B.TECH. CURRICULUM

ACADEMIC YEAR: 2026–27

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING (NETWORKS)

Undergraduate Rules and Regulations-2024-R26 (URR24-R25)
In accordance with the National Education Policy 2020
w.e.f AY 2026-27

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

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

(UGC Autonomous Institute Under Kakatiya University, Warangal)

Abbreviations

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

I SEMESTER

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 andCAD). (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

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	3	3
2	BSC	U24PY202B	Engineering Physics	2	1	-	3	3
3	PCC	U24CN203	Computer Architecture and Organization	2	1	-	3	3
4	PCC	U24CN204	Data Structures through C	2	1	-	3	3
5	ESC	U24EE205B	Basic Electrical Engineering	2	1	-	3	3
6	VAC	U24CY206	Environmental Studies	2	-	-	2	-
7	AEC	U24AE207	Idea Lab Makerspace	-	-	2	2	1
8	BSC	U24PY209B	Engineering Physics Laboratory	-	-	2	2	1
9	PCC	U24CN210	Data Structures through C Laboratory	-	-	2	2	1
10	ESC	U24EE211B	Basic Electrical Engineering Laboratory	-	-	2	2	1
			Total:	12	5	8	25	19
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 the2-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/Cplu s-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 DeanAA	-	-	6	-	6	3

III SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	PCC	U24CN301	Automata Theory and Compiler Design	2	1	-	3	3
2	PCC	U24CN302	Operating Systems	2	1	-	3	4
3	PCC	U24CN303	Advanced Data Structures	2	1	-	3	3
4	PCC	U24CN304	Computer Networks	2	1	-	3	3
5	PCC	U24CN305	Object Oriented Programming through Java	2	1	-	3	4
6	VAC	U24VA306B	Soft & Interpersonal Skills	-	-	2	2	1
7	PCC	U24CN307	Advanced Data Structures Laboratory	-	-	2	2	1
8	PCC	U24CN308	Computer Networks Lab oratory	-	-	2	2	1
9	PCC	U24CN309	Object Oriented Programming through Java Laboratory	-	-	2	2	1
			Total:	10	5	8	23	21
Summer/ Inter-semBridge 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)								

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	BSC	U24MH401	Discrete Mathematics and Probability, Statistics	2	1	-	3	3
2	PCC	U24CN402	Database Management Systems	2	1	-	3	4
3	PCC	U24CN403	Design and Analysis of Algorithms	2	1	-	3	4
4	PCC	U24CN404	Internetworks and Virtualization	2	1	-	3	3
5	PCC	U24CN405	Python Programming	2	1	-	3	3
6	PCC	U24CN406R25	Python Programming Laboratory	2	1	-	2	1
7	PCC	U24CN407R25	Design and Analysis of Algorithms Laboratory	-	-	2	2	1
8	PCC	U24CN408	Database Management Systems Laboratory	-	-	2	2	1
9	PCC	U24CN409	Internetworks and Virtualization Laboratory	-	-	2	2	1
10	VAC*	U24CY411*	Environmental Studies*	2*	-	-	2*	-
			Total:	12	6	6	23	21

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

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

(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)

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 andWirelss 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

V SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	OEC	U24OE501X	Open Elective – SDG	2	1	-	3	3
2	PCC	U24CN502	Full Stack 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	U26IK506B	Essence of Indian Traditional Knowledge	2	-	-	2	2
7	PCC	U24CN507	Full Stack Development Laboratory	-	-	2	2	1
8	PCC	U24CN508	Internet of Things Lab	-	-	2	2	1
9	PCC	U24CN509	Artificial Intelligence and Machine Learning Laboratory	-	-	2	2	1
11	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

Open Elective-I (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

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	OEC	U24CN601X	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	U26IK606A	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**	Design Thinking
2.	**U24OE602B**	Innovative Product Design and Development
3.	**U24OE603C**	Entrepreneurship
4.	**U24OE604D**	Design Studio
5.	**U24OE605E**	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

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. Tech (Vocational) in CSE(N))

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

Exit Option to Qualify B. Voc 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	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 forB. Voc in CSE(N)Degree.

Exit Option to Qualify B. Voc in CSE(N): Any Two (02) Skill based Courses -:								
S. No.	Category	Course Code	Course Title	L	T	P	E	C
1	SEC	U24SE610X	Software Testing Tools and Selenium *Reference:* https://www.careerpedia.co/software-testing-course-hyderabad	-	-	-	6	3
2	SEC	U24SE611X	Digital Marketing *Reference:* https://trainings.internshala.com/digital-marketing-course	-	-	-	6	3
3	SEC	U24SE612X	CISCO: Enterprise Networking,Security & Automation *Reference:* *Offered by CISCO CoE, KITSW*	-	-	-	6	3
4	SEC	U24SE613X	Bussiness Analytics *Reference:* https://trainings.internshala.com/business-analytics-course	-	-	-	6	3
5	SEC	U24SE614X	Any other skill based course approved by BoS Chair and Dean AA	-	-	-	6	3

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

VII SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	OEC	U24OE701X	Open Elective–III	2	1	-	3	3
2	PEC	U24CN702X	PE-II/MOOCS-II	2	1	-	3	3
3	PCC	U24CN703	Software Defined Networking	2	1	-	3	4
4	PCC	U24CN704	Quantum Computing	2	1	-	3	4
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	7	4
Total:				8	4	12	23	20
Additional Learning@: Maximum credits allowed for Honours/Minor				-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	24

Open Elective – III (Management Courses)		
S. No.	**Course Code**	**Course Title**
1.	U24OE701A	Managerial Economics and Accountancy
2.	U24OE701B	Industrial Psychology
3.	U24OE701C	E-Commerce and Digital Marketing
4.	U24OE701D	Organizational Behavior
5.	U24OE701E	Any other course approved by BoS Chair and Dean AA

Professional Elective-II		
S. No.	**Course Code**	**Course Title**
1.	U24CN702A	High Performance Computing
2.	U24CN702B	Cyber Physical Systems
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

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	4
5	ELC	U24CN804	Major Project, Phase–2/ Industrial Internship-2	-	-	12	12	6
Total:				6	3	12	21	16
Additional Learning@: Maximum credits allowed for Honours/Minor				-	-	-	-	4
Total credits for Honours/Minor students:				-	-	-	-	20

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 Models and LLMs
4.	U24CN802D	Data Analysis and Visualization
5.	U24CN802E	Any other course approved by BoS Chair and Dean AA

SUMMARY

SEMESTER	I	II	III	IV	V	VI	VII	VIII	TOTAL
CREDITS	21	19	21	21	21	21	20	16	160

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)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 2: Cloud Computing	**U24CN602B:** Fog and Edge Computing	**U24CN702B:** High Performance Computing	**U24CN801B:** Cloud Security	**U24CN802B:** Bigdata with Cloud Computing
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
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)			
	Equivalent MOOC approved by BoS Chair and Dean AA			
VERTICAL 4: Data Science	**U24CN602D:** Statistical Fundamentals	**U24CN702D:** Principles of Data Science	**U24CN801D:** Data Warehousing & Data Mining	**U24CN802D:** Data Analysis & Visualization
	(OR)			
	Equivalent MOOC approved by BoS Chair and Dean AA			

I SEMESTER

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):

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

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 appropriate methods of differential equations of first order and first degree to solve real life 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 (Geometrica linterpretation), 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 differential ability [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: exercise9.7(1, 7)]
Additional problems on fundamental theorems [(Text1: topic4.3, Solved problems: 4.13(i), 4.14, 4.17, Practice problems: exercise4.4 (1(i),1(ii), 3(ii), 10(i), 10(ii))]
Additional problems on Maclaurin's series [(Text1: 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, n 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 [(Text1: 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 [(Text1: topic (5.12), Solved problems: 5.45, 5.48, Practice problems: exercise 5.10 (3(i) ,3(ii))]

UNIT-III	**9 Hrs**

Differentialequationsoffirstorder (DE): Reorientation of differential equation of first order and first degree (Formation a differential equation, variables separable method, homogeneous equations, Linear equations), Exactdifferential equations, Equations reducible to exact equations,

Applications of differential equations of first order: Orthogonal trajectories - Orthogonal

trajectoriesof 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-exactDEs[(Text1: topic11.12(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 [(Text1: 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
Applicationsoflineardifferentialequations: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.,*Higher Engineering Mathematics*, Khanna Publishers, Delhi, 44th edition, 2017.

Reference Book(s):

1. Shanti Narayan, Dr. Mittal P.K, *Differential Calculus*, S. Chand & Co., New Delhi, 1stedition, Reprint 2014.
2. Kreyszig E, *Advanced Engineering Mathematics*, Inc, U.K, John wiely& sons, 10th edition, 2020.
3. S.S. Sastry, *Engineering Mathematics, Vol.II,* Prentice Hall of India, 3rd edition, 2014.

Web and Video link(s):

1. https://youtu.be/4EYko9rdF7g?si=WUu12*NPTEL Video Lecture on Infinite seriesby Prof. S.K.Ray, Professor of Mathematics, IITK Kanpur.*
2. https://youtu.be/0apMXhWG_W8?si=M-abw2Gq3buX5HLM*NPTEL Video Lecture on Fundamental mean value theorems by Prof. Jithedra Kumar, Professor of Mathematics, IITK Kharagpur.*
3. https://youtu.be/6r5jfT8xrXM?si=ryLXYVJr4-iUkdlV; *NPTEL Video Lecture on Exact Differential Equations, Prof. Jithedra Kumar, Professor of Mathematics, IIT Kharagpur.*
4. https://youtu.be/kbGhrqV9AOM?si=yGyK_V7kJKGa3OaR*NPTEL Video Lecture on Orthogonal Trajectories of family of curvesby 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. Jithedra 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	-	-
CO2	U24MH101.2	2	2	1	1	-	-	-	1	1		1	-	-
CO3	U24MH101.3	2	2	1	1	-	-	-	1	1		1	-	-
CO4	U24MH101.4	2	2	1	1	-	-	-	1	1		1	-	-
U24MH101		**2**	**2**	**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	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 (CH_3COOH) 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 (Fe^{2+}) 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, *Engineering Chemistry*, Dhanpat Rai Publishing Company, 17thEdn., 2019 (chapters 1, 3, 5, 6, 7, 35, 36, 37)
2. Dornfeld, D.A., *Green manufacturing: fundamentals and applications,* Springer Science & Business Media, 2012 (chapters 5, 8, 9)

Reference Book(s):

1. J.C. Kuriacose and J. Rajaram, *Chemistry in Engineering and Technology* (vol. I), Tata Mc. Graw-Hills Education Pvt. Ltd., 2010
2. Shashi Chawla, *Text book of Engineering Chemistry*, 3rdEdn., Dhanpat Rai Publishers, 2003
3. S.S. Dara, S.S. Umare, *A Text book of Engineering Chemistry*, 12thEdn., S. Chand & Company Ltd.,2010

Web and Video link:

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** *The student should be able to…*	**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 cellsprovide 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 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 techniquedevelops knowledge of

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				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):

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

CO1: apply Karnaugh maps for minimization of switching functions

CO2: design combinational circuits for real world applications

CO3: design sequential circuits for real world applications

CO4: design logic circuits using PLDs

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): *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)*

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): *Serial adder (Text1: topic 4.3), BCD to Seven Segment Decoder (Text1: topic 5.5), Solved problems on multiplexers (Ref.2: 4.29)*

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): *Mod-n asynchronous counters(Ref.2: topic 6.26), Solved problems on synchronous counters (Ref.2: topic 6.29)*

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): *Combinational circuit implementation (Ref.2: topic 8.4), Solved problems on ROM implementation (Ref.2: Example 8.1, 8.2, 8.3)*

Textbook(s):

1. Moris Mano, *Digital Design,* PHI, 4th edition, New Delhi, 2003
2. Zvi. Kohavi, *Switching and Finite Automata Theory*, Tata McGraw-Hill,New Delhi, 2nd edition, 2008

Reference Book(s):

1. R.P. Jain, *Modern Digital Electronics*, Tata McGraw-Hill, 3rd edition, New Delhi, 2003
2. A. Anand Kumar, *Fundamentals of Digital Circuits,* PHI, 3rd edition, New Delhi, 2014

3. Herbert Taub and Donald Schilling, *Digital Integrated Circuits*, Tata McGraw-HillNew Delhi, 2008
Web and Video link: 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** *The student should be able to…*	**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 minimization techniques.	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** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
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):

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

(based on cognitive skills acquired from theory component)

CO1: enumerate programming development steps, design an algorithm and draw a 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

(based on psychomotor skills acquired from laboratory component)

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

Self Learning Topics (SLTs): *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, *Programming in ANSI C*, 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):

1.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*

2.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** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	enumerate programming development steps, design an algorithm and draw flow chart for a given application	SDG4	Quality Education	Algorithm design and flowchart development strengthen computational thinking and problem-solving skills, which are fundamental competencies for 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):

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

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

- Paragraph Writing-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 clarity and brevity

LIFE SKILLS: Ethical Values and Humanity, TheLastLeaf: A Short Story by O.Henry

Self Learning Topics(SLTs):

Articles-(Text2,Unit-II),EnglishVocabulary(Text2,Unit-I,Unit-II,Unit-III)
Verb Forms (Reference book1,Topic:31),Tenses(Referencebook1,Topics:16,17,18,19)
Reported Speech (Reference book 2, Exercises for Practice, Topics : 161-167)

UNIT-II	**9 Hrs**

GRAMMAR

- Tenses-Revision-Exercises for practice
- Subject-Verb Agreement
- Reported Speech-Transformation
- Sentence Correction-Emphasis Concord ,Report Speech, Sentence Structures

VOCABULARY

- Synonyms-Antonyms-Single Word Substitutes-PopularAbbreviations

READINGSTRATEGY

- EmphasisonScanningtheText-Purpose-Advantages-Examples,ExercisesandPracticethroughTeamwork

WRITINGPRACTICES

- LetterWriting-EffectiveLetterWritingTechniques-InformationSeekingLetters-JobApplicationLetters- Apology Letters-Explanation to Memos- E-mails-Cover Letters-Resume

LIFE SKILLS: Determination

- How I Became a Public Speaker: An essay by George Bernard Shaw
- ***SelfLearningTopics(SLTs):****EnglishVocabulary(Text2,Unit-I,Unit-II,Unit-III),Tenses(Referencebook3,Topic-30, Exercises,30.1,30.2,30.3)*

UNIT-III	9 Hrs

GRAMMAR

- Tenses-Revision-Exercises for Practice
- Nouns-Prepositions-Adverbs-Adjectives
- Sentence Correction: Correct Use of tenses, nouns, prepositions, adverbs and adjectives

VOCABULARY

- Phrasal Verbs-Technical Words-Latin Words

READINGSTRATEGY

- IntensiveReading-purpose-TypesofComprehensionQuestions-Examples,ExercisesandPracticethrough Teamwork

WRITINGPRACTICES

- ReportWriting-Definition-Purpose-QualitiesofaGoodReport-FormalandInformalReports-Report Format-Sample Reports-Exercises
- Emphasis on Technical Reports

LIFE SKILLS: Positive Attitude

- Be the Best of Whatever You Are: A Poem by Douglas Malloch

Self Learning Topics(SLTs):
PartsofSpeech(Textbook1,Unit-I),Tenses(Referencebook1,Topics-16,17,18,19)
Phrasal Verbs (Reference book 3)

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

ACTIVEREADING and NOTE-MAKING

- Note-Making-Definition-Purpose-Effectiveness

WRITINGPRACTICES

- 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(Referencebook2, Topics:152-157))

Textbook(s):

1. Sanjay Kumar& PushpLata,"*English Language and Communication Skills for Engineers*" As per the latest AICTE syllabus,Oxford University Press, 1st edition 2018
2. *"Language and Life: A Skill'sApproach"* Based on the latest AICTE model curriculum Orient Black swan Private Limited 2nd Edition 2019.

Reference Book(s):

1. Thomson A.J. ,Martinet A.V.,"*APracticalEnglishGrammar*",OxfordUniversityPress 3rdEdition1997
2. Thomson A.J. ,.Martinet A.V,"*APracticalEnglishGrammar*"Exercise2,OxfordUniversity Press 3rdEdition1997
3. StandardAllen W. ,"*LivingEnglishStructure*",PearsonIndiaEducationPvtLtd. 5thEdition2009

Web and Videolink(s):

1. https://onlinecourses.nptel.ac.in/noc20_hs56/preview Technical English for Engineers by Aisha Icbal, IITMadars
2. https://onlinecourses.swayam2.ac.in/cec21_lg13/preview Indian Writing in English by Dr.Bindu Ann Philip, StMary's College Trissur

Course Articulation Matrix(CAM):		**U24MH105: ENGLISH COMMUNICATION & REPORTWRITING**												
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** *Thestudentshouldbeable to…*	**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 certainof her death when the last leaf falls
		SDG-5	Gender equality	This also aligns with SDG-5 as is 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 strengtheninggrammar,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 resumeseffectively applying grammar rules and using relevant vocabulary .
		SDG-8	Decentwork and economic growth	This aligns with SDG-8 as it indirectly contributes to economic 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 lengthytext, prepare SoP (Statement of Purpose) effectively and solve critical problems in life with emotional balance.	SDG-4	Quality education	This aligns with SDG-4 as it orientates the students towards reading and writing, and improves critical and critical thinking
		SDG-16	Peace, justice, and strong institutions	Though not completely, it aligns with SDG-16 partially as it emphasizes the need to give up anger which isthe 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 demonstrate …

CO1: demonstrate physical fitness by performing yoga aasanas

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

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:

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:

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

WebandVideolink(s):

1. Badminton game Video Link: https://www.youtube.com/watch?v=HucIqi8Lw3E&t=22s
2. Basket ball game Video Link: https://www.youtube.com/watch?v=-tkE2lJoR58
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	PSO1	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** *The student should be able to*	**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)

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

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., *Elementary Engineering Drawing*, Charotar Publishing House, Anand, India, 2017.
2. Kulkarni D. M., Rastogi A. P., and Sarkar A., *Engineering Graphics with AutoCAD*, PHI publisher, revised edition, July 2010.

Reference Book(s):

1. Dhananjay A Jolhe, *Engineering Drawing*, Tata Mc Graw- Hill, 2008.
2. Venugopal K. *Engineering Graphics with Auto CAD*, New Age International Publishers Ltd., Hyderabad, 2012.
3. Luzadder W.J and Duff J.M, *Fundamentals of Engineering Drawing*, Prentice-Hall of India, 1995.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc20_me79/preview *NPTEL video link for* ***Engineering drawing and computer graphics*** *By Prof. Rajaram Lakkaraju, IIT Kharagpur.*

Laboratory Manual (for laboratory component):

1. *Engineering Graphics through CAD Laboratory Manual & Record Book,* 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**
3 – HIGH, 2 – MEDIUM, 1 - LOW														

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):

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

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:

- **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
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:

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 teacheras 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):

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

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 activitiesstudent 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: E**minent 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):

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

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.

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

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

II-Sem Syllabi

(B.Tech CSE(Networks) URR24-R25)

II SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	BSC	U24MH201	Matrix Theory and Vector Calculus	2	1	-	3	3
2	BSC	U24PY202B	Engineering Physics	2	1	-	3	3
3	PCC	U24CN203	Computer Architecture and Organization	2	1	-	3	3
4	PCC	U24CN204	Data Structures through C	2	1	-	3	3
5	ESC	U24EE205B	Basic Electrical Engineering	2	1	-	3	3
6	VAC	U24CY206	Environmental Studies	2	-	-	2	-
7	AEC	U24AE207	Idea Lab Makerspace	-	-	2	2	1
8	BSC	U24PY209B	Engineering Physics Laboratory	-	-	2	2	1
9	PCC	U24CN210	Data Structures through C Laboratory	-	-	2	2	1
10	ESC	U24EE211B	Basic Electrical Engineering Laboratory	-	-	2	2	1
Total:				12	5	8	25	19
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-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: 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 Gaussdivergence 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 linearsystem 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:
Lineintegral, 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):

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

Reference Book(s):

1. Spiegel M, *Vector Analysis* -Schaum's Series, McGraw Hill,2nd edition, 2017
2. Sastry, *Engineering Mathematics, Vol.II,* Prentice Hall of India, 3rd edition, 2014.
3. 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=CNNA58OIuszubPiX: *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** *The student should be able to…*	**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		**Branches:** CSM, CSD, CSO, CSN, IT	
Course Code:	**U24PY202B**	**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: analyse the phenomena of interference, diffraction and polarization, working principles and applications of lasers

CO2: assess the operation and applications of optical fibre and interpret the formation and characteristics of special diodes through semiconductor physics principles

CO3: aluate the magnetic and superconducting properties of materials and justify their use in engineering applications

CO4: estimate the energy values of a particle in an infinite potential well and apply quantum mechanical principles to understand quantum computing

UNIT-I	**9 Hrs**

Applied Optics: Principle of Superposition, Concept and Types of interference, Interference in thin film due to reflection, Newton's Rings and its applications, Non- reflecting films; Definition and types of Diffractions, Single Slit Diffraction, Diffraction Grating- types and applications (qualitative); Introduction to Polarization, Malus law, Brewster's law, Double Refraction, Optical activity, LCD (qualitative)

Lasers: Difference between conventional light and laser,Basic principles and characteristicsof lasers, Absorption,Spontaneous and stimulated emission,Population inversion, Pumping methods, Optical resonator;Types of lasers,Ruby laser, Nd:YAG laser and He-Ne laser; Applications of lasers

UNIT-II	**9 Hrs**

Fiber Optics: Introduction,Total internal reflection,Optical fiber construction,Numerical aperture and acceptance angle,Types of optical fibers - Step index and graded index, Modes of propagation in an optical fibre;V-number;Power losses in optical fibers - Attenuation, Dispersion, Bending;Applications of optical fibers- Fiber optic communication system,Endoscopy,Fiber optic sensors- active and passive sensors

Semiconductor Physics: Classification of solids based on energy band theory-Conductors, Semiconductors and insulators;Types of semiconductors- carrier generation and recombination(qualitative); PN junction diode, Diode current equation and Diode current dependence on forward and reverse voltages; Direct and indirect band gap semiconductors, Light emitting diode (LED) and Photo diode

UNIT-III	**9 Hrs**

Magnetic materials: Introduction, Permeability, Magnetization, Susceptibility, Origin of magnetism, Bohr magneton, Ferro, Antiferro and ferri magnetic materials, Hysteresis, Soft and hard magnetic materials; Magnetic memories- core and bubble memories

Superconducting materials: Superconductivity, properties of superconductors, Transition temperature, Critical magnetic field and critical current, Isotope effect, Meissner effect, Type-I and type-II superconductors, High T_c superconductors, Magnetic levitation, Applications of superconductors

UNIT-IV	**9 Hrs**

Elements of Quantum Mechanics: Wave-particle duality, de-Broglie wavelength, Physical significance of wave function, Schrodinger time-independent wave equation, Schrodinger time-dependent 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

Textbook(s):

1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, *A Textbook of Engineering Physics,* S. Chand & Company Ltd, 11th edition, 2018 (Unit-I, II, III & IV)
2. S Salivahanan, N Suresh Kumar, *Electronic devices and circuits,* Mc Graw Hill edition, 2017 (Unit-II-Chapter 4 & 5)
3. Michael Nielsen and Isaac Chuang, *Quantum Computation and Quantum Information,* Cambridge University Press, 2010(Unit-IV-Chapter 1.1, 1.2 & 1.3)

Reference Book(s):

1. Neil Gershenfeld, *Physics of Information Technology*, Cambridge University Press, 1st edition, 2000
2. V. Rajendran, *EngineeringPhysics*,McGrawHill edition, 2013
3. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction,* 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 Superconductivityby Prof. Arghya Taraphder IIT Kharagpur*
2. https://onlinecourses.nptel.ac.in/noc24_lw07/preview; *NPTEL video lecture onIntroduction 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. SheshashayeeRaghunathan, IIT Madras*

Course Articulation Matrix (CAM):		**U24PY202B: ENGINEERING PHYSICS** (*for CSM, CSD, CSO, CSN&IT)*												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
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	**U24PY202.4**	2	1	-	-	-	1	1	1	1	1	1	-	-
U24PY202B		2	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	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-storage devices and high-speed transport systems, contributing

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				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-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: analyze instruction formats and addressing modes of assembly language

CO2: examine hardwired & CISC style processors and solve arithmetic operations using signed and unsigned integers

CO3: assess cache memory mapping techniques and examine data transfer between processor, memory & I/O

CO4: evaluate different modes of data transfer, classify interconnection structures

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, SafwatZaky,Naraig Manjikian, Computer Organization and

Embedded Systems, 6thed.,New Delhi: McGraw-HillEducation,2012. (Chapters1,2,5,7-9)
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, 2nded.,USA: Morgan Kauf mannisanim print of Elsevier,2013.(Chapters1,2)

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:

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** *The student should be able to…*	**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:**	**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: 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

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,Prob2,Prob3,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)
Textbook: 1. Debasis Samanta, *Classic Data Structures*, Prentice Hall India, 2nd edition, 2009
Reference Book(s): 1. Reema Thareja, *Data Structures Using C*, Oxford University Press, 2nd edition, 2014 2. Balagurusamy E, *Data Structure Using C*, McGraw Hill Education, 1st edition, 2017 3. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach with C*, 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.*

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**
U24CN204		**2**	**2**	**2**	**1.75**	**-**	**-**	**-**	**1**	**1**	**1**	**1.75**	**2**	**1.75**

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**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

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
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 CSE, CSE-Allied, IT	
Course Code:	**U24EE205B**	**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 network reduction, Kirchhoff's laws, nodal and mesh analysis to determine resistance, voltage, current & power in electrical circuits

CO2 : evaluate impedance, voltage, current, and power in 1- Ø AC circuits & select suitable motor for given application

CO3 : evaluate the voltage and current characteristics of PN junction diode and Zener diode

CO4 : evaluate the voltage and current characteristics of transistors and select suitable sensor for given application

UNIT-I	**9 Hrs**

DCcircuits: Networkelements,Linear&non-linearelements,Active&passiveelements,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, Mesh analysis & Nodal analysis

UNIT-II	**9 Hrs**

1-Ø AC circuits: R.M.S value, Average value, Concept of phasor, Phase and phase difference, Rectangular and polar form representation, Basic Sinusoidal steady state analysis of R, L, C, Series RL, RC, RLC circuits and Power factor.

Electrical Machines (Qualitative treatment): Construction, Principle of operation & applications of 1-Ø transformer, 1-Ø induction motor, DC motor, Stepper motor, and BLDC motor

UNIT-III	**9 Hrs**

Diodes: P-NJunctiondiode,volt-ampcharacteristics,Zenerdiode,volt-ampcharacteristics,Half-wave rectifier and Full-wave rectifier (center-tapped)

Rectifiers: P-N junction as a rectifier - Half Wave Rectifier, Ripple Factor - Full Wave Rectifier, Bridge Rectifier

UNIT-IV	**9 Hrs**

Transistors: Bi-polarJunctionTransistorsymbol,operationofN-P-NandP-N-Ptransistors,Characteristics of BJT (CE, CB & CC configurations), Applications of diodes and transistors

Sensors and Transducers: Introduction to Sensors and Transducers, Thermocouple, Thermistor, Resistance Temperature Detector (RTD), Hall Effect Sensor, Piezoelectric Sensor, Light Dependent Resistor (LDR), Ultrasonic Sensor, Applications of Sensors in IoT

Textbook(s):

1. K. Uma Rao, *Basic Electrical Engineering*, 5th ed., 2011, Pearson Education, Delhi. (Part-I-*Chapters 1 to 5, Part-II-Chapters 1 to 4 and 7*)
2. S Salivahanan& N Suresh Kumar, *Electronic Devices and Circuits*, 5th ed., 2006, Tata McGraw Hill, Delhi. (*Chapters 1 to 3*)

Reference Book(S):

1. B.L.Thereja, A.K.Thereja, *Electrical Technology Vol. I & II*, 2005, S.Chand& Company Ltd.
2. Chakravarthy A, Sudhipanath and Chandan Kumar, *Basic Electrical Engineering*, 3rd ed., 2009, Tata McGraw Hill, Delhi.

Web and Video link(s):

https://nptel.ac.in/courses/108105112; *Fundamentals of Electrical Engineering, by Prof. Debapriya Das, Professor, IIT Kharagpur*.

Course Articulation Matrix (CAM):		U24EE205B: BASIC ELECTRICAL ENGINEERING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24EE205B.1	3	3	1	1	1	–	–	–	1	1	1	3	–
CO2	U24EE205B.2	3	3	1	1	1	–	–	–	1	1	1	3	–
CO3	U24EE205B.3	2	2	1	1	1	–	–	–	1	1	2	2	–
CO4	U24EE205B.4	2	1	1	1	1	–	–	–	1	1	–	2	–
U24EE205B		2.5	2.25	1	1	1	–	–	–	1	1	1.33	2.25	-
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

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				infrastructure modernization.
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.II Semester		**Branch:** Common to ME, CSM, CSD, IT, CSN & CSO	
Course Code:	**U24CY206**	**Credits:**	**0**
Hours/Week(L-T-P-E):	**2-0-0-2**	**CIE:**	**60%**
Total Number of Teaching Hours:	**24Hrs**	**ESE:**	**40%**

Course Learning Outcomes(COs):

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

CO1:identifythenaturalresources and practice their usage more equitably

CO2:developanactionplanforsustainablealternativesandconserving 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, Green house 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

SelfLearningTopics(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. ErachBharucha,*TextBook of EnvironmentalStudies for UnderGraduateCourses,* ***2nd Edn.,UniversitiesPress(India)Pvt.Ltd,*****2013**

ReferenceBook(s):

1. Y. Anjaneyulu, *Introduction to Environmental Science*, B.S. Publications, 2004.
2. Gilbert M. Masters, *Introduction to Environmental Engineering & Science*, 3rdEdn., Prentice Hall of India,1991
3. Anubha Kaushik, C.P. Kaushik, *Environmental Studies*, 4thEdn., New Age International Publishers,2014
4. R. Rajagopalan, *Environmental Studies from crisis to cure*, Oxford University Press, 2nd Edn., 2011

WebandVideolink(s):

1. https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ch27/ video*lecture 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):		**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** *The student should be able to…*	**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.
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-E):	**0-0-2-2**	**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: 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	**U24AE107.1**	2	2	1	1	2	1	-	1	2	2	1	1	1
CO2	**U24AE107.2**	2	2	1	1	2	1	-	1	2	2	1	1	1
CO3	**U24AE107.3**	2	2	1	1	2	1	-	1	2	2	1	1	1
CO4	**U24AE107.4**	2	2	1	1	2	1	-	1	2	2	1	1	1
U24AE107		**2**	**2**	**1**	**1**	**2**	**1**	**-**	**1**	**2**	**2**	**1**	**1**	**1**

ENGINEERING PHYSICS LABORATORY

Class: B.Tech. II – Semester		**Branches:** CSM, CSD, CSO, CSN, IT	
Course Code:	**U24PY209B**	**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)

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

CO1: asure small lengths and diameters of wires, hollow tubes and thin objects using Vernier callipers and a screw gauge

CO2: ermine the wavelength of light and the dimensions of fine slits using interference and diffraction phenomena, including Newton's Rings and laser diffraction techniques

CO3: luate the numerical aperture of an optical fibre and the dielectric constant of a material using experimental setups

CO4: lyse the energy band gap and V-I characteristics of semiconductor devices such as PN junction diodes and LEDs

List of Experiments

1. Linear Measurements using Vernier callipers and screw gauge
2. Diffraction grating by normal incidence method
3. Determination of Wavelength of Sodium light using Newton's Rings
4. Determination of slit width using He-Ne laser
5. a. Determination of wavelength of He-Ne laser using reflection diffraction grating
   b. Determination of wavelength of He-Ne laser-using transmission diffraction grating
6. Determination of slit width using He-Ne laser
7. Numerical aperture and acceptance angle of an optical fiber
8. Determination of dielectric constant of materials using parallel plate capacitor
9. Energy band gap of a semiconductor material
10. Determination of Planck's constant
11. Study of V-I characteristics of PN junction diode
12. Study of V-I characteristics of LED

Textbook(s):

1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, *A Textbook of Engineering Physics,*S.Chand& Company Ltd, 11th edition, 2018 (Unit-I, II, III & IV)
1. S Salivahanan, N Suresh Kumar, *Electronic devices and circuits,* Mc Graw Hill edition, 2017 (Unit-II-Chapter 4 &5)
2. Michael Nielsen and Isaac Chuang, *Quantum Computation and Quantum Information,* Cambridge University Press, 2010(Unit-IV-Chapter 1.1, 1.2& 1.3)

Reference Book(s):

1. Neil Gershenfeld, *Physics of Information Technology*, Cambridge University Press, 1stedition, 2000
2. V. Rajendran, *Engineering Physics*, McGraw Hill, 2013
3. Eleanor Rieffel and Wolfgang Polak, *Quantum Computing: A Gentle Introduction,* 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, 5thedition, 2014

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc24_ph28/preview; NPTEL *video lecture on Concepts in Magnetism and SuperconductivitybyProf. Arghya Taraphder IIT Kharagpur*

2. https://onlinecourses.nptel.ac.in/noc24_lw07/preview; *NPTEL video lecture onIntroduction 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. SheshashayeeRaghunathan, IIT Madras*

Laboratory Manual:

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):		**U24PY209B: ENGINEERING PHYSICS LABORATORY** (*for CSM, CSD, CSO, CSN&IT*)												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	U24PY209B.1	2	1	1	-	1	1	1	1	2	-	1	-	-
CO2	U24PY209B.2	2	1	-	-	1	1	1	1	2	-	1	-	-
CO3	U24PY209B.3	2	1	-	-	1	1	1	1	2	-	1	-	-
CO4	U24PY209B.4	2	1	-	1	1	1	1	1	2	1	1	-	-
U24PY209B		2	1	1	1	1	1	1	1	2	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	measure diameter of wire and hollow tubes using Vernier callipers and screw gauge	SDG 4	Quality Education	Precision measurement using Vernier callipers and a screw gauge is a foundational laboratory skill. Hands-on experimentation with standard instruments builds scientific competency, promotes inquiry-based learning, and strengthens the quality of engineering education envisioned by SDG 4
CO2	determine the wavelengths of spectral lines using normal incidence method and Newton's Rings, and the width of a narrow slit and wavelength of laser using diffraction phenomenon	SDG 4, SDG 9	Quality Education	Experiments on diffraction grating, Newton's Rings and laser diffraction build core optical-physics competencies and experimental rigor, strengthening quality, inquiry-based STEM education as envisaged by SDG 4
			Industry, Innovation & Infrastructure	Wavelength and slit-width determination using lasers and diffraction gratings underpin precision metrology, photonics and laser-based sensing technologies that drive innovation in industrial and communication infrastructure

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO3	calculate the numerical aperture of an optical fiber and the dielectric constant of a material	SDG 9	Industry, Innovation & Infrastructure	Numerical aperture characterization of optical fibres is fundamental to fibre-optic communication systems, while dielectric constant measurement supports the design of capacitors and insulating materials used in electronic and energy infrastructure, both central to SDG 9
CO4	determine energy band gap, forward voltage and currents from V-I characteristics of semiconductor diodes	SDG 7, SDG 9	Affordable & Clean Energy	Energy band-gap determination and diode/LED V-I characterization underpin the design of energy-efficient semiconductor devices and solid-state lighting, supporting affordable and clean-energy solutions
			Industry, Innovation & Infrastructure	PN junction diodes and LEDs are fundamental building blocks of electronic circuits; experimental characterization of their behaviour supports innovation in the electronics and semiconductor industry

DATA STRUCTURES THROUGH C LABORATORY

Class: B.Tech. II –Semester		**Branch:** CSE (Networks)	
Course Code:	**U24CN210**	**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 Objectives (LOs):

This course will develop students' knowledge in /on…

LO1:time complexity, space complexity, array operations, and dynamic memory allocation

LO2:stacks and various forms of queues

LO3:various types of linked lists

LO4:various sorting techniques and hashing techniques

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:

1. Debasis Samanta, *Classic Data Structures*, Prentice Hall India, 2nd edition, 2009

Reference Book(s):

1. Reema Thareja, *Data Structures Using C*, Oxford University Press, 2nd edition, 2014
2. Balagurusamy E, *Data Structure Using C*, McGraw Hill Education, 1st edition, 2017
3. Richard F. Gilberg and Behrouz A. Forouzan, *Data Structures: A Pseudocode Approach with C*, 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):

Data Structures through C Laboratory Manual and Record Book, Department of CSE (IoT), KITSW.

Course Articulation Matrix (CAM):		**U24CN210: DATA STRUCTURES THROUGH C LABORATORY**												
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	**U24CN210.1**	2	2	2	1	-	-	-	1	1	1	1	**2**	**1**
CO2	**U24CN210.2**	2	2	2	2	-	-	-	1	1	1	2	**2**	**2**
CO3	**U24CN210.3**	2	2	2	2	-	-	-	1	1	1	2	**2**	**2**
CO4	**U24CN210.4**	2	2	2	2	-	-	-	1	1	1	2	**2**	**2**
U24CN210		**2**	**2**	**2**	**1.75**	**-**	**-**	**-**	**1**	**1**	**1**	**1.75**	**2**	**1.75**

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	develop and test basic data structures and array operations, including dynamic memory allocation to evaluate their performance and complexity	SDG 4	Quality education	These experiments build core computational thinking — traversal, searching, and dynamic memory management. Comparing linear vs binary search introduces algorithmic reasoning and efficiency trade-offs, directly reflecting SDG 4's goal of equipping learners with relevant, practical technical skills. DMA-based matrix operations further develop disciplined, structured problem-solving essential for quality engineering education
CO2	apply the linear data structures such as stacks and queues and perform various operations using LIFO or FIFO order respectively	SDG 9	Industry, Innovation and Infrastructure	Stacks, queues, and expression evaluation are the structural foundation of compilers, OS schedulers, and runtime systems — real industrial infrastructure. Infix-to-postfix conversion mirrors how compilers parse code; queues model network packet management and CPU job scheduling. Recursion (Tower of Hanoi, Fibonacci) drives innovation in algorithm design, aligning strongly with SDG 9's emphasis on resilient, modern technological infrastructure
CO3	solve problems using various linked list representations for efficiently storing and retrieving the data	SDG 4	Quality education	Linked list variants demand abstract thinking about pointers, dynamic memory, and node relationships — among the most cognitively demanding topics in undergraduate CS. Mastering singly, circular, doubly, and circular-doubly linked lists builds deep structural understanding, reflecting SDG 4's focus on high-quality, skill-building education. Reimplementing stacks and queues via linked lists reinforces conceptual reuse and flexible thinking
CO4	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	SDG 9	Industry, Innovation and Infrastructure	Sorting algorithms and hash tables are indispensable in industry-grade systems — database query optimisation, search engine indexing, caching layers, and load balancers all depend on them. Radix sort is used in network routing; hash tables power key-value stores like Redis and DNS lookups. These experiments directly develop skills for building scalable, innovative digital infrastructure, the core of SDG 9

BASIC ELECTRICAL ENGINEERING LABORATORY

Class: B. Tech. II – Semester		**Branch:** Common to CSE,CSE-Allied,IT	
Course Code:	**U24EE211B**	**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)

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

CO1 : validate mesh and nodal analysis

CO2 : determine the impedance of the series RL, RC circuits

CO3 : determine the efficiency of transformer by conducting load test and verify Kirchoff's laws using PSPICE

CO4 : determine the characteristics of BJT and parameters of a rectifier circuit

List of Experiments

1. Verification of voltage divider rule and current divider rule
2. Verification of Mesh Analysis
3. Verification of Nodal Analysis
4. Determination of internal parameters of a choke coil
5. Impedance calculations and phasor representation of R-L series circuit
6. Impedance calculations and phasor representation of R-C series circuit
7. Load test on 1-phase transformer
8. Single phase bridge rectifier using R load
9. Zener diode as voltage regulator
10. Input and output characteristics of BJT
11. Verification of Kirchoff's laws using PSPICE / MATLAB
12. Interfacing Sensors with Arduino using TINKER CAD
    a. LED blinking
    b. IR Sensor
    c. Ultrasonic Sensor
    d. Voltage Sensor
    e. Current Sensor
    f. Speed Sensor

Textbook(s):

1. K. Uma Rao, *Basic Electrical Engineering*, 5th ed., 2011, Pearson Education, Delhi. (*Chapters 1 to 9*)
2. S Salivahanan& N Suresh Kumar, *Electronic Devices and Circuits*, 5th ed., 2006, Tata McGraw Hill, Delhi. (*Chapters 1 to 6, 8 to 13*)

Reference Book(S):

1. B.L.Thereja, A.K.Thereja, *Electrical Technology Vol. I & II*, 2005, S.Chand& Company Ltd.
2. Chakravarthy A, Sudhipanath and Chandan Kumar, *Basic Electrical Engineering*, 3rd ed., 2009, Tata McGraw Hill, Delhi.

Laboratory Manual:

Basic Electrical & Electronics Engineering Laboratory Manual, Department of EEE, KITSW

Course Articulation Matrix (CAM):		U24EE211B: BASIC ELECTRICAL ENGINEERING LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24EE211B	3	3	2	2	1	-	-	-	2	2	-	2	1
CO2	U24EE211B	3	2	2	3	1	-	-	-	2	2	-	2	1
CO3	U24EE211B	2	2	3	2	3	-	-	-	2	2	-	3	2
CO4	U24EE211B	3	2	2	2	1	-	-	-	2	2	-	3	2
U24EE211B		2.75	2.25	2.25	2.25	1.5	-	-	-	2	2	-	2.5	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	validate mesh and nodal analysis along with voltage and current divider rules	**SDG 4**	Quality Education	Performing circuit analysis experiments builds foundational knowledge in electrical engineering, enhancing quality technical education and analytical skills
CO2	determine the impedance of series RL and RC circuits and represent phasor diagrams	**SDG 9**	Industry, Innovation and Infrastructure	Impedance calculations and phasor analysis are essential for AC circuit design, power factor correction, and industrial electrical infrastructure development
CO3	determine the efficiency of a single-phase transformer by load test and verify Kirchhoff's laws using PSPICE	**SDG 7** & **SDG 9**	Affordable and Clean Energy; Industry, Innovation and Infrastructure	Transformer efficiency testing promotes energy conservation (SDG 7); simulation using PSPICE / MATLAB encourages digital innovation in engineering (SDG 9)
CO4	determine the input-output characteristics of BJT and parameters of a rectifier circuit including zener diode as voltage regulator	**SDG 9**	Industry, Innovation and Infrastructure	BJT characteristics and rectifier circuits form the backbone of power supplies, sensor interfaces, and reliable electronic infrastructure for industrial applications

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))

(iii) The candidate should pass any two of the following additional courses (ITI Level) during the2-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)

(iv) 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/Cplu s-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 DeanAA	-	-	6	-	6	3

COMPUTER NETWORKS FUNDAMENTALS

Class: B. Tech syllabi of Exit Course for UG certificate inCSE(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)

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

(based on cognitive skills acquired from theory component)

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

(based on psychomotor skills acquired from laboratory component)

CO5: make use of reference models OSI & TCP/IP.
CO6: develop error detection mechanism.
CO7: constructrouting 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 toApplication 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 Illustratenetwork diagram of different network types (LAN, MAN,WAN)

2. Illustrate physical and logical diagrams of a campus network and draw the networkdiagram 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 serverusingTCP
6. Develop a socket program to implement date and time display from client to serverusingU D P
7. Develop a socket program to implement chat application usingTCP
8. Develop a java program to implement sliding windowprotocol
9. Develop a program for error detection code using CRC-CITTT(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														

JAVA PROGRAMMING

Class: B. Tech syllabi of Exit Course for UG certificate inCSE(NETWORKS)		**Branch:** CSE(Networks)	
Course Code:	**U24CN212**	**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)

After completion of this course, the students should be able to,
(based on cognitive skills acquired from theory component)

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

(based on psychomotor skills acquired from laboratory component)

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

Inheritance: 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

UNIT-IV	4 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, 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

Textbook:

1. HerbertSchildt, Java The Complete Reference, 11th ed., New Delhi: McGraw-Hill Education,2019

Reference Book(S):

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

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc24_cs105/preview; *NPTEL Video Lecture on Programmingin Java By Prof. Debasis Samanta, IIT Kharagpur.*

Laboratory Manual (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														

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):

This course will develop students' knowledge in/on . . .

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 datamodels 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 retrievalqueries 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 ofsecond 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, Characterizingschedules 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(s):

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**

III-Sem Syllabi

(B.Tech CSE(Networks) URR24-R25)

III SEMESTER

Sl. No.	Category	Course Code	Course Title	Lectures/week				Credits
				L	T	P	E	C
1	PCC	U24CN301	Automata Theory and Compiler Design	2	1	-	3	3
2	PCC	U24CN302	Operating Systems	2	1	-	3	4
3	PCC	U24CN303	Advanced Data Structures	2	1	-	3	3
4	PCC	U24CN304	Computer Networks	2	1	-	3	3
5	PCC	U24CN305	Object Oriented Programming through Java	2	1	-	3	4
6	VAC	U24VA306B	Soft & Interpersonal Skills	-	-	2	2	1
7	PCC	U24CN307	Advanced Data Structures Laboratory	-	-	2	2	1
8	PCC	U24CN308	Computer Networks Laboratory	-	-	2	2	1
9	PCC	U24CN309	Object Oriented Programming through Java Laboratory	-	-	2	2	1
			Total:	10	5	8	23	21
Summer/ Inter-semBridge 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)								

AUTOMATA THEORY AND COMPILER DESIGN

Class: B. Tech. III – Semester		**Branch: CSE(Networks)**	
Course Code:	**U24CN301**	**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 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 €-transitions to NFA without € transitions. Conversion of NFA to DFA, Moore and Melay machines, Minimization of DFA

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)

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

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

Textbook(s):

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

Reference Book(s):

1. Mishra and Chandrashekaran, *Theory of Computer Science – Automata, Languages and Computation*, 2nd Ed., PHI
2. Michael Sipser, *An Introduction to the Theory of Computation*, 3rd Edition, Cengage Learning
3. Kamala Krithivasan, Rama R, *Introduction to Formal Languages, Automata Theory and Computation*, Pearson
4. Peter Linz, Jones & Bartlett, *An Introduction to Formal Languages and Automata*, 6th Ed., Cengage Learning

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc21_cs83/preview, NPTEL video lecture on the theory of computation by Prof. Raghunath Tewari, IIT Kanpur
2. https://onlinecourses.nptel.ac.in/noc21_cs07/preview, NPTEL video lecture on compiler design by Prof. Santanu Chattopadhyay, IIT Kharagpur

Course Articulation Matrix (CAM):		**U24CN301: AUTOMATA THEORY AND COMPILER DESIGN**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CN301.1**	2	2	2	2	1	-	-	1	-	1	2	1	1
CO2	**U24CN301.2**	2	2	2	2	1	-	-	1	-	1	2	1	1
CO3	**U24CN301.3**	2	2	3	3	1	-	-	1	-	1	3	1	1
CO4	**U24CN301.4**	2	2	3	3	1	-	-	1	-	1	3	1	1
U24CN301R25		**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** *The student should be able to…*	**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-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 : 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 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

UNIT-II	9 Hrs

Process Concept: Process concept, Inter process communication

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms – first- come first serve, Shortest-job-first, Priority, Round-robin

Synchronization: Background, Theocratical- section problem, Peterson's solution ,Synchronization hardware, Mutex locks, Semaphores, Monitors

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

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

Textbook:

1. Abraham Silberschatz , Peter B Galvin, Gerg Gagne, *Operating System Concepts*, 10th ed., Newyork: Wiley publications, ISBN-978-1-119-32091-3, 2018

Reference Book(s):

1. Ekta Walia, Operating *System Concepts*, 2nd ed., Delhi: Khanna Publishers, ISBN-10: 9789380016658, ISBN-13: 978-9380016658, 2019
2. Dhananjay M. Dhamdhere, *Operating Systems A Concept-Based Approach*, 1st ed., Newdelhi: McGraw Hill Education, ISBN-10: 0072957697 ISBN-13: 978-0072957693, 2008
3. William Stalling, *Operating Systems*, Maxwell, McMillan International Editions, ISBN 81-203-1187- 6, 1992

Web and Video link(s):

https://www.youtube.com/watch?v=jciGIvn7UfM&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	1	-	1	2	2
CO2	U24CN302.2	3	2	2	2	-	-	-	1	1	-	1	2	2
CO3	U24CN302.3	3	2	2	2	2	-	-	1	1	-	1	2	2
CO4	U24CN302.4	2	2	2	1	2	-	-	1	1	-	1	2	2
U24CN302		2	2.5	1.75	2	1.5	2	-	-	1	1	-	1	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	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-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: implement and test binary trees and binary search trees to organise and retrieve data efficiently

CO2: apply AVL, red-black trees and B trees and B+ trees to optimize database queries

CO3: develop and analyze different sorting and searching techniques

CO4: apply graphs, spanning trees and develop string matching algorithms

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

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

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

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 morris pratt (KMP) algorithm, Boyer-moore algorithm

Textbook:

1. Debasis Samanta, *Classic Data Structures*, 2nd ed., New Delhi: Prentice Hall India, 2009 (*Chapters 7 to 11*)

Reference Book(s):

1. Reema Thareja, *Data Structures Using C,* 2nd ed., New Delhi: Oxford University Press, 2014
2. Narasimha Karumanchi, *Data Structures and Algorithms Made Easy*, 5th ed., Bombay: Careermonk, 2017

Web and Video link(s):

1. https://nptel.ac.in/courses/106102064; *NPTEL Video Lecture on Data Structures and Algorithms Prof. Naveen Garg, IIT Delhi*
2. https://nptel.ac.in/courses/106106130; *NPTEL Video Lecture on Programming and Data Structures Dr. N. S. Narayana Swamy, CSE, IIT Madras*

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
U24CN303		**2**	**2**	**2**	**1.5**	**1**	**-**	**1**	**1**	**-**	**1**	**1**	**2**	**2**

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	implement and test binary trees and binary search trees to organise and retrieve data efficiently	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	Develop and analyze different sorting and searching techniques	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
CO4	Apply graphs, spanning trees and develop string matching algorithms	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

COMPUTER NETWORKS

Class: B. Tech. III– Semester		**Branch: CSE (Networks)**	
Course Code:	**U24CN304**	**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 : evaluate OSI and TCP/IP reference models and compare their functionalities

CO2 : analyse various data link layer mechanisms and medium access control protocols to ensure efficient and reliable communication

CO3 : apply appropriate routing and congestion control algorithms to enhance and optimize network performance

CO4 : analyse the different services provided by transport and application layer protocols in network communication

UNIT-I	**9 Hrs**

Introduction: Uses of computer networks, Types of Computer Networks, Network Technology from Local to Global, Network Protocols

Reference Models: OSI reference model, TCP /IP reference model, Comparison of OSI and TCP/IP reference model

Physical Layer: Transmission media - Guided transmission media, Wireless transmission, Using the Spectrum for transmission, Digital modulation and multiplexing

Switching: Circuit and Packet switching

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, Data link layer switching

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

UNIT-IV	**9 Hrs**

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

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

Textbook(s):

1. Andrew S. Tanenbaum, David J. Wetherall, Nick Feamster, "Computer Networks", London: Pearson Education, 6th Edition, ISBN- 978-9356063600, 2023
2. Hallberg, Bruce, "Networking A Beginner's Guide", US: McGraw-Hill Osborne Media, 6th Edition, ISBN- 9780071812245, 2013

Reference Book(s):

1. William Stallings, "Data and Computer Communications", Pearson Education, 10th Edition, ISBN- 9780137561704, 2014
2. Behrouz Forouzan, "Data Communication and Networking", *Tata McGraw Hill*, 5th Edition, ISBN- 13978-1259064753, 2017
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks", *Morgan Kaufmann Publishers*., 5th Edition, ISBN- 978-0123850591, 2011
4. James F.Kurose and Keith W.Ross, "Computer Networking a Top-Down Approach", *Pearson Education,* 7th Edition, ISBN- 978-0133594140, 2016

Web and Video link(s):

https://www.youtube.com/watch?v=0--rkQNKqls *Video Lecture on Computer Networks and Internet Protocol, Multiplication by Prof Soumya Kanti Ghosh & Prof Sandip Chakraborty, NPTEL IIT Kharagpur*

Course Articulation Matrix (CAM):		**U24CN304 : COMPUTER NETWORKS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO 1**	**PSO2**
CO 1	**U24CN304.1**	3	2	1	1	1	–	–	–	–	–	–	3	2
CO 2	**U24CN304.2**	3	3	2	2	1	–	–	–	–	–	–	3	2
CO 3	**U24CN304.3**	3	3	3	2	2	–	–	–	1	1	1	3	3
CO 4	**U24CN304.4**	3	2	1	1	1	–	–	–	–	–	–	3	2
U24CN304		3	2.5	1.75	1.5	1.25	-	--	-	1	1	1	3	2.25
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	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

OBJECT ORIENTED PROGRAMMING THROUGH JAVA

Class: B. Tech. III – Semester		**Branch: CSE(Networks)**	
Course Code:	**U24CN305**	**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)

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

CO1: distinguish various programming paradigms and develop java fundamental programs involving the basic programming constructs like control structures, methods

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

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, Java buzzwords, Data types, Variables, scope and lifetime of Variables, arrays, Operators, expressions, Control statements, type conversion and casting, simple java program

Introducing Classes: Class fundamentals, Declaring objects, Object reference variables, Introducing methods, access control of methods

UNIT-II	**9 Hrs**

Classes and Methods: Overloading methods, this keyword, Passing and returning objects, Recursion, Variable length arguments, Constructors, Overloading constructors, Garbage collection, Static variables, Static blocks, Static methods, Method binding, Recursion, Nested and inner classes, Command line arguments, Wrapper classes

Strings: Exploring String, String Buffer, String Builder and String Tokenizer classes

UNIT-III	**9 Hrs**

Inheritance: Inheritance basics, Types of inheritance, Using *super keyword*, polymorphism-Method overriding, Order of constructors Execution, Dynamic method dispatch, Abstract classes, *final* with inheritance, Object class

Interfaces: Defining an interface, implementing interfaces, Nested interfaces, Variables in interfaces, Extending interfaces, differences between classes and interfaces

Packages: Defining a package, Creating and Accessing a Packages and Member Access, Importing package

UNIT-IV	**9 Hrs**

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

Multithreading: Creating a thread, thread life cycle, Creating multiple threads, Thread priorities, Synchronization, Interthread communication, daemon threads, Enumerations, autoboxing, generics

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

Textbook:

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

Reference Book(s):

1. Understanding OOP with Java, updated edition, T. Budd, Pearson education
2. Balaguruswamy, Programming with Java: A Primer, 7thed., New Delhi: McGraw- Hill Education India Pvt. Ltd 2019
3. Kathy Sierra, Bert Bates, Head First Java, 2nd ed., Boston: O' Reilly Publications,2005
4. Harvey Deitel, Paul J. Deitel, Java How to Program, 11thed., India: Pearson Publications, 2018
5. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John wiley & sons

Web and Video link(s):

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

Course Articulation Matrix (CAM):		**U24CN305: OBJECT ORIENTED PROGRAMMING THROUGH JAVA**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CN305.1**	3	2	2	1	-	-	1	-	1	-	2	2	1
CO2	**U24CN305.2**	3	2	3	1	-	-	1	-	2	-	2	3	2
CO3	**U24CN305.3**	3	3	3	2	-	-	1	-	2	-	3	3	2
CO4	**U24CN305.4**	3	3	3	3	-	-	1	-	2	-	3	3	2
U24CN305		3	2.5	2.75	1.75	-	-	1	-	1.75	-	2.5	2.75	1.75
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	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

SOFT AND INTERPERSONAL SKILLS LABORATORY

Class: B.Tech. III Semester		**Branch: CSE(Networks)**	
Course Code:	**U24VA306B**	**Credits:**	**1**
Hours/Week (L-T-P-O-E):	**0-0-2-2**	**CIE:**	**100 %**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**-**

Course Learning Outcomes (COs):

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

CO1: deliver concise & effective self-introduction and demonstrate confidence, spontaneous speaking skills within a limited time

CO2: conduct a personal SWOT analysis to identify areas for self-improvement and career development

CO3: demonstrate clear & respectful communication, leadership, positive attitude and improve interpersonal relationship by actively participating in group discussions, collaborative tasks & mock interviews

CO4: create a professional resume, develop a LinkedIn profile and demonstrate effective video communication by making effective videos on self-introduction, personal SWOT analysis & spontaneous speaking activity along with email & workplace etiquette

LIST OF ACTIVITIES

Activity 1: Ice-breaking, Self-Awareness and Just a Minute (JAM)
Activity 2: Self-Introduction & Personal SWOT Analysis
Activity 3: Reading Comprehension & Critical Thinking
Activity 4: Active Listening & Non-Verbal Observation (Video + Peer Practice)
Activity 5: Group Discussion - 1
Activity 6: Resume Building & LinkedIn Profile Review
Activity 7: Group Discussion - 2
Activity 8: Presentation Skills with PPT / Storytelling
Activity 9: Group Discussion - 3
Activity 10: Mock Interviews: Technical & HR
Activity 11: Email Etiquette & Professional Communication
Activity 12: Workplace Etiquette & Conflict Resolution

Textbook:

1. Krishna Mohan & Meera Benerji, *Developing Communications Skills*, 2nd ed., New Delhi: McMillan Publications, 2005

Course Articulation Matrix (CAM):		**U24VA306B 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**	**PSO 1**	**PSO 2**
CO1	**U24VA306B.1**	-	-	-	-	-	-	-	2	3	-	1		
CO2	**U24VA306B.2**	-	-	-	-	-	-	2	3	3	-	1		
CO3	**U24VA306B.3**	-	-	-	-	-	-	-	2	3	-	1		
CO4	**U24VA306B.4**	-	-	-	-	-	-	1	2	3	-	1		
U24VA306B		-	-	-	-	**-**	-	**1.5**	**2.25**	**3**	**-**	**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	deliver concise & effective self-introduction and demonstrate confidence, spontaneous speaking skills within a limited time	SDG 4	Quality Education	This aligns with SDG-4 as it focuses on developing communication skills, confidence and spontaneous speaking ability along with delivering a concise and effective self-introduction in a time-bound manner, which are essential for effective learning and employability
CO2	conduct a personal SWOT analysis to identify areas for self-improvement and career development	SDG 4	Quality Education	This aligns with SDG-4 as it encourages self-awareness and lifelong learning through personal SWOT analysis, enabling learners to identify strengths, weaknesses, opportunities, and threats for self-improvement and career development
CO3	demonstrate clear & respectful communication, leadership, positive attitude and improve interpersonal relationship by actively participating in group discussions, collaborative tasks & mock interviews	SDG 4	Quality Education	This aligns with SDG-4 as it develops communication, leadership, teamwork and interpersonal skills through active participation in group discussions, collaborative tasks and mock interviews, enhancing learners' overall competence and employability
CO4	create a professional resume, develop a LinkedIn profile and demonstrate effective video communication by making effective videos on self-introduction, personal SWOT analysis & spontaneous speaking activity along with email & workplace etiquette	SDG 4	Quality Education	This aligns with SDG-4 as it enhances learners' professional, digital and communication competencies through the creation of a resume, development of a LinkedIn profile, effective video-based communication and practice of email and workplace etiquette, thereby strengthening employability and career readiness

ADVANCED DATA STRUCTURES LABORATORY

Class: B.Tech. III–Semester		**Branch: CSE (Networks)**	
Course Code:	**U24CN307**	**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)

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

CO1 : implement and test binary trees and binary search trees to organise and retrieve data efficiently

CO2 : implement and test AVL trees and red-black trees to optimise data storage

CO3 : develop and test sorting techniques on unsorted data and searching techniques to retrieve the data effectively

CO4 : develop and test graphs and string manipulation algorithms to organize and retrieve the data

Experiment-1 (UNIT-I)

1. Program to perform following binary tree operations

i) creation ii) insertion of a node iii) traversal using recursion

Experiment-2 (UNIT-I)

1. Program to perform following binary search tree traversal operations without recursion

i) inorder ii) preorder iii) postorder iv) spiral order

Experiment-3 (UNIT-I)

1. Program to perform following binary search tree operations.

i) creation ii) insertion of a node iii) deletion of a node

Experiment-4 (UNIT-II)

1. Program to implement AVL tree construction

Experiment-5 (UNIT-III)

1. Program to implement search and insert operations on Trie

Experiment-6 (UNIT-III)

1. Program to implement the following sorting techniques.

a) Heap sort

b) Quick sort

Experiment-7 (UNIT-III)

1. Program to implement the following sorting techniques.

a) Merge sort

b) Bitonic generator sort

Experiment-8 (UNIT-III)

1. Program to implement the following search algorithms.

a) Fibonacci search

b) Interpolation search

Experiment-9 (UNIT-IV)

1. Program to implement the following

i) Graph Representations ii) Topological sort

Experiment-10 (UNIT-IV)

1. Program to implement the following graph traversal techniques.

i)Depth first search ii) Breadth first search

Experiment-11 (UNIT-IV)

1. Program to implement following shortest path algorithms.

i)Kruskal's algorithm ii) Prim's algorithm

Experiment-12 (UNIT-IV)

1. Program to implement the following string matching algorithms.
   i) Knuth morris pratt algorithm
   ii) Boyer-moore algorithm
   iii) Rabin-karp algorithm

Textbook:

1. Debasis Samanta, *Classic Data Structures*, 2nd ed., New Delhi: Prentice Hall India, 2009 (*Chapters 7 to 11*)

Reference Book(s):

[1] Reema Thareja, *Data Structures Using C,* 2nd ed., New Delhi: Oxford University Press, 2014

[2] Narasimha Karumanchi, *Data Structures and Algorithms Made Easy*, 5th ed., Bombay: Careermonk, 2017

Web and Video link(s):

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

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

Course Articulation Matrix (CAM):		U24CN307 : ADVANCED DATA STRUCTURES LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN307.1	1	1	3	2	1	-	1	1	-	1	1	1	1
CO2	U24CN307.2	1	1	3	2	1	-	1	1	-	1	1	1	1
CO3	U24CN307.3	1	1	3	2	1	-	1	1	-	1	1	1	1
CO4	U24CN307.4	1	1	3	2	1	-	1	1	-	1	1	1	1
U24CN307		1	1	3	2	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	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
CO2	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
CO3	Develop and test Sorting Algorithms and Searching Algorithms for efficient data handling	SDG9	Sustainable Development Goal 9 focuses on innovation and efficient digital infrastructur e	Sorting and searching algorithms improve data efficiency, supporting faster and smarter digital systems
CO4	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 LABORATORY

Class: B. Tech. III – Semester		**Branch: CSE (Networks)**	
Course Code:	**U24CN308**	**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)

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

CO1 : demonstrate the ability to design and configure small-scale campus networks by understanding network devices, topologies, IP addressing, and system/network administration roles

CO2 : apply socket programming techniques using TCP and UDP protocols to develop Client-server applications such as chat systems, date/time services, and file transfers

CO3 : develop data link and network layer protocols such as Stop-and-Wait, sliding window, CRC, ARP, RARP, SNMP, and Distance Vector Routing using Java programming

CO4 : analyze network behaviour and performance using NS3 and Wireshark tools, focusing on traffic, congestion, and packet-level protocol analysis

Experiment-1 (UNIT-I)

1. Draw the network diagrams of a campus network
   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

Experiment-2 (UNIT-I)

1. Build 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) Establish a LAN network with two computers and check network connectivity between two computers using Ping command

Experiment-3 (UNIT-I)

1. Study of socket programming and implement a socket
2. Develop a socket program to implement date and time display from client to server using TCP.
3. Develop a socket program to implement date and time display from client to server using UDP

Experiment-4 (UNIT-II)

1. Develop a socket program to implement chat application using TCP
2. Develop a socket program to implement chat application using UDP

Experiment-5 (UNIT-II)

1. Develop a java program to implement stop and wait protocol
2. Develop a java program to implement sliding window protocol

Experiment-6 (UNIT-II)

1. Develop a java program for file transfer using TCP sockets
2. Develop a program for error detection code using CRC-CITTT (16-bits)

Experiment-7 (UNIT-III)

1. Develop a java program to find subnet mask and networked for given IP address
2. Develop a java program that resolves IP address from a given domain name
3. Develop a java program for SNMP application

Experiment-8 (UNIT-III)

1. Develop a java program for simulating ARP and RARP protocols

Experiment-9 (UNIT-III)

1. Develop a program to implement distance vector routing

Experiment-10 (UNIT-IV)

1. Implementing simulations using NS3
   a) Study of network simulation tool NS3
   b) create nodes and connect nodes

Experiment-11 (UNIT-IV)

1. Implementing simulations using NS3
   a) simulate a simple network
   b) simulate to find number of packets dropped due to congestion

Experiment-12 (UNIT-IV)

1. Demonstration of Wireshark packet analyzer tool.
   a) Capture a HTTP packet
   b) View the captured packet
   c) Apply filters
   d) Analyze the packet

Textbook(s):

1. Andrew S. Tanenbaum, David J. Wetherall, Nick Feamster, "Computer Networks", London: Pearson Education, 6th Edition, ISBN- 978-9356063600, 2023
2. Hallberg, Bruce, "Networking A Beginner's Guide", US: McGraw-Hill Osborne Media, 6th Edition, ISBN- 9780071812245, 2013

Reference Book(s):

1. William Stallings, "Data and Computer Communications", Pearson Education, 10th Edition, ISBN- 9780137561704, 2014
2. Behrouz Forouzan, "Data Communication and Networking", *Tata McGraw Hill*, 5th Edition, ISBN- 13978-1259064753, 2017
3. Larry L. Peterson, Bruce S. Davie, "Computer Networks", *Morgan Kaufmann Publishers.*, 5th Edition, ISBN- 978-0123850591, 2011
4. James F.Kurose and Keith W.Ross, "Computer Networking a Top-Down Approach", *Pearson Education,* 7th Edition, ISBN- 978-0133594140, 2016

Web and Video link(s):

https://www.youtube.com/watch?v=O--rkQNKqls *Video Lecture on Computer Networks and Internet Protocol, Multiplication by Prof Soumya Kanti Ghosh & Prof Sandip Chakraborty, NPTEL IIT Kharagpur*

Laboratory Manual:

Computer Networks Manual and Record Book, Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		U24CN308: COMPUTER NETWORKS LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN308.1	3	2	3	2	3	–	–	–	2	2	1	3	3
CO2	U24CN308.2	3	3	3	2	3	–	–	–	2	2	1	3	3
CO3	U24CN308.3	3	3	3	2	3	–	–	–	1	1	1	3	3
CO4	U24CN308.4	3	3	2	3	3	–	–	–	1	1	2	3	3
U24CN308		3	2.75	2.75	2.25	3	--	--	--	1.5	1.5	1.25	3	3
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 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
CO2	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
CO3	develop data link and network layer protocols such as Stop-and-Wait, sliding window, CRC, ARP, RARP, SNMP, and Distance Vector Routing usingJava programming	SDG9	Industry, Innovation and Infrastructure	Involves implementing key data link and network layer protocols in Java to strengthen understanding of communication networks and infrastructure
CO4	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 LABORATORY

Class: B. Tech. III – Semester		**Branch: CSE(Networks)**	
Course Code:	**U24CN309**	**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)

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

CO1: develop and test java fundamental programs using operators, control structures and arrays

CO2: develop and test java programs using classes, constructors and various string concepts

CO3: build java programs on inheritance, dynamic method dispatch, interfaces and packages

CO4: implement and test java programs using I/O, exception handling and multithreading concepts

Experiment-1 (UNIT-I)

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

Experiment-2 (UNIT-I)

1. a) Develop a java program to read an array and display them using for-each control. 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 civilized form of break statement
2. Develop a java program to define a two dimensional (2D) array where each row contains a different number of columns. Display the 2D-array using for-each

Experiment-3 (UNIT-II)

1. a) Develop a java program to demonstrate class concept
   b) Develop a java program to demonstrate this keyword
2. a) Develop a java program to demonstrate object reference variable
   b) Develop a java program to demonstrate method overloading and overriding
3. Develop a java program to demonstrate passing and returning objects

Experiment-4 (UNIT-II)

1. 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

Experiment-5 (UNIT-II)

1. a) Read at least five strings from command line argument and display 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 and average
2. 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

Experiment-6 (UNIT-III)

1. a) Develop a java program to demonstrate single level-inheritance
   b) Develop a java program to demonstrate multi level-inheritance using super
   c) Develop a java program to demonstrate method overriding

Experiment-7 (UNIT-III)

1. 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

Experiment-8 (UNIT-III)

1. 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

Experiment-9 (UNIT-III)

1. Develop a java program to create a package and demonstrate to import the package into any java program (Consider the behaviour of all access specifiers)

Experiment-10 (UNIT-IV)

1. a) Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception.
   b) Develop a java program to demonstrate throws clause
   c) Develop a java program to demonstrate re-throw an exception and finally block

Experiment-11 (UNIT-IV)

1. a) Write a Java program that implements a multi-thread application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
   b) Develop a java program to demonstrate synchronization of threads

2. Write a Java program that correctly implements the producer – consumer problem using the concept of inter thread communication.

Experiment-12 (UNIT-IV)

1. a) Develop a java program to demonstrate read/write/copy a file using bytestream
   b) Develop a java program to demonstrate read/write/copy a file using character stream

Textbook:

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

Reference Book(s):

1. Understanding OOP with Java, updated edition, T. Budd, Pearson education.
2. Balaguruswamy, Programming with Java: A Primer, 7thed., New Delhi: McGraw-Hill Education India Pvt. Ltd 2019
3. Kathy Sierra, Bert Bates, Head First Java, 2nd ed., Boston: O' Reilly Publications,2005
4. Harvey Deitel, Paul J. Deitel, Java How to Program, 11thed., India: Pearson Publications, 2018
5. An Introduction to programming and OO design using Java, J. Nino and F.A. Hosch, John wiley & sons

Web and Video link(s):

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

Laboratory Manual:

Object oriented programming through java Laboratory Manual, Department of CSE (NETWORKS), KITSW

Course Articulation Matrix (CAM):		U24CN309 : OBJECT ORIENTED PROGRAMMING THROUGH JAVA LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CN309.1	3	3	2	1	3	-	-	1	1	-	2	3	1
CO2	U24CN309.2	3	3	3	1	3	-	-	1	1	-	2	3	1
CO3	U24CN309.3	3	3	3	2	3	-	-	1	1	-	2	3	1
CO4	U24CN309.4	3	3	3	2	3	1	1	1	2	1	3	3	1
U24CN309		3	3	2.75	1.5	3	0.25	0.25	1	1.25	0.25	2.25	3	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	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
		SDG 9	Industry, Innovation & Infrastructure	Basic coding skills contribute indirectly to software innovation and development infrastructure
CO2	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
CO3	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
CO4	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

IV-Sem Syllabi

(B.Tech CSE(Networks) URR24-R25)

IV SEMESTER

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	BSC	U24MH401	Discrete Mathematics and Probability, Statistics	2	1	-	3	3
2	PCC	U24CN402	Database Management Systems	2	1	-	3	4
3	PCC	U24CN403	Design and Analysis of Algorithms	2	1	-	3	4
4	PCC	U24CN404	Internetworks and Virtualization	2	1	-	3	3
5	PCC	U24CN405	Python Programming	2	1	-	3	3
6	PCC	U24CN406R25	Python Programming Laboratory	2	1	-	2	1
7	PCC	U24CN407R25	Design and Analysis of Algorithms Laboratory	-	-	2	2	1
8	PCC	U24CN408	Database Management Systems Laboratory	-	-	2	2	1
9	PCC	U24CN409	Internetworks and Virtualization Laboratory	-	-	2	2	1
10	VAC*	U24CY411*	Environmental Studies*	2*	-	-	2*	-
			Total:	12	6	6	23	21

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)

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

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, Hasee 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., *Discrete Mathematics for Computer Scientists*, PHI 2/e, New Delhi,1999. (*Unit I, Unit II and Unit III*)
2. Grewal, B.S., *Higher Engineering Mathematics*, Khanna Publishers, 44/e, Delhi, 2017. (*Unit IV)*

Reference Book(S):

1. Gupta. S.C and Kapoor. V. K, *Fundamentals of Mathematical Statistics*, Sultan Chand & Sons, New Delhi, 2020.
2. Tremblay, J, P, Manohar.R *Discrete Mathematical Structures with Applications to Computer Science*, MGH New York, 1977
3. Zohar Manna., *Mathematical Theory of Computation*, , MGH, New Delhi
4. C. L. Liu , *Elements of Discrete mathematics*, 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: *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** *The student should be able to…*	**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)

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

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, *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-HillEducation,3rded.,1997
3. Thomas Connolly and Carolyn Begg, *Database Systems*, Pearson Education,3rded.,2003

Web and Video link:

https://onlinecourses.nptel.ac.in/noc22_cs91/previewNPTEL *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** *The student should be able to…*	**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 services

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)

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

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** *The student should be able to…*	**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)

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

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

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

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc22_ee116/preview; *NPTEL Video Lecture on* ***Advance Computer Networks*** *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* ***Computer Networks and Internet protocol*** *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	0.25	0.25	0.50	0.50	0	1	2.75	2.75
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 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)

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

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** *The student should be able to…*	**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

PYTHON PROGRAMMING LABORATORY

Class: B. Tech. IV – Semester		**Branch: CSE (Networks)**	
Course Code:	**U24CN406R25**	**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)

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

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
   a) Installation of Python and verifying PATH environment variable
      a. Running instructions in Interactive interpreter and a python script
      b. Executing instructions in Python Interactive Interpreter
      c. Running python scripts in Command Prompt
      d. Running python scripts in IDLE
   b) Write a program to demonstrate importance of indentations
   c) raise indentation error and correct it
   d) 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
   a) Write a program that takes 2 numbers as command line arguments and print its sum
   b) Write a program to check whether the given number is even or odd
   c) Write a program to calculate GCD of 2 numbers
   d) Write a program to find Exponentiation (Power) of a number
   e) Write a program to find given year is leap year or not
   f) 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:
   a) Write a program to find the Factorial of a given number
   b) Write a program to evaluate the Fibonacci series for a given number ‗n'
   c) Write a program to demonstrate tuple, set and related functions
   d) 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 ‗n' 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. DevelopPythonprogramstodemonstrateobject-orientedprogrammingconceptsandfile 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): *Python programming Laboratory Manual,* Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		**U24CN406R25 : PYTHON PROGRAMMING LABORATORY**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CN406R25.1**	2	2	2	2	2	1	-	2	1	-	1	2	2
CO2	**U24CN406R25.2**	2	2	2	2	2	1	-	2	1	-	1	2	2
CO3	**U24CN406R25.3**	2	2	2	2	3	1	-	2	1	-	1	2	2
CO4	**U24CN406R25.4**	2	2	2	2	3	1	-	2	1	-	1	2	2
U24CN406R25		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** *The student should be able to*	**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

DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

Class: B. Tech. IV – Semester		**Branch: CSE (Networks)**	
Course Code:	**U24CN407R25**	**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)

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

CO1 : demonstrate programs on binary search, min-max, merge sort, quick sort and strassen's matrix multiplication problems

CO2 : develop knapsack, job sequencing with deadline, shortest path using greedy method, N-Queens and sum of subsets using backtracking method

CO3 : construct programs on single source shortest path, multistage graph and all pairs shortest path using dynamic programming technique

CO4 : develop programme for travelling sales person problem using branch and bound method

Experiment-1 (UNIT-I)

1. Develop a program to implement binary search algorithm
2. Develop a program to implement min-max algorithm

Experiment-2 (UNIT-I)

1. Develop a program to implement merge sort algorithm
2. Develop a program to implement quick sort algorithm

Experiment-3 (UNIT-I)

1. Apply Strassen's matrix multiplication to multiply following matrix

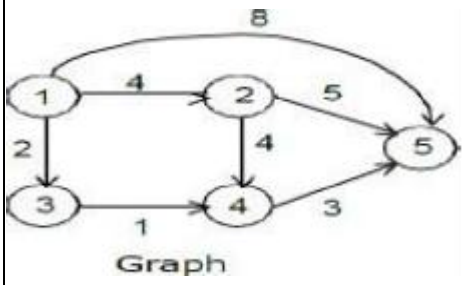
$$A=\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix} \qquad B=\begin{pmatrix} 2 & 1 \\ 4 & 3 \end{pmatrix}$$

Experiment-4 (UNIT-II)

1. Develop a program to implement 0/1 knapsack problem
2. Develop a program to implement Job sequencing with deadlines

Experiment-5 (UNIT-II)

1. Apply Dijkstras algorithm find the shortest path from 1 to each of the other five vertices in the graph



Graph

2. Develop a program to implement N-Queens problem

Experiment-6 (UNIT-II)

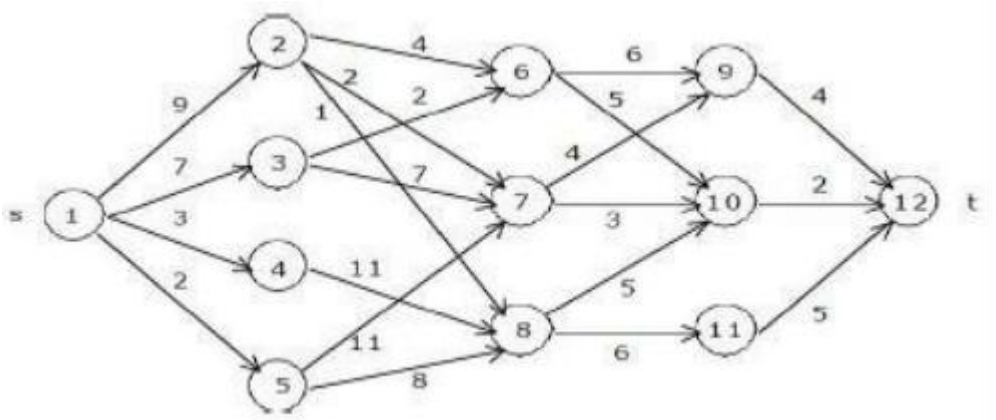
1. Develop a program to implement sum of subsets

Experiment-7 (UNIT-II)

1. Implement Single source shortest paths using bellman ford algorithm

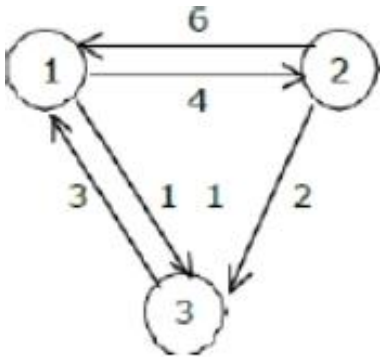
Experiment-8 (UNIT-III)

1. Apply Multistage graph algorithm and find shortest path



Experiment-9 (UNIT-III)

1. Apply All pairs shortest paths algorithm and find shortest path



Experiment-10 (UNIT-III)

1. Develop a program to implement Optimal binary search trees

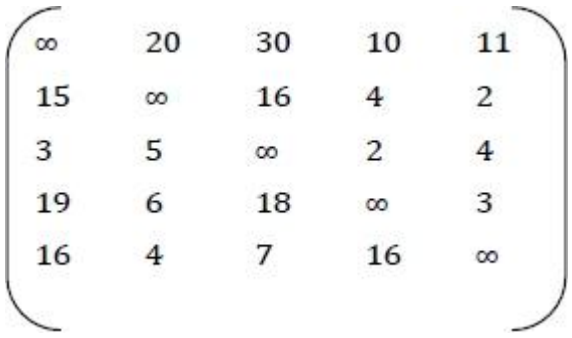
Experiment-11 (UNIT-IV)

1. Apply travelling sales person algorithm using dynamic programming and find shortest path

$$\begin{pmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 13 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{pmatrix}$$

Experiment-12 (UNIT-IV)

1. Apply travelling salesperson algorithm using branch and bound and find shortest path



Textbook:

1. E. Horowitz, S. Sahni, S. Rajasekaran, *Fundamentals of Computer Algorithms*, 2nd ed., Hyderabad: Universities Press, 2018. *(Chapters 1 to 12)*

Reference Book(S):

1. E.Horowitz, S.Sahni, S.Rajasekaran, Fundamentals of Computer Algorithms, 2nd ed., Universities Press, 2018
2. Mark Allen Weiss, Data Structures and Algorithm Analysis in Java, 3rd ed., Pearson, 2012
3. Kathy Sierra, Bert Bates, Head First Java8, 2nd ed., O"Reilly Publications, 2020
4. Narasimha Karumanchi, Data Structures and Algorithms Made Easy in Java, careermonk, 2011
5. Uttam K. Roy, Advanced JAVA Programming, Oxford Publications, 2015

Web and Video link(s):

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*

Laboratory Manual (for laboratory component):

Design And Analysis Of Algorithms Laboratory Manual, Department of CSE (Networks), KITSW

Course Articulation Matrix (CAM):		**U24CN407R25 : DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U24CN407R25.1**	3	3	2	2	1	-	1	1	1	-	1	2	1
CO2	**U24CN407R25.2**	3	3	3	2	1	-	1	1	1	-	1	2	1
CO3	**U24CN407R25.3**	3	3	3	2	1	-	1	1	1	-	1	2	1
CO4	**U24CN407R25.4**	2	2	2	2	1	-	1	1	1	-	1	2	1
U24CN407R25		**1.75**	**2.75**	**2.75**	**2.5**	**1**	**-**	**1**	**1**	**1**	**-**	**2**	**1**	**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 programs on binary search, min-max, merge sort, quick sort and Strassen's matrix multiplication problems	SDG9	Industry, Innovation and Infrastructure	Efficient algorithms improve computational speed and performance in software systems, enabling scalable solutions in industries such as data processing and scientific computing
CO2	develop knapsack, job sequencing with deadline, shortest path using greedy method, N-Queens and sum of subsets using backtracking method	SDG8	Decent Work and Economic Growth	Optimization and scheduling algorithms support efficient resource allocation, workforce planning, and operational productivity in industries
CO3	construct programs on single source shortest path, multistage graph and all pairs shortest path using dynamic programming technique	SDG11	Sustainable Cities and Communities	Path finding and optimization algorithms are applied in transportation systems, traffic management, and urban planning for smarter cities
CO4	develop programme for travelling salesperson problem using branch and bound method	SDG9	Industry, Innovation and Infrastructure	Advanced optimization techniques like branch and bound are used in logistics, supply chain management, and route optimization, improving industrial efficiency and infrastructure

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)

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

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-HillEducation,3rded.,1997
3. Thomas Connolly and Carolyn Begg, *Database Systems*, Pearson Education,3rded.,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** *The student should be able to*	**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)

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

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)ConfigureIPv4 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: *Internetworks and Virtualization Laboraory Manual,* Department of CSE (Networks), KITSW

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	0.25	0.25	0.75	0.75	0	1	2.75	2.75
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	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.

ENVIRONMENTAL STUDIES

Class: B. Tech. IV – Semester		Branch: Common to ME, CSM, CSD, IT, CSN & CSO	
Course Code:	**U24CY411**	**Credits:**	**0**
Hours/Week (L-T-P- E):	**2-0-0-2**	**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 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	9 Hrs

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

UNIT-II	9 Hrs

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

UNIT-III	9 Hrs

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

UNIT-IV	9 Hrs

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

Textbook:

1. Erach Bharucha, Text Book of Environmental Studies for Under Graduate Courses, 2nd Edn., Universities Press (India) Pvt. Ltd, 2013

Reference Book(s):

1. Y. Anjaneyulu, Introduction to Environmental Science, B.S. Publications, 2004
2. Gilbert M. Masters, Introduction to Environmental Engineering & Science, 3rd Edn., Prentice Hall of India,1991
3. Anubha Kaushik, C.P. Kaushik, Environmental Studies, 4th Edn., New Age International Publishers,2014
4. R. Rajagopalan, Environmental Studies from crisis to cure, Oxford University Press, 2nd Edn., 2011

Web and Video link(s):

1. https://archive.nptel.ac.in/noc/courses/noc22/SEM1/noc22-ch27/ video lecture 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):		U24CY411: ENVIRONMENTAL STUDIES												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CY411.1	2	1	2	1	-	2	1	1	1	-	-	-	-
CO2	U24CY411.2	-	-	2	-	-	1	1	1	1	1	-	-	-
CO3	U24CY411.3	1	2	1	-	-	1	1	1	1	1	1	-	-
CO4	U24CY411.4	-	-	1	-	-	1	1	1	1	-	1	-	-
U24CY411		1.50	1.50	1.50	1.00	-	1.25	1.25	1.00	0.50	1.00	1.00	-	-
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	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

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

(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
1	PCC	U24CN412X	Artificial Intelligence and Machine Learning	2	-	-	4	2
2	PCC	U24CN413X	Cryptography and Network Security	2	-	-	4	2
3	PCC	U24CN414X	Internet of Things	2	-	-	4	2
5	PCC	U24CN415X	Any other course approved by BoS Chair and Dean AA	2	-	-	4	2

(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	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

ARTIFICIAL INTELLIGENCE & MACHINE LEARNING

Class: B. Tech syllabi of Exit Course for UG Diploma in CSE(NETWORKS)		**Branch:**CSE(Networks)	
Course Code:	**U24CN412X**	**Credits:**	**4**
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,

(based on cognitive skills acquired from theory component)

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

(based on psychomotor skills acquired from laboratory component)

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).

5. Implement Multiple Linear Regression for predicting a target variable using multiple input features.
6. Implement Logistic Regression for binary classification (e.g., email spam detection or disease prediction).
7. Implement K-Nearest Neighbors (KNN) algorithm for classification using the Iris dataset.
8. Implement Naïve Bayes algorithm for text classification (e.g., spam vs. non-spam email classification).
9. Implement Support Vector Machine (SVM) with linear and RBF kernels for classification tasks.
10. Implement Decision Tree and Random Forest algorithms for classification and compare their performance.
11. Implement K-Means Clustering on an unlabeled dataset (e.g., customer segmentation) and analyze cluster formation.
12. Apply Principal Component Analysis (PCA) for dimensionality reduction and visualize the transformed dataset.

Text Book(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. Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press, 4th edition, 2020, Massachusetts.KathySierra, BertBates, *Head First Java*, O'Reilly Publications, 2nd edition, 2005, Boston.
2. Harvey **Aurélien Géron**, *Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow*, O'Reilly Media, 2nd edition, 2019, California.
3. **Shai Shalev-Shwartz and Shai Ben-David**, *Understanding Machine Learning: From Theory to Algorithms*, Cambridge University Press, 1st edition, 2014, New York

Web and Video link(s):

https://onlinecourses.nptel.ac.in/noc19_cs53*NPTEL Video Lecture on Machine Learning*by Prof. Bala Ravindran,Professor of CSE, IITMadras.

Laboratory Manual (for laboratory component):

1. *Artificial Intelligence & Machine Learning Manual and Record Book,* 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** *The student should be able to…*	**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:** CSN	
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,

(based on cognitive skills acquired from theory component)

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

(based on psychomotor skills acquired from laboratory component)

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** *The student should be able to…*	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

	and theorems			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 cyber security infrastructure by ensuring secure communication, safe internet services, and protection against cyber attacks 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 in CSE(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
2. Write an Arduino program to demonstrate if statements, switch case, loops and arrays
3. Write an Arduino program to demonstrate string object, timebased functions, digital and analog I/O functions.
4. Write an Arduino program to demonstrate light an LED with button and 7-segement display

5. Write an Arduino program to demonstrate I2C and SPI communication protocol
6. Write an Arduino program for interfacing with potentiometer and temperature sensor
7. Write an Arduino program for interfacing with PIR sensor and infrared and ultrasonic sensor
8. Write an Arduino program for interfacing with DC motor

Textbook(s):

[1] Sudeep Mishra, Anandarupmukherjee and Arijit Roy, *Introduction to IoT*, New Delhi: University Cambridge Press, 2021. (Chapter 4)

[2] Cornel Amariei, *Arduino Development Cook Book*, Birmingham: Packt Publishing Ltd., 2015. (Chapter 2-6)

Reference Book(S):

[1] ArshdeepBahga 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://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. *Internet of Things laboratory manual,* 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** *The student should be able to…*	**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	