B.TECH. CURRICULUM

ACADEMIC YEAR: 2026–27

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

Undergraduate Rules and Regulations-2026 (URR26)
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)

B. Tech (CSE) –CURRICULUM (KITSW-URR26)

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

History:

PROGRAM	DESCRIPTION	
	INTAKE	NBA ACCREDITATION
UG in B.Tech. COMPUTER SCIENCE & ENGINEERING	• Started with 60seatsin1994 • Intake increased to 120 in 2002 • Intake increased to 180 in 2015	• First time accreditation: 2008 • Reaccreditation-1: 2014 • Reaccreditation-2: 2016 • Reaccreditation-2: 2018 • Reaccreditation-2: 2020 • Reaccreditation-2: 2022

INSTITUTE VISION AND MISSION

INSTITUTE VISION

To make our students technologically superior and ethically strong by providing quality education with the help of our dedicated faculty & staff and thus improve the quality of human life

INSTITUTE MISSION

M1	■ **To provide latest technical knowledge, analytical & practical skills, managerial competence and interactive abilities to students, so that their employability is enhanced**
M2	■ **To provide strong human resource base to cater to the changing needs of the industry and commerce**
M3	■ **To inculcate a sense of brotherhood and National Integrity**

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING: VISION AND MISSION

VISION

Attaining center of excellence status in various fields of Computer Science and Engineering by offering worth full education, training and research to improve quality of software services for ever growing needs of the industry and society.

MISSION

M1:	Practice qualitative approach and standards to provide students better understanding and profound knowledge in the fundamentals and concepts of computer science with its allied disciplines
M2:	Motivate students in continuous learning to enhance their technical, communicational, and managerial skills to make them competent and cope with the latest trends, technologies, and improvements in computer science to have a successful career with professional ethics.
M3	Involve students to analyze, design and experiment with contemporary research problems in computer science to impact socio-economic, political and environmental aspects of the globe.

PROGRAM EDUCATIONAL OBJECTIVES

PEO1:	Escalate the technical skills within and across disciplines of Computer Science Engineering for productive career by maintaining professional ethics
PEO2:	Develop and exercise their capabilities to demonstrate their creativity in engineering practice and team work with increasing responsibility and leadership
PEO3:	Refine their knowledge and skills to attain professional competence through lifelong learning such as higher education, advanced degrees and professional activities

PEO TO MISSION MAPPING

	M1	**M2**	**M3**
PEO1	3	3	2
PEO2	3	2	3
PEO3	2	2	3

PEO Statements	Mission Statements	Mapping Level	Justification
PEO1	M1	3	A strong foundation in M1 principles is crucial for developing effective and transformational software solutions, which directly aligns with PEO1's objective of applying fundamental knowledge to real-world problems.
	M2	3	Technical expertise requires staying updated with new technologies and methodologies, aligning perfectly with PEO1's goal of leveraging updated knowledge for software development
	M3	2	While M3 is more focused on engaging students in contemporary research challenges and innovative solutions, it still supports the development of technical expertise by exposing students to real-world problems and interdisciplinary applications.
PEO2	M1	3	A Good understanding of core principles in Computer Science is mandatory for a successful career. Mastery of these principles ensures that graduates are well-prepared for various professional roles, higher education, or entrepreneurial endeavors.
	M2	2	Continuous learning and skill enhancement are vital for career success. M2's focus on fostering technical, communication, and managerial skills ensures that students are well-rounded and adaptable, which is crucial for thriving in a dynamic and evolving field.
	M3	3	To address contemporary research challenges and contributing to innovative solutions prepare students for high-impact careers. The ability to solve global issues using advanced technologies of computer science and engineering not only makes students highly employable but also positions them as leaders in their fields, directly supporting the objective of a successful career.
PEO3	M1	2	Understanding core principles also indirectly supports the development of professional ethics and effective communication. This foundational knowledge is essential for team work and problem-solving in professional settings.
	M2	2	The focus on professional ethics and embracing new technologies supports life-long learning and the development of soft skills nCSEssary for effective teamwork and social innovation.
	M3	3	Engaging students in real-world research challenges and encouraging them to address global issues inherently requires teamwork, effective communication, and ethical considerations. This mission strongly supports the development of soft skills and fosters a commitment to life-long learning.

PROGRAM SPECIFIC OBJECTIVES

PSO1: (Software Development and Quality assurance)	Transform various legacy or manual systems into computer automated systems using modern programming languages, integrated development environments and apply testing tools for efficient verification and validation of this software systems.
PSO2: (Immediate professional practice)	Work as software practitioner or continue higher education by adopting advanced technologies in various fields of Computer Science and Engineering.

PO/PSO TO PEO MAPPING

PO's		PEO1	PEO2	PEO3
PO1	Engineering Knowledge	3	2	3
PO2	Problem Analysis	3	3	3
PO3	Design/Development of solutions	3	3	3
PO4	Conduct investigations of complex problems	3	3	3
PO5	Modern tool usage	3	3	3
PO6	The engineer and the world	1	3	1
PO7	Ethics	2	3	3
PO8	Individual and Teamwork	3	3	2
PO9	Communication	2	3	3
PO10	Project management and finance	3	3	2
PO11	Lifelong Learning	3	3	3
PSO1	Transform various legacy or manual systems into computer automated systems using modern programming languages, integrated development environments and apply testing tools for efficient verification and validation of this software systems.	3	2	3
PSO2	Work as software practitioner or continue higher education by adopting advanced technologies in various fields of Computer Science and Engineering.	3	3	2

ISO 9001:2015 AICTE-CII: GOLD Category Institute NAAC-'A' Grade Institute (CGPA: 3.21) NIRF-2021 Rank : 197

KAKATIYA INSTITUTE OF TECHNOLOGY & SCIENCE
Opp : Yerragattu Gutta, Hasanparthy (Mandal), WARANGAL - 506 015, Telangana, INDIA.
काकतीय प्रैद्योगिकी एवं विज्ञान संस्थान, वरंगल - ५०६ ०१५ तेलंगाना, भारत
కాకతీయ సాంకేతిక విజ్ఞాన శాస్త్ర విద్యాలయం, వరంగల్ - ౫౦౬ ౦౧౫ తెలంగాణ, భారతదేశము
Estd-1980 KITSW
(An Autonomous Institute under Kakatiya University, Warangal)
(Approved by AICTE, New Delhi; Recognised by UGC under 2(f) & 12(B); Sponsored by EKASILA EDUCATION SOCIETY)
website: www.kitsw.ac.in E-mail: principal@kitsw.ac.in ✆ : +91 9392055211, +91 7382564888

URR26: SYLLABI FOR I & II SEMESTERS
of
B.TECH COMPUTER SCIENCE & ENGINEERING

w.e.f. A.Y. 2026-27

I SEMESTER (Stream – I)

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
-	IKSC	U26IK100	AICTE Mandated Student Induction Programme (Universal Human Values - I)					-
1	BSC	U26MH101	Differential Calculus and Ordinary Differential Equations	2	1	-	3	3
2	BSC	U26PY102D	Engineering Physics (for CS/IT)	2	1	-	3	3
3	ESC	U26CS103	Programming for Problem Solving with C	2	1	-	3	3
4	ESC	U26EE104D	Basic Electrical & Electronics Engineering (for CS/IT)	2	1	-	3	3
5	PCC	U26CS105	Computer Architecture & Oragnization	2	1	-	3	3
6	VAC	U26PY106D	Engineering Physics Lab (for CS/IT)	-	-	2	2	1
7	PCC	U26CS107	Programming for Problem Solving with C Lab	-	-	2	2	1
8	ESC	U26EE108	Basic Electrical & Electronics Engineering Lab (for CS/IT)	-	-	2	2	1
9	PCC	U26CS109	IT Workshop Laboratory	-	-	2	2	1
10	AEC	U26AE110	IDEA Lab Makerspace	-	-	2	2	1
Total:				**10**	**5**	**10**	**25**	**20**
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)				**NIL**				

DIFFERENTIAL CALCULUS AND ORDINARY DIFFERENTIAL EQUATIONS			
Class: B. Tech. I – Semester		**Branch:** Common to all branches	
Course Code:	**U26MH101**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

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 equations with constant coefficients

UNIT-I	**9 Hrs**

Infinite Series: Sequences, Series, General properties of series, Series of positive terms, Comparison tests-Limit form, Integral test, D'Alembert's Ratio test, Cauchy's root test

Differential Calculus and its applications: Fundamental theorems-Rolle's theorem (Geometrical interpretation), Lagrange's mean value theorem (Geometrical interpretation), Cauchy's mean value theorem, Taylor's theorem (Generalized mean value theorem), Expansions of functions- Maclaurin's series, Taylor's series, Maxima and Minima-Conditions, Practical problems (rectangle, right circular cylinder, cone)

UNIT-II	**9 Hrs**

Partial differentiation and its applications: Functions of two or more variables, Partial derivatives, Total derivative, Change of variables, Jacobians, Functional relationship, Geometrical Interpretation-Tangentplane 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

UNIT-III	**9 Hrs**

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

Applications of differential equations of first order: Orthogonal trajectories - Orthogonal trajectories of the family of curves f(x, y, c)=0, Physical applications-Motion of a boat across a stream, Resisted motion, Velocity of escape from the earth, Simple electric circuits - RL series circuit, Newton's law of cooling, Rate of decay of Radio-active materials, Rate of growth of population

UNIT-IV	**9 Hrs**

Linear differential equations: Linear differential equations with constant coefficients, Rules for finding complementary function, Inverse operator, Rules for finding the particular integral ($Q=e^{ax}$, sin(ax+b) or cos(ax+b), x^m and $e^{ax}V(x)$), Method of variation of parameters, Linear dependence of solutions

Applications of linear differential equations: Simple harmonic motion, Simple pendulum, Oscillations of spring, Oscillatory electrical circuit-LCR circuit, Electro-mechanical analog

Textbook(s):

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, 1st edition, 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 series by 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 curves by Prof. Aditya Sharma, Professor of Physics, IISE Bhopal.*
5. *https://youtu.be/btOCUmJkrrg?si=zq3nB00kplm7b5se; NPTEL Video Lecture on Higher Order Linear Differential Equations, Prof. Jithedra Kumar, Professor of Mathematics, IIT Kharagpur..*

Course Articulation Matrix (CAM):		**U26MH101: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**	**PSO1**	**PSO2**
CO1	**U26MH101.1**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO2	**U26MH101.2**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO3	**U26MH101.3**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO4	**U26MH101.4**	2	2	1	1	-	-	-	1	1	-	1	1	1
U26MH101		**2**	**2**	**1**	**1**	**-**	**-**	**-**	**1**	**1**	**-**	**1**	**1**	1
3 – HIGH, 2 – MEDIUM, 1 - LOW1														

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 PHYSICS (*for CSE*)

Class: B.Tech. I – Semester		**Branch:** CSE	
Course Code:	**U26PY102D**	**Credits:**	**3**
Hours/Week (L-T-P-E):	**3-1-0-4**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

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 characteristics of 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 Text Book 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, *Engineering Physics*, Mc Graw Hill 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 Superconductivity by Prof. Arghya Taraphder IIT Kharagpur*
2. https://onlinecourses.nptel.ac.in/noc24_lw07/preview; *NPTEL video lecture on Introduction to Law on Electricity by Prof. Uday Shankar, IIT Kharagpur*
3. https://onlinecourses.nptel.ac.in/noc24_ph45/preview; *NPTEL Video Lecture on Introduction to LASER - Course by Prof. M. R. Shenoy, IIT Delhi*
4. https://onlinecourses.nptel.ac.in/noc20_ee77/preview; *NPTEL Video Lecture on Semiconductor Devices and Circuits By Prof. Sanjiv Sambandan, IISc Bangalore*
5. https://nptel.ac.in/courses/106106232; *NPTEL Video Lecture on Introduction to Quantum Computing: Quantum Algorithms and Qiskit by Prof. Prabha Mandayam, Prof. Anupama Ray, Prof. Sheshashayee Raghunathan, IIT Madras*

Course Articulation Matrix (CAM):		U26PY102D : ENGINEERING PHYSICS (*for CSE*)												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26PY102D.1	2	1	1	-	-	1	1	1	1	-	1	1	1
CO2	U26PY102D.2	2	1	-	-	-	1	1	1	1	-	1	1	1
CO3	U26PY102D.3	2	1	-	-	-	1	1	1	1	-	1	1	1
CO4	U26PY102D.4	2	1	-	-	-	1	1	1	1	1	1	1	1
U26PY102D		2	1	1	-	-	1	1	1	1	1	1	1	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	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 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,	Quantum computing concepts (superposition,

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
			Innovation & Infrastructure	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.

PROGRAMMING FOR PROBLEM SOLVING WITH C

Class: B. Tech. I – Semester		**Branch: CSE**	
Course Code:	**U26CS103**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1 : enumerate programming development steps, design an algorithm and draw flow chart for a given application

CO2 : apply logical skills for problem solving using control structures and arrays

CO3 : develop string operations and modular programming with functions

CO4 : analyse and implement structures, unions, pointers and files in C programming

UNIT-I	**9 Hrs**

Introduction to Programming: Components of a computer, concept of hardware and software, 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

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, Dynamic arrays

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, Nesting of functions Recursion, The scope, visibility and lifetime of variables (storage classes)

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, Aarray of pointers

File Management in C: Defining and opening a file, Closing a file, Input and output operations on sequential text files, Random access to files

Textbook(s):

1. E. Balagurusamy, *Programming in ANSI C*, 8th ed., New Delhi, India: McGraw Hill

Education (India), 2022

Reference Book(S):

1 P. Deitel and H. Deitel, *C How to Program: With Case Studies Introducing Applications Programming and Systems Programming*, 9th ed., Harlow, England: Pearson Education Limited, 2022

2 B. W. Kernighan and D. M. Ritchie, *The C Programming Language*, 2nd ed., New Delhi, India: Pearson Education India, 2015

3 R. Thareja, *Programming in C*, 3rd ed., New Delhi, India: Oxford University Press, 2023

4 Y. Kanetkar, *Let Us C*, 19th ed., New Delhi, India: BPB Publications, 2022

5 A. K. Sharma, *Computer Fundamentals and Programming in C*, 2nd ed., Hyderabad, India: Universities Press, 2018

Web and Video link(s):

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

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

Course Articulation Matrix (CAM): U26CS 103: PROGRAMMING FOR PROBLEM SOLVING WITH C

CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26CS103.1	2	1	1	1	1	-	-	1	-	1	2	1	2
CO2	U26CS 103.2	2	2	2	1	1	-	-	1	-	1	2	2	2
CO3	U26CS 103.3	2	2	3	1	1	-	-	1	-	1	2	2	2
CO4	U26CS 103.4	2	2	3	2	1	-	-	1	-	1	2	2	2
U26CS 103		**2**	**1.75**	**2.25**	**1.25**	**1**	**-**	**-**	**1**	**-**	**1**	**2**	**1.75**	**2**

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	Writing a C program begins with understanding **algorithms and flowcharts** — these teach learners how to break any problem into logical, sequential steps before touching a keyboard. This systematic thinking is the essence of quality technical education. When a student declares a variable, assigns a data type, and uses printf() / scanf() for formatted I/O, they are learning how a computer receives, stores, and communicates information — skills directly applicable to any software career. Operators and expressions in C train students to translate real-world mathematical and logical problems into executable instructions. These concepts make C programming education a powerful vehicle for building digital literacy and

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				technical competence, perfectly aligned with SDG 4's goal of ensuring inclusive, equitable, and quality education that equips youth with relevant skills for employment and life.
CO2	apply logical skills for problem solving using control structures and arrays	SDG9	Industry, Innovation and Infrastructure	In C programming, **control structures** like if-else and switch are the decision-making engines of every industrial software system — from automated assembly lines to embedded controllers in machines. for and while loops enable repetitive tasks such as reading data from sensors in a loop, continuously monitoring a system state, or iterating over a production dataset. **Arrays** in C allow storage and manipulation of large datasets in contiguous memory — a technique central to writing efficient firmware for industrial microcontrollers. **Linear search** in C is a direct implementation of the most basic data retrieval algorithm used in low-level embedded systems where advanced libraries are unavailable. Writing these constructs in C — a language used in 70%+ of critical infrastructure software — directly develops the skills that power industrial innovation and technological infrastructure, the heart of SDG 9.
CO3	develop string operations and modular programming with functions	SDG3	Good Health & Well-Being	In C, **character arrays and string functions** like strlen(), strcpy(), strcmp(), and strcat() are the primary tools for handling text-based patient data — names, diagnoses, prescriptions — in medical device firmware written in C. **User-defined functions** in C promote modular programming, where each function handles one specific task (e.g., calculate_bmi(), check_heartrate()), making medical software reliable, testable, and maintainable — critical in life-saving devices. **Recursion** in C is used in algorithms like binary search for patient records and tree traversal in medical data structures. **Storage**

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				classes (auto, static, extern, register) control memory efficiently in embedded health devices like ECG monitors, pulse oximeters, and insulin pumps — where every byte of memory matters. C remains the dominant language in medical device programming, making this unit directly relevant to SDG 3.
CO4	Analyse and implement structures, unions, pointers and files in C programming	SDG11	Sustainable Cities & Communities	Advanced programming concepts such as data structures, pointers, and file handling form the foundation for developing reliable software systems and modern computing infrastructure In C, a struct groups related data under one name — for example, a struct citizen can hold name, ID, address, and utility usage together, exactly how urban management systems model real-world entities. Pointers in C enable dynamic and efficient memory access — critical in C programs that run on resource-constrained urban devices like smart meters, traffic signal controllers, and public transport embedded systems. Pointers to structures allow linked-list based data structures used in city-wide route management and network topology of infrastructure. Together, these advanced C concepts are the building blocks of the embedded and systems software that makes smart,

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Class: B. Tech. I		**Branch:** Common to CSE, CSE-Allied, IT	
Course Code:	**U26EE104A**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

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**

DC circuits: Network elements, Linear & non-linear elements, Active & passive elements, Unilateral & bilateral elements, Ohm's law, Power, Energy, Kirchhoff's laws, Resistances connected in series and parallel, Voltage divider rule & Current divider rule.

DC Circuit analysis: Source trans formation, 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-N Junction diode, volt-amp characteristics, Zener diode, volt-amp characteristics, 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-polar Junction Transistor symbol, operation of N-P-N and P-N-P transistors, 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):

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

Course Articulation Matrix (CAM):		U26EE104A: BASIC ELECTRICAL & ELECTRONICS ENGINEERING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26EE104A.1	3	3	1	1	1	–	–	–	1	1	1	3	–
CO2	U26EE104A.2	3	3	1	1	1	–	–	–	1	1	1	3	–
CO3	U26EE104A.3	2	2	1	1	1	–	–	–	1	1	2	2	–
CO4	U26EE104A.4	2	1	1	1	1	–	–	–	1	1	–	2	–
U26EE104A		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

CO–SDG Alignment Matrix				
CO	**CO Statement (The student should be able to…)**	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				and infrastructure.
CO3	Evaluate the voltage and current characteristics of PN junction diode and Zener diode.	**SDG 9**	Industry, Innovation and Infrastructure	Understanding the V-I characteristics of PN junction and Zener diodes is fundamental to modern electronics. This knowledge is critical for designing power supplies, rectifiers, and protection circuits, which are key components in developing innovative industrial electronics and communication systems, thereby driving infrastructure modernization.
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.

COMPUTER ARCHITECTURE & ORAGNIZATION

Class: B. Tech. V – Semester		**Branch:** CSE	
Course Code:	**U26CS105**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1 : examine the study of the basic structure and operation of a digital computer operations and performance, data representation methods, and digital logic circuit analysis

CO2 : analyze instruction execution, addressing modes, hardware components, and control mechanisms in processors

CO3 : apply ALU operations on positive and negative numbers and analyze the features of various types of memory

CO4 : analyze I/O interfaces, bus systems, data transfer methods, and pipeline processing concepts

UNIT-I	**9 Hrs**

Digital Computers: Introduction to computers, Functional units, Basic operational concepts of a computer, Performance

Data Representation: Binary number system, Octal and hexadecimal numbers, Decimal representation, Alphanumeric representation

Digital Logic Circuits: Logic gates-symbols and truth tables, Map simplification, Flip flops, Registers

UNIT-II	**9 Hrs**

Instruction Set Architecture: Memory locations and addresses, Memory operations, Instructions and instruction sequencing, Addressing modes

Basic Processing Unit: Fundamental concepts, Instruction execution, Hardware components, Instruction fetch and execution steps, Control signals

UNIT-III	**9 Hrs**

Arithmetic: Addition and subtraction of signed numbers, Multiplication of numbers, Integer division

The Memory System: Basic concepts, Semiconductor RAM memories- Internal organization of memory chips, Static memories, Dynamic RAMs; Read-only memories, Memory hierarchy, Cache memories, Direct memory access, Performance considerations

UNIT-IV	**9 Hrs**

Input-Output Organization: Input-output interface- I/O bus and interface modules, I/O versus memory bus, Isolated versus memory-mapped I/O, Asynchronous data transfer- Strobe control, Handshaking

Pipeline Processing: Pipelining, Arithmetic pipeline, Instruction pipeline

Textbook(s):

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, "Computer Organization and Embedded Systems", McGraw-Hill Education, 6th Edition, ISBN-9789355323729, 2023.(ChapterNos.1,2,5,7,8,9)
2. M. Morris Mano, "Computer System Architecture", Revised Third Edition, Pearson Education, ISBN: 978-93-325-8560-7, 2019. (ChapterNos.9,10,11,12,14)

Reference Book(S):

1. B Ram, Sanjay Kumar, "Computer Fundamentals: Architecture and Organization", *New Age International Publishers*, 5th Edition, ISBN: 978-81-224-3610-5,2018.
2. W. Stallings, "Computer Organization and Architecture - Designing for Performance", 7th Edition, Pearson Education, ISBN 978-81-7758-993-1,2009.

Web and Video link(s):

1. **https://youtu.be/Kn5ipjXJvpQ?si=qsl9paRizepEmRZ5;** ***NPTEL Video Lecture on Fast Addition , Multiplication by Prof. Anshul Kumar, Professor of CSE ,IIT Delhi***
2. https://youtu.be/CSkN0wj0zZU?si=suwgssCvvwvTIytn; *NPTEL Video Lecture on DMA transfer by Prof. Jatindra Kumar Deka, Professor of CSE, IIT Guwahati.*

Course Articulation Matrix (CAM):		U24CS105: COMPUTER ARCHITECTURE & ORAGNIZATION												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U24CS105.1	2	2	2	2	2	1	1	-	1	1	1	2	2
CO2	U24CS105.2	2	2	2	2	2	-	-	-	-	-	1	2	2
CO3	U24CS105.3	2	2	3	3	2	-	-	-	-	-	1	2	2
CO4	U24CS105.4	2	2	3	3	2	1	1	-	1	1	1	2	2
U24CS105		2	2	2.5	2.5	2	1	1	-	1	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	examine the study of the basic structure and operation of a digital computer operations and performance, data representation methods, and digital logic circuit analysis	SDG9	Industry, Innovation and Infrastructure	Fundamental knowledge of computer hardware organization, digital systems, and performance optimization, which are essential for developing innovative computing technologies, strengthening digital infrastructure, and advancing industrial automation and technological innovation
CO2	analyze instruction execution, addressing modes, hardware components, and control mechanisms in processors	SDG9	Industry, Innovation and Infrastructure	Enabling students to understand processor architecture and control mechanisms, which are fundamental for designing efficient computing systems, improving industrial technologies, and supporting innovation in digital infrastructure and advanced electronic systems
CO3	apply ALU operations on positive and negative numbers and analyze the features of various types of memory	SDG9	Industry, Innovation and Infrastructure	Arithmetic processing and memory system analysis, which are essential for designing high-performance computing systems, optimizing digital infrastructure, and fostering innovation in modern electronic and industrial applications
CO4	analyze I/O interfaces, bus systems, data transfer methods, and pipeline processing concepts	SDG9	Industry, Innovation and Infrastructure	Enabling students to understand efficient data communication and processing techniques, which are vital for developing reliable computing infrastructure, enhancing system performance, and supporting innovation in industrial and technological applications

ENGINEERING PHYSICS LABORATORY (*for CSE*)

Class: B.Tech. I – Semester		**Branch:** CSE	
Course Code:	**U26PY106D**	**Credits:**	**1**
Hours/Week (L-T-P-E):	**0-0-3-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

(based on cognitive skills acquired from theory component)

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

CO2 : lyse the energy band gap and V-I characteristics of semiconductor devices such as PN junction diodes and LEDs.

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

CO4 : ermine the wavelength of light and the dimensions of fine slits using interference and diffraction phenomena, including Newton's Rings and laser diffraction techniques.

List of Experiments

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

Textbook(s):

1. M. Avadhanulu and Kshirsagar, TVS Arun Murthy, *A Text Book 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, *Engineering Physics*, Mc Graw Hill 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 Superconductivity by Prof. Arghya Taraphder IIT Kharagpur*
2. https://onlinecourses.nptel.ac.in/noc24_lw07/preview; *NPTEL video lecture on Introduction to Law on Electricity by Prof. Uday Shankar, IIT Kharagpur*
3. https://onlinecourses.nptel.ac.in/noc24_ph45/preview; *NPTEL Video Lecture on Introduction to LASER - Course by Prof. M. R. Shenoy, IIT Delhi*
4. https://onlinecourses.nptel.ac.in/noc20_ee77/preview; *NPTEL Video Lecture on Semiconductor Devices and Circuits By Prof. Sanjiv Sambandan, IISc Bangalore*
5. https://nptel.ac.in/courses/106106232; *NPTEL Video Lecture on Introduction to Quantum Computing: Quantum Algorithms and Qiskit by Prof. Prabha Mandayam, Prof. Anupama Ray, Prof. Sheshashayee Raghunathan, IIT Madras*

Laboratory Manual:

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):		U26PY106D : ENGINEERING PHYSICS LABORATORY (*for CSE*)												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26PY106D.1	2	1	1	-	1	1	1	1	2	-	1	-	-
CO2	U26PY106D.2	2	1	-	-	1	1	1	1	2	-	1	-	-
CO3	U26PY106D.3	2	1	-	-	1	1	1	1	2	-	1	-	-
CO4	U26PY106D.4	2	1	-	1	1	1	1	1	2	1	1	-	-
U26PY106D		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	SDG 4	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

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
	using diffraction phenomenon.			envisaged by SDG 4.
		SDG 9	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.
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	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.
		SDG 9	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.

PROGRAMMING FOR PROBLEM SOLVING WITH C LABORATORY			
Class: B. Tech. I – Semester		**Branch: CSE**	
Course Code:	**U26CS107**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**40%**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1: develop programs using operators and decision making statements

CO2 : apply loops and arrays to develop a program of an application

CO3: implement string operations and develop modular programs using user-defined functions, recursion, and storage classes

CO4: develop programs using structures, unions, pointers and files

LIST OF EXPERIMENTS
Experiment-1
To develop the Programs using input output functions, operators (arithmetic, relational and conditional)
Experiment-2
To develop the Programs using operators (bit-wise, logical, increment and decrement)
Experiment-3
To develop the Programs using conditional control structures: if, if-else, nested if
Experiment-4
To develop the Programs using else if ladder, switch and goto statements
Experiment-5
To develop the Programs using loop control structures: while
Experiment-6
To develop the Programs using loop control structures: do-while and for
Experiment-7
To develop the Programs on one dimensional array and two-dimensional array
Experiment-8
To develop the Programs on String operations and string handling functions
Experiment-9
To develop the Programs on different types of functions, parameter passing using call-by-value & call-by-address, recursion and storage classes
Experiment-10
To develop the Programs using structures, unions, pointers to arrays and pointers to strings
Experiment-11
To develop the Programs using array of pointers and pointers to structures
Experiment-12
To develop the Programs on File operations and file handling functions for sequential text files

Text Book(s):

1. Balagurusamy, *Programming in ANSI C*, 8th ed., New Delhi, India: McGraw Hill Education (India), 2022

Reference Book(s):

1. P. Deitel and H. Deitel, *C How to Program: With Case Studies Introducing Applications*

Programming and Systems Programming, 9th ed., Harlow, England: Pearson Education Limited, 2022

2. B. W. Kernighan and D. M. Ritchie, *The C Programming Language*, 2nd ed., New Delhi, India: Pearson Education India, 2015
3. R. Thareja, *Programming in C*, 3rd ed., New Delhi, India: Oxford University Press, 2023
4. Y. Kanetkar, *Let Us C*, 19th ed., New Delhi, India: BPB Publications, 2022
5. A. K. Sharma, *Computer Fundamentals and Programming in C*, 2nd ed., Hyderabad, India: Universities Press, 2018

Web and Video link(s):

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

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

Laboratory Manual (for Laboratory Component):

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

Course Articulation Matrix (CAM):		**U26CS107: PROGRAMMING FOR PROBLEM SOLVING WITH C LABORATORY**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U26CS107.1**	1	1	1	1	1	-	1	1	1	-	2	1	2
CO2	**U26CS107.2**	1	2	2	2	1	-	1	1	1	-	2	2	2
CO3	**U26CS107.3**	1	2	3	2	1	-	1	1	1	-	2	2	2
CO4	**U26CS107.4**	1	2	3	2	1	-	1	1	1	-	2	2	2
U26CS107		**1**	**2.25**	**2.25**	**1.75**	**1**	**-**	**1**	**1**	**1**	**-**	**2**	**1.75**	**2**

CO–SDG Alignment Matrix				
CO	CO Statement The student should be able to…	Relevant SDG	SDG Description	Mapping Justification
CO1	develop programs using operators and decision making statements	SDG 4	Quality education	Unit I introduces the absolute fundamentals of programming — I/O, operators, and decision-making — which are the entry point to computational literacy for every learner. Mastering bitwise, relational, and conditional constructs develops precise logical thinking that SDG 4 promotes: inclusive, quality education that equips individuals with foundational digital skills relevant to today's economy.
CO2	apply loops and arrays to develop a program of an	SDG 9	Industry,	Control flow structures — branching and iteration — are the

CO–SDG Alignment Matrix				
CO	CO Statement The student should be able to…	Relevant SDG	SDG Description	Mapping Justification
	application		Innovation and Infrastructure	building blocks of every industrial software system. Switch-case logic powers embedded firmware, protocol handlers, and state machines used in industrial automation. Loop constructs drive data processing pipelines, sensor polling, and real-time monitoring systems. These experiments develop the programming capability needed to build the innovative, reliable software infrastructure that SDG 9 calls for.
CO3	implement string operations and develop modular programs using user-defined functions, recursion, and storage classes	SDG 4	Quality education	Unit III marks the transition to structured, modular thinking — arrays, strings, functions, and recursion represent the intellectual leap from writing instructions to designing programs. Understanding parameter passing (by value vs address), scope via storage classes, and recursive decomposition develops higher-order analytical skills. This directly advances SDG 4's goal of fostering deep, transferable learning outcomes in technical education.
CO4	develop programs using structures, unions, pointers and files	SDG 9	Industry, Innovation and Infrastructure	Structures, pointers, and file handling are the cornerstones of systems-level and application programming used across industrial software. Structures model real-world entities in embedded systems and device drivers; pointer arithmetic is essential for OS kernel development and memory-efficient applications; file I/O enables persistent data storage in every production system. These skills directly contribute to building the robust digital infrastructure that SDG 9 envisions.

BASIC ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY

Class: B. Tech. I		**Branch:** Common to CSE, CSE-Allied, IT	
Course Code:	**U26EE108A**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

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 (for laboratory component):

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

Course Articulation Matrix (CAM):		U26EE108A: BASIC ELECTRICAL & ELECTRONICS ENGINEERING LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26EE108A.1	3	3	2	2	1	-	-	-	2	2	-	2	1
CO2	U26EE108A.2	3	2	2	3	1	-	-	-	2	2	-	2	1
CO3	U26EE108A.3	2	2	3	2	3	-	-	-	2	2	-	3	2
CO4	U26EE108A.4	3	2	2	2	1	-	-	-	2	2	-	3	2
U26EE108A		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.

Information Technology Workshop Laboratory

Class: B. Tech. I – Semester		**Branch:** CSE	
Course Code:	**U26CS109**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1 : Identify and explain the functions of computer hardware components, peripheral devices, BIOS settings, operating system features, and system resources.

CO2 : Demonstration on Install, configure, and manage operating systems, network , user accounts, files, folders, storage devices, and system utilities using Windows, Linux, DOS

CO3 : Create and develop professional documents, spreadsheets, presentations, and technical reports using MS Word, MS Excel, MS PowerPoint, and LaTeX document preparation systems.

CO4 : Design and develop basic websites using HTML by incorporating text, images, tables, forms, hyperlinks, and multi-page web structures.

Experiment-1

1. Study and identification of computer hardware components including CPU, motherboard, RAM, storage devices, power supply, and peripheral devices
2. Demonstration of computer assembly/disassembly and exploration of BIOS/UEFI settings and boot sequence configuration

Experiment-2

1. Installation and basic configuration of operating systems (Windows & Linux), including user account creation and system customization.
2. Examine system performance and storage resources using operating system utilities such as Task Manager, Device Manager, and Disk Management tools

Experiment-3

1. Organize files and folders using file management operations such as creating, copying, moving, renaming, compressing, and deleting files and directories using DOS and Linux commands

Experiment-4

Installation and Configuration of Virtual Machines using VMware Workstation

1. Install and configure VMware Workstation software, create a new virtual machine, allocate hardware resources (CPU, RAM, storage), and install an operating system (Windows/Linux) on the virtual machine.
2. Perform virtual machine management operations, including starting, stopping, suspending, cloning, taking snapshots, configuring network settings (NAT, Bridged, Host-Only), and sharing files between the host and guest operating systems.

Experiment-5

1. Prepare professional documents using MS Word by applying text formatting, page layout, headers, footers, and styles
2. Design advanced documents using MS Word features such as tables, images, templates, references, and mail merge.

Experiment-6

1. Develop and analyze spreadsheets using MS Excel by applying formulas, functions, cell formatting, and worksheet management techniques.

2. Create multimedia presentations using MS PowerPoint by incorporating themes, animations, transitions, and multimedia content.

Experiment-7

1. Create basic documents using LaTeX by applying document classes, text formatting, and page layout features.
2. Develop structured documents in LaTeX using sections, subsections, lists, and special characters.
3. Format documents using page numbering, alignment, spacing, and text styling commands.

Experiment-8

1. Create and format tables in LaTeX using appropriate table environments and formatting options.
2. Insert and manage figures, images, captions, and labels in LaTeX documents.
3. Prepare technical documents containing mathematical expressions, equations, and scientific symbols using LaTeX.

Experiment-9

1. Design basic web pages using HTML by incorporating headings, paragraphs, text formatting, and horizontal rules.
2. Create web pages using ordered lists, unordered lists, hyperlinks, and images.

Experiment-10

1. Develop structured web pages using HTML tables to organize and present information effectively.
2. Create web forms using HTML form elements such as text boxes, radio buttons, check boxes, and submit buttons.

Experiment-11

1. Design multi-page websites using HTML by linking web pages through internal and external hyperlinks.
2. Develop web pages that integrate text, images, tables, and forms to create a complete website layout.

Experiment-12

1. Identify networking devices and transmission media including hubs, switches, routers, modems, NICs, and network cables.
2. Perform network cable crimping, configure IP addressing settings, and demonstrate the use of transmission media for establishing and troubleshooting network connectivity.

Textbook(s):

1. P.K.Sinha and Priti Sinha, *Computer Fundamentals*, BPB, 1st edition, 2018, New York. *(Chapters 1 to 3, 9 to 12)*
2. Joan Lambert, *Microsoft Office 365 & Office 2021 Step by Step,* Microsoft Press, 1st edition, 2021
3. Tobias Oetiker, Hubert Partl, Irene Hyna, and Elisabeth Schlegl, *The Not So Short Introduction to LaTeX2ε*, Comprehensive TeX Archive Network, Version 7.0, 2025
4. Thomas A. Powell, *HTML & CSS: The Complete Reference*, McGraw-Hill Education, 5th Edition, 2017.

Laboratory Manual (for laboratory component):

1. *Computer Systems and Networking Laboratory Manual,* Department of CSE , KITSW

Course Articulation Matrix (CAM):		U26CS109 : Information Technology Workshop Laboratory												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26CS109.1	2	2	2	1	2	1	1	1	1	-	-	2	2
CO2	U26CS109.2	2	2	2	2	2	1	1	1	1	-	2	2	2
CO3	U26CS109.3	2	2	2	2	2	1	1	1	1	-	2	2	2
CO4	U26CS109.4	2	2	3	3	3	1	1	1	1	-	2	2	2
U26CS109		1.75	2	2.25	1.75	2.25	1	1	1	1	-	2	2	2
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	Identify and explain the functions of computer hardware components, peripheral devices, BIOS settings, operating system features, and system resources.	SDG9	Industry, Innovation and Infrastructure	Builds foundational knowledge of computing infrastructure and digital systems.
CO2	Demonstration on Install, configure, and manage operating systems, network , user accounts, files, folders, storage devices, and system utilities using Windows, Linux, DOS	SDG9	Industry, Innovation and Infrastructure	Develops practical knowledge on operating systems installation, configurations and management.
CO3	Create and develop professional documents, spreadsheets, presentations, and technical reports using MS Word, MS Excel, MS PowerPoint, and LaTeX document preparation systems.	SDG8	Decent Work and Economic growth	Enhances employability through practical skills in office productivity tools used in workplaces.
CO4	Design and develop basic websites using HTML by incorporating text, images, tables, forms, hyperlinks, and multi-page web structures.	SDG9	Industry, Innovation and Infrastructure	Builds foundational knowledge of networking technologies, and digital systems.

IDEA LAB MAKERSPACE

Class: B. Tech. I – Semester		**Branch:** Common to all branches	
Course Code:	**U26AE110**	**Credits:**	**1**
Hours/Week (L-T-P-E):	**0-0-2-4**	**CIE:**	**40%**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

(based on psychomotor skills acquired from laboratory component)

CO1 : develop technical skills such as 3D printing, Laser engraving, Wood carving and Robotics

CO2 : apply the techniques and principles of welding, carpentry and foundry to produce required prototype/model

CO3 : design and build a IoT based and PCB system for a given application

CO4 : engage in project-based learning which reinforces theoretical knowledge through practical application

S. No.	Creative Fabrication Technology	List of Experiments
1.	3D Printing	Prepare a key chain on 3D printer with the given dimensions
2.		Prepare a Spur Gear on 3D printer with the given dimensions
3.	Laser Engraving	Perform key chain by using CO_2 laser cutting machine
4.	Welding	Prepare a Single V-Butt joint on mild steel plates using AC arc welding machine
5.	CNC Wood Router	Perform wood carving using CNC (Computer numerical Control) Wood Router
6.	Carpentry	Prepare a half lap dovetail joint
7.	Foundry	Prepare a sand mould using single piece pattern
8.	Injection Moulding	Prepare a plastic product using Injection moulding machine
9.	Printed Circuit Board (PCB)	Design and fabricate a PCB (Printed Circuit Board) for a given application
10.	Internet of Things (IoT)	Measure the temperature and humidity by using DHT11 sensor and Arduino UNO
11.		Create a Smart Plant Watering System using IoT (Internet of Things) technology
12.	Robotics	Perform basic pick-and-place operation using robot
Course Project		• Students are required to create an affordable prototype as their final project for the end semester exam (ESE), 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.

Textbook(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.

Reference Book(S):

1. Ian Gibson, David Rosen, Brent Stucker, Mahyar Khorasani, "Additive Manufacturing Technologies-3D Printing, Rapid Prototyping, and Direct Digital Manufacturing" Springer Nature, 2nd Edition 2021.
2. R.S. Khandpur, "Printed Circuit Boards: Design, Fabrication, Assembly and Testing", New Delhi Tata Mc Graw Hill-2008.
3. Sudeep Mishra, Anandarupmukherjee and Arijit Roy, "Introduction to IoT", New Delhi: University Cambridge Press, 2021.

Laboratory Manual (for laboratory component):

1. *Workshop practice laboratory manual & record book prepared by the faculty of department of Mechanical engineering, KITSW, Revised version 4, July-2026*.

Course Articulation Matrix (CAM):		**U26AE110: 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	**U26AE110.1**	2	2	1	1	2	1	1	1	1	1	1	1	2
CO2	**U26AE110.2**	2	2	1	1	2	1	1	1	1	1	1	1	2
CO3	**U26AE110.3**	2	2	1	1	2	1	1	1	1	1	1	1	2
CO4	**U26AE110.4**	2	2	1	1	2	1	1	1	1	1	1	1	2
U26AE110		**2**	**2**	**1**	**1**	**2**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
CO1	develop technical skills such as 3D printing, Laser engraving, Wood carving and Robotics	SDG 4	Quality Education	Development of modern fabrication and automation skills enhances technical competency, creativity, innovation and employability of students through hands-on learning and skill-oriented education
CO2	apply the techniques and principles of welding, carpentry and foundry to produce required prototype/model	SDG 9	Industry, Innovation and Infrastructure	Practical exposure to manufacturing and prototyping techniques promotes industrial skills, innovation capability and infrastructure-oriented engineering practices required for sustainable industrial development
CO3	design and build a IoT based and PCB system for a given application	SDG 11	Sustainable Cities and Communities	IoT and embedded system development supports smart technologies, automation, efficient resource monitoring and sustainable solutions for modern

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				industries & communities
CO4	engage in project-based learning which reinforces theoretical knowledge through practical application	SDG 8	Decent Work and Economic Growth	Project-based learning improves problem-solving, teamwork, innovation and practical engineering skills, preparing students for productive employment and entrepreneurship in emerging technologies

II SEMESTER (Stream – I)

S. No.	Category	Course Code	Course Title	Lectures / week				Credits
				L	T	P	E	C
1	BSC	U26MH201	Matrix Theory & Vector Calculus	2	1	-	3	3
2	BSC	U26CY202D	Engineering Chemistry (from Pool – I)	2	1	-	3	3
3	ESC	U26CS203	Data Structures Through C	2	1	-	3	3
4	HSMC	U26MH204	English Communication and Report Writing	2	1	-	3	3
5	PCC	U26CS205	Python Programming	2	1	-	3	3
6	BSC	U26CY206D	Engineering Chemistry Lab (from Pool – II)	-	-	2	2	1
7	ESC	U26CS207	Data Structures Through C Lab	-	-	2	2	1
8	VAC	U26VA208	Sports and Yoga	-	-	2	2	1
9	PCC	U26AE209	Python Programming Laboratory	-	-	2	2	1
10	ESC	U26ME210	Engg. Graphics & CAD*	-	-	2	2	1
			Total:	**10**	**5**	**10**	**25**	**20**

MATRIX THEORY AND VECTOR CALCULUS

Class: B. Tech. II – Semester		**Branch:** Common to all branches	
Course Code:	**U26MH201**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

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 Gauss divergence theorems

UNIT-I	**9 Hrs**

Matrices:

Rank of a Matrix, Elementary transformations of a matrix, Gauss Jordan method of finding the inverse, Normal form of a matrix, Consistency of linear system of equations, System of linear homogenous equations, Eigen values, Eigen vectors, Properties of Eigen values, Cayley Hamilton's theorem, Reduction to diagonal form, Factorization method (LU Decomposition)

Applications of Eigen value problems: Stretching of an elastic membrane, Eigen value problems arising from Markov processes, Eigen value problems arising from population models, Leslie model

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)

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

UNIT-IV	**9 Hrs**

Integration of vectors:

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

Textbooks:

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. S.S. 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):		**U26MH201 MATRIX THEORY AND VECTOR CALCULUS**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U26MH201.1**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO2	**U26MH201.2**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO3	**U26MH201.3**	2	2	1	1	-	-	-	1	1	-	1	1	1
CO4	**U26MH201.4**	2	2	1	1	-	-	-	1	1	-	1	1	1
U26MH201		**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.

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				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 CHEMISTRY *(for CSE)*

Class: B. Tech. II – Semester		**Branche:** CSE	
Course Code:	**U26CY202D**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

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

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

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

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

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

Textbook(s):

1. Jain and Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Company, 17th edition, 2019

Reference Book(s):

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

Web and Video link(s):

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

Course Articulation Matrix (CAM):		U26CY202D: ENGINEERING CHEMISTRY *(for CSE)*												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26CY202D.1	2	-	-	-	1	1	1	-	1	-	1	1	1
CO2	U26CY202D.2	2	-	-	-	1	1	1	-	1	-	1	1	1
CO3	U26CY202D.3	2	-	-	-	1	1	1	-	1	-	1	1	1
CO4	U26CY202D.4	2	-	-	-	1	2	1	-	1	-	1	1	1
U26CY202D		2	-	-	-	1	1.25	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 the concepts of electrochemical energy systems for batteries and fuel cells	SDG7	Affordable and Clean Energy	Electrochemical energy systems such as batteries and fuel cells provide clean, reliable, and efficient energy storage and reduce dependence on fossil fuels, promote renewable energy utilization.
CO2	interpret suitable techniques of water analysis and corrosion treatment of solid materials	SDG3	Good Health and well being	Water analysis techniques help identify contaminants and ensure safe drinking water, thereby protecting human health and preventing water-borne diseases. Corrosion treatment of solid materials improves the safety and durability of pipelines, storage systems, and medical equipment.
CO3	apprise manufacturing of	SDG9	Industry,	Engineering materials enhancing

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
	engineering materials and spectroscopic techniques of chemical analysis		Innovation and Infrastructure	knowledge of manufacturing processes for engineering materials and Spectroscopic technique develops knowledge of modern spectroscopic techniques used in chemical analysis. These concepts promote industrial innovation, quality improvement, and advanced material development for sustainable industries.
CO4	apprise the synthesis, materials and principles of green chemistry applications of engineering	SDG9	Industry, Innovation and Infrastructure	Engineering materials, and principles of green chemistry promote 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.

DATA STRUCTURES THROUGH C

Class: B. Tech. – II Semester		**Branch: CSE**	
Course Code:	**U26CS203**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

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, Three dimensional and n-dimensional arrays, Passing arrays to functions and pointers

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

Queues: Queues, Array representation of queues, Double ended queues, Circular queues Priority Queue

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, Skiplist

UNIT-IV	**9 Hrs**

Sorting Techniques: Selection sort, Insertion Sort, Shell sort and Radix sort, Time complexities of sorting, Two way insertion sort, Comparison of sorting techniques

Hashing: Hashing techniques, Collision resolution techniques, Closed hashing, Open hashing, Comparison of collision resolution techniques

Textbook(s):

1. D.Samantha, *Classic Data Structure,* Prentice Hall India New Delhi, 2nd edition, 2009

Reference Book(s):

1. R. Thareja, *Data Structures Using C,* Oxford University Press, New Delhi, India, 2nd edition, 2014.
2. E. Balagurusamy, *Data Structure Using C*, McGraw Hill Education, New Delhi, India: 1st edition, 2017
3. R. F. Gilberg and B. A. Forouzan, *Data Structures: A Pseudocode Approach with C*, Cengage Learning, Boston, MA, USA, 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):		**U26IT203 : DATA STRUCTURES THROUGH C**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U26CS203.1**	2	2	2	1	-	-	1	-	1	-	1	2	2
CO2	**U26CS203.2**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO3	**U26CS203.3**	2	2	2	2	-	-	1	-	1	-	2	2	2
CO4	**U26CS203.4**	2	2	2	2	-	-	1	-	1	-	2	2	2
U26CS203		2	2	2	1.75	-	-	1	-	1	-	1.75	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	analyze and implement array operations by utilizing dynamic memory allocation and evaluating their time and space complexities	SDG 4	Quality education	Unit I introduces foundational thinking skills — algorithmic analysis, complexity trade-offs, and memory management — that are core to inclusive, quality technical education (SDG 4). Teaching students *how to reason about efficiency* equips them with problem-solving competencies that transcend programming languages and support lifelong learning in computing.
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	Stacks and queues are the structural backbone of real-world software infrastructure — OS process scheduling, compiler design (infix→postfix parsing), undo/redo systems, and network packet buffering. Recursion and the Tower of Hanoi build the algorithmic innovation skills that drive SDG 9's

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
				goal of fostering resilient, modern industrial systems through technology.
CO3	analyze and implement various types of linked lists by utilizing dynamic memory allocation techniques and evaluating their operational complexities	SDG 4	Quality education	Linked lists require students to reason about pointer manipulation, memory deallocation, and abstract data representation — demanding higher-order thinking that reflects SDG 4's emphasis on deep, quality learning. The progression from arrays to dynamic structures builds adaptable knowledge, and topics like skip lists and merging extend learners toward self-directed inquiry beyond the classroom.
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	Sorting and hashing are workhorses of industry-grade systems — database indexing, search engines, cryptographic hashing, and load balancing all rely on these techniques. Collision resolution directly models the design challenges engineers face building scalable, fault-tolerant infrastructure. This unit's focus on performance trade-offs and real-world applicability aligns strongly with SDG 9's innovation and infrastructure mandate.

ENGLISH COMMUNICATION AND REPORT WRITING

Class: B.Tech. I & II–Semesters		**Branch:** Common to all branches	
Course Code:	**U26MH204**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

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 : create effective letters, e-mails, reply to Memos and do the given tasks with confidence

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	**9 Hrs**

SPEAKING ACTIVITIES

Self-Introduction- News Paper Reading (reading aloud)-Pronunciation check-Presentation, Narration/ Oral Description of a story/incident/event with the clues (JAM)

GRAMMAR

Tenses: Definition and identification through examples-Main and Sub Tenses-Present Tense-Structures through examples-usage- Correct use of Tenses with a focus on Present Tense- exercises for practice

VOCABULARY

Word formation: Prefixes-Suffixes- Definition & Examples-Sentence Formation with newly

READING SKILL

Reading: Definition: Sub skills of Reading- Emphasis on Skimming-Definition-Purpose-How to skim through the text- Exercises for practice

WRITING PRACTICES

Report Writing: Definition-Purpose- Qualities of a good Report-Types-Format

Paragraph Writing: Definition-Organizing Principles of paragraphs-Making a paragraph through hints/graphs and pictures-Coherence-Linking Devices- Systematic Development of Ideas

LIFE SKILLS: Ethical Values and Humanity

The Last Leaf: A Short Story by O. Henry - Discussion based on collaborative interaction - Comprehension of Grammar, Vocabulary and Content

UNIT-II	**9 Hrs**

SPEAKING ACTIVITIES

Group Discussion-Narration/ Oral Description of a story/incident/event with the clues provided (JAM)--Debate

GRAMMAR

Tenses: Past Tense-Sub Tenses-Structures- Correct use of Past Tense- exercises for practice

Subject-Verb Agreement: Identification with examples-Rules-Exercises for practice

Reported Speech: Definition-Rules-Examples-Transformation Process-Exercises for practice

Sentence Correction: Emphasis on Concord, Reported Speech and Present and Past Tenses-Sentence Structures

VOCABULARY

Synonyms-Antonyms-Single-Word Substitutes- Definition-Examples-Popular Abbreviations

READING STRATEGY

Reading Strategy-Emphasis on Scanning the Text- Definition of Scanning-Purpose advantages- Examples, Exercises and Practice through Team work

WRITING PRACTICES

Report Writing:Technical Reports-Purpose-Format-significance of abstract/Executive Summary

Letter Writing: Effective Letter Writing Techniques-Information Seeking Letters-Job Application Letters- Apology Letters –Resume and Cover letter

LIFE SKILLS: Determination

How I Became a Public Speaker: An essay by George Bernard Shaw

Discussion based on collaborative interaction - Comprehension of Grammar, Vocabulary and Content

UNIT-III	**9 Hrs**

SPEAKING ACTIVITIES

Self-Introduction through videos- Narration/ Oral Description of a story/incident/event with the clues provided (JAM)- Poster presentations / Power-Point presentations

GRAMMAR

Tenses: Future Tense- Sub Tenses-Structures- Correct use of Future Tense- exercises for practice

Nouns-Prepositions-Adverbs-Adjectives-Definition-Identification-Exercises for practice

Sentence Correction based on correct use of Future Tense- Nouns- Prepositions-Adverbs – Adjectives

VOCABULARY

Phrasal Verbs- Technical Words-Latin Words

READINGS TRATEGY

Intensive Reading: purpose-Types of Comprehension Questions-Examples, Exercises and Practice through Team work

WRITING PRACTICES

Report Writing: Informational Reports- Inspection Reports –Feasibility Reports- Purpose -Format-Content-Exercises for Practice

LIFE SKILLS: **Positive Attitude**

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

Discussion based on collaborative interaction - Comprehension of Content

UNIT-IV	**9 Hrs**

SPEAKING ACTIVITIES

Extempore speech on the given topic- Visual Presentation- Group Discussion on the topic given well in advance- Providing the required inputs- Story telling of one's choice

GRAMMAR

Tenses: Revision-Exercises for Practice

Clauses: Definition-Identification through examples-Objective/Purpose- Types-Conjunctions-Transformation of Sentences

Sentence Correction (Based on Parts of Speech)-Clauses-Tenses

VOCABULARY

Appropriate Use of Words in Communication-Commonly Confused Words

ACTIVE READING and NOTE-MAKING

Note-Making-Definition-Purpose-Effectiveness

WRITING PRACTICES

Report Writing: Progress Report-Purpose- Format-Content-Exercises for Practice

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

Discussion based on collaborative interaction - Comprehension of Content

Textbook(s):

1. Sanjay Kumar& Pushp Lata, "*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's Approach*" 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., "*A Practical English Grammar*", Oxford UniversityPress3rd Edition1997
2. Thomson A.J. Martinet A.V, "*A Practical English Grammar*" Exercise2, Oxford University Press3rd Edition1997
3. Standard Allen W., "*Living English Structure*", Pearson India Education Pvt Ltd.5th Edition 2009

Web and Video link(s):

1. https://onlinecourses.nptel.ac.in/noc20_hs56/Preview Technical English for Engineers by Aishaicbal, IIT Madras
2. https://onlinecourses.swayam2.ac.in/cec21_lg13/preview Indian Writing in English by Dr. Bindu Ann Philip, St Mary's College Trissur

Course Articulation Matrix (CAM):		U26MH204: ENGLISH COMMUNICATION AND REPORT WRITING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26MH204.1	-	-	-	-	-	1	-	2	2	2	2	1	1
CO2	U26MH204.2	-	-	-	-	-	1	-	2	2	2	2	1	1
CO3	U26MH204.3	-	-	-	-	-	1	-	2	2	2	2	1	1
CO4	U26MH204.4	-	-	-	-	-	1	-	2	2	2	2	1	1
U26MH204		-	-	-	-	-	1	-	2	2	2	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	apply basic grammar principles in speech and writing, read fast, form new words, make coherent paragraphs and adapt the real value of life	SDG-3	Good health and well-being	This aligns with SDG-3 as it partially contributes to the negative impact of mental imbalance on health through the irrational fears of Johnsy who is certain of her death when the last leaf falls down
			Gender	This also aligns with SDG-5 as is highlights

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
		SDG-5 SDG-4	equality Quality education	women accomplishments on par with men by exposing Johnsy and Sue as painters who come out of their home town to stay in another place and work along with men for societal exposure This aligns with SDG-4 as its primary focus is on enhancing the quality of language in speech and writing by strengthening grammar, vocabulary and writing skills.
CO2	create effective letters, e-mails, reply to Memos and do the given tasks with confidence	SDG-4 SDG-8	Quality education Decent work and economic growth	This aligns with SDG-4 as its aim is to enhance reading and writing skills by helping students write letters and resumes effectively applying grammar rules and using relevant vocabulary 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 work place by exhibiting professionalism in the usage of language
CO4	deduct the superfluous information from lengthy text, prepare SoP (Statement of Purpose) effectively and solve critical problems in life with emotional balance	SDG-4 SDG-16	Quality education Peace, justice and strong institutions	This aligns with SDG-4 as it orientates the students towards reading and writing, and improves critical and critical thinking Though not completely, it aligns with SDG-16 as it emphasizes the need to give up anger which is the most potential enemy of man to enjoy peace and become morally strong

PYTHON PROGRAMMING

Class: B. Tech. II – Semester		**Branch:** CSE	
Course Code:	**U26CS205**	**Credits:**	**3**
Hours/Week (L-T-P- E):	**2-1-0-3**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1: apply python programming fundamentals, operators, control structures, and expressions to develop solutions for basic computational problems

CO2: develop modular Python programs using functions, modules, packages, and Python collections

CO3: utilize python strings, regular expressions, file operations, and exception handling for efficient data processing and problem solving

CO4: apply data analysis libraries to process and analyze structured data efficiently

UNIT-I	**9 Hrs**

Introduction to Python: Features of Python, Applications of Python, Installing Python, Writing and Executing Python IDEs, Literal Constants, Variables and Identifiers, Data Types, Input and Output Operations, Comments, Reserved Words, Indentation, Operators, Expressions, Type Conversion

Decision Control Statements: Conditional Branching Statements, Nested Conditions, Loop Structures, Nested Loops, break, continue, pass, else with loops

Functions: Function Definition, Function Call, Variable Scope and Lifetime, Return Statement, Types of Arguments, Default Arguments, Keyword Arguments, Variable-Length Arguments, Lambda Functions, Recursive Functions

UNIT-II	**9 Hrs**

Modules and Packages: Import Statement, from...import Statement, Creating User Defined Modules, Packages, Standard Library Modules, dir() Function

Python Collections: Lists, Tuples, Sets, Dictionaries, List Comprehensions, Tuple Comprehensions, Dictionary Comprehensions, Built-in Functions on Collections, High order functions: Map, Reduce, Filter, Generators expressions and functions.

UNIT-III	**9 Hrs**

Strings: String Operations, String Methods, String Formatting, Slicing, Comparing Strings, Membership Operators, Regular Expressions, Meta Characters, Pattern Matching

Error and Exception handling: Introduction to errors and exceptions, Handling exceptions, Multiple except blocks, The finally Block

File Handling: Opening and Closing Files, Reading and Writing Files, File Modes, Working with Text Files

UNIT-IV	**9 Hrs**

NumPy: The basics of NumPy arrays, Array indexing, Array slicing, Reshaping of array, Concatenation and splitting arrays, Introducing Ufuncs

Introduction to pandas: Installation of Pandas, Series, DataFrame, Panel, Indexing and Slicing Aggregation Functions and Grouping

Visualization with Matplotlib: Importing Matplotlib, Saving figures to files, Simple line plots, Simple scatter plots, Histograms, Binning, and density

Textbook(s):

1. Reema Thareja, *Python Programming Using Problem Solving Approach*, 1st ed., New Delhi: Oxford University Press, 2017. (Chapters 1–9)
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. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, 2nd ed., O'Reilly Media, 2016.
3. Eric Matthes, *Python Crash Course*, 3rd ed., No Starch Press, 2023.
4. David Beazley, *Python Cookbook*, 3rd ed., California: O'Reilly Media, Inc., 2013.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs84 , NPTEL Video Lecture on The Joy of Computing using Python by Prof. Sudarshan Iyengar, IIT Ropar

Course Articulation Matrix (CAM):		U26CS205: PYTHON PROGRAMMING												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26CS205.1	2	2	2	2	1	1	1	1	1	-	2	2	1
CO2	U26CS205.2	2	3	3	2	1	1	1	1	1	-	2	3	1
CO3	U26CS205.3	2	3	3	2	1	1	1	1	1	-	2	3	1
CO4	U26CS205.4	2	2	2	3	1	1	1	1	1	-	2	3	1
U26CS205		2	2.5	2.5	2.25	1	1	1	1	1		2	2.75	1
3 – HIGH, 2 – MEDIUM, 1 - LOW														

CO	CO Statement The student should be able to…	Relevant SDG	SDG Description	Mapping Justification
CO1	apply python programming fundamentals, operators, control structures, and expressions to develop solutions for basic computational problems	SDG 4	Quality Education	The course develops foundational programming and computational thinking skills, promoting quality technical education and lifelong learning opportunities.
CO2	develop modular Python programs using functions, modules, packages, and Python collections	SDG 4	Quality Education	Modular programming concepts enhance problem-solving abilities and software development skills, contributing to quality education and technical competency.
CO3	utilize python strings, regular expressions, file operations, and exception handling for efficient data processing and problem solving	SDG 9	Industry, Innovation and Infrastructure	Data processing and software development skills support innovation and the development of efficient digital solutions required for modern technological infrastructure.
CO4	apply data analysis libraries to process and analyze structured data efficiently	SDG 9	Industry, Innovation and Infrastructure	Data analysis enables informed decision-making and supports the development of innovative and efficient digital solutions and infrastructure.

ENGINEERING CHEMISTRY LABORATORY *(for CSE)*

Class: B. Tech. II– Semester		**Branche: CSE**	
Course Code:	**U26CY206D**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1: make use of analytical instruments for chemical analysis

CO2: determine water quality parameters-alkalinity, hardness

CO3: determine metals present in their ores

CO4: design the synthesis of nanomaterial and polymer

List of Experiments

1. Estimation of hydroxide ion by acidimetry
2. Estimation of alkaline species present in the given water sample
3. Determination of viscosity of the given liquid by Ostwald's viscometer
4. Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
5. Determination of hardness of water by complexometric method
6. Determination of dissolved oxygen in water sample
7. Estimation of chloride ion in water sample by argentometry method
8. Standardization of weak acid (acetic acid) by conductometry using sodium hydroxide (NaOH) and standard hydrochloric acid (HCl)
9. Standardization of strong acid (HCl) by potentiometry using standard sodium hydroxide (NaOH)
10. Colorimetric analysis-verification of Lambert-Beer's law
11. Estimation of ferrous (Fe^{2+}) ion in the given solution using potassium permanganate
12. Synthesis of polymer (phenol- formaldehyde)

Textbook(s):

1. Mendham, J., Denney, R.C., Barnes, J.D. and Thomas, M.J.K., *Vogel's Textbook of Quantitative Chemical Analysis*, Pearson Education, 6th edition, 2009.
2. Sivasankar, B., *Engineering Chemistry*, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2nd edition, 2013.

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. Sharma, B.K., *Instrumental Methods of Chemical Analysis*, Goel Publishing House, Meerut, 24th Edition, 2005.

Laboratory Manual:

Engineering Chemistry Laboratory Manual for CSE, Department of PS, KITSW

Course Articulation Matrix (CAM):		U26CY206D: ENGINEERING CHEMISTRY LABORATORY *(for CSE)*												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26CY206D.1	2	1	-	-	-	1	1	-	1	-	1	-	-
CO2	U26CY206D.2	2	1	-	-	2	1	1	-	1	-	1	-	-
CO3	U26CY206D.3	2	1	-	-	-	1	1	-	1	-	1	-	-
CO4	U26CY206D.4	2	1	-	-	-	1	1	-	1	-	1	-	-
U26CY206D		2	1	-	-	2	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	make use of analytical instruments for chemical analysis	SDG9	**Industry, Innovation and Infrastructure**	Analytical instruments such as electrochemical analyzers help in accurate chemical analysis and research. These techniques improve industrial quality control, product development, and technological innovation.
CO2	Determine waterquality parameters-alkalinity, hardness	SDG6	Clean water and sanitation	Determination of alkalinity and hardness is essential for assessing the suitability of water for drinking and industrial purposes. Monitoring these parameters helps in maintaining water quality and preventing health and environmental issues.
CO3	determine metals present in their ores	SDG9	Industry, Innovation and Infrastructure	Determining metals present in ores forms the basis for metallurgical and material industries. It supports technological advancement and efficient industrial processing of mineral resources.
CO4	design the synthesis of nanomaterial and polymer	SDG9	Industry, Innovation and Infrastructure	Synthesis of nanomaterials and polymers promotes technological innovation and the development of advanced engineering materials. These materials are widely used in electronics, healthcare, energy storage, construction, and manufacturing industries, supporting sustainable industrial growth and modern infrastructure development.

DATA STRUCTURE THROUGH C LABORATORY			
Class: B. Tech. II – Semester		**Branch:** CSE	
Course Code:	**U26CS207**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**40%**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1: develop and test basic data structures and array operations, including dynamic memory allocation to evaluate their performance and complexity

CO2 : apply the linear data structures such as stacks and queues and perform various operations using LIFO or FIFO order respectively

CO3: solve problems using various linked list representations for efficiently storing and retrieving the data

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

Experiment-1

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-2

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-3

7. Program to implement initialization of arrays and traversal operation with DMA
8. Program to implement matrix addition and subtraction with DMA
9. Program to implement matrix multiplication with DMA

Experiment-4

10. Program to implement stack operations
11. Program to convert infix expression into postfix

Experiment-5

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-6

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-7

19. Program to create single linked list and implement its operations

Experiment-8
20. Program to create circular linked list and implement its operations 21. Program to create double linked list and implement its operations
Experiment-9
22. Program to create circular double linked list and implement its operations
Experiment-10
23. Program to implement stack operations using linked list 24. Program to implement queue operations using linked list
Experiment-11
25. Program to implement selection sort 26. Program to implement insertion sort
Experiment-12
27. Program to implement shell sort 28. Program to implement radix sort 29. Program to implement hash table
Textbook(s): 1. D.Samantha, *Classic Data Structure,* Prentice Hall India New Delhi, 2nd edition, 2009
Reference Book(S): 1. R. Thareja, *Data Structures Using C,* Oxford University Press, New Delhi, India, 2nd edition, 2014. 2. E. Balagurusamy, *Data Structure Using C*, McGraw Hill Education, New Delhi, India: 1st edition, 2017 3. R. F. Gilberg and B. A. Forouzan, *Data Structures: A Pseudocode Approach with C*, Cengage Learning, Boston, MA, USA, 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 Structure Through C Laboratory Manual and Record Book,* Department of IT, KITSW.

Course Articulation Matrix (CAM):		**U26IT207: DATA STRUCTURE THROUGH C LABORATORY**												
CO		**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**
CO1	**U26CS207.1**	2	2	2	1	-	-	1	1	1	-	1	2	1
CO2	**U26CS207.2**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO3	**U26CS207.3**	2	2	2	2	-	-	1	1	1	-	2	2	2
CO4	**U26CS207.4**	2	2	2	2	-	-	1	1	1	-	2	2	2
U26CS207		**1**	**2.25**	**2.25**	**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	SDG 9	Industry,	Sorting algorithms and hash tables

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to…*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
	techniques on unsorted data and sort them in an order, able to store the data using hashing techniques to retrieve the data very effectively		Innovation and Infrastructure	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.

SPORTS & YOGA

Class: B. Tech. I & II – Semester		**Branch:** Common to All Branches	
Course Code:	**U26VA208**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1 : Demonstrate Physical Fitness by performing Yoga Asanas.

CO2 : Demonstrate Physical Fitness through various games & Sports

CO3 : Demonstrate Sportsman spirit and ethics

CO4 : Demonstrate Physical, Psychological, Social and Emotional balance.

Event-1

BASKET BALL: Passing, Dribbling, Shooting, Blocking, Rebounding, Offense/ Defence.

Event-2

FOOT BALL : Dribbling, Passing, Receiving , Shooting ,Ball Control ,Heading ,Tracking Marking, Movement off the Ball.Develop a program to implement contrast stretching.

Event-3

VOLLEY BALL: Serving, Passing (upper hand / under hand), Setting, Blocking, Spiking

Event-4

BADMINTON : Proper Grip , Footwork, Stance, Serving, Basic Strokes.

Event-5

CHESS : Tactics, Calculation, Visualization, Opening, Evaluation ,Ending games, Strategy

Event-6

CARROMS : Proper Flicking technique, Angle Awareness, Controlling force, Focus and Consistency, Visualize the shot, Body Alignment and Posture, Watch your Wrist. Use the Right Finger.

Event-7

TABLE TENNIS : Grip, Stance, Footwork, Basic Stokes, Serving.

Event-8

CRICKET : Batting ,Bowling , Fielding ,Wicket Keeping.

Event-9

HAND BALL : Gripping, Catching Passing, Dribbling ,Faking, Shooting .

Event-10

KABADDI : Offensive (Raiding) Skills, Defensive (Tackling) Techniques.

Event-11

KHO-KHO : Chasing (Attacking) ,Running(Evading)Techniques.

Event-12

YOGA : Surya Namaskar, Thirkonasanam, Vajrasanam, Shashankasanam, Navukasanam, Chakrasanam, Dhanurasanam, Pranayamam.

Textbook(s):

1. Rules and Skills of Games and Sports, Author – B.K.Chaturvedi, Publisher – Goodwill Publishing House, B-9, Rattan Jyoti, 18 Rajendra Place, New Delhi – 110008 (India)
2. Yoga For Every Athlete, Secrets of an Olympic Coach, Author – Aladar Kogler, Ph.D., Sports Psychologist, JAICO Publishing House, Mumbai, Delhi, Bangalore, Calcutta, Hyderabad, Chennai.
3. Coaching Successfully BasketBall, Author – Yograj Thani, Sports Publication, WP-474, 1st Floor, Shiv Market, Ashok Vihar, Delhi-110052.
4. Badminton for Schools, AuthorJake Downey, Publisher – S.Chand & Company Ltd, Ram Nagar, New Delhi-110055.
5. Volleyball for Schools, Author- Dave James Phtographs by Gordon Ruck, Publisher – S.Chand & Company (Pvt) LTD, Ram Nagar, New Delhi – 110055.
6. FootBall Skills & Rules, Author – O.P.Sharma, Publisher- Khel Sahitya Kendra, 4264/3, Ansari Road, Darya Ganj, New Delhi-110002.

Reference Book(S):

1. Foundation of Physical Education and Sports, Dr.Sakure Girish Madhaorao,Sports Publication 7/26,Ground Floor,New Delhi-110002,E-mail:lakshaythani@hotmail.com.

Course Articulation Matrix (CAM):		U26VA208 : SPORTS & YOGA Common to All Branches												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26VA208.1	-	-	1	-	-	2	1	2	-	-	1	-	-
CO2	U26VA208.2	-	-	1	-	-	2	1	2	1	-	1	-	-
CO3	U26VA208.3	-	-	1	-	-	2	1	2	-	-	1	-	-
CO4	U26VA208.4	-	-	1	-	-	2	1	2	-	1	1	-	-
U26VA208		-	-	1	-	-	2	1	2	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	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

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

PYTHON PROGRAMMING LABORATORY

Class: B. Tech. II – Semester		**Branch:** CSE	
Course Code:	U26CS209	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**40%**
Total Number of Teaching Hours:	**36 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

CO1: apply Python programming fundamentals, operators, control structures, and expressions to solve computational problems

CO2: develop Python programs using strings, data structures, functions, modules, packages, and regular expressions

CO3: utilize file handling techniques to develop Python applications for data processing

CO4: apply NumPy and Pandas libraries to process and analyze structured data

Experiment-1

1. Installation of Python and verification of Python environment.
2. Execute Python programs using: (a) Interactive Interpreter, (b) IDLE Editor, (c) Command Prompt.
3. Develop a program to demonstrate the importance of indentation.
4. Develop a program to display a message using print() function.
5. Develop a program to perform input and output operations.
6. Develop programs to demonstrate variables, data types, operators, and type conversion.

Experiment-2

1. Develop a program to check whether a number is even or odd.
2. Develop a program to find the largest among three numbers.
3. Develop a program to check whether a given year is a leap year or not.
4. Develop a program to find the factorial of a number using loops.
5. Develop a program to generate the Fibonacci series.
6. Develop a program to demonstrate break, continue, pass, and else with loops.

Experiment-3

1. Develop a program to print multiplication tables.
2. Develop a program to generate star patterns using nested loops.
3. Develop a program to check whether a number is prime.
4. Develop a program to find all prime numbers within a given range.
5. Develop a program to find Armstrong numbers within a given range.
6. Develop a program using nested conditional statements.

Experiment-4

1. Develop a program to define and call a user-defined function.
2. Develop a program to demonstrate the return statement.
3. Develop a program to demonstrate default arguments.
4. Develop a program to demonstrate keyword arguments.
5. Develop a program to demonstrate variable-length arguments.
6. Develop a program to calculate factorial using recursion.

Experiment-5

1. Develop a program using lambda functions.
2. Develop a program to sort a list using lambda expressions.
3. Create a user-defined module and import it into another program.
4. Develop a program to demonstrate the from...import statement.
5. Develop a program to demonstrate the dir() function.

6. Create and use a package containing multiple modules.
Experiment-6
1. Develop a program to create and manipulate lists. 2. Develop a program to perform list operations. 3. Develop a program to create and manipulate tuples. 4. Develop a program to perform set operations. 5. Develop a program to create and manipulate dictionaries. 6. Develop a program to demonstrate built-in functions on collections.
Experiment-7
1. Develop a program to perform string concatenation. 2. Develop a program to demonstrate string slicing. 3. Develop a program to compare two strings. 4. Develop a program to count vowels, digits, and special characters in a string. 5. Develop a program to reverse a string. Develop a program to demonstrate built-in string methods and string formatting.
Experiment-8
1. Develop a program to demonstrate regular expression matching. 2. Develop a program to validate email IDs using regular expressions. 3. Develop a program to demonstrate metacharacters in regular expressions. 4. Develop a program to validate mobile numbers using regular expressions. 5. Develop a program to extract patterns using regular expressions. 6. Develop a program to perform text processing using regular expressions.
Experiment-9
1. Develop a program to create a text file and write data into it. 2. Develop a program to read data from a text file. 3. Develop a program to append data to an existing file. 4. Develop a program to count the number of characters, words, and lines in a file. 5. Develop a program to copy the contents from one file to another. 6. Develop a program to demonstrate different file modes.
Experiment-10
1. Develop a Python program to create one-dimensional and two-dimensional NumPy arrays. 2. Develop a Python program to demonstrate array indexing operations. 3. Develop a Python program to perform array slicing operations. 4. Develop a Python program to reshape NumPy arrays into different dimensions. 5. Develop a Python program to concatenate multiple arrays. 6. Develop a Python program to split arrays into smaller sub-arrays. 7. Develop a Python program to perform mathematical operations using NumPy Universal Functions (Ufuncs).
Experiment-11
1. Develop a Python program to create and manipulate Pandas Series objects. 2. Develop a Python program to create and manipulate Pandas DataFrame objects. 3. Develop a Python program to demonstrate indexing and slicing operations on Series and DataFrames. 4. Develop a Python program to perform data selection and filtering using Pandas. 5. Develop a Python program to apply aggregation functions on datasets.
Experiment-12
1. Develop a Python program to group and summarize data using grouping operations. 2. Develop a Python program to perform data preprocessing using Pandas. 3. Develop a Python program to generate summary statistics for a dataset. 4. Develop a Python program to generate Bar chat, Line plots and scatter plots, Histograms, Binning, and density

5. Develop a Python program to generate Histograms, Binning, and Density

Textbook(s):

1. Reema Thareja, *Python Programming Using Problem Solving Approach*, 3rd edition, Oxford University Press, 2025, New Delhi, India. (Chapters 1 to 9)
2. Jake VanderPlas, *Python Data Science Handbook: Essential Tools for Working with Data*, 2nd edition, O'Reilly Media, 2022, Sebastopol, California, USA. (Chapters 2 to 4)

Reference Book(S):

1. Charles R. Severance, *Python for Everybody: Exploring Data Using Python*, 1st edition, Open Book Project, 2016, USA.
2. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, 2nd edition, O'Reilly Media, 2016, Sebastopol, California, USA.
3. Eric Matthes, *Python Crash Course*, 3rd edition, No Starch Press, 2023, San Francisco, California, USA.

Web and Video link(s):

https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs84, NPTEL Video Lecture on The Joy of Computing using Pythonby Prof. Sudarshan Iyengar, IIT Ropar

Laboratory Manual (for laboratory component):

1. *Python Programming,* Department of CSE (AI & ML), KITSW

Course Articulation Matrix (CAM):		U26CS209: PYTHON PROGRAMMING LABORATORY												
CO		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2
CO1	U26CS209.1	3	2	1	-	3	-	-	-	1	-	2	2	-
CO2	U26CS209.2	3	2	2	-	3	-	-	1	1	-	2	3	1
CO3	U26CS209.3	3	2	2	1	3	-	-	1	1	-	2	3	1
CO4	U26CS209.4	2	2	2	2	3	-	-	-	1	-	2	3	2
U26CS209		2.75	2	1.75	1.50	3	-	-	1	1	-	2	2.75	1.33
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 Python programming fundamentals, operators, control structures, and expressions to solve computational problems	SDG4	Quality Education	Provides practical experience in Python programming and computational problem solving.
CO2	develop Python programs using strings, data structures, functions, modules, packages, and regular expressions	SDG4	Quality Education	Develops programming proficiency using modular programming concepts and text processing techniques.
CO3	utilize file handling techniques to develop Python applications for data processing	SDG9	Industry, Innovation and Infrastructure	Builds practical skills in file handling and data processing required for software applications.
CO4	apply NumPy and Pandas	SDG9	Industry, Innovation	Applies modern data analysis

CO–SDG Alignment Matrix				
CO	**CO Statement** *The student should be able to*	**Relevant SDG**	**SDG Description**	**Mapping Justification**
	libraries to process and analyze structured data		and Infrastructure	libraries to solve real-world data processing problems efficiently.

ENGINEERING GRAPHICS & CAD

Class: B. Tech. II– Semester		**Branch:** Common to all Branches	
Course Code:	**U26ME210**	**Credits:**	**1**
Hours/Week (L-T-P- E):	**0-0-2-2**	**CIE:**	**40%**
Total Number of Teaching Hours:	**24 Hrs**	**ESE:**	**60%**

Course Learning Outcomes (COs)

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

(based on psychomotor skills acquired from laboratory component)

CO1:	draw projections of points and straight lines
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; develop the simple electrical, electronic circuit & 3D model using Auto CAD

List of Experiments

1. Draw the simple geometries (Polygons, circle and semi-circle)
2. Draw the Projection of points in different quadrants
3. Draw the Projection of straight lines in simple position and inclined to one plane
4. Draw the Projection of straight lines inclined to both the planes & traces
5. Draw the Projection of planes
6. Draw the Projection of solids- Simple position (Axis perpendicular to HP or VP)
7. Draw the projections of solids inclined to both the planes
8. Draw the Sections of solids
9. Draw the Orthographic projections of given objects
10. Draw the Isometric view from the given orthographic views
11. Draw the given Electrical and Electronics circuit diagrams
12. Draw the given 3D object for engineering applications

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): U26ME210 ENGINEERING GRAPHICS & CAD														
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	U26ME210.1	2	1	1	-	2	1	-	1	2	-	1	2	1
CO2	U26ME210.2	2	1	1	-	2	1	-	1	2	-	1	2	1
CO3	U26ME210.3	2	1	1	-	2	1	-	1	2	-	1	2	1
CO4	U26ME210.4	2	1	1	-	2	1	-	1	2	-	1	2	1
U26ME210		**2**	**1**	**1**	**-**	**2**	**1**	**-**	**1**	**2**	**-**	**1**	**2**	**1**

CO	CO Statement – The student should be able to…	Relevant SDG	SDG Description	Mapping Justification
CO1	Draw projections of points and straight lines.	SDG 4	Quality Education	Develops fundamental engineering graphics knowledge, spatial visualization skills, and technical competencies required for quality engineering education.
CO2	Develop the projections of planes using CAD.	SDG 4	Quality Education	Enhances students' proficiency in CAD-based drafting and graphical communication, promoting modern technology-enabled learning.
		SDG 9	Industry, Innovation and Infrastructure	Introduces the use of CAD tools employed in industrial design and infrastructure-related engineering applications.
CO3	Construct the projections of solids and sections of solids using CAD.	SDG 4	Quality Education	Strengthens analytical thinking, visualization, and engineering drawing skills through practical CAD applications.
		SDG 9	Industry, Innovation and Infrastructure	Supports engineering design and manufacturing practices by enabling the creation and interpretation of complex engineering models.
CO4	Create orthographic and isometric projections; develop simple electrical, electronic circuits and 3D models using CAD.	SDG 4	Quality Education	Promotes advanced technical skills, creativity, and lifelong learning through modern engineering software and design practices.
		SDG 9	Industry, Innovation and Infrastructure	Facilitates innovation and industrial development by equipping learners with CAD-based design, modeling, and visualization skills used in engineering industries.