interchange (edi), E-commerce functions, Types of e-commerce – B2B, B2C, C2C, C2B, B2G, G2B, and G2C, forces fuelling e-commerce – Differences between traditional commerce and e-commerce, Limitations of e-commerce, Introduction to artificial intelligence (AI) in e-commerce			
UNIT-II			9 Hrs
E-payment Systems: Digital payment Requirements, Types of E-Payment Systems - Digital Token-based E-payment systems, Credit card as E-payment system, Mobile payments, smart card cash payment system, Micropayment system, E-Security, E- Cash, E-Finance: Areas of Financing, E-Banking - Traditional Banking Vs E-Banking, Operations in E-Banking, E-Trading – Stock Market trading, Importance and advantages of E-Trading			
Legal Framework for E-Commerce: E-Commerce Legal Framework - The Information Technology Act 2000, Information Technology (Amendment) Act, 2008, Copyrights, Defamation, Privacy, Contracts, Taxation, Signing a contract Electronically, Domain name and Registration			
UNIT-III			9 Hrs
Digital Marketing: Concept, Components of Digital Marketing, Need and Scope of Digital Marketing, Benefits of Digital Marketing, Digital Marketing Platforms and Strategies, Comparison of Marketing and Digital Marketing, Digital Marketing Trends, Marketing in the Digital Era: Segmentation – Importance of Audience Segmentation, different segments used in Digital Media – Organizational characteristics, purchasing characteristics, using Digital Media to Reach, acquisition and retention of new customers, Digital Media for Customer Loyalty			
UNIT-IV			9 Hrs
Channels of Digital Marketing: Digital Marketing, Website Marketing, Search Engine Marketing, Search Engine optimization, Online Advertising, Email Marketing-Campaign Design, Automation, Personalization, Blog Marketing-Content Creation, Blogging Platforms, Social Media Marketing-Marketing through Facebook, Instagram, LinkedIn, X (Twitter), and youtube, Audio, Video and Interactive Marketing, Mobile Marketing, Digital Marketing Plan: Need for Digital Marketing Plan, Elements of Digital Marketing Plan, Writing the Marketing Plan and Implementation			

Textbook(s):

1. C S V Murthy- *E-Commerce: Concepts, Models & Strategies*, Himalaya Publishing House 2nd Edition (2025)
2. Seema Gupta – *Digital Marketing*, McGraw-Hill 3rd Edition, 2022/2023
3. Tracy L Tuten & Michael R Solomon – *Social Media Marketing*, SAGE Publication, 5th Edition, 2023

Reference Book(S):

1. Matthew Reynolds – *Beginning E-Commerce with Visual Basic, ASP, SQL Server 70 & MTS*, published by Wrox Publisher
2. P T Joseph, SJ *E-Commerce: An Indian Perspective*, Latest Edition: 7th Edition (2023) Publisher: PHI Learning Pvt Ltd
3. Michael Miller – *B2B Digital Marketing: Using the Web to Market Directly to Businesses* 1st Edition (2012, Indian reprint 2014/2015) Pearson India / Que Publishing

Web and Video link(s):

1. <https://youtube/qnBhOVH1QQ8?si=6UtzpR5d6t8Rk5da> Digital Marketing Full Course 2026 In 24 Hrs | Digital Marketing Tutorial For Beginners
2. https://youtube/qsO_YCjgBFI?si=zVdKwrU8l6eEr4wg

Course Articulation Matrix (CAM):				U24OE701D-MB:E-COMMERCE & DIGITAL MARKETING										
	CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24OE701D-MB.1	2	2	1	1	2	1	1	-	1	-	2	1	1
CO2	U24OE701D-MB.2	2	2	1	1	2	2	1	-	1	1	1	1	1
CO3	U24OE701D-MB.3	2	2	2	1	2	1	1	1	2	1	2	1	1
CO4	U24OE701D-MB.4	2	2	2	2	2	1	1	2	2	2	2	1	1
U24OE701D-MB		2	2	1.5	1.25	2	1.25	1	1.5	1.5	2	1.75	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	understand the concepts, scope, types, functions, framework, opportunities, and limitations of e-commerce, and analyse its role in modern business and electronic transactions	SDG 8	Decent Work and Economic Growth	E-Commerce promotes entrepreneurship, digital business growth, employment opportunities, and innovation in the global economy
CO2	analyse e-payment systems, e-finance operations, e-banking, e-trading, and the legal framework governing e-commerce transactions	SDG 9	Industry, Innovation and Infrastructure	Digital payment systems and e-banking strengthen technological infrastructure, financial inclusion, and innovation in digital industries
CO3	evaluate digital marketing practices, emerging trends, and consumer behaviour in the online environment	SDG 12	Responsible Consumption and Production	Digital marketing helps organizations understand consumer behaviour and promote sustainable and responsible consumption patterns
CO4	analyse digital marketing channels and design effective online marketing plans	SDG 17	Partnerships for the Goals	Digital marketing channels improve global communication, collaboration, networking, and partnerships among businesses and stakeholders

BLOCKCHAIN TECHNOLOGIES			
Class: B. Tech. VIII- Semester		Branch: CSE(Networks)	
Course Code:	U24CN702A	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1: distinguish different types of blockchains and consensus algorithms based on their characteristics and use cases CO2 : apply Bitcoin network and transaction concepts to solve basic cryptocurrency-related problems and assess alternative cryptocurrencies. CO3: apply smart contract principles and Ethereum architecture to develop decentralized applications using blockchain technology. CO4: compare Hyperledger fabric and corda block chain frameworks			
UNIT-I			9 Hrs
Distributed Systems: Evolution of distributed systems Distributed Ledger Technology (DLT): Concept of distributed ledgers Introduction to Blockchain: History of blockchain, electronic cash, generic elements Structure and Working of Blockchain: Blocks, hashing, linking, architecture, features, benefits and limitations Types of Blockchain: Public, Private, Consortium, Tokenized, Token-less CAP Theorem: Concept and intuition Consensus Mechanisms: Introduction and types			
UNIT-II			9 Hrs
Cryptographic Foundations of Bitcoin: Asymmetric (public key) cryptography, Public and private keys, Hash functions, Digital signatures (RSA and Elliptic Curve Concepts), Role of cryptography in Bitcoin, Digital Signature Foundations of Bitcoin: Introduction to Bitcoin, Digital keys, addresses, and Basic cryptography (hashing, digital signatures), Bitcoin transactions (inputs, outputs, UTXO) Blockchain and Network: Structure of blockchain (blocks, hashing, Merkle tree), Mining and Proof-of-Work, Bitcoin network (nodes, P2P architecture), Transaction lifecycle (creation → validation → confirmation) Usage and Beyond Bitcoin: Wallets, Bitcoin payments and transaction fees, Limitations of Bitcoin Bitcoin Clients and APIs: Bitcoin installation Alternative Coins: Litecoin, Z cash			
UNIT-III			9 Hrs
Smart Contracts Fundamentals: History of smart contracts, Definition and characteristics, Ricardian contracts, Applications of smart contracts Ethereum: Introduction to Ethereum, Ethereum vs Bitcoin, Ethereum – bird’s eye view, Ethereum accounts (EOA and Contract accounts), Ether, Gas and transaction fees Ethereum Architecture and Network: Ethereum network and nodes, Components of Ethereum ecosystem, Transactions and state changes, Ethereum Virtual Machine (EVM) Smart Contract Development: Programming languages for Ethereum, Solidity language (basics) Structure of smart contracts			

Ethereum Development Environment: Test networks (public testnets), Setting up a private blockchain, Running and managing a private network, Development frameworks. Decentralized Applications and Web3: Introduction to DAO, Introduction to DApps, Web3 introduction	
UNIT-IV	9 Hrs
Enterprise Blockchain Platforms: Introduction to enterprise blockchains, Overview of Hyperledger Hyperledger projects (Fabric – basic idea), Hyperledger architecture (reference model – concept) Corda: Introduction to Corda, Architecture and components and Corda development environment Introduction to alternative Blockchain Platforms: Ripple, Quorum, Multichain, Rootstock, BigchainDB, Storj, Tezos Blockchain Applications and Industry Landscape: Real-world implementations of blockchain, Start-ups and industry adoption, Blockchain as a Service (BaaS), Employment opportunities in blockchain Other challenges: Regulation, Dark side Blockchain research: Smart contracts, Centralization issues, Limitations in cryptographic functions, Consensus algorithms, Scalability and Code obfuscation	
Text Book: 1. Imran Bashir, <i>Mastering Blockchain: Inner workings of blockchain, from cryptography and decentralized identities to DeFi, NFTs and Web3</i> , Mastering Blockchain, Packt Publishing, 4th edition, 2023, Birmingham, UK. (Chapters 1 to 12)	
Reference Book(S): 1. Joseph Bonneau et al., <i>Blockchain Technology: From Theory to Practice</i> , Springer, 1st Edition, 2022. (Chapters 1–8) 2. Brenn Hill, Samanyu Chopra, Paul Valencourt, <i>Blockchain Quick Reference</i> , Packt Publishing, 2018. (Chapters 1–6) 3. Kumar Saurabh, Ashutosh Saxena, <i>Blockchain Technology: Concepts and Applications</i> , Wiley, 2020. (Chapters 1–9).	
Web and Video link(s): ps://in.video.search.yahoo.com/search/video?fr=mcafee&p=NPTEL+BLOCKCHAIN+TECHNOLOGIES+VIDEO&type=E210IN885G0#id=2&vid=0d4dce47729f5f0dcca1ea877588f56&action=click	

Course Articulation Matrix (CAM):				U24CN702A:BLOCKCHAIN TECHNOLOGIES										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN702.1	1	2	2	2	1	-	-	-	-	1	-	1	3
CO2	U24CN702.2	3	3	2	2	1	-	-	-	-	1	-	2	3
CO3	U24CN702.3	3	2	3	2	2	-	-	-	-	1	-	3	3
CO4	U24CN702.4	1	2	3	2	1	-	-	-	-	1	-	2	3
U24CN702A		2	2.25	2.5	2	1.25	-	-	-	-	1	-	2	3
3 – HIGH, 2 – MEDIUM, 1 – LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	distinguish different types of blockchains and consensus algorithms based on their characteristics and use cases	SDG9	Industry, Innovation and Infrastructure	Understanding blockchain types and consensus mechanisms builds foundational knowledge for developing secure, decentralized digital infrastructure, which is essential for innovation and modern industrial systems.
CO2	understand the working of Bitcoin, its network, transactions, and explore alternative cryptocurrencies	SDG9	Industry, Innovation and Infrastructure	Bitcoin and cryptocurrencies introduce decentralized financial systems, enabling innovative digital payment infrastructures that enhance financial inclusion and technological advancement.
CO3	understand smart contracts, Ethereum architecture, and the development of decentralized applications using blockchain	SDG3	Good Health and Well-being	Smart contracts and decentralized applications enable secure healthcare systems such as electronic health records, telemedicine platforms, and automated insurance processing, improving healthcare accessibility and efficiency.
CO4	compare Hyperledger Fabric and Corda blockchain frameworks	SDG9	Industry, Innovation and Infrastructure	Enterprise blockchain frameworks like Hyperledger Fabric and Corda support scalable, secure, and efficient industrial applications, strengthening digital infrastructure and fostering innovation in sectors such as supply chain and finance.

HIGH PERFORMANCE COMPUTING			
Class: B. Tech. VII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN702B	Credits:	3
Hours/Week (L-T-P- E):	3-0-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : explain the concepts, architectures, and performance metrics of high-performance computing systems CO2 : analyze cluster computing architectures and resource management strategies CO3 : apply message-passing techniques using MPI for distributed-memory systems CO4 : develop parallel applications using OpenMP, CUDA, and OpenCL programming models			
UNIT-I			9 Hrs
Evolution of Computing and Need for High-Performance Computing, Parallel Computing Fundamentals, Multiprocessor and Multicomputer Architectures, Flynn’s Classification of Computer Architectures, Scalar and Vector Processing, Pipelined and Superscalar Architectures, SIMD and MIMD Systems, Types of Parallelism: Instruction Level, Data Level and Thread Level Parallelism, Program Partitioning and Scheduling Concepts, Performance Metrics including Speedup, Efficiency and Scalability			
UNIT-II			9 Hrs
Introduction to Cluster Computing, Scalable Parallel Computer Architectures, Cluster Computing Architecture, Components of Cluster Systems, Cluster Middleware and Single System Image (SSI), Types of Clusters including High Availability, Load Balancing and High-Performance Clusters, Resource Management in Clusters, Job Scheduling Techniques, Programming Environments for Cluster Computing, Case Studies of Modern HPC Clusters			
UNIT-III			9 Hrs
High-Speed Interconnection Networks, Network Topologies for HPC Systems, Communication Performance Metrics, Lightweight Messaging Systems, Distributed Memory Computing Concepts, Message Passing Paradigm, MPI Architecture and Programming Model, MPI Communication Operations, Collective Communication and Synchronization, Performance Analysis and Optimization of MPI Applications			
UNIT-IV			9 Hrs
Shared Memory Architecture, Introduction to OpenMP, OpenMP Directives and Runtime Environment, Parallel Loops and Work Sharing Constructs, Synchronization and Scheduling in OpenMP, Performance Optimization using OpenMP, Introduction to GPU Computing, CUDA Architecture and Programming Model, Thread Hierarchy and Memory Organization, Basic CUDA-C Programming, OpenCL Platform Model, OpenCL Programming Framework, Comparison of CUDA and OpenCL			
Textbook: 1. Rajkumar Buyya, High Performance Cluster Computing, 1 st Edition, Pearson Education, 2002 (Chapters 1 to 9)			
Reference Book(S): 1. John Levesque, High Performance Computing: Programming and Application, Jim, 1 st Edition, CRC Press, 2018			

Course Articulation Matrix (CAM):				U24CN702B: HIGH PERFORMANCE COMPUTING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN702B.1	3	2	1	2	3	-	-	-	-	1	1	3	2
CO2	U24CN702B.2	3	3	3	2	3	-	-	-	1	1	2	3	3
CO3	U24CN702B.3	3	3	2	3	2	1	-	-	1	1	2	2	3
CO4	U24CN702B.4	2	2	2	1	2	1	2	1	2	2	1	2	2
U24CN702B		2.75	2.5	2	1	2.5	1	2	1	4	1.25	1.5	2.5	2.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	explain the concepts, architectures, and performance metrics of high-performance computing systems	SDG 4	Quality Education	Provides advanced computing knowledge and technical skills necessary for quality higher education and lifelong learning.
CO2	analyze cluster computing architectures and resource management strategies.	SDG 9	Industry, Innovation and Infrastructure	Supports the development of resilient digital infrastructure and promotes innovation through efficient computing systems and resource utilization
CO3	apply message-passing techniques using MPI for distributed-memory systems.	SDG 9	Industry, Innovation and Infrastructure	Enables the design of scalable computing solutions used in scientific research, industrial automation and advanced engineering applications.
CO4	develop parallel applications using OpenMP, CUDA, and OpenCL programming models.	SDG 11	Sustainable Cities and Communities	Efficient parallel programs reduce computational time, energy consumption and carbon footprint of large-scale computing systems, contributing to sustainable and green computing practice

COMPUTER VISION AND IMAGE PROCESSING			
Class: B. Tech. VII – Semester		Branch: CSE(Networks)	
Course Code:	U24CN702C	Credits:	3
Hours/Week (L-T-P- E):	3-1-0-4	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1: understand the fundamentals of digital image processing including image acquisition, sampling, image representation, imaging devices, gray level transformations, histogram processing, statistical operations CO2: apply spatial filtering, convolution, smoothing and edge detection techniques for image enhancement and analysis CO3: analyze and implement morphological operations and image compression techniques for efficient image processing and storage CO4: apply image segmentation and pattern classification techniques for extracting regions and recognizing image patterns using prototype matching and Bayes classifiers			
UNIT-I			9 Hrs
Fundamentals of Digital Image Processing: Introduction to digital image, Processing image model and image acquisition, Image shape and sampling, Intensity images and colour images, Range images and Image capture scanners, Imaging devices statistical operations and spatial operations gray level transformations, histogram equalization multi image operations			
UNIT-II			9 Hrs
Spatial Filtering and Edge Detection: Spatially Dependent transformations templates and convolution window operations, directional smoothing, Other smoothing techniques, Segmentation and Edge detection region operations, Basic edge detection, second order detection, crack edge detection, Edge following gradient operators, Compass and laplace operators			
UNIT-III			9 Hrs
Morphological Operations and Image Compression: Morphological and area operations, Basic morphological operations, opening and closing operations, Morphological transformations image compression: Types and Requirements, Statistical compression, Spatial Compression, Contour coding quantizing compression			
UNIT-IV			9 Hrs
Image Segmentation: Fundamentals, Point, Line and edge detection, Thresholding, Segmentation by region growing, region splitting and merging, Region segmentation using clustering and super pixels Image Pattern Classification: Background, Patterns and pattern classes, Pattern classification by prototype matching, Optimum (Bayes) statistical classifiers			

Textbook(s):

1. D.A. Forsyth, J. Ponce, Computer Vision: A Modern Approach, PHI Learning, 2009.
2. Milan Soanka, Vaclav Hlavac and Roger Boyle, *Digital Image Processing and Computer Vision* Cengage Learning, 2014

Reference Book(S):

1. Rafael C. Gonzalez, Richard E. Woods, *Digital Image Processing*, Pearson, 4th edition, 2018, New York. (Chapters 1 to 3, 9 to 12)
2. Anil K. Jain, *Fundamentals of Image Processing*, Pearson, 1st edition, 2015, Chennai.
3. B. Chanda, D. Dutta Majumder, *Digital Image Processing and Analysis*, Prentice Hall of India, 2nd edition, 2011, New Delhi

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc22_ee116/preview; NPTEL Video Lecture on Digital Image Processing by Prof. Prabir Kumar Biaswas, Professor of EEE, IIT Kharagpur

Course Articulation Matrix(CAM):				U24CN702C: COMPUTER VISION AND IMAGE PROCESSING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN702C.1	1	2	2	1	-	-	1	-	1	-	-	2	1
CO2	U24CN702C.2	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	U24CN702C.3	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	U24CN702C.4	2	2	3	3	-	-	1	-	1	-	2	2	2
U24CN702C		1.75	2	2.25	2	-	-	1	-	1	-	2	2	1.75
3-HIGH, 2-MEDIUM, 1- LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to ...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Understand fundamentals of digital image processing including image acquisition, image representation, sampling, intensity transformations, histogram processing, and spatial operations	SDG4	Quality Education	The course develops foundational knowledge and technical skills in digital image processing, enhancing students' analytical and problem-solving abilities in modern engineering applications.
CO2	Apply spatial filtering, convolution, smoothing, and edge detection techniques for image enhancement and analysis	SDG9	Industry, Innovation and Infrastructure	Image enhancement and edge detection techniques are widely used in industrial automation, machine vision, surveillance, and intelligent imaging systems, supporting innovation and infrastructure development.
CO3	Analyze and implement morphological operations and image compression techniques for efficient image processing and storage	SDG12	Responsible Consumption and Production	Efficient image compression and processing reduce storage, bandwidth, and computational resource usage, promoting sustainable and optimized digital resource management.
CO4	Apply image segmentation and pattern classification techniques for extracting regions and recognizing image patterns using prototype matching and Bayes classifiers	SDG3	Good Health and Well-being	Segmentation and pattern classification techniques are extensively used in medical image analysis disease diagnosis, and healthcare imaging systems for improved patient care and early detection.

PRINCIPLES OF DATA SCIENCE			
Class: B. Tech. VII – Semester		Branch: CSE (Networks)	
Course Code:	U24IN702D	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : explain core data science lifecycles, team profiles, and differentiate primary data repositories CO2 : apply fundamental R programming operations and statistical frequency distributions to sample datasets CO3 : choose appropriate retinal encodings and structural variables for mapping complex visualization parameters CO4 : analyze modern visualization landscapes, interactive Bokeh frameworks, and handle big data analytical constraints			
UNIT-I			9 Hrs
Introduction to Data Science: Data science, Terminology related with data science, Methods of data repository, Personnel involved with data science, Types of data, The Data Science Process (DSP), Data science project's lifecycle, Popular data science toolkits, Familiarity with example applications			
UNIT-II			9 Hrs
Data Analysis using R Programming Language: Introduction to applied statistical techniques, Types of statistical data, Types of big data analytics, Collecting data for sampling and distribution, Probability, Frequency distribution, Population and parameters, Central tendency or central value, Measures of central tendency, Different types of statistical means, Problems of estimation, Normal distribution curve			
UNIT-III			9 Hrs
Data Visualization: Data visualization, Importance of data visualization, Conventional data visualization methods, Retinal variables, Mapping variables to encodings Applications of Data Science, Technologies for Visualization and Bokeh (Python): Applications of data science technologies for visualization, Introduction to python, Basic numeric operations, Data types in python, Modules, Library, Introduction to Bokeh			
UNIT-IV			9 Hrs
Recent Trends in Data Science : Recent trends in various data collection and analysis techniques, Various big data visualization tools, Visualizing big data, Preattentive attributes, Challenges of big data visualization, Potential solutions, Future progress of big data visualization			
Textbook(s): 1. VKJain, <i>Data Science & Analytics(with Python, R and SPSS Programming)</i> , New Delhi: Khanna Book Publishing, 2018 (Chapters: 1, 3 to 6)			
Reference Book(S): 1. Dr Tirthajyoti Sarkar and Shubhadeep Roychowdhury, <i>Data Wrangling with Python</i> , UK: Packt Publishing Ltd,2019 2. Joel Grus, <i>Data Science from Scratch</i> , USA: O'Reilly Media, Inc, 2015Dinesh Kumar, <i>Business Analytics</i> , New Delhi: Wiley, 2017			

Web and Video link(s):

1. NPTEL Course Link: https://onlinecoursesnptelacin/noc21_ma35/preview
 Video Lectures: "Essentials of Data Science With R Software" by IIT Faculty

Course Articulation Matrix (CAM):			U24IN702D: PRINCIPLES OF DATA SCIENCE											
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24IN702D.1	2	2	1	1	1	1	2	1	1	-	1	2	1
CO2	U24IN702D.2	3	3	2	2	3	1	2	1	1	-	1	3	2
CO3	U24IN702D.3	2	2	2	1	2	1	2	1	1	-	1	2	2
CO4	U24IN702D.4	3	3	3	2	3	1	2	1	1	-	2	3	3
U24IN702D		2.5	2.5	2	1.5	2.25	1	2	1	1	-	1.25	2.5	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	explain core data science lifecycles, team profiles, and differentiate primary data repositories	SDG9	Industry, Innovation and Infrastructure	Understanding structured data engineering lifecycles and differentiating primary data repositories forms the foundational infrastructure needed to drive analytical innovations within enterprise architectures
CO2	apply fundamental r programming operations and statistical frequency distributions to sample datasets	SDG4	Quality Education	Utilizing scripting platforms like R to evaluate mathematical sample parameters, distributions, and descriptive statistics enhances quantitative logical reasoning and high-level technical competency in engineering education
CO3	choose appropriate retinal encodings and structural variables for mapping complex visualization parameters	SDG11	Sustainable Cities and Communities	Selecting optimal retinal variables and graphics encodings translates massive data trends into interpretable telemetry diagrams, which are vital for real-time traffic, utility monitoring, and smart city applications
CO4	analyze modern visualization landscapes, interactive bokeh frameworks, and handle big data analytical constraints	SDG9	Industry, Innovation and Infrastructure	Evaluating large-scale interactive visualization toolkits (such as Bokeh) enables engineering networks to optimize high-volume data streams, expanding industrial capacity and modern cloud-network automation frameworks

SOFTWARE DEFINED NETWORKING			
Class: B. Tech. VII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN703	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1: Demonstrate the Concepts of software defined networks CO2 : Demonstrate the interface between networking devices and the software controlling them CO3: Apply the SDN in data centers and how to use SDN CO4: Explore modern approaches like openflow, openstack			
UNIT-I			9 Hrs
SDN Introduction: Basic packet-switching terminology, Historical background, The modern data center, Traditional switch architecture, Autonomous and dynamic forwarding tables, Open source and technological shifts Why SDN: Evolution of switches, Control plane, Cost, SDN implications for research and innovation, Data center innovation, Data center needs The evolution of networking technology, Forerunners of SDN, Sustaining SDN interoperability, Open source contributions, Legacy mechanisms evolve towards SDN network virtualization			
UNIT-II			9 Hrs
SDN and Open Flow Specification: Fundamental characteristics of SDN, SDN operation, SDN devices, SDN controller, SDN applications, Alternate SDN methods Open Flow Specification: OpenFlow overview, OpenFlow 1.0, OpenFlow basics, OpenFlow 1.1 additions, OpenFlow 1.2 additions, OpenFlow 1.3 additions, OpenFlow limitations			
UNIT-III			9 Hrs
SDN in data center and other environment: Data center definition, Data center demands, Tunnelling technologies for the data center, Path technologies in the data center, Ethernet fabrics in the data center, SDN use cases in the data center, Open SDN vs Overlays in the data center, Real world data center implementations SDN in other environments: SDN in other environments, Wide area networks, Service provider and carrier networks, Campus networks, Hospitality networks, Mobile network, In-Line network functions Optical networks, SDN vs P2P/Overlay networks			
UNIT-IV			9 Hrs
SDN Applications: Reactive versus proactive applications, Analyzing simple SDN applications, A simple reactive Java application, Background on controllers, Using the floodlight controller, Using the open daylight controller, Using the cisco XNC controller, Switch considerations, Creating network virtualization tunnels, Offloading flows in the data center, Access control for the campus traffic engineering for service providers Open source perspectives: Open source licensing issues, Profiles of SDN open source users, OpenFlow source code, Switch implementations, Controller implementations, SDN applications, Orchestration and network virtualization, Simulation and testing, Tools open Stack			

Textbook:

1. Paul Goransson and Chuck Black, *Software Defined Networks: A Comprehensive Approach*, Morgan Kaufmann Publications, First Edition, 2014. (Chapters 1 to 5, 7 to 8, 10,11)

Reference Books(S):

1. Thomas D. Nadeau and Ken Gray, *SDN - Software Defined Networks* O'Reilly Media, 2013.
2. Siamak Azodolmolky, *Software Defined Networking with OpenFlow*, Packt Publishing, 2013.
3. Vivek Tiwari, *SDN and Open Flow for Beginners*, Amazon Digital Services, Inc., 2013.
4. Fei Hu, Editor, *Network Innovation through Open Flow and SDN: Principles and Design*, CRC Press, 2014.

Web and Video link:

https://youtu.be/CaukSKg_sI NPTEL-Software Defined Networking - I (Basics)

Course Articulation Matrix (CAM):				U24CN703: SOFTWARE DEFINED NETWORKING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN703.1	2	1	2	1	-	-	-	1	1	-	1	2	1
CO2	U24CN703.2	2	1	2	1	-	-	-	1	1	-	1	2	1
CO3	U24CN703.3	2	1	2	2	-	-	-	1	1	-	1	2	1
CO4	U24CN703.4	2	1	1	1	-	-	-	1	1	-	1	1	1
U24CN703		2	1	1.75	1.25	-	-	-	-	1	-	1	1.75	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Demonstrate the Concepts of software defined networks	SDG4 SDG9	Quality Education Industry, Innovation and Infrastructure	Builds foundational knowledge for students and professionals, enabling inclusive and equitable access to modern networking education Data centers are critical infrastructure; efficient architectures support resilient and sustainable industrial growth
CO2	The interface between networking devices and the software controlling them	SDG 11 SDG 12	Sustainable Cities and Communities Responsible Consumption and Production	Enables smart city applications (IoT, traffic, energy grids) through adaptive networking Virtualized devices reduce hardware dependency, lowering e-waste and energy use
CO3	SDN in data centers and how to use SDN	SDG 7 SDG 9	Affordable and Clean Energy Industry, Innovation, and Infrastructure	Highlights energy efficiency, cooling, and sustainability requirements. Ensures resilient and efficient routing for modern infrastructure
CO4	Explore modern approaches like openflow, openstack	SDG 4 SDG 9	Quality Education Industry, Innovation, and Infrastructure	Builds foundational skills for students and professionals in programmable networking Demonstrates adaptive infrastructure design for resilient and innovative networking

QUANTUM COMPUTING			
Class: B. Tech. VII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN704	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs)			
<i>After completion of this course, the students should be able to,</i>			
CO1 : understand the fundamentals of classical and quantum computing principles, qubits, superposition, and measurement.			
CO2 : apply quantum gates, circuits, and quantum programming techniques using open-source quantum simulators and frameworks.			
CO3 : analyze entanglement, quantum protocols, and quantum algorithms for computational problem solving.			
CO4 : analyze the performance and limitations of quantum computing systems, error correction methods, and real-world quantum applications			
UNIT-I			9 Hrs
Foundations of Classical and Quantum Computing - Introduction to computation, Classical bits and binary systems, Logic gates and reversible computation, Introduction to quantum computing, Qubits and quantum states, Superposition, Complex numbers in quantum computing, Quantum measurement, Bloch sphere representation			
UNIT-II			9 Hrs
Quantum Gates and Quantum Circuits - Linear algebra for quantum computing, Vectors and matrices, B-K notation, Quantum gates: Pauli-X, Y, Z, Hadamard gate, Phase gates, Unitary operations, Quantum circuit representation, Multi-qubit systems, Tensor products, Controlled gates (CNOT, Toffoli)			
UNIT-III			9 Hrs
Quantum Algorithms and Quantum Information- Quantum entanglement, Bell states, Quantum teleportation, Superdense coding, Quantum key distribution (BB84), Deutsch algorithm, Deutsch-Jozsa algorithm, Grover's search algorithm, Quantum Fourier Transform, Introduction to Shor's algorithm			
UNIT-IV			9 Hrs
Quantum Programming and Applications -Quantum programming frameworks, IBM Quantum Experience, Qiskit fundamentals, Quantum simulators, Open QASM basics, Quantum circuit implementation, Quantum error correction, Decoherence and noise, Quantum machine learning overview, Applications of quantum computing in cryptography, healthcare, optimization, and AI			
Textbook:			
1. Thomas G. Wong, <i>Introduction to Classical and Quantum Computing</i> , Rooted Grove Publications, 2022			
Reference Book(s):			
1. Quantum Computing for Computer Scientists by Noson S. Yanofsky and Mirco A. Mannucci.			

2. Benenti G., Casati G. and Strini G., Principles of Quantum Computation and Information, Vol. I: Basic Concepts, Vol II.
3. Basic Tools and Special Topics, World Scientific. Pittenger A. O., An Introduction to Quantum Computing Algorithms.

Web and Video link(s):

1. <https://nptel.ac.in/>
2. <https://www.youtube.com/watch?v=2SPjEA-4IKk&list=PLuBwWyD3M82x9PfxeF7oxb0E122mQAWH6>

Course Articulation Matrix (CAM):		U24CN704 : QUANTUM COMPUTING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN704.1	1	1	1	1	1	-	1	-	1	-	-	1	1
CO2	U24CN704.2	2	2	2	2	1	-	1	-	1	-	2	1	1
CO3	U24CN704.3	2	2	2	2	2	-	1	-	1	-	2	1	1
CO4	U24CN704.4	2	2	2	2	2	-	1	-	1	-	2	1	1
U24CN704		1.75	1.75	2.25	2.25	1.5	-	1	-	1	-	2	1	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	understand the fundamentals of classical and quantum computing principles, qubits, superposition, and measurement.	SDG 4	Quality Education	Quantum computing introduces advanced interdisciplinary knowledge in mathematics, physics, and computing, promoting higher-order learning, innovation, and modern technical education.
CO2	apply quantum gates, circuits, and quantum programming techniques using open-source quantum simulators and frameworks	SDG 9	Industry, Innovation and Infrastructure	Qubit implementation technologies contribute to next-generation computational infrastructure and foster innovation in emerging quantum hardware systems.
CO3	analyze entanglement, quantum protocols, and quantum algorithms for computational problem solving	SDG 9	Industry, Innovation and Infrastructure	Quantum algorithms support technological advancement in optimization, artificial intelligence, simulation, and computational efficiency for future industries.
CO4	analyze the performance and limitations of quantum computing systems, error correction methods, and real-world quantum applications	SDG 16	Peace, Justice and Strong Institutions	Quantum cryptography enhances secure communication, data privacy, and cybersecurity mechanisms that strengthen trustworthy digital systems and institutions.

MOBILE APPLICATION DEVELOPMENT LABORATORY			
Class: B. Tech. VII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN705	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	60 %
Total Number of Teaching Hours:	60 Hrs	ESE:	40 %
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : install and configure Android application development tools CO2 : design and develop user Interfaces for the Android platform CO3 : save state information across important operating system events CO4 : apply programming concepts to development mobile application			
List of Experiments			
Experiment-1			
1. To study Android architecture and android studio installation 2. Develop an application to display “Hello World”			
Experiment-2			
1. Write an Android application program that demonstrates the following: (a)Linear Layout (b)Relative Layout (c)Table Layout (d)Grid view Layout			
Experiment-3			
1. Develop an application that uses GUI components (Font colors) 2. Write an Android application program that converts the temperature in Celsius to Fahrenheit			
Experiment-4			
1. Create an application with login module (Check username and password) to understand Activity, Intent			
Experiment-5			
Design simple calculator GUI application with activity and intents			
Experiment-6			
1. Develop an application that makes use of RSS Feed			
Experiment-7			
1. Design an application that draws basic line-based drawings on the screen			
Experiment-8			
1. Develop an application that implements multi-threading			
Experiment-9			
1. Create an android app that makes use of Database (SQLite)			
Experiment-10			
1. Develop a native application that uses GPS location information			

Experiment-11
1. Design an application that writes data to the external card
Experiment-12
1. Develop an android application that creates alarm clock
Textbook:
1. Jeff Mcherter, Scott Gowell, <i>Professional Mobile Application Development</i> , 1 st edition., NewYork: Wiley India Private Limited, 2012.
Reference Book(S):
1. RetoMeier, <i>Professional Android 4 Application Development</i> , 1 st edition., New York:Wiley Publications, 2012.
Laboratory Manual :
1. Mobile Application Development Laboratory Manual, Dept. of CSN, KITS Warangal.

Course Articulation Matrix (CAM):				U24CN705: MOBILE APPLICATION DEVELOPMENT LABORATORY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN705.1	2	1	-	-	3	-	-	-	-	-	1	2	2
CO2	U24CN705.2	2	2	3	1	3	-	-	-	1	-	-	3	3
CO3	U24CN705.3	2	2	2	2	2	-	-	-	-	-	1	2	2
CO4	U24CN705.4	2	3	3	2	3	-	-	-	1	-	1	3	3
U24CN705		2	2	2.67	1.67	2.75	-	-	-	1	-	1	2.5	2.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Install and configure Android application development tools	SDG4	Quality Education	Learning Android development tools and environments enhances technical knowledge and practical software development skills through hands-on learning.
CO2	Design and develop user interfaces for the Android platform	SDG9	Industry, Innovation and Infrastructure	Designing mobile user interfaces promotes innovation in software applications and supports development of modern digital infrastructure.
CO3	Save state information across important operating system events	SDG9	Industry, Innovation and Infrastructure	Developing reliable and efficient mobile applications with proper state management improves software quality and system reliability.
CO4	Apply programming concepts to development mobile application	SDG8	Decent Work and Economic Growth	Mobile application development skills improve employability, entrepreneurship opportunities and industry-ready software development practices.

INTERNSHIP EVALUATION			
Class: B.Tech. VII – Semester		Branch: CSN(Networks)	
Course Code:	U24CN706	Credits:	1
Hours/Week (L-T-P- E):	0-0-2-2	CIE:	100%
Total Number of Teaching Hours:	-	ESE:	
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to,</i> CO1: demonstrate understanding of professional practices, workplace ethics, and organizational functioning through internship experience CO2: apply engineering knowledge and modern tools to perform assigned tasks and solve real-world problems CO3: exhibit professional skills including communication, teamwork, leadership, and lifelong learning CO4: prepare internship reports and effectively communicate internship outcomes through presentations and viva-voce			
Mandatory Internships: - The internships provide exposure to the real-world, get a feel for the work environment and how a professional workplace operates - During the internship, students will experience a real-life engineering workplace and understand how their engineering and professional knowledge, skills, and qualities (KSQs) can be utilized in industry - Students can learn, more importantly, how to apply the KSQs they have acquired during an internship to their future workplaces - Students will also be able to demonstrate functioning engineering knowledge, both new & existing, and identify areas of further development for their future careers - Internships give the student an opportunity to bridge theory and practice - Internships also provide students with the soft skills needed at workplace and leadership positions - The internship guidelines are governed by the rules stipulated in the Institute's Internship Policy-2020 document - The students shall have to undergo 6-8 weeks of mandatory internship during summer/winter vacation at industry/R&D organization / Academic Institutes like IITs, IIITs& NITs - HoD, along with Prof i/c internships, shall address students (<i>of 2nd, 4th and 6th semesters</i>) during last week of even semester of every academic year on the following - creating awareness on mandatory 6-8 weeks internship by every student - creating awareness on COs of internships - KSQs the students would acquire doing internships - expected internship outcomes - available internship options, and organizations offering internships - progressively completing 6-8 weeks internship by the end of 6th semester summer, starting from 2nd semester summer break - internship evaluation in 7th semester			

- h. internship report submission and oral presentation (through PPT) by student
- 10. Students undergoing the internship shall be required to submit their details to the department internship coordinators of the respective branches He will coordinate all the internship activities of the students of that department
- 11. Students have to submit a signed undertaking to the department internship coordinator for demonstrating honesty, integrity, professionalism and regular attendance at work place to add value to the organization where the internship is allotted Students also have to uphold the professional image of our institute
- 12. In case, a student is found to violate the internship rules and regulations, the student will have to produce a valid reason for the violation of internship rules Without a valid reason, the student will be debarred from taking part in subsequent placement activities of the institute
- 13. The students preferably shall undergo internship at one organization only In case of any difficulty, the stipulated period of internship shall be completed at different organizations with minimum of one week internship at every stage
- 14. The internship evaluation shall be done in the VII semester of study and hence the students shall complete the prescribed period of internship before start of VII semester (from end of II semester to commencement of VII semester)
- 15. The student learning assessment process (SLAP): The SLAP in internships shall include feedback from internship supervisor, submission of internship report on the complete internship and PPT presentation
- 16. Internship Log Book: The activity journaling in a log book is very important for a successful internship
 - a. The internship supervisor identifies the work goals at the beginning of the internship
 - b. Student has to maintain internship log book, where in the activities undertaken during internship and timely submission at periodic intervals are to be documented
 - c. At the conclusion of the internship, the supervisor shall specifically comment, in the internship log book, on whether the student met each of the work goals and to give evidence which describes the quality of work For student, this also serves as a self-assessment
 - d. Internship log book (with due signatures of the internship supervisor) shall be considered for evaluation during presentation, ie, number of planned meetings with internship supervisor and number attended by student
- 17. Meeting Cadence:
 - i. **Regular meetings with internship supervisor:** Regular meetings with the internship supervisor to discuss work goals and review the status of activities undertaken are very essential Student shall participate in discussions and take notes
 - ii. **Meeting Frequency:** The meeting cadence, ie, meeting frequency shall be fixed in consultation with the internship supervisor and accordingly student has to participate in discussions and take notes Take signatures of internship supervisor as per the planned cadence in the internship log book
- 18. The internship evaluation shall be done by *department internship evaluation committee (DIEC)* based on the submitted report by student and oral presentation
- 19. There shall be only Continuous Internal Evaluation (CIE) for internship evaluation

20. CIE for the Internship evaluation in VII semester shall be as below:

Internship evaluation	Weightage
A Internship Supervisor's Assessment (i) Feedback from the internship supervisor - on completion of internship assignment/work (20%) (ii) Feedback from the internship supervisor - on quality of work in internship assignment/work (10%) (iii) Feedback from the internship supervisor - internship log book (10%) (iv) Feedback from the internship supervisor - on attendance, punctuality and work hours (10%) (For the case of 6-8 week internship done in more than one spell, it will be the average of all the internship supervisors' assessments)	50%
B DIEC Assessment (i) Internship duration (8 /12 weeks) (6/8 weeks online via NPTEL and 2/4 weeks offline) (10% / 10%) (ii) Internship Report (20%) (iii) Oral Presentation (with PPT) and viva voce (10%) (iv) SDG (5%) (v) Research Orientation (5%)	50%
Total Weightage:	100%

Note: It is mandatory for the student to appear for oral presentation (with PPT) and viva voce to qualify for course evaluation

- (a) **Internship Report:** Each student is required to submit a well-documented internship report (both soft copy and softbound hard copy) as per format specified by DIEC In case of completing the 6-8 weeks internship in more than one organization, the student shall be required to prepare separate softbound internship reports signed by the internship supervisor (s) along with the seal(s) of the organization(s) The student shall submit two final softbound internship reports along with a soft copy, keeping all the certificate(s) issued by the internship supervisor(s) and all the individual internship reports cleared by the respective internship supervisor Chapter 1 of the final internship report shall clearly describe the following, indicating an overall summary
- Internship(s) attended:** A table with name & address of organization, organization's vision and mission, internship weeks attended, internship period (exact dates attended), internship supervisor, head of the section and head of the organization
 - Duties/tasks during internship(s):** Table describing name & address of organization, and the duties/tasks undertaken during internships This indicates what opportunities and learning experiences the interns got to get hands-on experience on a wide range of KSQs of a professional engineer
 - Tangible outcomes of internship:** These are the lessons learnt from internship experience The students have to describe in their own words what they learnt from the internship experience The student has to describe what specific KSQs are acquired by him, with reference to the expected internship COs, after successful completion of

internship(s) Finally, a table depicting systematic mapping of what they have learnt and the expected internship COs is to be shown

- (iv) Student feedback on internship: To gather information on whether the internship was useful and gave practical experience in the chosen field of interest, and other learning, a well-defined feedback questionnaire (*made available by the dept*) with closed and open questions shall be kept in the report
- (v) Pictures at the worksite: Student has to keep, in the report, his working pictures at the worksite, discussing with the internship supervisor, the creative project he is working on, or an event he is attending for work, group photo of the team/section/department he worked with

(b) Anti-Plagiarism Check: The internship report should clear the plagiarism check as per the Anti-Plagiarism policy-2020 of the institute

(c) Presentation: Each student should prepare PPT with informative slides and make an effective oral presentation before the DIEC as per the schedule notified by the department. The presentation shall compulsorily have slides on the points mentioned in (a)(i)-(v)

(d) It is mandatory for every student to *appear for oral presentation(with PPT) and viva-voce*, to qualify for internship evaluation

(e) A student shall register for supplementary examination for the internship evaluation in the following cases:

- (i) absent for oral presentation and viva-voce
- (ii) fails to submit the internship report in prescribed format
- (iii) fails to fulfill the requirements of internship evaluation as per specified guidelines

(f) Supplementary examination for internship evaluation

- (i) The CoE shall send the list of students registered for supplementary examination to the HoD concerned
- (ii) The DIEC, duly constituted by the HoD, shall conduct the internship evaluation supplementary exam and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):		U24CN706: INTERNSHIP EVALUATION												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN706.1	1	2	1	1	3	-	1	3	1	3	2	2	2
CO2	U24CN706.2	3	2	1	1	3	-	1	1	1	3	2	2	2
CO3	U24CN706.3	2	2	1	1	3	-	1	1	3	3	2	2	2
CO4	U24CN706.4	2	2	1	1	3	-	1	1	1	3	2	2	2
U24CN706		2	2	1	1	3	-	1	1.75	1.5	3	2	2	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement (The student should be able to...)	Relevant SDG	SDG Description	Mapping Justification
CO1	demonstrate understanding of professional practices, workplace ethics, and organizational functioning through internship experience	SDG 4	Quality Education	Industrial internship provides experiential learning in networking and security domains such as network protocols, communications, firewalls, routing, AI-based networking, VPN Technologies. Students acquire practical skills, industry exposure, professional networking opportunities, and lifelong learning abilities, thereby strengthening quality technical education and employability.
CO2	apply engineering knowledge and modern tools to perform assigned tasks and solve real-world problems	SDG 11	Sustainable Cities and Communities	Effective communication and collaboration are essential for multidisciplinary networks and security projects such as advanced networks, protocol implementation, network security and threat intelligence platforms that contribute to sustainable and connected communities.
CO3	exhibit professional skills including communication, teamwork, leadership, and lifelong learning	SDG 9	Industry, Innovation and Infrastructure	Application of networking concepts to industrial problems through communication networks, firewall systems, advanced networks, AI-enabled network systems, and automation technologies promotes innovation, industrial modernization, and sustainable infrastructure development.
CO4	prepare internship reports and effectively communicate internship outcomes through presentations and viva-voce	SDG 12	Responsible Consumption and Production	Professional ethics, quality assurance, responsible technology deployment, resource optimization, and sustainable engineering practices in networking and security industries encourage responsible production, efficient use of resources, and continuous improvement.

MAJOR PROJECT PHASE 1			
Class: B. Tech. VII – Semester		Branch: CSE(Networks)	
Course Code:	U24CN707	Credits:	1
Hours/Week (L-T-P- E):	0-0-8-8	CIE:	100%
Total Number of Teaching Hours:	-	ESE:	
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to,</i> CO1: review research literature, identify gaps in the literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques, synthesize technical knowledge and innovative approaches to generate suitable solutions for real- world complex engineering problems (Technical skills) CO2: design a system or product based on product/customer specifications, develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations, use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget (Problem solving and critical thinking skills) CO3: apply project management and organizational skills, demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader to produce time-sensitive deliverables in a multi-disciplinary team (Ethics and teamwork) CO4: collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written (report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and life-long learning demonstrating the KSQ of a professional engineer (Communication skills and life-long learning)			
1. Final Year Major Project work represents the culmination of study towards the B Tech degree <i>Major project offers an opportunity to integrate the knowledge acquired from various courses and apply it to solve real-world complex engineering problems</i> The student learning assessment process (SLAP) shall include good number of presentations, demonstration of work undertaken, submission of a project report, writing project paper in scientific journal style & format, preparing project poster and creating video pitch on the complete project work 2. Activities of major project SLAP shall be planned in such a way to ensure that the students acquire the essential knowledge, skills and qualities (KSQ) of a professional engineer 3. Team work: Major project work is a team work (i) The students of a project team shall work together to achieve a common objective (ii) Every student of a project team is expected to function effectively as an individual, and also with others as a team member in an ecosystem of a team having knowledge diversity, gender diversity, social and cultural diversity among its members 4. Two phases: Major project work shall be carried out in two phases Nearly 50 - 75% of the proposed work to be completed in 7 th semester as <i>Phase-I</i> and the remaining work to be continued and completed in 8 th semester as <i>Phase-II</i>			

5. Every student is expected to put approximately **72hours of work** into the major project *phase-I* course over the 12weeks of 7thsemester

6. Major project work Phase-I: 7th semester

- (i) The HoD shall constitute the *department project evaluation committee (DPEC)* with following composition

<i>Department project evaluation committee (DPEC)</i>	
HoD	Chairman
SeniorFaculty	Convener
Coordinator(s)	Section-wise coordinator(s) <i>One coordinator for each section</i>
ThreeFaculty members	Section-wise faculty members <i>Three faculty members for each section representing various specializations (specializations will be covered including the coordinator's and Convener's)</i>

- (ii) Major project allotment to students during last working week of 6thsemester:

- (a) **First / Second week of 6thSemester:** The process shall be initiated during the first / second week of 6thsemester by collecting project titles from the department faculty research groups, on offering innovative ideas/solutions for engineering problems
- (b) **MSE-I period of 6th Semester - Notifying project titles:** The finalized project titles shall be notified to students during the MSE-I period of 6th semester and student teams shall be allowed to exercise their options on titles that interest them
- (c) **Last working week of 6th Semester - Allotment of titles and supervisors to project teams:** The project title allotment to major project teams shall be completed before the last day of instruction of 6th semester
- (d) **6th semester summer break - Literature review:** This 6th semester schedule enables students to complete literature review, preliminary simulations / investigations / experimentation during 6th semester summer break and *start the work from day-one in 7thsemester*
- (e) **Registration Presentation - Notifying the tentative dates:** The major project teams are expected to give registration presentation during second / third week from the commencement of 7th semester. The tentative dates for conducting the registration presentation shall be notified at the time of releasing the circular on allotted project title and project supervisors, as indicated in (c) above. This enables student teams to plan the work accordingly during summer break, to complete the literature review, preliminary simulations / investigations and get ready for informative, confident and comfortable presentations on their project work

- (iii) The convener DPEC shall notify, during MSE-I period of 6th semester, the list of implementable project titles offered by the faculty of different research groups of the department

- (a) Project titles shall come with the following details to be made available to students on dept webpage and notice boards, facilitating students to select problems that interest them
 - i. abstract
 - ii. deliverables / outcomes
 - iii. knowledge and skills required to complete the project
 - iv. resources required

- v. one of the deliverables shall be writing a technical paper out of the major project work done for submission to a reputed non-predatory conference/non-paid peer reviewed journal
- (iv) The major project teams, finalized by the convener DPEC, shall be allowed to exercise their options on the titles that interest them from the notified list
- (v) **Project supervisor allotment:** The convener DPEC shall allot, during the last week of 6th semester, the faculty supervisors to all project teams
 - (a) The project supervisors shall
 - i. **define project objectives and expected deliverables**
 - ii. **help the students plan their project work and timeline**
 - iii. **provide enough resources for successful project completion**
- (vi) The faculty supervisors are expected to provide guidance to project teams on
 - (a) *Knowledge, skills and qualities (KSQ) to be acquired* to propose solutions to the identified real-world problems
 - (b) *Problem analysis* - to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
 - (c) *Applying engineering knowledge* - to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
 - (d) *Design/development of solutions* - to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations
 - (e) *Conduct investigations of complex problems* - to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
 - (f) *Modern tool usage* - to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
 - (g) *The Engineering and the world* - to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
 - (h) *Ethics* - to apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice
 - (i) *Individual and team work* - to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
 - (j) *Communication* - to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
 - (k) *Project management and finance* - to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
 - (l) *Life-long learning* - to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change
- (vii) The project supervisors are also expected to continuously emphasize and guide students on

- (a) **Meeting Cadence:**
 - i. **Regular meetings with supervisor:** Short and frequent meetings increase a team's work momentum. Regular meetings with supervisor to review the status of project are very essential. All students of the team shall participate in discussions and take notes.
 - ii. **Meeting Frequency: Semi-weekly cadence,** ie, the meeting frequency shall be **twice a week**. Due weightage will be given to meeting cadence and considered for evaluation during presentations, ie, number of planned meetings and number attended by students.
- (b) **Project Log Book:** The activity journaling in project log book is very important for a successful project.
 - i. Project log book is a written record showing the daily project activity on project goals from the very first thing like starting the project (an introduction statement what the project is all about), to the completion of the work (including the final results, and whether project met the core objectives / outcomes, etc).
 - ii. In project log book, the activities like regular meetings with project supervisor, and work carried out on daily/weekly basis are to be recorded. This ensures that the student progress is being monitored well.
 - iii. The project supervisor shall regularly check the log book of every student of project team and endorse each and every activity by affixing his signature with date. With this, the number of planned meetings and number attended by the students will be also monitored.
 - iv. Log books are to be shown during all presentations and will be graded along with the project.
 - v. At the conclusion of the project work *phase-I*, the supervisor shall specifically comment, in the project log book, on whether the project team met each of the project work *phase-I* goals and to give evidence which describes the quality of work. For project teams, this also serves as self-assessment.
- (c) **Following project timeline:** completing the tasks as planned in project timeline.
- (d) The relevant knowledge, skills and qualities (**KSQ**) an engineering graduate should possess, which can be specially acquired by participating in major project work.
- (e) **Writing down whatever is done and making notes of whatever is read** Writing down the procedures/models followed, designs made, experiments conducted, simulations carried out, intermediate results obtained, *difficulties faced and how they were fixed* are very important. This kind of documenting the whole process as we go with project implementation is a very effective way and will help preparing a well- documented report having original content. Note down and include information about all the resources that you used, magazines, Journals, patents, books, and so on. This information will be needed for the bibliography in your project report. On the other hand, documenting a report *on the spur of the moment* would end up copying things from other sources resulting in a plagiarized document.
- (f) **Good and sufficient literature review:** Literature review is a description and analysis of information related to the topic of project work. Reading good number of review articles, research articles published in recent issues of peer reviewed journals, technical magazines, patents, reference books on the topics of potential interest, will help one understand what has already been discovered and what questions remain to identify gaps in the literature.

- (g) Completing nearly 50 - 75% of the proposed work during phase-I
- (h) Right conduct of research to promote academic integrity, honesty and time management
- (i) Preparing a well-documented report in proper format, covering the progress made during Phase-I
- (j) Consequences of plagiarism and use of anti-plagiarism software to detect plagiarism in documents
- (k) Submission of major project phase-I report within acceptable plagiarism levels, as per the *Anti-plagiarism policy-2020 of our institute*
- (l) **Video pitch:** Capturing short videos, photos, screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed during course of project execution, photos showing interaction with supervisor for creating a short video pitch on the work done during *phase-I*
- (m) **Project Paper:** Writing a technical paper at the end of *phase-II* based on the solution(s) proposed, results obtained, and prototype / working model / process / software package / system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal
- (n) **Project poster:** At the end of phase-II, the project teams shall have to present their project in the form of posters, at the time of demonstration of complete prototype / working model / software package / system developed
- (viii) **Phase- I evaluation:** There shall be only Continuous Internal Evaluation (CIE) for major project work *phase-I* with following components
 - (a) **Registration Presentation** (*during second / third week of 7th semester*): The Registration Presentation shall include a brief report and presentation focusing the identified problem, objective(s), literature review, identifying research gap in the literature, implementation of existing methods, proposed solution, and expected outcome(s)
 - i. The registration presentation shall invariably include the **project plan timeline** with actual start and finish dates- monthly/weekly project milestones/ timeline prepared in MS Excel or any other project management tool
 - ii. **Project timeline - Weekly project milestones:** It's a compact and creative way to present a project plan Identify the project intermediate goals and related tasks for completing each of those goals Categorize tasks for each week In the project timeline use different colors to the tasks for each week Horizontal timeline layouts shall be preferred or any other layout of team's choice
 - iii. Project teams shall create and present the following during registration presentation
 - 1. Complete project timeline
 - 2. Phase-I project timeline
 - 3. Phase-II project timeline
 - iv. During every presentation, project teams shall compulsorily show the following as part of their presentation
 - 1. The slides on project timeline and
 - 2. A table showing targeted tasks as per timeline and status - whether tasks accomplished?
 - v. **Project log book:** Every student of the Project team shall compulsorily show the activity journaling in the log book (*with due signatures of project supervisor*) during presentations
 - (b) **Progress Presentation-I** (*during penultimate week of 7th semester*): At the end of first stage (7th semester), student teams shall be required present, before the DPEC, the progress made during phase-I and submit a well-documented report of work

done for evaluation to the project coordinator

- i. **Following project timeline:** The project timeline shall be meticulously followed and the tasks shall be completed as planned in the project timeline
 - ii. Project teams shall compulsorily show the following as part of their progress presentation-I
 1. *The slides on project timeline and*
 2. *A table showing targeted tasks as per timeline and whether tasks are accomplished?*
 - iii. **Project log book:** Every student of the Project team shall compulsorily show the activity journaling in the log book (*with due signatures of project supervisor*)
- (c) **CIE schedule:** The convener DPEC shall release the complete schedule of CIE before start of 7th semester well in advance, so that student teams will complete the scheduled works and get ready with an informative, confident, and comfortable presentation for registration and progress presentations

(ix) CIE for the Major project work Phase-I shall be as given below:

Major project work Phase-I Assessment (7th semester)	Weightage
A Supervisor Assessment	20%
B. DPEC Assessment (i) <i>Registration Presentation (10%)</i> (ii) <i>Progress Presentation-I (20%)</i> (iii) <i>Project progress*: Part of working model/ process/software package/system developed (30%)</i> (iii) <i>Well-documented Progress Report on Phase-I work (10%)</i> (iv) <i>Video pitch on Phase-I (10%)</i>	80%
Total Weightage	100 %

* Students are advised to complete major part of the project in phase-I only

- (a) **Working Model:** Every project team shall be required to develop a working model/ process/software package/system, on the chosen work. The progress made in this shall be demonstrated during progress presentation-I at the end of *phase-I* and the completed working model/ process/software package/system before the DPEC as per the dates specified by DPEC at the end of *phase-II*
- (b) **Progress Report on phase-I:** Every project team shall be required to submit a well-documented progress report on dissertation phase-I as per format specified by DPEC
 - a. **Tangible outcomes of phase-I in Conclusions - Chapter:** These are the lessons learnt from doing a project work. The students have to describe in their own words what they learnt from the *phase-I* project work experience. They have to describe what specific KSQs are acquired by them, with reference to the expected COs, after successful completion of *phase-I* work. Finally, a table depicting systematic mapping of what they have learnt and the expected major project work COs, is to be presented in the conclusions chapter of *phase-I* report
- (c) **Video pitch on phase-I:** Every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I*. The project team shall present the produced video pitch during progress presentation-I. The produced video pitch should
 - a. be 3 to 5-minute-long video (no longer than 5 minutes)
 - b. be concise and to the point, on the problem and proposed solution

- c. show project timeline and sample page of log book
 - d. highlight the progress made at various stages during *phase-I* project implementation with the help of short videos/photos / screenshots on experiments conducted, simulations carried out, part of prototype/ working model/process / software package/system being under development as part of proposed solution and also photos showing team interactions with supervisor and the team working in the lab on project
 - e. discuss the impact of proposed solution in *ethical, environmental, societal and sustainable development contexts*
 - f. emphasize key points about *business idea, potential market for the proposed solution*
- (x) It is mandatory for
- (a) every student of the team to *appear for oral presentation and viva-voce*, as part of progress presentation -I to qualify for course evaluation
 - (b) every project team to *submit a well-documented progress report on major project work phase-I*, as part of progress presentation -I to qualify for course evaluation
 - (c) every project team to create and present a good video pitch on major project work *phase-I*, as part of progress presentation -I to qualify for course evaluation
- (xi) A student shall register for supplementary examination for the Major project work *phase-I* in the following cases:
- (a) He/she is absent for oral presentation and viva-voce as part of progress presentation-I
 - (b) The project team fails to submit the progress report on *Phase-I* in prescribed format
 - (c) The project team fails to submit the video pitch on the progress made during the *phase-I* period
 - (d) he/she fails to fulfill the requirements of Major project work *phase-I* evaluation as per specified guidelines
- (xii) Supplementary examination for Major project work *phase-I*
- (a) The CoE shall send the list of students registered for supplementary examination to the HoDs concerned
 - (b) The DPEC, duly constituted by the HoD, shall conduct Major Project Phase I supplementary exam and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):				U24CN707: MAJOR PROJECT PHASE I										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN707.1	3	3	2	3	2	1	1	1	1	1	2	2	2
CO2	U24CN707.2	3	3	3	2	3	3	2	1	1	2	2	2	1
CO3	U24CN707.3	1	1	1	1	1	2	3	3	2	3	1	2	1
CO4	U24CN707.4	1	1	1	2	2	1	2	1	3	1	3	2	2
U24CN707		2	2	1.75	2	2	1.75	2	1.5	1.75	175	2	2	1.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement (The student should be able to...)	Relevant SDG	SDG Description	Mapping Justification
CO1	review research literature, identify gaps in the literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques; synthesize technical knowledge and innovative approaches to generate suitable solutions for real-world complex engineering problems (Technical skills)	SDG 9	Industry, Innovation and Infrastructure	Research gap identification, problem formulation, and development of innovative engineering solutions promote technological advancement, industrial innovation, and sustainable infrastructure development in computer networks domains such as communication systems, networks, AI based networks, and cloud networks.
CO2	design a system or product based on product/customer specifications; develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations; use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget (Problem solving and critical thinking skills)	SDG 12	Responsible Consumption and Production	Engineering design considering resource optimization, environmental impact, sustainability, and efficient utilization of technology promotes responsible production and sustainable engineering practices in the networking field of networking..
CO3	Apply project management and organizational skills; demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader of a multidisciplinary team.	SDG 11	Sustainable Cities and Communities	Effective teamwork, ethical engineering practices, leadership, and multidisciplinary collaboration facilitate the development of sustainable technological solutions that improve societal well-being and community infrastructure.
CO4	Collate results, compare prototype performance with	SDG 4	Quality	Technical communication, dissemination of

	specifications, communicate findings through reports, posters, technical papers, presentations, and video pitches; engage in self-directed and lifelong learning.		Education	knowledge, professional documentation, and lifelong learning foster continuous education, skill enhancement, and knowledge sharing among engineering professionals.

VIII-Sem Syllabi

(B.Tech CSE(Networks) URR24)

VIII SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	PEC	U24CN801X	PE-III/MOOCs-III	2	1	-	3	3
2	PEC	U24CN802X	PE-IV/MOOCs-IV	2	1	-	3	3
3	PCC	U24CN803	AI Networking	2	1	-	3	3
5	ELC	U24CN804	Major Project, Phase-2/ Industrial Internship-2	-	-	12	12	6
Total:				6	3	12	21	15
Additional Learning®: Maximum credits allowed for Honours/Minor				-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	19

Professional Elective-III		
S. No.	Course Code	Course Title
1.	U24CN801A	Ethical Hacking
2.	U24CN801B	Cloud Security
3.	U24CN801C	Natural Language Processing
4.	U24CN801D	Data Warehousing and Data Mining
5.	U24CN801E	Any other course approved by BoS Chair and Dean AA

Professional Elective-IV		
S. No.	Course Code	Course Title
1.	U24CN802A	Cyber Physical Systems
2.	U24CN802B	Bigdata with Cloud Computing
3.	U24CN802C	Introduction to Gen AI and LLM Models
4.	U24CN802D	Data Analysis and Visualization
5.	U24CN802E	Any other course approved by BoS Chair and Dean AA

ETHICAL HACKING			
Class: B. Tech. VIII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN801A	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : analyze security vulnerabilities, security models and phases of penetration testing frameworks CO2 : analyze various cyber attacks and security threats in business and network environments CO3 : apply reconnaissance, enumeration and exploitation techniques using ethical hacking tools CO4 : evaluate penetration testing results and recommend suitable mitigation and defense mechanisms			
UNIT-I			9 Hrs
Introduction: Hacking impacts, The hacker-Type of hacker, Script kiddies Framework: Planning the test, Sound operations, Reconnaissance, Enumeration, Vulnerability analysis, Exploitation, Final analysis, Deliverable, Integration Information Security Models: Computer security, Network security, Service security, Application security, Security architecture Information Security Program: The process of information security, Component parts of information security programs, Risk analysis and ethical hacking			
UNIT-II			9 Hrs
The Business Perspective: Business objectives, Security policy, Previous test results, Business challenges Planning for a Controlled Attack: Inherent limitations, Imposed limitations, Timing is everything, Attack type, Source point, Required knowledge, Multi-phased attacks, Teaming and attack structure, Engagement planner, The right security consultant, The tester, logistics, Intermediates, Law enforcement			
UNIT-III			9 Hrs
Reconnaissance: Social engineering, Physical security, Internet reconnaissance Preparing for a Hack: Technical preparation, Managing the engagement Enumeration: Enumeration techniques, Soft objective, Looking around or attack, Elements of enumeration, Preparing for the next phase Exploitation: Intuitive testing, Evasion, Threads and groups, Operating systems, Password crackers, Rootkits, Applications, Wardialing, Network, Services and areas of concern			
UNIT-IV			9 Hrs
Deliverable: The deliverable, The document, Overall structure, Aligning findings, Presentation Integration: Integrating the results, Integration summary, Mitigation, Defense planning, Incident management, Security policy, Conclusion Case study: various attacks scenarios and their remedies			

Textbook:

1. James S. Tiller, *The Ethical Hack: A Framework for Business Value Penetration Testing*, Auerbach Publications, 1st edition, 2019, New York.

Reference Book(S):

1. Michael Simpson, Kent Backman, James Corley, *Hands-On Ethical Hacking and Network Defense*, Cengage Learning, 2nd edition, 2005, New York.
2. Patrick Engebreston, *The Basics of Hacking and Penetration testing*, Syngress Publishers, , 2011, New York.
3. EC-Council, *Ethical Hacking and Counter measures: Attack Phases*, Course Technology Press, 2016, New York.
4. Hein Smith, Hilary Morrison, *ETHICAL HACKING: A Comprehensive Beginner's Guide to Learn and Master Ethical Hacking*, Kindle Edition, 2018, New York.

Web and Video link(s):

<https://nptel.ac.in/courses/106105217>; NPTEL Video Lecture on Ethical Hacking by Prof. Indranil Sengupta, Department of Computer Science and Engineering, IIT Kharagpur

Course Articulation Matrix (CAM):				U24CN801A: ETHICAL HACKING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN801A.1	2	3	1	-	2	-	2	-	-	-	1	1	1
CO2	U24CN801A.2	2	3	2	-	2	1	2				1	2	1
CO3	U24CN801A.3	2	2	2	2	3	-	1	1	-	-	1	2	2
CO4	U24CN801A.4	2	3	3	2	2	2	2	-	1	-	2	2	2
U24CN802A		2	2.7 5	2	2	2.2 5	1.5	1.7 5	1	1	-	1.2 5	1.7 5	1.6 7
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Analyze security vulnerabilities, security models and phases of penetration testing frameworks	SDG9	Industry, Innovation and Infrastructure	Analysis of security vulnerabilities and penetration testing frameworks supports the development of secure and resilient digital infrastructure for industrial and communication systems.
CO2	Analyze various cyber attacks and security threats in business and network environments	SDG16	Peace, Justice and Strong Institutions	Understanding cyber attacks and security threats helps in protecting information systems and ensuring secure and trustworthy digital environments.
CO3	Apply reconnaissance, enumeration and exploitation techniques using ethical hacking tools	SDG9	Industry, Innovation and Infrastructure	Application of ethical hacking and reconnaissance tools enables proactive identification of system vulnerabilities, supporting reliable and secure computing infrastructure.
CO4	Evaluate penetration testing results and recommend suitable mitigation and defense mechanisms	SDG11	Sustainable Cities and Communities	Evaluation of penetration testing results and implementation of defense mechanisms contribute to securing smart systems, communication networks and digital services in modern communities.

CLOUD SECURITY			
Class: B. Tech. VIII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN801B	Credits:	3
Hours/Week (L-T-P- E):	3-0-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1: Explain the fundamentals of virtualization, distributed systems, and cloud computing architectures CO2: Analyze cloud service models, infrastructure provisioning, and cloud deployment environments CO3: Apply cloud data security, identity management, auditing, and monitoring mechanisms in cloud platforms CO4: Design and evaluate secure cloud applications using secure SDLC, DevSecOps, and cloud security practices to mitigate security threats			
UNIT-I			9 Hrs
System Modeling – Distributed System Models and Enabling Technologies. Clustering and Virtualization – Computer Clusters for Scalable Parallel Computing – Virtual Machines and Virtualization of Clusters and Data Centers. Introduction to Cloud Computing – Migrating into Cloud – Enterprise Cloud Computing Paradigm – Advantages and Challenges of Cloud Computing.			
UNIT-II			9 Hrs
Infrastructure as a Service (IaaS) – Platform as a Service (PaaS) – Software as a Service (SaaS) – Virtual Machine Provisioning and Migration Services – Management of Virtual Machines for Cloud Infrastructure – Cluster as a Service – Secure Distributed Data Storage in Cloud Computing – Aneka – Comet Cloud – Workflow Engines for Cloud Environments – Scientific Applications in Cloud Computing.			
UNIT-III			9 Hrs
Data Protection: Data at Rest, Data in Transit, and Data in Use – Data Information Lifecycle. Cloud Data Audit: Introduction, Audit Process, and Best Practices – AWS EBS and Amazon S3 Security – Azure Shared Access Signature (SAS) – Key Management Concepts – AWS Key Management Service (KMS) – Azure Key Vault. Introduction to Identity and Access Management (IAM), Federated Identity Management – Authentication and Authorization – Cloud IAM Audit and Best Practices.			
UNIT-IV			9 Hrs
Cloud Application Security Challenges: OWASP Top 10 – Secure Software Development Life Cycle (Secure SDLC) – DevSecOps Concepts – AWS CloudTrail – Amazon CloudWatch – AWS Lambda – Security Monitoring and Logging in Cloud Environments – Threat Detection and Risk Mitigation Techniques – Trusted Cloud Security Practices.			
Textbook(s): 1. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley Publishing, 30 July 2010 2. Securing the Cloud: Cloud Computer Security Techniques and Tactics, Syngress Publications, 1 June 2011			

Reference Book(S):

1. Network Security: Private Communication in a Public World, 2nd Edition, Prentice Hall
2. Cryptography and Network Security, 2nd Edition, Tata McGraw-Hill, India, 2008.
3. Cloud Security and Privacy, O'Reilly Media
4. Cloud Security Handbook, McGraw-Hill Education

Web and Video link(s):

1. https://nptel.ac.in/courses/106105167?utm_source=chatgpt.com;
NPTEL Video Lecture on Cloud Computing by Prof. Rajiv Misra, IIT Karagpur.
2. https://learn.microsoft.com/en-us/azure/security/?utm_source=chatgpt.com;
AWS Cloud Security Documentation
3. https://learn.microsoft.com/en-us/azure/security/?utm_source=chatgpt.com;
Microsoft Azure Security Documentation
4. https://cloud.google.com/security/best-practices?utm_source=chatgpt.com;
Google Cloud Security Best Practices
5. https://owasp.org/www-project-top-ten/?utm_source=chatgpt.com;
OWASP Top 10 Web Application Security Risks
6. https://www.ibm.com/topics/cloud-security?utm_source=chatgpt.com;
IBM Cloud Security Learning Resources

Course Articulation Matrix (CAM):				U24CN801B : CLOUD SECURITY										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN801B.1	3	2	2	1	2	-	-	-	1	-	1	3	2
CO2	U24CN801B.2	2	3	3	2	3	-	-	-	1	1	1	3	3
CO3	U24CN801B.3	2	3	2	3	3	1	1	1	1	1	1	3	3
CO4	U24CN801B.4	3	3	3	3	3	1	2	1	1	1	1	3	3
U24CN801B		2.5	2.75	2.5	2.25	2.75	0.5	0.75	0.5	1	0.75	1	3	2.75
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Explain the fundamentals of virtualization, distributed systems, and cloud computing architectures.	SDG 9	Industry, Innovation and Infrastructure	Understanding cloud computing and virtualization technologies supports the development of resilient digital infrastructure and innovative enterprise computing solutions.
CO2	Analyze cloud service models, infrastructure provisioning, and cloud deployment environments.	SDG 8	Decent Work and Economic Growth	Knowledge of cloud service models and infrastructure management enhances employability and supports growth in cloud-based industries and enterprise services.

CO3	Apply cloud data security, identity management, auditing, and monitoring mechanisms in cloud platforms.	SDG 16	Peace, Justice and Strong Institutions	Cloud security, identity management, and auditing mechanisms contribute to secure digital systems, data protection, and trustworthy information infrastructures.
CO4	Design and evaluate secure cloud applications using secure SDLC, DevSecOps, and cloud security practices to mitigate security threats.	SDG 9	Industry, Innovation and Infrastructure	Secure cloud application development and DevSecOps practices support innovative, scalable, and secure digital infrastructures for modern enterprises and industries.

NATURAL LANGUAGE PROCESSING			
Class: B. Tech. VIII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN801C	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : make use of the essential concepts of natural language processing to train a machine to understand text and spoken words in much the same way human beings can understand CO2 : analyse language models, naïve bayes and sentiment classifiers to recommend an opinion model CO3 : apply the part of speech tagging and parsing techniques to automate the system responses CO4 : analyse and develop different applications based on natural language processing such as named entity recognition, question answering, machine translation and chat bots			
UNIT-I			9 Hrs
Natural Language Processing (NLP): Introduction to NLP, Ambiguity, Language, Thought and Understanding Regular Expressions, Text Normalization, Edit Distance: Regular Expression, Words, Morphology, Morphology parsing, Word tokenization, Lemmatization, Stemming, Edit distance			
UNIT-II			9 Hrs
N-gram Language Models: N-Grams, Evaluating language models and smoothing, Kneser-Ney smoothing, Perplexity's relation to entropy Naïve Bayes and Sentiment Classification: Naïve bayes classifiers, Training the naïve bayes classifier, Worked example, Optimizing for sentiment analysis			
UNIT-III			9 Hrs
Sequence Labelling for Parts of Speech and Named Entities: English word classes, Part-of-Speech tagging, Named entities and Named entity tagging, Hidden markov models (HMM) part-of-speech tagging Constituency Parsing: Ambiguity, Cocke-kasami-younger(CKY) parsing, Partial parsing			
UNIT-IV			9 Hrs
Compositional Semantics: Introduction, Semantic role labelling and Semantic parsing, Discourse analysis Applications: Named entity recognition and relation extraction-IE using sequence labeling – Machine Translation (MT) – Basic issues in MT- Statistical translation-word alignment-phrase – based translation-question answering, Chatbots and dialog system			
Textbook(s): 1. Daniel Jurafsky and James H.Martin, <i>Speech and Language Processing</i> , Pearson Education, 2 nd edition, ISBN: 978-9332518414, 2009 2. Daniel Jurafsky and James H.Martin, <i>Speech and Language Processing</i> , Pearson Education, 3 rd edition-Drafted Copy- available online			

Reference Book(s):

1. Steven Bird, Ewan Klein and Edward Loper, *Natural Processing with Python*, O'Reilly Media, 1st edition, ISBN: 978-0596516499, 2009
2. Roland R.Hausser, *Foundations of Computational Linguistics: Human-Computer Communication in Natural Language*, MIT Press 1st edition, ISBN: 978-3540424178, 2011

Web and Video link(s):

[p://www.digimat.in/nptel/courses/video/106101007/106101007.html](http://www.digimat.in/nptel/courses/video/106101007/106101007.html), NPTEL Video Lecture on Natural Language Processing by Prof. Pushpak Bhattacharya, Professor of CSE, IIT Bombay.

Course Articulation Matrix (CAM):				U24CN801C : NATURAL LANGUAGE PROCESSING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN801C.1	3	1	-	-	3	-	-	-	-	-	2	3	-
CO2	U24CN801C.2	2	3	-	3	3	-	-	-	-	-	2	3	-
CO3	U24CN801C.3	2	2	3	-	3	-	-	-	2	-	2	3	-
CO4	U24CN801C.4	2	3	3	3	3	-	-	-	2	-	3	3	2
U24CN801C		2.25	2.25	1.5	1.5	3	0	0	0	1	0	2.25	3	0.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	make use of the essential concepts of natural language processing to train a machine to understand text and spoken words in much the same way human beings can understand	SDG 4	Quality Education	NLP enables intelligent learning systems, language translation, and accessible educational technologies.
CO2	analyse language models, naïve bayes and sentiment classifiers to recommend an opinion model	SDG 9	Industry, Innovation and Infrastructure	Sentiment analysis and language models support AI-based industrial and innovative applications.
CO3	apply the part of speech tagging and parsing techniques to automate the system responses	SDG 10	Reduced Inequalities	Automated language processing improves communication accessibility across diverse linguistic groups.
CO4	analyse and develop different applications based on natural language processing such as named entity recognition, question answering, machine translation and chat bots	SDG 17	Partnerships for the Goals	NLP applications enhance global communication, collaboration, and multilingual interaction.

DATA MINING AND DATA WAREHOUSING			
Class: B. Tech. VIII- Semester		Branch: CSE(NETWORK)	
Course Code:	U24CN801D	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : demonstrate data warehouse architecture, multidimensional data models, OLAP operations, and preprocessing techniques. CO2 : apply frequent pattern mining and association rule mining algorithms to discover knowledge from datasets. CO3 : analyze classification models using suitable performance evaluation techniques. CO4 : develop clustering techniques and examine data mining applications in web, finance, and retail domains			
UNIT-I			9 Hrs
Data Warehouse: Basic concepts, Multitier architecture, Data warehouse models, ETL tools, Metadata repository Multidimensional Data Modeling: Data cube, Star, Snowflake and Fact constellation schemas, Dimensions, Measures, OLAP operations, Star net query model Data Warehouse Implementation: Efficient data cube computation, Indexing OLAP, Efficient processing of OLAP queries, OLAP servers Data Preprocessing: Data cleaning, Integration, Reduction and transformation.			
UNIT-II			9 Hrs
Data Mining: Introduction, Types of data and patterns can be mined, Technologies used, Applications targeted, Major issues in data mining Association Rule Mining: Basic concepts, Apriori algorithm, Generating association rules from frequent item sets, Improvements of Apriori algorithm, Pattern-Growth approach, Mining frequent Item sets using vertical data format, Mining closed frequent item sets, Correlation analysis, Pattern mining in multilevel and multidimensional space, Constraint based frequent pattern mining			
UNIT-III			9 Hrs
Classification: Basic Concepts, Classification by decision tree induction, Bayesian classification, Rule based classification, Model evaluation and Selection Advanced Classification: Classification by back propagation, Associative classification, K Nearest Neighbor classifiers, Rough set and Fuzzy set approaches			
UNIT-IV			9 Hrs
Cluster Analysis: Introduction, Types of data in cluster analysis, Partitioning methods by K-Means and K-Medoids, Agglomerative versus Divisive hierarchical clustering, BIRCH Multiphase hierarchical clustering, Density based method with DBSCAN algorithm, Grid based method with STING, Evaluation of clusters, Outlier Analysis and detection methods Data Mining Trends: Mining sequence data, Web data mining, Data mining applications with Finance data analysis, Retail industry and Recommender systems			

Textbook(s):

1. Jiawei Han, Micheline Kamber, *Data Mining Concepts and Techniques*, 3rd ed., Singapore: Morgan Kaufmann Publishers, 2016. (Chapters: 1 to 10)

Reference Book(S):

1. Sam Anahory, Dennis Murray, *Data warehousing in the real world*, New Delhi: Pearson Education, 2003.
2. C.S.R. Prabhu, *Data Warehousing Concepts, Techniques, Products and Applications*, 2nd ed. New Delhi: Prentice-Hall of India, 2002.
3. Arun K. Pujari, *Data Mining Techniques*, 2nd ed. Hyderabad: Universities Press, 2010.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc22_ee116/preview; NPTEL Video Lecture on Data mining by Prof. Pabitra Mitra Indian Institute of Technology Kharagpur.

Course Articulation Matrix (CAM):				U24CN801D: DATA MINING AND DATA WAREHOUSING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN801D.1	2	2	2	2	2	-	-	1	1	1	-	2	1
CO2	U24CN801D.2	2	2	2	2	2	-	-	1	1	1	-	2	1
CO3	U24CN801D.3	2	2	2	2	2	-	-	1	1	1	-	2	1
CO4	U24CN801D.4	2	2	2	2	2	-	-	1	1	1	-	2	1
U24CN801D		2	2	2	2	2	-	-	1	1	1	-	2	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Explain data warehouse architecture, multidimensional data models, OLAP operations, and preprocessing techniques.	SDG9	Industry, Innovation and Infrastructure	Data warehousing and preprocessing techniques support intelligent infrastructure, industrial analytics, and efficient data management systems.
CO2	Apply frequent pattern mining and association rule mining algorithms to discover knowledge from datasets.	SDG 8	Quality Education	Knowledge discovery and pattern mining help organizations improve business intelligence, productivity, and decision-making processes.
CO3	Analyze and evaluate classification models using suitable performance evaluation techniques.	SDG 4	Sustainable Cities and Communities	Classification and evaluation models promote analytical thinking, data-driven learning, and advanced computational skills.
CO4	Implement clustering techniques and examine data mining applications in web, finance, and retail domains.	SDG9	Industry, Innovation and Infrastructure	Clustering and domain-specific data mining applications contribute to

CYBER PHYSICAL SYSTEMS			
Class: B. Tech. V – Semester		Branch: CSE (Networks)	
Course Code:	U24CN802A	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : elaborate Cyber Physical Systems and its applications CO2 : analyze the safety requirements of Cyber Physical Systems and its models CO3 : analyze the Asynchronous design primitives in Cyber Physical Systems CO4 : analyze the applications of Cyber Physical Systems and apply the techniques to ensure security in CPS			
UNIT-I			9 Hrs
Cyber-Physical System (CPS): Introduction, Emergence of CPS, CPS drivers, Key features of CPS – Reactive computation, Concurrency, Feedback control of the physical world, Real time computation, Safety critical application, Overview – Formal models, Specification and analysis, Model based design and case studies. Synchronous Model: Reactive components – Variables, Valuations, Expressions, Input, Output, States, Initialization, Update, Executions, Extended state machines, Properties of components – Finite state, Combinational, Event triggered, Non deterministic, Input enabled components, Task graphs and await dependencies, Composing components – Block diagrams, Input/output variable renaming, Parallel composition, Output hiding, Synchronous designs – Synchronous circuits, Cruise control System, Synchronous networks.			
UNIT-II			9 Hrs
Safety requirements: Safety specifications – Invariants of transition systems, Role of requirements in system design, Safety monitors, verifying invariants – Providing invariants, Automated invariant verification, Simulation based analysis, Enumerative search, Symbolic search. Asynchronous Model: Asynchronous processes – States, Inputs, Outputs and Internal actions, Executions, Extended state machines, Operations on processes, Safety requirements.			
UNIT-III			9 Hrs
Asynchronous Design Primitives: Blocking and non-blocking synchronization, Deadlocks, Shared memory, Fairness assumptions, Asynchronous coordination protocols – Leader election, Reliable transmission, Wait free consensus, Dynamical systems – Continuous time models, Linear systems, Design controllers, Analysis techniques, Time model – Timed processes, Timing based protocol, Hybrid systems – Hybrid dynamical models, Designing hybrid systems.			
UNIT-IV			9 Hrs
Security of Cyber-Physical Systems: Introduction, Basic techniques, Cyber security requirements, Attack model, Cyber and physical consequences, Counter measures, Advanced			

techniques, System theoretic approaches.

Overview of Cyber-Physical Systems Applications: Introduction and Motivation, System description and operational scenarios, Key design drivers and quality attributes of health care and medical CPS, Grid and energy CPS, and CPS built on wireless sensor networks.

Textbook(s):

- [1] Rajeev Alur, *Principles of Cyber-Physical Systems*, 2nd ed., London: MIT Press, 2015 (Chapters 1, 2, 3, 4, 6, 7, 9).
[2] Raj Rajkumar, Dionisio de Niz and Mark Klein, *Cyber-Physical Systems*, 1st ed., New Delhi: Addison-Wesley, 2017 (Chapters 1, 7).

Reference Book(S):

- [1] E. A. Lee and S. A. Seshia, *Introduction to Embedded Systems: A Cyber-Physical Systems Approach*, 2nd ed., New Delhi: PHI Learning, 2019.
[2] Fei Hu, *Cyber-Physical Systems*, 1st ed., Florida: CRC Press, 2014.

Web and Video link(s):

[NPTEL: Foundations of Cyber Physical Systems](#) – NPTEL Video Lecture on *Foundations of Cyber Physical Systems* by Soumyajit Dey, Professor of CSE, Indian Institute of Technology Kharagpur

Course Articulation Matrix (CAM):				U24CN802A: CYBER PHYSICAL SYSTEMS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN802A.1	2	2	1	1	1	-	-	1	1	1	-	1	1
CO2	U24CN802A.2	2	2	1	1	1	-	-	1	1	1	-	1	1
CO3	U24CN802A.3	2	2	1	1	1	-	-	1	1	1	-	1	1
CO4	U24CN802A.4	2	2	1	1	1	-	-	1	1	1	-	1	1
U24CN802A		2	2	1	1	1	-	-	1	1	1	-	1	1
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Understand the fundamentals, architecture and models of Cyber Physical Systems	SDG9	Industry, Innovation and Infrastructure	Cyber Physical Systems integrate computation, communication and physical processes to develop intelligent industrial systems, smart manufacturing and modern infrastructure, supporting innovation and sustainable industrial growth.
CO2	Apply synchronous and asynchronous models in CPS design and analysis	SDG11	Sustainable Cities and Communities	Synchronous and asynchronous CPS models are widely used in smart transportation, traffic control, automation and smart city applications, enabling efficient and reliable urban services.
CO3	Analyze safety, security and verification techniques in Cyber Physical Systems	SDG16	Peace, Justice and Strong Institutions	Synchronous and asynchronous CPS models are widely used in smart transportation, traffic control, automation and smart city applications, enabling efficient and reliable urban services.
CO4	Apply CPS concepts in healthcare, energy systems and wireless sensor network applications	SDG3	Good Health and Well-being;	CPS applications in healthcare improve patient monitoring and medical automation, while CPS-based smart grids and energy management systems enhance efficient utilization of clean and sustainable energy resources.

BIG DATA WITH CLOUD COMPUTING			
Class: B. Tech. VIII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN802B	Credits:	3
Hours/Week (L-T-P- E):	3-0-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : understand the background on big data, proficient in hadoop programming CO2 : demonstrate big data platforms such as Hadoop - HDFS, YARN, Spark CO3 : make use Spark Streaming, and Spark SQL for practical use cases CO4 : develop applications over cloud AWS, Azure, or Cloudera			
UNIT-I			9 Hrs
Introduction to Big Data and Cloud Computing: Big data characteristics and benefits, Data storage technologies and storing data on Amazon S3, Cloud infrastructure and management, Cloud security, Prominent cloud vendors and their services Data Extraction, Data Processing and Knowledge Extraction: Data extraction process and tools, Change Data Capture (CDC), Distributed data processing, Different data processing engines, ETL using Amazon Glue, Data processing using Amazon, Data querying using Amazon Athena			
UNIT-II			9 Hrs
Cloud for Big Data Storage: Introduction to storage systems, Cloud storage concepts, Distributed file systems (HDFS, Ceph FS), Cloud databases (HBase, MongoDB, Dynamo DB), Cloud Object Storage (Amazon S3, OpenStack Swift)			
UNIT-III			9 Hrs
Programming Models: Distributed programming for the cloud, Data-parallel analytics with Hadoop MapReduce (YARN), Data-parallel iterative analytics (Spark), and Graph-parallel analytics with graph Lab 2.0 (PowerGraph)			
UNIT-IV			9 Hrs
Big Data Deployment and Real Time Data Processing: Spark SQL, Big data collection, Data lake, Spark streaming, Big data deployment: Hadoop solution, Cloud solution, Real-time vs batch processing, Advantages and tools, Use cases, Using Amazon Kinesis and Spark streaming			
Textbook: 1. Rudy Lai and B. Potaczek, "Hands-On Big Data Analytics with PySpark", Packt publication LTD			
Reference Book(S): 1. "Learning Apache Spark with Python", https://runawayhorse001.github.io/LearningApacheSpark/ 2. Danda B. Rawat, Lalit K Awasthi, Valentina Emilia Balas, Mohit Kumar and Jitendra Kumar Samriya "Convergence of Cloud with AI for Big Data Analytics", Wiley Publication			

Course Articulation Matrix (CAM):				U24CN802B: BIG DATA WITH CLOUD COMPUTING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN802B.1	3	2	-	1	2	-	-	-	-	-	2	2	2
CO2	U24CN802B.2	3	2	2	1	3	-	-	-	-	-	2	2	3
CO3	U24CN802B.3	2	3	3	2	3	-	-	-	1	-	2	2	3
CO4	U24CN802B.4	2	2	3	2	3	-	-	-	2	1	2	2	2
U24CN802B		2.5	2.25	2.66	1.5	2	-	-	-	1.5	1	2	2	2.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	understand the background on big data, proficient in hadoop programming	SDG4	Quality Education	Provides students with foundational knowledge and practical skills in Big Data technologies, promoting quality technical education and lifelong learning
CO2	demonstrate big data platforms such as Hadoop - HDFS, YARN, Spark	SDG4, SDG9	Quality Education Industry, Innovation and Infrastructure	Enables students to use modern Big Data frameworks widely adopted in industry, fostering innovation and preparing a skilled workforce for digital infrastructure
CO3	make use Spark Streaming, and Spark SQL for practical use cases	SDG9, SDG11	Industry, Innovation and Infrastructure Sustainable Cities and Communities	Develops the ability to analyze large-scale real-time data for intelligent applications such as smart transportation, healthcare, and urban planning, supporting sustainable and data-driven solutions
CO4	develop applications over cloud AWS, Azure, or Cloudera	SDG8, SDG9	Decent work and Economic Growth Industry, Innovation and Infrastructure	Equips students with cloud-based Big Data development and deployment skills, improving employability, supporting digital transformation, and encouraging innovation in industry

INTRODUCTION TO GENERATIVE AI AND LLM MODELS			
Class: B. Tech. VIII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN802C	Credits:	3
Hours/Week (L-T-P- E):	3-1-0-0	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i> CO1 : understand the fundamentals of Generative AI, LLMs, and the role of data in AI systems. CO2 : analyze different types of LLMs, vector embeddings, governance, and security mechanisms. CO3 : apply prompt engineering, fine-tuning, reinforcement learning, and vector databases in LLM applications. CO4 : develop and deploy LLM-based applications using deployment, optimization, and AI operational techniques.			
UNIT-I			9 Hrs
Introduction to Generative AI: Introducing Generative AI and the Role of Data; Historical Context of Generative AI; Introduction to LLMs and Foundation Models; Transforming the AI Landscape; Accelerating AI Functions Data and Enterprise Applications: Role of Data in AI Projects; Importance of Generative AI to Enterprises; Pretrained Models; Security versus Ease of Use; Managing Generative AI Projects with Cloud Data Platforms			
UNIT-II			9 Hrs
Transformers: Introduction; Pre-Transformer era; Core components of transformer; General architecture Types and Categories of LLMs: Categorizing Large Language Models; General-purpose LLMs; Task-specific and Domain-specific LLMs Core Technologies and Governance: Technology Behind LLMs; Key Terms and Concepts in LLMs; Importance of Vector Embeddings; Developer Tools and Frameworks; Data Governance and Security; Extending Governance for Different Data Types			
UNIT-III			9 Hrs
LLM Selection and Adaptation: Defining Use Cases and Scope; Selecting the Right LLM; Comparing Small and Large Language Models; Adapting LLMs to Use Cases Techniques for LLM Enhancement: Prompt Engineering; Learning from Context; Text Retrieval Augmentation; Fine-tuning Language Models; Reinforcement Learning; Using Vector Databases			
UNIT-IV			9 Hrs
Implementation and Deployment: Implementing LLM Applications; Deploying Applications into Containers; Allocating Specialized Hardware; Integrating Applications and Data; Adapting Data Pipelines Optimization and AI Operations: Semantic Caching; Feature Injection; Context Retrieval; Processing for Inference; Reducing Latency; Calculating Costs; Creating User Interfaces; Simplifying Development and Deployment; Orchestrating AI Agents			
Textbook: 1. Pam Baker, <i>Generative AI For Dummies</i> , Wiley Publications, 1st edition, 2024, New York. (Chapters 1 to 18)			
Reference Book(S): 1. Roland Huß and Daniele Zonca, <i>Generative AI on Kubernetes: Operationalizing Large Language Models</i> , O'Reilly Media, 1st edition, 2024, California			

2. Elena Dubrova, *Fundamentals of Generative Large Language Models and Perspectives in Cyber-Defense*, Springer, 1st edition, 2024, Switzerland
3. Jonathan Chang, *Building Generative AI Services with FastAPI*, O'Reilly Media, 1st edition, 2024, California
4. Ethan Mollick, *Co-Intelligence: Living and Working with AI*, Portfolio Publications, 1st edition, 2024, New York

Web and Video link(s):

<https://nptel.ac.in/courses/106108703>; NPTEL Online Certification Course on Programming with Generative AI by Prof. Viraj Kumar, Visiting Professor, Kotak-IISc AI-ML Centre, Indian Institute of Science (IISc) Bangalore.

Course Articulation Matrix (CAM):				U24CN802C : INTRODUCTION TO GEN AI AND LLM MODELS										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN802C.1	3	2	-	1	1	-	-	-	-	1	-	2	1
CO2	U24CN802C.2	3	3	1	2	2	1	-	1	-	1	-	2	2
CO3	U24CN802C.3	3	3	3	2	3	-	-	-	1	1	-	3	3
CO4	U24CN802C.4	3	3	3	3	3	1	1	1	2	2	1	3	3
U24CN802C		3	2.75	1.75	2	2.25	0.5	1	0.5	0.75	1.25	1	2.5	2.25
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Understand the fundamentals of Generative AI, LLMs, and the role of data in AI systems.	SDG4	Quality Education	Helps students gain knowledge and modern AI learning skills, supporting quality technical education and lifelong learning.
CO2	Analyze different types of LLMs, vector embeddings, governance, and security mechanisms.	SDG9	Industry, Innovation and Infrastructure	Promotes innovation and advanced digital infrastructure through understanding modern AI technologies and secure AI systems.
CO3	Apply prompt engineering, fine-tuning, reinforcement learning, and vector databases in LLM applications.	SDG9	Industry, Innovation and Infrastructure	Encourages development of innovative AI applications and intelligent solutions for industrial and technological advancement.
CO4	Develop and deploy LLM-based applications using deployment, optimization, and AI operational techniques.	SDG11	Sustainable Cities and Communities	Supports creation of smart and sustainable digital solutions using AI technologies for efficient community and urban services.

DATA ANALYSIS AND VISUALIZATION			
Class: B. Tech. VIII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN802D	Credits:	3
Hours/Week (L-T-P- E):	2-1-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : apply visualization techniques for different types of data and apply data preprocessing techniques to prepare datasets for analysis and visualization. CO2 : apply visualization techniques for representing spatial and geospatial data. CO3 : apply visualization techniques for representing time oriented and unstructured data. CO4 : analyze text and document visualization techniques.			
UNIT-I			9 Hrs
Data Foundations: Types of data, Data preprocessing, Visualization foundations, The eight visual variables, Taxonomies Data Visualization: Visualization functionalities, importance, The difference between visualization and computer graphics, The visualization process, The scatter plot			
UNIT-II			9 Hrs
Visualization Techniques for Spatial Data : One-dimensional data, Two-dimensional data, Three dimensional data, Visualizing volume data, Dynamic data Visualization Techniques for Geospatial Data: Visualizing geospatial data, Map projections, Visualization of point data, line data			
UNIT-III			9 Hrs
Visualization Techniques for Time-Oriented Data: Introduction, Definitions, characterizing time-oriented data, Relating data and time, Visualizing time-oriented data, Categorization Visualization Techniques for Trees, Graphs, and Networks: Displaying hierarchical structures, Displaying arbitrary graphs, networks, Node-link graphs, Matrix representations for graphs			
UNIT-IV			9 Hrs
Text and Document Visualization: Levels of text representations, The Vector space model, Single document and Document collection visualizations Image Visualization: Image Data Representation, Image Processing and Visualization, Basic Imaging Algorithms, Shape Representation and Analysis, Conclusion Visualization Systems: Systems based on data type, Systems based on analysis type, Toolkits, Libraries, Research directions in visualization			
Textbook(s): 1. Matthew O. Ward , Georges Grinstein , Daniel Keim, Interactive Data Visualization: Foundations, Techniques, and Applications, 2nd ed., Boca Raton: A K Peters/CRC Press, 2015. 2. Exandru C. Telea , Data Visualization: Principles and Practice , 2nd ed., Boca Raton : CRC Press, 2015.			

Reference Book(S):

3. Claus Wilke, Fundamentals of Data Visualization: A Primer on Making Informative and Compelling Figures, 1st ed., Sebastopol: O'Reilly Media Inc, 2019.
4. Kristen Sosulki, Data Visualization Made Simple Insights into Becoming Visual, 2nd ed., Oxon: Routledge, 2015.
5. Ben Fry, Visualizing Data, 1st ed., Sebastopol, O'Reilly Media Inc, 2008.

Course Articulation Matrix (CAM):				U24CN802D : DATA ANALYSIS AND VISUALIZATION										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN802D.1	1	3	2	2	1	-	-	1	1	1	-	1	2
CO2	U24CN802.2.2	2	3	2	2	2	-	-	1	1	1	-	1	2
CO3	U24CN802D.3	2	3	2	3	2	-	-	1	1	1	-	1	2
CO4	U24CN802D.4	2	3	2	3	2	-	-	1	1	1	-	1	2
U24CN802D		1.75	3	2	2.5	1.75	-	-	1	1	1	-	1	2
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Advanced techniques of data visualization, types of data and data processing	SDG4	Quality Education	It focuses on developing analytical, technical, and problem-solving skills through data visualization and data foundations. It enables students to understand data types, preprocessing techniques, visualization principles, and effective graphical representation methods, which are essential competencies in modern education
CO2	Apply visualization techniques for representing the spatial and geospatial data	SDG9	Industry, Innovation and Infrastructure	It emphasizes advanced visualization techniques for spatial and geospatial data that are widely used in smart infrastructure, urban planning, environmental monitoring, transportation systems, and scientific research.
CO3	Apply visualization techniques for representing the time-oriented and unstructured data	SDG9	Industry, Innovation and Infrastructure	It focuses on advanced techniques for visualizing time-oriented data, hierarchical structures, graphs, and networks that are essential in modern information systems and data-driven technologies.
CO4	Analyze text and document visualization techniques	SDG9	Industry, Innovation and Infrastructure	It focuses on modern visualization systems and techniques used in handling textual, document, and image-based data for advanced analytical applications.

AI NETWORKING			
Class: B. Tech. VIII – Semester		Branch: CSE (Networks)	
Course Code:	U24CN803	Credits:	3
Hours/Week (L-T-P- E):	3-0-0-3	CIE:	60%
Total Number of Teaching Hours:	36 Hrs	ESE:	40%
Course Learning Outcomes (COs) <i>After completion of this course, the students should be able to,</i>			
CO1 : Analyze the role of networking fundamentals, data centers, and edge computing in supporting AI/ML systems CO2 : Design AI/ML networking infrastructure using advanced protocols, SDN, NFV, and high-performance interconnects CO3 : Evaluate automation, reliability, and security mechanisms for efficient AI/ML network operations CO4 : Apply real-world AI networking applications and emerging trends in distributed and intelligent networks			
UNIT-I			9 Hrs
Introduction to Networking for AI: Historical perspective on AI/ML revolution, Rising to the AI/ML challenge Networking fundamentals as Essential building blocks: Key Networking concepts, Network Topologies, Impact of Networking on AI/ML, Additional Networking considerations for AI/ML Data centers, Edge computing and High-Speed Interconnects: Data Centers, Edge Computing, High-speed interconnects			
UNIT-II			9 Hrs
Networking protocols for AI/ML: Ethernet, Infiniband, Remote Directory Memory Access, RDMA Protocol, GPU Direct storage, NVMe over fabrics, High-speed Ethernet variants Engineering the end-end Infrastructure: Right RDMA Technology, SDN for AI/ML workloads, SDN Use cases, Network Functions Virtualization, High-Performance Computing Fabrics, Smart NICs			
UNIT-III			9 Hrs
Network Automation for AI/ML Workloads: Network Automation, Key use cases, Automated Troubleshooting, Scaling and Resource Optimization, Enforcing Security Policies, Automation tools Reliability and Security in AI/ML: Importance of continuous operations, Network Reliability, Redundancy, Fault Tolerance, Load Balancing, High Availability Architecture, Data Protection and Privacy			
UNIT-IV			9 Hrs
Case Studies and Real-world Applications: AI Networking in Hyper Scalers, Network design, Topology, Congestion control, Oracle Cloud Infrastructure, Azure, Financial Services, Health care, Automotive, Networking Strategy, Natural Language Processing, Computer Vision Future Trends in Networking for AI/ML: Next Generation High Performance interconnects, Quantum Networking, Networking for Distributed and Edge AI, Federated Learning and Private AI, Sustainability and energy efficiency in AI Networks			
Textbook(s): 1. Shankar Ramanathan, Handson AI Networking, BPB Publications, First Edition, 2026, New Delhi. (Chapters 1 to 9)			
Reference Book(S):			

3. Rich Seifert, All-New Switch Book: The Complete Guide to LAN Switching Technology – , Wiley India, 2008, New Delhi

Course Articulation Matrix (CAM):				U24CN803: AI NETWORKING										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN803.1	3	2	1	2	3	-	-	-	-	1	1	3	2
CO2	U24CN803.2	3	3	3	2	3	-	-	-	1	1	2	3	3
CO3	U24CN803.3	3	3	2	3	2	1	-	-	1	1	2	2	3
CO4	U24CN803.4	2	2	2	1	2	1	2	1	2	2	1	2	2
U24CN803		2.75	2.5	2	1	2.5	1	2	1	4	1.25	1.5	2.5	2.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement <i>The student should be able to...</i>	Relevant SDG	SDG Description	Mapping Justification
CO1	Analyze the role of networking fundamentals, data centers, and edge computing in supporting AI/ML systems.	SDG 9	Industry, Innovation and Infrastructure	Supports the development of resilient digital infrastructure and intelligent networking technologies for AI/ML applications.
CO2	Design AI/ML networking infrastructure using advanced protocols, SDN, NFV, and high-performance interconnects.	SDG 9	Industry, Innovation and Infrastructure	Promotes innovation in high-performance and scalable communication infrastructure for next-generation AI systems.
CO3	Evaluate automation, reliability, and security mechanisms for efficient AI/ML network operations.	SDG 11	Sustainable Cities and Communities	Encourages secure, reliable, and trustworthy digital network operations through automation mechanisms.
CO4	Apply real-world AI networking applications and emerging trends in distributed and intelligent networks.	SDG 11	Sustainable Cities and Communities	Supports smart and sustainable technologies through distributed AI, edge computing, and energy-efficient networking solutions.

MAJOR PROJECT PHASE II			
Class: B. Tech. VIII – Semester		Branch: CSE(Networks)	
Course Code:	U24CN804	Credits:	6
Hours/Week (L-T-P- E):	0-0-12-12	CIE:	60%
Total Number of Teaching Hours:	-	ESE:	40%
Course Learning Outcomes (COs): <i>After completion of this course, the students should be able to,</i> Upon completion of the major project work, students will be able to... CO1: review research literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques, synthesize technical knowledge and innovative approaches to generate suitable solutions for real-world complex engineering problems (Technical skills) CO2: design a system or product based on product/customer specifications, develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations, use modern engineering and IT tools to design, build and test a prototype within specified project timeline and budget (Problem solving and critical thinking skills) CO3: apply project management and organizational skills, demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader to produce time-sensitive deliverables in a multi-disciplinary team (Ethics and teamwork) CO4: collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written (report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and life-long learning demonstrating the KSQ of a professional engineer (Communication skills and life-long learning)			
Major project work shall be continued in 8th semester as major project phase-II: All the major project teams shall take the <i>phase -I</i> work forward and complete the remaining work as <i>Phase-II</i> in the 8th semester - Final Year Major Project work represents the culmination of study towards the B Tech degree Major project offers an opportunity to integrate the knowledge acquired from various courses and apply it to solve real-world complex engineering problems The student learning assessment process (SLAP) shall include good number of presentations, demonstration of work undertaken, submission of a project report, writing project paper in scientific journal style & format, preparing project poster and creating video pitch on the complete project - Activities of major project SLAP shall be planned in such a way to ensure that the students acquire the essential knowledge, skills and qualities (KSQ) of a professional engineer Team work: Major project work is a team work - The students of a project team shall work together to achieve a common objective - Every student of a project team is expected to function effectively as an individual, and also with others as a team member in an ecosystem of team having knowledge diversity, gender diversity, social and cultural diversity among its members - Every student is expected to put approximately 168 hours of work into the major project phase-II course over the 12 weeks of 8th semester			

6. **Major project work Phase-II: 8th semester**

- (i) The convener DPEC shall release complete schedule of *phase-II* CIE during last week of 7th semester (*well in advance before start of 8th semester*), immediately after completion of Progress Presentation-I, so that student teams would complete the scheduled works during inter-semester break and get ready with informative, confident and comfortable presentation for progress presentation-II
- (ii) The project supervisors: The project supervisors are expected to guide the students to systematically continue the phase-I work, useful work during inter- semester break, meeting the deadlines as proposed in project timeline
- (iii) The project supervisors shall ensure students focus on the project objectives and expected deliverables
- (iv) The project supervisors shall ensure students have sufficient resources for successful project completion
- (v) The project supervisors shall ensure students have sufficient resources for successful project completion
- (vi) The project supervisors shall continue guiding students on
 - (a) *Knowledge, skills and qualities (KSQ) of a professional engineer to be acquired to propose solutions and design the systems to the identified real-world problems*
 - (b) *Problem analysis -to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences*
 - (c) *Applying engineering knowledge - to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems*
 - (d) *Design/development of solutions - to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental Considerations*
 - (e) *Conduct investigations of complex problems - to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions*
 - (f) *Modern tool usage - to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations*
 - (g) *The Engineering and the world- to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice*
 - (h) *Ethics - to apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice*
 - (i) *Individual and team work - to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings*
 - (j) *Communication - to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able*

to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

- (k) *Project management and finance* – to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
- (l) *Life-long learning* – to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

(vii) The project supervisors are also expected to continuously emphasize and guide the students on

- (a) **Following project timeline:** completing the tasks as planned in project timeline
- (b) **Meeting Cadence:**

- i. **Regular meetings with supervisor:** Short and frequent meetings increase a team's work momentum Regular meetings with supervisor to review the status of project are very essential All students of the team shall participate in discussions and take notes
- ii. **Meeting Frequency: Semi-weekly cadence,** ie, the meeting frequency shall be **twice a week** Due weightage will be given to meeting cadence and considered for evaluation during presentations, ie, number of planned meetings and number attended by students

- (c) **Project Log Book:** The activity journaling in project log book is very important for a successful project

- i. Project log book is a written record showing the daily project activity on project goals from the very first thing like starting the project (an introduction statement what the project is all about), to the completion of the work (including the final results, and whether project met the core objectives / outcomes, etc)
- ii. In project log book, the activities like regular meetings with project supervisor, and work carried out on daily/weekly basis are to be recorded This ensures that the student progress is being monitored well
- iii. The project supervisor shall regularly check the log book of every student of project team and endorse each and every activity by affixing his signature with date With this, the number of planned meetings and number attended by the students will be also monitored
- iv. Log books are to be shown during all presentations and will be graded along with the project
- v. At the conclusion of the project work *phase-II*, the supervisor shall specifically comment, in the project log book, on whether the project team met each of the project work outcomes and to give evidence which describes the quality of work For project teams, this also serves as self-assessment

- (d) **Writing down whatever is done and making notes of whatever is read** Writing down the procedures / models followed, designs made, experiments conducted, simulations carried out, intermediate results obtained, *difficulties faced and how they were fixed* are very important This kind of documenting the whole process as we go with project implementation is a very effective way and will help preparing a well- documented report having original

- content Note down and include information about all the resources that you used, magazines, Journals, patents, books, and so on This information will be needed for the bibliography in your project report On the other hand, documenting a report *on the spur of the moment* would end up copying things from other sources resulting in a plagiarized document
- (e) The relevant knowledge, skills and qualities (**KSQ**) an engineering graduate should possess, which can be specially acquired by participating in major project work
 - (f) **Good and sufficient literature review:** Literature review is a description and analysis of information related to the topic of project work Reading good number of review articles, research articles published in recent issues of peer reviewed journals, technical magazines, patents, reference books on the topics of potential interest, will help one understand what has already been discovered and what questions remain to identify gaps in the literature
 - (g) Completing the proposed work by the end of *phase-II*
 - (h) Right conduct of research to promote academic integrity, honesty and time management
 - (i) Preparing a well-documented overall project report in proper format, covering the complete work carried out during both the phases (*phase-I and phase-II*)
 - (j) Consequences of plagiarism, and use of anti-plagiarism software to detect plagiarism in the report
 - (k) Submission of major project work report within acceptable plagiarism levels (including AI Plagiarism), as per the *Anti-plagiarism policy-2020 of our institute*
 - (l) **Video pitch on complete project work:** Capturing short videos, photos, screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed during course of project execution, photos showing interaction with supervisor for creating a short video pitch on the complete work done during both phases (*phase-I and phase-II*)
 - (m) **Project Paper:** Writing a technical paper at the end of *phase-II* based on the solution(s) proposed, results obtained and prototype / working model / process / software package / system developed, for submission to a reputed non-predatory conference/non-paid peer reviewed journal
 - (n) **Project poster:** At the end of *phase-II*, the project teams shall have to present their project in the form of posters, at the time of demonstration of complete prototype / working model / software package / system developed
 - (viii) **Phase – II evaluation:** There shall be only Continuous Internal Evaluation (CIE) for major project work *phase-I* with following components
 - (a) **Progress Presentation -II** (*during third / fourth week of 8th semester*): The progress presentation-II shall include the identified problem, objective(s), literature review, expected outcome(s), results of work done as per project plan timeline
 - i. **Following project timeline:** The project timeline shall be meticulously followed and the tasks shall be completed as planned in project timeline
 - ii. 80-85% of work is expected to be completed
 - iii. Project teams shall compulsorily show the following as part of their progress presentation-II
 - 1. The slides on project timeline and
 - 2. A table showing targeted tasks as per timeline and status – whether tasks accomplished?

- iv. **Project log book:** Every student of the Project team shall compulsorily show the activity journaling in the log book (with due signatures of project supervisor) during presentations
- (b) **Final Presentation** (*during penultimate week of 8th semester*): **Project supervisor shall ensure that the project team has accomplished 100% of work proposed**
The project team shall
 - i. **Follow project timeline:** The project timeline shall be meticulously followed and the tasks shall be completed as planned in project timeline
 - ii. compulsorily show the following as part of their final presentation
 - 1. *The slides on project timeline and*
 - 2. *A table showing targeted tasks as per timeline and whether all the identified tasks accomplished?*
 - iii. **show project log book:** Every student of the Project team shall compulsorily show the complete activity journaling in the log book (*with due signatures of project supervisor*)
 - iv. present complete results & analysis
 - v. **demonstrate the completed project:** working model / process / software package / system developed
 - vi. demonstrate the completed project with the **project poster presentation**
- (ix) **Evaluation for Major project phase-II:** There shall be continuous internal evaluation (CIE) and end semester examination (ESE) The evaluation for *phase-II* shall be as given below:

Assessment	Weightage
A. CIE (i) Supervisor Assessment (10%) (ii) DPEC Assessment (50%) <i>(a) Progress presentation-II(10%)</i> <i>(b) Final presentation(10%)</i> <i>(c) Working model/process/software package/system developed (20%)</i> <i>(d) Project video pitch(5%)</i> <i>(e) Project paper(5%)</i>	60%
B. ESE <i>(i) Well-documented project report(15%)</i> <i>(DPEC shall evaluate the project reports, as per the rubrics, well before the ESE At the time of ESE, evaluated project report marks shall be posted in the award list, along with the ESE oral presentation marks Students shall appear for Viva-Voce with project report)</i> <i>(ii) Oral presentation with PPTs and viva-voce(10%)</i> <i>(iii) Project poster(5%)</i> <i>(DPEC shall evaluate the project poster, as per the rubrics, well before the ESE At the time of ESE, evaluated project poster marks shall be posted in the award list Students shall appear for Viva-Voce with project poster)</i> <i>(iv) SDG (5%)</i> <i>(v) Research Orientation (5%)</i>	40%
Total Weightage	100%

- (a) **Working Model:** Every project team shall be required to develop a working model/ process/ software package/ system on the chosen work The completed working model/ process/ software package/ system shall be demonstrated

during the final presentation at the end of *phase-II*

- (b) **Video pitch:** Every project team shall be required to create a pitch video, which is a video presentation on their major project work *phase-I & phase-II*. The project team shall present the produced video pitch during Final presentation. The produced video pitch should
 - (i) be 3 to 5-minute-long video (no longer than 5 minutes)
 - (ii) be concise and to the point, on the problem, proposed solution and its salient features
 - (iii) show project timeline and sample page of log book
 - (iv) highlight the various stages during project implementation with the help of short videos / photos / screenshots on experiments conducted, simulations carried out, prototype / working model / process / software package / system developed as part of proposed solution and also photos showing team interactions with supervisor and the team working in the lab on project
 - (v) discuss the impact of proposed solution in *ethical, environmental, societal and sustainable development contexts*
 - (vi) emphasize key points about *business idea, potential market for the proposed solution*
- (c) **Project poster:** At the end, the project teams shall present their project in the form of posters (A2 size). The teams shall have to present their work during the poster presentation session scheduled at the end of the 8th semester, at the time of demonstration of complete prototype / working model / software package / system developed
- (d) **Well-documented plagiarism-cleared project report:** Every project team shall be required to submit a well-documented project report on the work carried out, as per the format specified by the DPEC. The report should clear plagiarism check as per the anti-plagiarism policy-2020 of the institute. The following shall compulsorily be included in the Results-Chapter of the project report
 - (i) Photos / screen shots taken at various stages during the development of working model/ process/software package/system as part of Results-Chapter
 - (ii) Snapshot of final working model/ process/software package/system developed
 - (iii) Pictures of the team working in the lab, the team discussing with the project supervisor, working on creative project, or an event they are attending for work
 - (iv) *All these photos / screen shots shall be properly referred in the project report by assigning figure numbers*
- (e) **Tangible outcomes of project work in Conclusions - Chapter:** These are the lessons learnt from doing a project work. The students have to describe in their own words what they learnt from the project work experience. They have to describe what specific KSQs are acquired by them, with reference to the expected COs, after successful completion of major project work. Finally, a table depicting systematic mapping of what they have learnt and the expected major project work COs, is to be shown in the conclusions chapter
- (f) **Student feedback on major project in Conclusions - Chapter:** To gather information on whether project work was useful and gave practical experience on chosen field of interest, and other learning, a well-defined

- feedback questionnaire (*made available by the dept*) with closed and open questions shall be kept in the conclusions chapter of the project report
- (x) It is mandatory for
 - (a) every student of the team to appear for ESE oral presentation and viva-voce, to qualify for course evaluation
 - (b) every project team to write a technical paper based on the solution(s) proposed, results obtained and prototype/working model/process/software package/system developed, for submission to a reputed non-predatory conference/non-paid peer-reviewed journal
 - (c) every project team shall be required to create a pitch video, which is a video presentation on their major project work phase-I & phase-II
 - (d) every project team shall present their project in the form of a poster, during the demonstration of complete prototype/working model/software package/system developed
 - (xi) The student has to register for the Major project work phase-II as supplementary examination in the following cases:
 - (a) he/she is absent for oral presentation and viva-voce as part of ESE presentation
 - (b) he/she fails to fulfill the requirements of Major project work phase-II evaluation as per specified guidelines
 - (xii) Supplementary examination for Major project work phase-II
 - (a) The CoE shall send the list of students registered for supplementary examination to the HoDs concerned
 - (b) The DPEC, duly constituted by the HoD, shall conduct Major Project Phase-II supplementary exam and send the award list to the CoE within the stipulated time

Course Articulation Matrix (CAM):				U24CN804: MAJOR PROJECT PHASE II										
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN804.1	3	3	2	3	2	1	1	1	1	1	2	2	2
CO2	U24CN804.2	3	2	3	2	2	1	2	1	1	2	2	2	1
CO3	U24CN804.3	1	1	1	1	1	2	1	1	2	2	1	2	1
CO4	U24CN804.4	1	1	1	2	2	1	2	1	2	1	2	2	2
U24CN804		2	1.75	1.75	2	1.75	1.25	1.5	1	1.5	1.5	1.75	2	1.5
3 - HIGH, 2 - MEDIUM, 1 - LOW														

CO-SDG Alignment Matrix				
CO	CO Statement (The student should be able to...)	Relevant SDG	SDG Description	Mapping Justification
CO1	review research literature, identify gaps in the literature, formulate problem, apply knowledge of mathematics, sciences, engineering fundamentals, experimental and data analysis techniques, synthesize technical knowledge and innovative approaches to generate suitable solutions for real-world complex engineering problems (technical skills)	SDG 9	Industry, Innovation and Infrastructure	Research gap identification, problem formulation, and development of innovative engineering solutions promote technological advancement, industrial innovation, and sustainable infrastructure development in computer networks domains such as communication systems, networks, AI based networks, and cloud networks
CO2	design a system or product based on product/customer specifications, develop, analyze, and critically evaluate the design alternatives in order to justify the solutions to a real-world problem guided by ethical, environmental, societal and sustainable development considerations, use modern engineering and its tools to design, build and test a prototype within specified project timeline and budget (problem solving and critical thinking skills)	SDG 12	Responsible Consumption and Production	Engineering design considering resource optimization, environmental impact, sustainability, and efficient utilization of technology promotes responsible production and sustainable engineering practices in the networking field of networking.
CO3	apply project management and organizational skills, demonstrate integrity, leadership, creativity, professional and ethical responsibilities as an individual and as a member or leader of a multidisciplinary team	SDG 11	Sustainable Cities and Communities	Effective teamwork, ethical engineering practices, leadership, and multidisciplinary collaboration facilitate the development of sustainable technological solutions that improve societal well-being and community infrastructure.
CO4	collate the results, compare performance of prototype to design specifications and present clearly and effectively the proposed solution, conclusions and/or recommendations in written	SDG 4	Quality Education	Technical communication, dissemination of knowledge, professional documentation, and lifelong learning foster continuous education, skill enhancement, and knowledge

CO-SDG Alignment Matrix				
CO	CO Statement (The student should be able to...)	Relevant SDG	SDG Description	Mapping Justification
	(report, poster, technical paper), oral (presentations) and multimedia formats (video pitch) and engage in self-directed independent learning and life-long learning demonstrating the ksq of a professional engineer (communication skills and life-long learning)			sharing among engineering professionals.

*** End of Syllabi ***