BACHELOR OF TECHNOLOGY

Computer Science and Engineering (AI & ML)

COURSE STRUCTURE

(Batches admitted from the Academic Year 2026 -2027)



MALLA REDDY ENGINEERING COLLEGE FOR WOMEN

(Autonomous Institution-UGC, Govt. of India)
Accredited by NAAC with 'A+' Grade, UGC,
Govt. of India Affiliated to JNTUH Approved by AICTE,
ISO 9001:2015 Certified Institution
Maisammaguda, Dhullapally, Secunderabad, Kompally-500100

B.Tech.in CSE(ARTIFICIALINTELLIGENCE&MACHINELEARNING)
Course Structure& Syllabus (R26Regulations)
Applicable from AY 2026-2027 Batch

I Year I SEMESTER

S.No.	Course Code	CourseTitle	L	T	P	Credits
1	2600BS01	Matrices and Calculus	3	1	0	4
2	2600BS04	Advanced Engineering Physics	3	0	0	3
3	2605ES01	Programming for Problem Solving	3	1	0	4
4	2602ES01	Basic Electrical and Electronics Engineering	3	0	0	3
5	2603ES01	Computer Aided Engineering Graphics	2	0	2	3
6	2600BS62	Advanced Engineering Physics LAB	0	0	2	1
7	2605ES61	Programming for Problem Solving LAB	0	0	2	1
8	2602ES61	Basic Electrical and Electronics Engineering Lab	0	0	2	1
9	2603ES61	Engineering Workshop	0	0	2	1
		Induction Program				
		TotalCredits	**14**	**2**	**10**	**21**

I Year II SEMESTER

S.No.	Course Code	CourseTitle	L	T	P	Credits
1	2600BS03	Ordinary Differential Equations and Vector Calculus	3	1	0	4
2	2600BS02	Engineering Chemistry	3	0	0	3
3	2605ES03	Data Structures	3	0	0	3
4	2605ES02	Python Programming	3	0	0	3
5	2600HS01	English for Skill Enhancement	3	0	0	3
6	2600BS61	Engineering Chemistry LAB	0	0	2	1
7	2605ES63	Data structures LAB	0	0	2	1
8	2600HS61	English Language and Communication Skills LAB	0	0	2	1
9	2605ES62	Python Programming LAB	0	0	2	1
		TotalCredits	**15**	**1**	**08**	**20**

II YEAR I SEMESTER

S.No.	Course Code	CourseTitle	L	T	P	Credits
1.	2600BS06	Mathematical and Statistical Foundations	2	1	0	3
2.	2605PC02	Computer Organization and Architecture	3	0	0	3
3.	2605PC03	Object Oriented Programming t hrough j ava	3	0	0	3
4.	2605PC06	Software Engineering	3	0	0	3
5.	2605PC05	Data base Management System	3	0	0	3
6	2600HS04	Innovation and Entrepreneurship	2	0	0	2
7	2600BS64	Computational Mathematics LAB Using Python	0	0	2	1
8	2605PC61	Object Oriented Programming through Java LAB	0	0	2	1
9	2605PC63	Data base Management Systems LAB	0	0	2	1
10	2605SD01	**Skill Development Course-1** Node JS/React JS/Django	0	0	2	1
		TotalCredits	**16**	**01**	**08**	**21**

II YEAR II SEMESTER

S.No.	Course Code	CourseTitle	L	T	P	Credits
1.	2605PC01	Discrete Mathematics	2	1	0	3
2	2605PC04	Operating Systems	3	0	0	3
3	2605PC09	Design and Analysis of Algorithms	2	1	0	3
4	2605PC07	Computer Networks	3	0	0	3
5	2666PC01	Machine Learning	2	1	0	3
6	2605PC62	Operating Systems LAB	0	0	2	1
7	2605PC65	Computer Networks LAB	0	0	2	1
8	2666PC61	Machine Learning LAB	0	0	2	1
9	2667SD01	**Skill Development Course-2** Data Visualization- R Programming/ Power BI	0	0	2	1
10	2600IP01	Innovative Product Development-1	0	0	2	1
11	2600MC01*	IndianKnowledgeSystem	1	0	0	0
		TotalCredits	**13**	**03**	**10**	**20**

III YEAR I SEMESTER

S.No.	Course Code	CourseTitle	L	T	P	Credits
1.	2666PC02	Artificial Intelligence	2	1	0	3
2.	2605PC11	Automata theory and Compiler Design	3	1	0	4
3.	2600HS02	Fundamentals of Management for Engineers	3	0	0	3
4.	PE-I	Professional Elective-I	3	0	0	3
5.	OE-I	Open Elective-I	2	0	0	2
6.	2666PC62	Artificial Intelligence Lab	0	0	2	1
7.	2605PC66	Compiler Design Lab	0	0	2	1
8.	2600HS63	English for Employability Skills Lab	0	0	2	1
9.	2666PR01	Field Based Research Project	0	0	4	2
10.	2605SD02	**Skill Development Course-3** UI Design –Flutter/ Android Studio	0	0	2	1
11.	2600MC02*	GenderSensitization*/HumanValues and ProfessionalEthics*	1	0	0	0
		TotalCredits	**14**	**02**	**12**	**21**

***Note: For the courses Gender Sensitization and Human Values and Professional Ethics -** one hour of instruction will be conducted on alternate weeks. For example, if a one-hour class for Gender Sensitizationisconductedthisweek,thenaone-hourclassforHumanValuesandProfessionalEthics will be conducted in the following week.

III YEAR II SEMESTER

S.No	Course Code	CourseTitle	L	T	P	Credits
1	2666PC03	Deep Learning	2	1	0	3
2	2666PC04	Data Analytics and Visualization	3	1	0	4
3	2600HS03	Business Economics and Financial Analysis	2	1	0	3
4	PE-II	Professional Elective-II	3	0	0	3
5	OE-II	Open Elective–II	2	0	0	2
6	2600HS62	Professional English	1	0	0	1
7	2666PC63	Deep Learning Lab	0	0	2	1
8	2666PC64	Data Analytic sand Visualization Lab	0	0	2	1
9	2666PC65	Chatbots Lab	0	0	2	1
10	2666SD01	**Skill Development Course-4** Prompt Engineering	0	0	2	1
11	2600ES01	Environmental Science	1	0	0	0
		TotalCredits	**14**	**03**	**06**	**20**

IV YEAR I SEMESTER

S. No.	Course Code	CourseTitle	L	T	P	Credits
1.	2666PC05	Reinforcement Learning	3	0	0	3
2.	2666PC06	Generative AI	3	0	0	3
3.	2666PC07	Natural Language Processing	3	0	0	3
4.	PE-III	Professional Elective-III	3	0	0	3
5.	PE-IV	Professional Elective–IV	3	0	0	3
6.	OE-III	Open Elective–III	2	0	0	2
7.	2666PC66	Reinforcement Learning Lab	0	0	2	1
8.	2666PC67	Natural Language ProcessingLab	0	0	2	1
9.	2666PR02	Industry Oriented MiniProject/Internship	0	0	4	2
10	2600MC03*	Research Methodology & IPR	1	0	0	0
		TotalCredits	**18**	**0**	**08**	**21**

IV YEAR II SEMESTER

S. No.	Course Code	CourseTitle	L	T	P	Credits
1.	PE-V	Professional Elective–V	3	0	0	3
2.	PE-VI	Professional Elective–VI	3	0	0	3
3.	2666PR03	Project Work	0	0	36	12
4.	2600IP02	Innovative Startup	0	0	6	2
		TotalCredits	**6**	**0**	**42**	**20**

PROFESSIONALELECTIVES

PROFESSIONALELECTIVE–I

2662PE16	Fundamentals of Cyber Security Essentials
2612PE03	Computer Vision
2605PE03	SoftwareTestingMethodologies
2667PE06	Introduction to DataMining
2612PE11	Advanced WebTechnologies
2667PE02	DistributedSystems

PROFESSIONALELECTIVE-II

2612PE10	ImageProcessing
2612PE05	Block chainTechnology
2605PE05	SoftwareProject and Process Management
2667PE07	MiningMassiveDatasets
2612PE02	Full Stack Development
2666PE01	Large Language Models

PROFESSIONALELECTIVE-III

2605PE14	Cognitive Computing
2605PE08	BigDataAnalytics
2662PE19	Principles of CryptographyandNetworkSecurity
2667PE05	Basics of DataStreamMining
2605PE06	CloudComputing
2666PE13	Introduction to Agentic AI

PROFESSIONALELECTIVE-IV

2667PE12	AugmentedReality&VirtualReality
2662PE18	PenetrationTestingandIncidentResponse
2605PE01	Agilesoftware Development
2666PE09	Quantum Computing
2667PE14	RoboticProcessAutomation
2662PE17	CyberForensics

PROFESSIONALELECTIVE-V

2667PE11	SocialMediaMining
2667PE13	NatureInspiredComputing
2612PE04	InternetofThings
2666PE10	GameTheory
2612PE09	MobileApplicationDevelopment
2666PE16	AI Ethics and Responsible AI

PROFESSIONALELECTIVE-VI

2605PE11	HighPerformanceComputing
2666PE07	Edge Computing for AI
2666PE08	Explainable AI
2666PE15	Retrieval-Augmented Generation
2666PE12	SustainableEngineering
2667PE01	DistributedDatabase

OPENELECTIVES-1

2666OE01	FundamentalsofAI
2666OE02	MachineLearningBasics
2666OE03	GenerativeAI
2666OE04	Design Patterns using Python

OPENELECTIVES-2

2666OE05	IntroductiontoNaturalLanguageProcessing
2666OE06	AIapplications
2666OE07	PromptEngineering
2666OE08	Edge Computing

OPENELECTIVES-3

2666OE09	Chatbots
2666OE10	ComputerVisionwithOpenCV
2666OE11	DeepLearning
2666OE12	Cognitive Computing &Applications

2600BS01: MATRICES AND CALCULUS

B.Tech. I Year I Sem. **L T P C**
3 1 0 4

Course Objectives:

- To learn the concepts of matrix rank, matrix inverse, and methods for solving homogeneous and non-homogeneous systems of linear equations.
- To study the concepts of eigenvalues, eigenvectors, diagonalization, the Cayley–Hamilton theorem, and quadratic forms.
- To understand the concepts of limits, continuity, Mean Value Theorems, and Taylor's series.
- To study the concepts of partial differentiation for determining the maxima and minima of functions of two variables.
- To apply multiple integration techniques and coordinate transformations for evaluating double and triple integrals.

Course Outcomes: After learning the contents of this course, the student will be able to:

- Solve systems of linear equations and determine the rank and inverse of matrices using appropriate matrix methods.
- Apply the concepts of eigenvalues, eigenvectors, diagonalization, the Cayley–Hamilton theorem, and quadratic forms to solve matrix-related problems.
- Analyze the properties of continuous functions using Mean Value Theorems to solve mathematical problems.
- Apply Taylor's series to approximate functions and solve mathematical problems.
- Determine the maxima and minima of functions of two variables using partial differentiation.
- Evaluate double and triple integrals using appropriate integration techniques and coordinate transformations.

UNIT-I: Matrices **8 L**

Rank of a matrix by Echelon form and Normal form - Inverse of Non-singular matrices by GaussJordan method. System of linear equations: Solving system of Homogeneous and Non-Homogeneous equations. Gauss Seidel Iteration Method.

UNIT-II: Eigen values and Eigen vectors **10 L**

Linear Transformation and Orthogonal Transformation: Eigen values - Eigen vectors and their properties (without proofs) - Diagonalization of a matrix - Cayley-Hamilton Theorem (without proof) - Finding inverse and power of a matrix by Cayley-Hamilton Theorem. Quadratic forms and Nature of the Quadratic Forms - Reduction of Quadratic form to canonical form by Orthogonal Transformation

UNIT-III: Single Variable Calculus **10 L**

Limit and Continuous of functions and its properties. Mean value theorems: Rolle ’s Theorem - Lagrange’s Mean value theorem with their Geometrical Interpretation and applications - Cauchy’s Mean value Theorem-Taylor’s Series (All the theorems without proof).

UNIT-IV: Multivariable Calculus (Partial Differentiation and Applications) **10 L**

Definitions of Limit and continuity - Partial Differentiation: Euler’s Theorem – Total derivative - Jacobian - Functional dependence & independence. Applications: Maxima and minima of functions of two variables.

UNIT-V: Multivariable Calculus (Integration) 10 L

Evaluation of Double Integrals (Cartesian and polar coordinates) - change of order of integration (only Cartesian form) - Change of variables for double integrals (Cartesian to polar). Evaluation of Triple Integrals- Change of variables for triple integrals (Cartesian to Spherical and Cylindrical polar coordinates).

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2017.
2. R. K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9thEdition,2013.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,38th Reprint, 2022.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson, 9thEdition, Reprint, 2002.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

2600BS04: ADVANCED ENGINEERING PHYSICS

B.Tech. I Year I Sem. **L T P C**
3 0 0 3

Course Objectives:

- To study crystal structures, defects, and material characterization techniques like XRD.
- To familiarize students with demonstrating skills in scientific enquiry, problem solving techniques and to develop competency and understanding the concepts found in quantum mechanics.
- To introduce quantum computing principles, quantum gates, and basic quantum algorithms.
- To solve non-traditional problems that potential drawn on knowledge in multiple areas of physics.

Course Outcomes:

- To understand the crystal structures, identify defects, and apply XRD techniques for material characterization.
- To apply quantum mechanical principles to explain particle behaviour and energy band formation in solids.
- To analyse the advance concepts linear algebra for quantum computation along operators', Dirac's Bra and Ket notations and their properties.
- To understand quantum computing concepts, use quantum gates and explain basic quantum algorithms.
- To classify magnetic and dielectric materials and explain their properties, synthesis, and applications.
- To explain the principles of lasers and fibre optics and their applications in communication and sensing

UNIT - I: Crystallography & Materials Characterization

Introduction: Unit cell, space lattice, basis, lattice parameters; crystal structures, Bravais lattices, packing factor: SC, BCC, FCC; Miller indices, inter-planar distance; defects in crystals (Qualitative): point defects, line defects, surface defects and volume defects. concept of nanomaterials: surface to volume ratio, X -ray diffraction: Bragg's law, powder method, calculation of average crystallite size using Debye Scherrer's formula.

UNIT - II: Quantum Mechanics

Introduction, de-Broglie hypothesis, Heisenberg uncertainty principle, physical significance of, postulates of quantum mechanics: operators in quantum mechanics, eigen values and eigen functions, expectation value; Schrödinger's time independent wave equation, particle in a 1D box, Bloch's theorem (qualitative), Kronig-Penney model (qualitative): E-k diagram, formation of energy bands, origin of bandgap, classification of solids, concept of discrete energy levels and quantum confinement in nanomaterials

UNIT - III: Quantum Computing

Introduction, linear algebra for quantum computation, Dirac's Bra and Ket notation and their properties, Hilbert space, Bloch's sphere, concept of quantum computer, classical bits, Qubits, multiple Qubit system, quantum computing system for information processing, evolution of quantum systems, quantum measurements, entanglement, quantum gates, challenges and advantages of quantum computing over classical computation, quantum algorithms: Deutsch-Jozsa, Shor, Grover (qualitative).

UNIT - IV: Magnetic and Dielectric Materials

Introduction to magnetic materials, origin of magnetic moment-classification of magnetic materials, hysteresis, Weiss domain theory of ferromagnetism, soft and hard magnetic materials, synthesis of ferrimagnetic materials using sol-gel method, applications: magnetic hyperthermia for cancer treatment, magnets for EV, Giant Magneto Resistance (GMR) device.

Introduction to dielectric materials, types of polarization (qualitative): electronics, ionic & orientation; ferroelectric, piezoelectric, pyroelectric materials and their applications: Ferroelectric Random-Access Memory (Fe-RAM), load cell and fire sensor.

UNIT - V: Laser and Fibre Optics

Introduction to laser, characteristics of laser, Einstein coefficients and their relations, metastable state, population inversion, pumping, lasing action, Ruby laser, He-Ne laser, CO2 laser, semiconductor diode laser, applications: Bar code scanner, LIDAR for autonomous vehicle.

Introduction to fibre optics, total internal reflection, construction of optical fibre, acceptance angle, numerical aperture, classification of optical fibres, losses in optical fibre, applications: optical fibre for communication system, sensor for structural health monitoring.

TEXT BOOKS:

1. Walter Borchardt-Ott, *Crystallography: An Introduction*, Springer.
2. Charles Kittel, *Introduction to Solid State Physics*, John Wiley & Sons, Inc.
3. Thomas G. Wong, *Introduction to Classical and Quantum Computing*, Rooted Grove
4. *A Textbook of Advanced Engineering Physics*, Dr. T.V.S Arun Murthy, Dr. M. N.
5. Avadhanulu, S. Chand, First edition, 2026.
6. *Engineering Physics* by P.K. Palanisamy, SciTech Publications.

REFERENCE BOOKS:

1. Jozef Gruska, *Quantum Computing*, McGraw Hill
2. Michael A. Nielsen & Isaac L. Chuang, *Quantum Computation and Quantum Information*, Cambridge University Press.
3. John M. Senior, *Optical Fiber Communications Principles and Practice*, Pearson Education Limited.

USEFUL LINKS

1. https://shijuinpallotti.wordpress.com/wp-content/uploads/2019/07/optical-fibercommunications-principles-and-pr.pdf
2. https://www.geokniga.org/bookfiles/geokniga-crystallography_0.pdf
3. https://dpbck.ac.in/wp-content/uploads/2022/10/Introduction-to-Solid-State-PhysicsCharlesKittel.pdf
4. https://www.thomaswong.net/introduction-to-classical-and-quantum-computing-1e4p.pdf
5. https://profmcruz.wordpress.com/wp-content/uploads/2017/08/quantum-computation-andquantum-information-nielsen-chuang.pdf

2605ES01: PROGRAMMING FOR PROBLEM SOLVING

B.Tech. I Year I Sem.

L	T	P	C
3	1	0	4

Course Objectives:

- To learn the fundamentals of computers.
- To understand the various steps in program development.
- To learn the syntax and semantics of the C programming language.
- To learn the usage of structured programming approaches in solving problems.

Course Outcomes: The student will learn

- To write algorithms and to draw flowcharts for solving problems.
- To convert the algorithms/flowcharts to C programs.
- To code and test a given logic in the C programming language.
- To decompose a problem into functions and to develop modular reusable code.
- To use arrays, pointers, strings and structures to write C programs.
- Searching and sorting problems.

UNIT - I: Overview of C:C Language Elements, Variable Declarations and Data Types, Executable Statements, General Form of a C Program, Arithmetic Expressions, Formatting Numbers in Program Output.
Selection Structures: Control Structures, Conditions, if Statement, if Statements with Compound Statements, Decision Steps in Algorithms.
Repetition and Loop Statements: Repetition in Programs, Counting Loops and the while Statement, Computing a Sum or Product in a Loop, for Statement, Conditional Loops, Loop Design, Nested Loops, do-while Statement.

UNIT - II: Top-Down Design with Functions: Building Programs from Existing Information, Library Functions, Top-Down Design and Structure Charts, Functions without Arguments, Functions with Input Arguments.
Pointers and Modular Programming: Pointers and the Indirection Operator, Functions with Output Parameters, Multiple Calls to a Function with Input/ Output Parameters, Scope of Names, Formal Output Parameters as Actual Arguments.

UNIT - III: Arrays: Declaring and Referencing Arrays, Array Subscripts, Using for Loops for Sequential Access, Using Array Elements as Function Arguments, Array Arguments, Searching and Sorting an Array, Parallel Arrays and Enumerated Types, Multidimensional Arrays.
Strings: String Basics, String Library Functions: Assignment and Substrings, Longer Strings: Concatenation and Whole-Line Input, String Comparison, Arrays of Pointers.

UNIT - IV: **Recursion:** The Nature of Recursion, Tracing a Recursive Function, Recursive Mathematical Functions, Recursive Functions with Array and String Parameters
Structure and Union Types: User-Defined Structure Types, Structure Type Data as Input and Output Parameters, Functions with Structured Result Values, Union Types.

UNIT - V: Text and Binary File Pointers: Input/ Output Files - Review and Further Study, Binary Files, Searching a Database.
Searching and Sorting: Basic searching in an array of elements (linear and binary search techniques), Basic algorithms to sort array of elements (Bubble, Insertion and Selection sort algorithms).

TEXT BOOKS:

1. Jeri R. Hanly and Elliot B. Koffman, Problem solving and Program Design in C 7th Edition, Pearson.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition).

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill.
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB.
4. R.G. Dromey, How to solve it by Computer, Pearson (16th Impression).
5. Programming in C, Stephen G. Kochan, Fourth Edition, Pearson Education.
6. Herbert Schildt, C: The Complete Reference, Mc Graw Hill, 4th Edition.
7. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.

2602ES01: BASIC ELECTRICAL & ELECTRONICS ENGINEERING

B.Tech. I Year I Sem. **L T P C**
3 0 0 3

UNIT I:

Diode Characteristics:

Semiconductors –classification -PN Junction Diode, Avalanche breakdown, zener break down, forward bias and reverse bias characteristics, diode resistance an capacitance, diode models (Ideal, simplified, piecewise linear) Zener diode-I-V characteristics and zener diode as voltage regulator

UNIT II:

Bipolar Junction Transistor (BJT)

Structure and working principle of BJT, Transistor as switch, configuration: Common base (CB), Common emitter (CE), Common collector(CC), Common Base(CB), input and output characteristics. Applications of transistor.

UNIT III :

Number Systems and Boolean algebra

Overview of Number Systems, 1's complement and 2's Complement, addition, subtraction using 1's complement and 2's Complement, BCD codes, Excess-3 codes, HEX codes, parity bit generator. Boolean Algebra-Basic Theorems and properties, Minimization of Boolean function using K-Maps up to four variables.

UNIT IV:

DC and AC Circuits

Electrical circuit elements (R, L, and C), Ohm's Law and its limitations, KCL & KVL, series, parallel, series-parallel circuits, Thevenin's, Norton's, and Super Position theorem, and Simple numerical problems.

A.C. Fundamentals: Equation of AC Voltage and current, waveform, time period, frequency, amplitude, phase, phase difference, average value, RMS value, form factor, and peak factor, (Simple Numerical problems).

UNIT V:

Electrical Machines

Construction and working principle of DC Motor, DC Generator, Single Phase Transformer, Three Phase Induction Motors and Alternator.

TEXT BOOKS:

1. Basic Electrical Engineering - D.P. Kothari and I.J. Nagrath, Tata McGraw Hill.
2. A text book of Electrical Technology Vol- 1, 2 by B.L.Theraja and A K Theraja- S Chand Publications.
3. Electronic Devices and Circuits, S. Salivahanan, N. Suresh Kumar, A. Vallavaraj, Tata McGrawHill companies.
4. Switching Theory and Logic Design by A. Anand Kumar, PHI Publications.

REFERENCE BOOKS:

1. 1 Basic Electrical Engineering, T.K. Naga sarkar and M.S. Sukhija, Oxford University Press 2. M. Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003

2603ES01: COMPUTER AIDED ENGINEERING GRAPHICS

B.Tech. I Year I Sem. **L T P C**
2 0 2 3

Course Objectives:

- To impart conceptual knowledge about AutoCAD software in creating, editing and manipulating 2D engineering drawings.
- To inculcate the required skills to apply engineering drawing principles effectively for accurately sketching conics, scales and cycloids.
- To enhance visualization skills for better interpreting the position of points and lines, enabling accurate representation of their orthographic projections.
- To familiarize drafting skills for constructing orthographic views of planes, solids and development of surfaces in diverse orientation.
- To develop the competency in creating isometric views from orthographic views and vice-versa.

Course Outcomes:

Upon the completion of the course students should be able to

- Demonstrate proficiency in using AutoCAD software to create, edit, and manipulate 2D engineering drawings.
- Apply the concepts of engineering drawing for sketching conic sections, scales and cycloids.
- Analyze position of points and lines for representing their orthographic projections.
- Sketch orthographic projections of planes, solids and development of surfaces to analyze their different orientations
- Apply the principle of projections for sketching the isometric views.
- Interpret the given orthographic projections to convert isometric view and vice versa

UNIT-I

Introduction to AutoCAD Software: Menu Bar, Ribbon – Draw and Modify Toolbar, Dimension, Status Bar, Command Bar, etc., Basic geometrical constructions using AutoCAD commands. **Introduction to Engineering Drawing:** Principles of Engineering drawing and their significance, Conventions.

Conic Sections: Construction of Ellipse, Parabola, Hyperbola - General method only. Scales, Plain and Diagonal.

Cycloidal Curves: Cycloid, Epicycloid and Hypocycloid.

UNIT-II

Principles of Orthographic Projections: Conventions; Projections of Points; Projections of lines - Parallel to one Plane and Perpendicular to other Plane, Inclined to one Plane and Parallel to other Plane, inclined to both the planes.

UNIT-III

Projections of Planes: Surface Parallel to one Plane and Perpendicular to other Plane, Surface Inclined to one Plane and Perpendicular to other Plane, Surface Inclined to both the Planes.

UNIT-IV

Projection of Regular Solids: Prisms, Pyramids, Cylinder and Cone – Axis parallel to one plane and perpendicular to other plane, Axis Inclined to one plane and parallel to other plane. **Development of Surfaces:** Prism, Cylinder, Pyramid and Cone.

UNIT-V

Principles of Isometric projection: Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple Solids only. Conversion of Isometric Views to Orthographic View and Viceversa, Conventions. Introduction to Solid Modeling: Creation of simple solid models relevant to the domain

TEXT BOOKS

1. Engineering Drawing, N.D. Bhatt – N.D. Bhatt & V.M Panchal, 48th Edition, 2005 Charotar Publishing House, Gujarat.
2. Engineering Drawing / Basant Agarwal and MC Agarwal / McGraw Hill

REFERENCES

1. Engineering drawing – P.J. Shah .S.Chand Publishers.
2. Engineering Drawing- Johle/Tata Macgraw Hill Book Publisher.
3. Computer Aided Engineering Drawing – S. Trymbaka Murthy, - I.K. International Publishing House Pvt. Ltd., New Delhi, 3rd revised edition-2006.
4. "Computer Aided Engineering Drawing"by Dr. M H Annaiah, Dr C N Chandrappa and Dr B Sudheer Premkumar Fifth edition, New Age International Publishers.
5. Engineering Drawing by K.Venu Gopal& V.Prabu Raja New Age Publications

2600BS62: ADVANCED ENGINEERING PHYSICS LAB

B.Tech. I Year I Sem. **L T P C**
0 0 2 1

Course Objectives:

- To provide practical exposure to advanced concepts in solid-state and modern physics.
- To synthesize and study the physical properties of materials like semiconductors, ferromagnetic, and ferroelectric substances.
- To perform semiconductor characterization using Hall effect and band gap experiments.
- To explore the working principles of lasers and optical fibers through hands-on experiments.
- To develop skills in data analysis, interpretation, and scientific reporting.

Course Outcomes:

- To synthesize and analyze nanomaterials such as magnetite (Fe_3O_4) using chemical methods.
- To determine key electrical, magnetic, and optical properties of semiconductors and other functional materials.
- To characterize semiconductors using Hall effect and energy gap measurement techniques.
- To demonstrate working knowledge of laser systems and optical fiber parameters through experimental study.
- To apply scientific methods for accurate data collection, analysis, and technical report writing.
- To calculate the dielectric constant of a given material and its applications.

List of Experiments:

1. Synthesis of magnetite (Fe3O4) powder using sol-gel method.
2. Determination of energy gap of a semiconductor.
3. Determination of Hall coefficient and carrier concertation of a given semiconductor.
4. To determine the magnetic induction at the centre and at several points on the axis of a circular coil
5. Study of B-H curve of a ferro magnetic material.
6. Study of P-E loop of a given ferroelectric crystal.
7. Determination of dielectric constant of a given material.
8. Determination of Curie's temperature of a given ferroelectric material.
9. Study of V-I & L-I characteristics of a given laser diode.
10. a. Determination of numerical aperture of a given optical fibre.
    b. Determination of bending losses of a given optical fibre.

Note: Any 8 experiments are to be performed.

2605ES61: PROGRAMMING FOR PROBLEM SOLVING LAB

B.Tech. I Year I Sem. **L T P C**
0 0 2 1

Course Objectives: The students will learn the following:
- To work with an IDE to create, edit, compile, run and debug programs
- To analyze the various steps in program development.
- To develop programs to solve basic problems by understanding basic concepts in C like operators, control statements etc.
- To develop modular, reusable and readable C Programs using the concepts like functions, arrays etc.
- To Write programs using the Dynamic Memory Allocation concept.
- To create, read from and write to text and binary files

Course Outcomes: The candidate is expected to be able to:
- formulate the algorithms for simple problems
- translate given algorithms to a working and correct program
- correct syntax errors as reported by the compilers
- identify and correct logical errors encountered during execution
- represent and manipulate data with arrays, strings and structures
- use pointers of different types
- create, read and write to and from simple text and binary files
- modularize the code with functions so that they can be reused

PRACTICE SESSIONS:

Simple numeric problems:
1. Write a program for finding the max and min from the three numbers.
2. Write the program for the simple, compound interest.
3. Write a program that prints a multiplication table for a given number and the number of rows in the table. For example, for a number 5 and rows = 3, the output should be: 5 x 1 = 5
   5 x 2 = 10
   5 x 3 = 15
4. Write a program that shows the binary equivalent of a given positive number between 0 to 255.

Expression Evaluation:
5. Write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement).
6. Write a program that finds if a given number is a prime number.
7. Write a C program to find the sum of individual digits of a positive integer and test given number is palindrome.
8. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write
9. a C program to generate the first n terms of the sequence.

Arrays, Pointers and Functions:
10. Write a C program to find the minimum, maximum and average in an array of integers.

11. Write a C program that uses functions to perform the following:
    a. Addition of Two Matrices
    b. Multiplication of Two Matrices
12. Write a program for reading elements using a pointer into an array and display the values using the array.
13. Write a program for display values reverse order from an array using a pointer.

Files:

14. Write a C program which copies one file to another, replacing all lowercase characters with their uppercase equivalents.
15. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file).

Strings:

16. Write a C program that uses functions to perform the following operations:
    a. To insert a sub-string into a given main string from a given position.
    b. To delete n Characters from a given position in a given string
17. Write a C program to determine if the given string is a palindrome or not (Spelled same in both directions with or without a meaning like madam, civic, noon, abcba, etc.)
18. Write a C program that displays the position of a character ch in the string S or – 1 if S doesn't contain ch.
19. Write a C program to count the lines, words and characters in a given text.

Sorting and Searching:

20. Write a C program that uses non-recursive function to search for a Key value in a given list of integers using linear search method.
21. Write a C program that uses non-recursive function to search for a Key value in a given sorted list of integers using binary search method.
22. Write a C program that implements the Bubble sort method to sort a given list of integers in ascending order.
23. Write a C program that sorts the given array of integers using selection sort in descending order
24. Write a C program that sorts the given array of integers using insertion sort in ascending order
25. Write a C program that sorts a given array of names.

TEXT BOOKS:

1. Jeri R. Hanly and Elliot B.Koffman, Problem solving and Program Design in C 7th Edition, Pearson.
2. B.A. Forouzan and R.F. Gilberg C Programming and Data Structures, Cengage Learning, (3rd Edition).

REFERENCE BOOKS:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India
2. E. Balagurusamy, Computer fundamentals and C, 2nd Edition, McGraw-Hill
3. Yashavant Kanetkar, Let Us C, 18th Edition, BPB

2602ES61: BASIC ELECTRICAL & ELECTRONICS ENGINEERING LAB

B.Tech. I Year I Sem. **L T P C**
0 0 2 1

LIST OF EXPERIMENTS

The following experiments are required to be conducted compulsory experiments:

1. PN Junction diode characteristics.
2. Zener diode characteristics.
3. Transistor as a switch
4. Input – Output Characteristics of Transistor of BJT
5. Realization of Basic logic gates.
6. Implementation of Universal gates using Basic gates
7. Verification of Ohm's Law 8. Verification of KVL and KCL.

In addition to the above eight experiments, at least any two of the experiments from the following list are required to be conducted

8. Verification of Thevenin's &Norton's theorem.
9. Verification of Superposition theorem.
10. Calculations and Verification of Impedance and current of RL, RC, and RLC Series Circuits
11. Load test on DC shunt Motor.
12. Measurement of voltage, and current of a single-phase transformer.

2603ES61: ENGINEERING WORKSHOP

B.Tech. I Year I Sem. **L T P C**
0 0 2 1

Course Objectives:

- To Study different hand operated power tools, uses and their demonstration.
- To gain a good basic working knowledge required for the production of various engineering products.
- To provide hands on experience about use of different engineering materials, tools, equipment's and processes those are common in the engineering field.
- To develop a right attitude, team working, precision and safety at work place.
- To study commonly used carpentry joints and to have practical exposure to various welding and joining processes.

Course Outcomes: At the end of the course, the student would able to:

- Identify and make use of various tools to perform a range of basic manufacturing operations in different trades to make/repair engineering components with workshop safety regulations.
- Illustrate knowledge of various trade operations based on requirements of the job.
- Illustrate knowledge of various trade tools based on requirements of the job.
- Interpret and establish residential wiring circuits according to given specifications and circuit diagram.
- Demonstrate working principles of power tools in different trades to use and to make with them engineering components.
- Develop model various basic prototypes to explore its functions and features of a innovative system.

TRADES FOR EXERCISES:

I. Carpentry

1. T- Lap Joint
2. Dovetail Lap Joint

II. Fitting

1. Semi-circular Fitting
2. V- Fitting

III. Tin Smithy

1. Rectangular Tray
2. Square Tin

IV. House Wiring

1. Two bulbs controlled by two independent switches (Series and parallel connection)
2. One bulb controlled by two-two way switches (Stair case connection).

V. Foundry

1. Single piece pattern
2. Split piece pattern

VI. Black Smithy

1. Round to Square
2. S - Hook

Trades for Demonstration:

1. Plumbing
2. Welding
3. Machine Shop
4. Power tools

TEXT BOOKS:

1. Workshop Manual, P. Kannaiah and K. L. Narayana, 3rd Edition, Scitech, 2015
2. Elements of Workshop Technology Vol.1 & 2, S. K. Hajra Choudhury, A. K. Hajra Choudhury and Nirjhar Roy, 13th Edition, Media Promoters & Publishers Pvt. Ltd., 2010.

REFERENCE BOOKS:

1. Workshop Manual / Venkat Reddy/ BSP
2. Workshop Manual / K Venu Gopal / Anuradha

2600BS03: ORDINARY DIFFERENTIAL EQUATIONS AND VECTOR CALCULUS

B.Tech. I Year II Sem. **L T P C**
3 1 0 4

Course Objectives:

- To learn the methods of solving first-order and higher-order differential equations.
- To learn the concepts and properties of Laplace transforms.
- To learn the techniques of solving ordinary differential equations using Laplace transforms.
- To understand the concepts of vector-valued functions and vector differential operators used in engineering applications.
- To understand the properties of vector integration and apply Green's, Gauss's, and Stokes' theorems to line, surface, and volume integrals.

Course Outcomes: After learning the contents of this course, the student must be able to

- Identify whether a given first-order differential equation is exact or reducible to an exact equation and solve it using appropriate methods.
- Solve higher-order linear differential equations with constant coefficients using appropriate analytical techniques.
- Compute Laplace transforms of standard functions using the properties and theorems of Laplace transforms.
- Apply Laplace transform techniques, including the convolution theorem, to solve initial value problems involving linear ordinary differential equations.
- Apply the concepts of gradient, directional derivative, divergence, curl, and scalar potential to analyze vector fields.
- Evaluate line, surface, and volume integrals and apply Green's, Gauss's, and Stokes' theorems to solve vector calculus problems.

UNIT-I: First Order ODE **8 L**

Exact differential equations - Equations reducible to exact differential equations - linear and Bernoulli's equations - Orthogonal Trajectories (only in Cartesian Coordinates). Newton's law of cooling.

UNIT-II: Ordinary Differential Equations of Higher Order **10 L**

Higher order linear differential equations with constant coefficients: Non-Homogeneous terms of the type eax,,sinax,cosax polynomials in x, $eaxV(x)$ & $xV(x)$ - Method of variation of parameters.

UNIT-III: Laplace Transforms **10L**

Laplace Transform of standard functions - First shifting theorem - Laplace transforms of functions multiplied by 't' and divided by 't' - Laplace transforms of derivatives and integrals of function - Evaluation of integrals by Laplace transforms - Inverse Laplace transform, convolution theorem (All theorems without proof). Applications: solving Initial value problems (Linear ODEs with constant coefficients) by Laplace Transform.

UNIT-IV: Vector Differentiation **10 L**

Vector Differentiation: Vector point functions and scalar point functions – Gradient – Directional derivatives -Divergence and Curl - Solenoidal and Irrotational vectors - Scalar potential functions

UNIT-V: Vector Integration **10 L**

Line, Surface and Volume Integrals. Theorems of Green, Gauss and Stokes (without proofs) and their applications.

TEXTBOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44thEdition, 2017.
2. R. K. Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, Narosa Publications, 5th Edition, 2016.

REFERENCE BOOKS:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 9thEdition,2013.
2. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi,38th Reprint, 2022.
3. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, Pearson, 9thEdition, Reprint, 2002.
4. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
5. H. K. Dass and Er. Rajnish Verma, Higher Engineering Mathematics, S Chand and Company Limited, New Delhi.

2600BS02: ENGINEERING CHEMISTRY

B.Tech. I Year II Sem. **L T P C**
3 0 0 3

Course Objectives:

- To acquire the knowledge of water treatment which are essential for the Engineers and in industry.
- To include the importance of fundamental aspects of electrochemistry, significance of corrosion and it's control to protect the structures.
- To impart foundational knowledge of various energy sources and their practical applications in engineering.
- To account the applications of different kinds of polymers in various fields.
- To equip students with an understanding of smart materials, biosensors, and analytical techniques applicable in engineering, industrial, environmental, and biomedical fields.

Course Outcomes:

- Students will be able to understand the fundamental properties of water and its applications in both domestic and industrial purposes.
- Students will gain basic knowledge of electrochemical processes to understand the functioning of electrodes.
- Students will be able to assess the underlying causes and consequences of corrosion, distinguishing between various corrosion types and evaluate advanced corrosion control strategies.
- Students will comprehend the significance and practical applications of batteries and various energy sources, enhancing their potential as future engineers and entrepreneurs.
- Students will learn the basic concepts and properties of polymers and other engineering materials.
- Students will be able to apply the principles of UV-Visible, IR spectroscopy and Raman spectroscopy in analyzing pollutants in dye industries and biomedical applications.

UNIT-I: Water and its treatment: [8]

Introduction- Hardness, types, degree of hardness and units. Estimation of hardness of water by complexometric method - Numerical problems. Potable water and its specifications (WHO) - Steps involved in the treatment of potable water - Disinfection of potable water by chlorination and breakpoint chlorination. Defluoridation - Nalgonda technique.

Boiler troubles: Scales, Sludges and Caustic embrittlement. Internal treatment of boiler feed water - Calgon conditioning, Phosphate conditioning, Colloidal conditioning. External treatment methods - Softening of water by ion- exchange processes. Desalination of brackish water – Reverse Osmosis.

UNIT-II: Electrochemistry and Corrosion: [8]

Introduction- Electrode potential, standard electrode potential, Nernst equation (no derivation), electrochemical cell - Galvanic cell, cell representation, Types of electrodes, reference electrodes - Primary reference electrode - Standard Hydrogen Electrode (SHE), Secondary reference electrode - Calomel electrode. Construction, working and determination of pH of unknown solution using SHE and Calomel electrode, **Glass electrode-Construction, working and determination of pH of unknown solution using glass electrode.**

Corrosion: Introduction- Definition, causes and effects of corrosion – Theories of corrosion, chemical and electrochemical theories of corrosion, Types of corrosion: galvanic, water-line and pitting corrosion. Factors affecting rate of corrosion - Nature of the metal, Nature of the corroding environment. Corrosion control methods - Cathodic protection Methods - Sacrificial anode and impressed current methods.

UNIT–III: Energy sources: [8]

Batteries: Introduction – Classification of batteries - Primary, secondary and reserve batteries with examples. Construction, working and applications of Zn-air and Lithium ion battery. Fuel Cells – Differences between a battery and a fuel cell, Construction and applications of Direct Methanol Fuel Cell (DMFC).

Fuels: Introduction and characteristics of a good fuel, **Solid fuels-classification, analysis of coal–proximate and ultimate analysis and their significance.** Fossil fuels: Introduction, Classification, Petroleum - Refining of Crude oil, Cracking - Types of cracking - Moving bed catalytic cracking. LPG and CNG composition and uses.

Synthetic Fuels: Fischer-Tropsch process, Introduction and applications of Hythane and Green Hydrogen.

UNIT - IV: Polymers: [8]

Definition - Classification of polymers: Based on origin and tacticity with examples – Types of polymerization - Addition (free radical addition mechanism) and condensation polymerization. **Plastics, Elastomers and Fibers:** Definition and applications (PVC, Buna-S, Nylon-6,6). Differences between themoplastics and thermo setting plastics, Fiber reinforced plastics (FRP). **Conducting polymers:** Definition and Classification with examples - Mechanism of conduction in transpoly-acetylene and applications of conducting polymers. Biodegradable polymers: Polylactic acid and its applications.

UNIT-V- Advanced Functional Materials: [8]

Smart materials: Introduction, Classification with examples - Shape Memory Alloys – Nitinol, **Piezoelectric materials** – quartz and their engineering applications.

Biosensor - Definition, Amperometric Glucose monitor sensor.

Interpretative spectroscopic applications of UV-Visible spectroscopy for Analysis of pollutants in dye industry, IR spectroscopy in night vision-security, Pollution Under Control- CO sensor (Passive Infrared detection), Raman spectroscopy (application) - Tumour detection in medical applications.

TEXT BOOKS:

1. Engineering Chemistry by P.C. Jain and M. Jain, Dhanpatrai Publishing Company, 2010.
2. Engineering Chemistry by Rama Devi, Dr. P. Aparna and Rath, Cengage learning, 2025.

REFERENCE BOOKS:

1. Engineering Chemistry: by Thirumala Chary Laxminarayana & Shashikala, Pearson Publications (2020)
2. Engineering Chemistry by Shashi Chawla, Dhanpatrai and Company (P) Ltd. Delhi 2011.
3. Engineering Chemistry by Shikha Agarwal, Cambridge University Press, Delhi 2015.
4. Engineering Analysis of Smart Material Systems by Donald J. Leo, Wiley, 2007.
5. Challenges and Opportunities in Green Hydrogen by Editors: Paramvir Singh, Avinash Kumar Agarwal, Anupma Thakur, R.K Sinha.
6. Raman Spectroscopy in Human Health and Biomedicine, https://www.worldscientific.com/doi/epdf/10.1142/13094
7. E-Content- https://doi.org/10.1142/13094 | October 2023
8. E-books: https://archive.org/details/EngineeringChemistryByShashiChawla/page/n11/mode/2u

2605ES03: DATA STRUCTURES

B.Tech. I Year II Sem. **L T P C**
3 0 0 3

Prerequisites: A course on "Programming for Problem Solving

Course Objectives

- Exploring basic data structures such as stacks and queues.
- Introduces a variety of data structures such as hash tables, search trees, tries, heaps, graphs.
- Introduces sorting and pattern matching algorithms.

Course Outcomes

- Ability to select the data structures that efficiently model the information in a problem.
- Ability to assess efficiency trade-offs among different data structure implementations or combinations.
- Implement and know the application of algorithms for sorting and pattern matching.
- Design programs using a variety of data structures, including hash tables, binary and general tree structures, search trees, tries, heaps, graphs, and AVL-trees.
- Analyze and implement advanced data structures, searching, sorting, hashing, and graph algorithms to solve computational problems efficiently.
- Evaluate the performance of different data structures and algorithms using complexity analysis, and develop optimized solutions for real-world applications involving file organization and data management

UNIT – I

Introduction to Data Structures: Basic Terminology, Classification of Data Structures, Operation on Data Structures, abstract data types, selecting a Data Structure, Linear list – Introduction, singly linked list, Circular Linked Lists, Doubly Linked List, Stacks- Operations, Stack algorithm, Stack ADT, Stack applications, Queues- operations, Queue Algorithm, Queue ADT, Queue Applications.

UNIT - II

Trees: Introduction, Types of Trees, creating a Binary Tree from a General Tree, traversing a Binary Tree, Binary Search Trees (BST), BST Operations- Searching, Insertion and Deletion, BST ADT, BST Applications, Threaded Binary Trees, AVL Trees.

UNIT – III

Multi way Search Trees: Introduction, B Trees, B Trees ADT, B+ Trees. Heaps: Binary Heaps, Binomial heaps, Fibonacci heaps, Comparison of Various Heaps. Applications Searching: Introduction, Interpolation Search, Jump search.

UNIT - IV

Graphs: Introduction, Directed Graphs, Bi connected Components, Representation of Graphs, Graph Traversal Algorithms, Graph ADT, Applications of Graphs
Sorting: Heap sort, merge sort, quick sort

UNIT – V Hashing and Collision: Introduction, Hash Tables, Hash Functions, Different Hash Functions: Division Method, Multiplication Method, Mid-square Method, Folding Method; collisions: Collision Resolution by Open Addressing, Collision Resolution by Chaining

Files and their Organization: Introduction, Data hierarchy, File Attributes, Text and Binary Files, Basic File Operations, File Organization, Indexing.

TEXTBOOKS:

1. Data Structures: A Pseudocode Approach with C, 2 nd Edition, R. F. Gilberg and B.A.Forouzan, Cengage Learning
2. Data Structure using C– Reema Thareja, 3rd Edition, Oxford University Press.

REFERENCE:

1. Data Structures using C – A. S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson Education

2605ES02: PYTHON PROGRAMMING

B.Tech. I Year II Sem. **L T P C**
3 0 0 3

Prerequisites: Basic knowledge of computer fundamentals, C programming.

Course Objectives:
- Introduce the fundamentals of Python programming for problem-solving.
- Develop skills to write structured, modular, and efficient Python code.
- Enable students to use Python's built-in data structures and libraries effectively.
- Provide knowledge on file handling, exception handling, and object-oriented programming in Python.
- Equip students with the ability to apply Python for real-world applications including data
- processing and automation.

Course Outcomes:
- Write Python programs using variables, operators, expressions, and control structures. Implement Python programs using built-in data structures like lists, tuples, sets, and dictionaries.
- Apply modular and object-oriented programming principles in Python.
- Handle files, exceptions, and apply Python libraries for problem-solving.
- Develop small-scale applications in Python for automation and data manipulation.

UNIT-1 – Introduction to Python and Basics of Programming
Introduction to Python: Features, Applications, Installation, IDEs, Python Syntax, Indentation, Comments, Variables, Data Types, Type Casting, Operators: Arithmetic, Relational, Logical, Assignment, Membership, Identity, Bitwise, Input/Output functions (input(), print()), Control Structures:
if, if-else, if-elif-else, Nested Conditions, Looping: for, while, Nested Loops, break, continue, pass.

UNIT-2 – Data Structures in Python
Strings: Creation, Indexing, Slicing, Methods, String Formatting, Lists: Creation, Indexing, Slicing, List Comprehension, Methods, Tuples: Properties, Indexing, Methods, Sets: Creation, Operations, Methods, Dictionaries: Creation, Access, Methods, Dictionary Comprehension, Iterating over data structures.

UNIT-3 – Functions and Modules
Functions: Defining, Calling, Parameters, Return Values, Types of Arguments: Positional, Keyword, Default, Variable Length, Scope of Variables: Local and Global, Lambda Functions, Map, Filter, Reduce, Recursion in Python, Modules: Importing, Creating User-defined Modules, Standard Modules (math, random, datetime), Packages in Python.

UNIT-4 – File Handling and Exception Handling
File Handling: Opening, Reading, Writing, Appending, File Modes, File Methods, Working with CSV and JSON Files, Exception Handling: try, except, else, finally, Built-in Exceptions, Raising Exceptions, Introduction to Regular Expressions (re module).

UNIT-5 – Object-Oriented Programming and Applications
OOP Basics: Classes, Objects, Attributes, Methods, Constructor (__init__), self keyword, Inheritance: Single, Multiple, Multilevel, Hierarchical, Method Overriding, Method Overloading (conceptual),

Encapsulation and Polymorphism, Application Development: Data Processing Script, Basic Calculator, File Organizer, Simple Data Analysis with pandas.

TEXT BOOKS:

1. Python Programming: Using Problem Solving Approach by Reema Thareja.
2. Python Crash Course by Eric Matthes, Learning Python by Mark Lutz.

REFERENCE BOOKS:

1. Introduction to Python Programming by Gowrishankar S., Veena A.
2. Python Cookbook by David Beazley and Brian K. Jones.
3. Fluent Python by Luciano Ramalho, Automate the Boring Stuff with Python by Al Sweigart.

2600HS01: ENGLISH FOR SKILL ENHANCEMENT

B.Tech. I Year II Sem. **L T P C**
3 0 0 3

INTRODUCTION

National Education Policy-2020 aims at preparing students with knowledge, skills, values, leadership qualities and initiates them for lifelong learning. It also emphasizes language study and promotion of languages through understanding and proper interpretation. English language is central to the educational eco system. The importance of language as medium of communication for personal, social, official and professional needs to be emphasized for clear and concise expression. Teaching and learning of receptive and productive skills viz., Listening, Speaking, Reading and Writing (LSRW) are to be taught and learnt effectively in the undergraduate Engineering programs. Learners should be encouraged to engage in a rigorous process of learning to become proficient users of English language by adopting a deeply focused and yet flexible approach as opposed to rote learning.

In this connection, suitable syllabus, effective pedagogy, continuous assessments and students' involvement result in productive learning. This course supports the latest knowledge and skill requirements and shall meet specified learning outcomes. The main objectives of English language teaching and learning as medium of communication and for promotion of cultural values are embedded in this syllabus. Efforts are being made in providing a holistic approach towards value-based language learning which equips the learner with receptive as well as productive skills.

The focus in this syllabus is on skill development, fostering ideas and practice of language skills in various contexts and cultures in the areas of vocabulary, grammar, reading and writing. For this, the teachers should use the prescribed textbook for detailed study. The students should be encouraged to read the texts leading to reading comprehension. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind, for example, newspaper articles, advertisements, promotional material.

LEARNING OBJECTIVES: This course will enable the students to:

- Improve their vocabulary.
- Use appropriate sentence structures in their oral and written communication.
- Develop their reading and study skills.
- Equip students to write paragraphs, essays, précis and draft letters.
- Acquire skills for Technical report writing.

COURSE OUTCOMES: Students will be able to:

- Choose appropriate vocabulary in their oral and written communication.
- Demonstrate their understanding of the rules of functional grammar and sentence structures.
- Develop comprehension skills from known and unknown passages.
- Write paragraphs, essays, précis and draft letters.
- Write abstracts and reports in various contexts.

UNIT –I

Theme: Perspectives

Lesson on 'The Generation Gap' by Benjamin M. Spock from the prescribed textbook titled *English for the Young in the Digital World* published by Orient Black Swan Pvt. Ltd.

Vocabulary: The Concept of Word Formation -The Use of Prefixes and Suffixes - Words Often Misspelt - Synonyms and Antonyms

Grammar: Identifying Common Errors in Writing with Reference to Parts of Speech particularly Articles and Prepositions – Degrees of Comparison

Reading: Reading and Its Importance- Sub Skills of Reading – Skimming and Scanning.

Writing: Sentence Structures and Types -Use of Phrases and Clauses in SentencesImportance of Proper Punctuation- Techniques for Writing Precisely – Nature and Style of Formal Writing.

UNIT –II

Theme: Digital Transformation

Lesson on '*Emerging Technologies*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Homophones, Homonyms and Homographs

Grammar: Identifying Common Errors in Writing with Reference to Noun-pronoun Agreement and Subject-verb Agreement.

Reading: Reading Strategies-Guessing Meaning from Context – Identifying Main Ideas – Exercises for Practice

Writing: Paragraph Writing – Types, Structures and Features of a Paragraph - Creating Coherence – Linkers and Connectives - Organizing Principles in a Paragraph – Defining- Describing People, Objects, Places and Events – Classifying- Providing Examples or Evidence - Essay Writing - Writing Introduction and Conclusion.

UNIT –III

Theme: Attitude and Gratitude

Poems on '*Leisure*' by William Henry Davies and '*Be Thankful*' - Unknown Author from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Words Often Confused - Words from Foreign Languages and their Use in English.

Grammar: Identifying Common Errors in Writing with Reference to Misplaced Modifiers and Tenses.

Reading: Sub-Skills of Reading – Identifying Topic Sentence and Providing Supporting Ideas - Exercises for Practice.

Writing: Format of a Formal Letter-Writing Formal Letters E.g.., Letter of Complaint, Letter of Requisition, Job Application with CV/Resume –Difference between Writing a Letter and an Email - Email Etiquette.

UNIT –IV

Theme: Entrepreneurship

Lesson on '*Why a Start-Up Needs to Find its Customers First*' by Pranav Jain from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.

Vocabulary: Standard Abbreviations in English – Inferring Meanings of Words through Context – Phrasal Verbs – Idioms.

Grammar: Redundancies and Clichés in Written Communication – Converting Passive to Active Voice and Vice-Versa.
Reading: Prompt Engineering Techniques– Comprehending and Generating Appropriate Prompts
- Exercises for Practice
Writing: Writing Practices- Note Making-Précis Writing.

UNIT –V
Theme: Integrity and Professionalism
Lesson on '*Professional Ethics*' from the prescribed textbook titled *English for the Young in the Digital World* published by Orient BlackSwan Pvt. Ltd.
Vocabulary: Technical Vocabulary and their Usage– One Word Substitutes – Collocations.
Grammar: Direct and Indirect Speech - Common Errors in English (Covering all the other aspects of grammar which were not covered in the previous units)
Reading: Survey, Question, Read, Recite and Review (SQ3R Method) – Inferring the Meaning and Evaluating a Text- Exercises for Practice
Writing: ***Report Writing - Technical Reports- Introduction – Characteristics of a Report***

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Categories of Reports Formats- Structure of Reports (Manuscript Format) Types of Reports - Writing a Technical Report.

Prescribed Textbook:
1. Board of Editors. *2025. English for the Young in the Digital World.* Orient Black Swan Pvt. Ltd.

REFERENCE BOOKS:

1. Swan, Michael. (2016). *Practical English Usage.* Oxford University Press. New Edition.
2. *Karal, Rajeevan. 2023. English Grammar Just for You.* Oxford University Press. New Delhi
3. 2024. *Empowering with Language: Communicative English for Undergraduates.* Cengage Learning India Pvt. Ltd. New Delhi
4. Sanjay Kumar & Pushp Lata. 2022. *Communication Skills – A Workbook.* Oxford University Press. New Delhi
5. Wood,F.T. (2007). *Remedial English Grammar.* Macmillan.
6. Vishwamohan, Aysha. (2013). *English for Technical Communication for Engineering Students.* Mc Graw-Hill Education India Pvt. Ltd.

2600BS61: ENGINEERING CHEMISTRY LAB

B.Tech. I Year II Sem. **L T P C**
0 0 2 1

Course Objectives:

- Students will understand and perform experiments based on core chemical principles relevant to engineering applications.
- Students will learn to estimate the hardness of water to assess its suitability for drinking purposes.
- Students will acquire the ability to perform acid-base titrations using instrumental methods such as conductometry, potentiometry, and pH metry.
- Students will gain hands-on experience in synthesizing polymers like Bakelite and Nylon – 6, 6 in the laboratory.
- Students will learn to determine the unknown concentration of potassium permanganate (KMnO4) using a calibration curve.

Course Outcomes:

- Students will develop practical skills through hands-on chemistry experiments relevant to engineering.
- Students will learn to determine important parameters such as water hardness and the corrosion rate of mild steel under various conditions.
- Students will be able to apply techniques like conductometry, potentiometry, and pH metry to determine concentrations or equivalence points in acid-base reactions.
- Students will gain experience in synthesizing polymers such as Bakelite and Nylon-6,6.
- Students will understand the working principle of colorimetry and the relationship between absorbance and concentration (Beer-Lambert Law).
- Students will gain the skills in resolving the societal issues and are able to understand the realworld scenario

List of Experiments:

1. **Volumetric Analysis:** Estimation of Hardness of water by EDTA Complexometry method.
2. **Conductometry:** Estimation of the concentration of strong and weak acid in an acid mixture by Conductometry.
3. **Potentiometry:** Estimation of concentration of Fe+2ion by Potentiometry using K2Cr2O7.
4. **pH Metry:** Determination of an acid concentration using pH meter.
5. **Colorimetry:** Verification of Lambert-Beer's law using KMnO4.
6. **Preparations:**
    i Preparation of Bakelite.
    ii Preparation Nylon – 6, 6.
7. **Corrosion:** Determination of rate of corrosion of mild steel in the presence and absence of inhibitor.
8. **Lubricants:**
    i Determination of surface tension of a given liquid using stalagmometer.
    ii Determination of viscosity of lubricant oil by using Ostwald's viscometer.
9. **Virtual lab experiments:**
    i Construction of Fuel cell and it's working.
    ii Smart materials for Biomedical applications
    iii Batteries for electrical vehicles.
    iv Functioning of solar cell and its applications.

REFERENCE BOOKS:

1. Lab manual for Engineering chemistry by B. Ramadevi and P. Aparna, S Chand Publications, New Delhi (2022).
2. Vogel's text book of practical organic chemistry 5th edition.
3. Inorganic Quantitative analysis by A.I. Vogel, ELBS Publications.
4. College Practical Chemistry by V.K. Ahluwalia, Narosa Publications Ltd. New Delhi (2007).

2605ES63: DATA STRUCTURES LAB

B.Tech. I Year II Sem. **L T P C**
0 0 2 1

Prerequisites: 1. A Course on "Programming for problem solving".

Course Objectives:

- It covers various concepts of C programming language
- It introduces searching and sorting algorithms
- It provides an understanding of data structures such as stacks and queues.

Course Outcomes:

- Ability to develop C programs for computing and real-life applications using basic elements like control statements, arrays, functions, pointers and strings, and data structures like stacks, queues and linked lists.
- Ability to Implement searching and sorting algorithms.
- Implement and analyze linear and non-linear data structures, including linked lists, stacks, queues, trees, graphs, and hash tables using C programming.
- Apply tree traversal, graph traversal, and hashing techniques to efficiently organize, search, and retrieve data.
- Design and implement efficient solutions using advanced data structures such as Binary Search Trees, AVL Trees, B-Trees, and B+ Trees for real-world applications.
- Evaluate the performance of different data structures and algorithms based on time and space complexity to develop optimized software solutions.

List of Experiments

1. Write a program that uses functions to perform the following operations on singly linked list
   i) Creation ii) Insertion iii) Deletion iv) Traversal
2. Write a program that uses functions to perform the following operations on doubly linked list.
   i) Creation ii) Insertion iii) Deletion iv) Traversal
3. Write a program that uses functions to perform the following operations on circular linked list.
   i) Creation ii) Insertion iii) Deletion iv) Traversal
4. Write a program that implement stack (its operations) using
   i)Arrays ii) ADT
5. Write a program that implement Queue (its operations) using
   i)Arrays ii) ADT
6. Write a program that implements the following sorting methods to sort a given list of integers in ascending order
   i)Heap sort, ii) Merge Sort, iii) Quick Sort
7. Write a program to implement the tree traversal methods (Recursive and Non-Recursive).
8. Write a program to implement
   i)Binary Search tree ii) B Trees iii) B+ Trees iv) AVL trees
9. Write a program to implement the graph traversal methods.
10. Write a program to implement the following Hash Functions:
    i) Division Method, ii) Multiplication Method, iii) Mid-square Method, iv) Folding Method

TEXT BOOKS:

1. Fundamentals of Data Structures in C, 2nd Edition, E. Horowitz, S. Sahni and Susan Anderson Freed, Universities Press.
2. Data Structures using C – A. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, PHI/Pearson Education.

REFERENCE BOOK:

1. Data Structures: A Pseudocode Approach with C, 2nd Edition, R. F. Gilberg and B. A. . Forouzan, Cengage Learning.

2600HS61: English Language and Communication Skills LAB

B.Tech. I Year II Sem. **L T P C**
0 0 2 1

The **English Language and Communication Skills (ELCS) Lab** focuses on listening and speaking skills, particularly on the production and practice of sounds of language and familiarizes the students with the use of English in everyday situations both in formal and informal contexts.

Course Objectives:

- To facilitate computer-assisted multi-media instruction enabling individualized and independent language learning
- To sensitize students to the nuances of English speech sounds, word accent, intonation and rhythm
- To bring about a consistent accent and intelligibility in students' pronunciation of English by providing an opportunity for practice in speaking
- To improve the fluency of students in spoken English and neutralize their mother tongue influence
- To train students to use language appropriately for public speaking and interviews
- To foster better understanding of nuances of English language through audio- visual experience and group activities
- To inculcate Neutralization of accent for intelligibility
- To enhance students' speaking skills with clarity and confidence which in turn enhances their employability skills

Learning Outcomes: Students will be able to:

- Listen actively and identify important information in spoken texts
- Interpret the speech and infer the intention of the speaker
- Improve their accent for intelligibility
- Speak fluently with clarity and confidence
- Use the language in real life situations

Syllabus: English Language and Communication Skills Lab (ELCS) shall have two parts:

i **Computer Assisted Language Learning (CALL) Lab which focusses on listening skills**
ii **Interactive Communication Skills (ICS) Lab which focusses on speaking skills**

Listening Skills: Objectives

1. To enable students develop their active listening skills
2. To equip students with necessary training in listening, so that they can comprehend the speech of people from different linguistic backgrounds

Speaking Skills:

3. To improve their pronunciation and neutralize accent
4. To enable students express themselves fluently and appropriately 5. To practice speaking in social and professional contexts

The following course content is prescribed for the **English Language and Communication Skills Lab**.

Exercise – I CALL Lab:
Instruction: Speech Sounds-Listening Skill - Importance – Purpose - Types- Barriers- Active Listening
Practice: Listening to Distinguish Speech Sounds (Minimal Pairs) **-** *Testing Exercises* **ICS Lab**:

❖ **Diagnostic Test – Activity titled '*Express Your View'***
Instruction: Spoken and Written language - Formal and Informal English - Greetings - Introducing Oneself and Others
Practice: Any Ice-Breaking Activity

Exercise – II CALL Lab:
Instruction: Listening vs. Hearing - Barriers to Listening
Practice: Listening for General Information - Multiple Choice Questions - *Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)* **ICS Lab**:
Instruction: Features of Good Conversation – Strategies for Effective Communication
Practice: Role Play Activity - Situational Dialogues –Expressions used in Various Situations – Making Requests and Seeking Permissions – Taking Leave - Telephone Etiquette

Exercise - III
CALL Lab:
Instruction: Errors in Pronunciation – Tips for Neutralizing Mother Tongue Influence (MTI) *Practice:* Differences between British and American Pronunciation –*Listening Comprehension Exercises* **ICS Lab**:
Instruction: Describing Objects, Situations, Places, People and Events
Practice: Picture Description Activity – Looking at a Picture and Describing Objects, Situations, Places, People and Events *(A wide range of Materials / Handouts are to be made available in the lab.)*

Exercise – IV CALL Lab:
Instruction: Techniques for *Effective* Listening
Practice: Listening for Specific Details - Listening - Gap Fill Exercises - *Listening Comprehension Exercises (It is essential to identify a suitable passage with exercises for practice.)* **ICS Lab**:
Instruction: How to Tell a Good Story - Story Star- Sequencing-
Creativity *Practice:* Activity on Telling and Retelling Stories - Collage

Exercise – V CALL Lab:
Instruction: Identifying the literal and implied meaning
Practice: Listening for Evaluation - Write the Summary – Listening Comprehension Exercises *(It is essential to identify a suitable passage with exercises for practice.)* ICS Lab:
Instruction: Understanding Non-Verbal Communication
Practice: Silent Speech - Dumb Charades Activity

Minimum Requirement of infrastructural facilities for ELCS Lab:

1. **Computer Assisted Language Learning (CALL) Lab:**
   The Computer Assisted Language Learning Lab has to accommodate 40 students with 40 systems, with one Master Console, LAN facility and English language learning software for self-study by students.

   System Requirement (Hardware component):
   Computer network with LAN facility (minimum 40 systems with multimedia) with the following specifications:
   i) Computers with Suitable Configuration ii) High Fidelity Headphones

2. **Interactive Communication Skills (ICS) Lab:**

The Interactive Communication Skills Lab: A Spacious room with movable chairs and audio-visual aids with a Public Address System, a T. V. or LCD, a digital stereo – audio & video system and camcorder etc.

Suggested Software:

1. Cambridge Advanced Learners' English Dictionary with CD.
2. Grammar Made Easy by Darling Kindersley.
3. Punctuation Made Easy by Darling Kindersley.
4. Oxford Advanced Learner's Compass, 10th Edition.
5. English in Mind (Series 1-4), Herbert Puchta and Jeff Stranks with Meredith Levy, Cambridge.
6. English Pronunciation in Use (Elementary, Intermediate, Advanced) Cambridge University
7. Press.
8. English Vocabulary in Use (Elementary, Intermediate, Advanced) Cambridge University Press.
9. TOEFL & GRE (KAPLAN, AARCO & BARRONS, USA, Cracking GRE by CLIFFS).

REFERENCE BOOKS:

1. Shobha, KN & Rayen, J. Lourdes. (2019). *Communicative English – A workbook.* Cambridge University Press
2. Board of Editors. (2016). *ELCS Lab Manual: A Workbook for CALL and ICS Lab Activities.* Orient BlackSwan Pvt. Ltd.
3. Mishra, Veerendra et al. (2020). *English Language Skills: A Practical Approach.* Cambridge University Press
4. (2022). *English Language Communication Skills – Lab Manual cum Workbook.* Cengage Learning India Pvt. Ltd.
5. Ur, Penny and Wright, Andrew. 2022. *Five Minute Activities – A Resource Book for Language Teachers.* Cambridge University Press.

2605ES62: PYTHON PROGRAMMING LAB

B.Tech. I Year II Sem. **L T P C**
0 0 2 1

Course Objectives:

- To install and run the Python interpreter
- To learn control structures.
- To Understand Lists, Dictionaries in python
- To Handle Strings and Files in Python

Course Outcomes: After completion of the course, the student should be able to

- Develop the application specific codes using python.
- Understand Strings, Lists, Tuples and Dictionaries in Python
- Verify programs using modular approach, file I/O, Python standard library
- Implement Digital Systems using Python

Note: The lab experiments will be like the following experiment examples.

List of Experiments:

a Use a web browser to go to the Python website http://python.org. This page contains information about Python and links to Python-related pages, and it gives you the ability to search the Python documentation.

b Start the Python interpreter and type help() to start the online help utility.

1. Start a Python interpreter and use it as a Calculator.
2. Write a program to calculate compound interest when principal, rate and number of periods are given.
3. Read the name, address, email and phone number of a person through the keyboard and print the details.
4. Print the below triangle using for loop.

   5
   4 4
   3 3 3
   2 2 2 2
   1 1 1 1 1

5. Write a program to check whether the given input is digit or lowercase character or uppercase character or a special character(use 'if-else-if' ladder) 6. Python program to print all prime numbers in a given interval (use break)
7. Write a program to convert a list and tuple into arrays.
8. Write a program to find common values between two arrays.
9. Write a function called palindrome that takes a string argument and returnsTrue if it is a palindrome and False otherwise. Remember that you can use the built-in function len to check the length of a string.
10. Write a function called is_sorted that takes a list as a parameter and returns True if the list is sorted in ascending order and False otherwise.
11. Write a function called has_duplicates that takes a list and returns True if there is any element that appears more than once. It should not modify the original list.

12. Write a function called remove_duplicates that takes a list and returns a new list with only the unique elements from the original. Hint: they don't have to be in the same order.
13. The wordlist I provided, words.txt, doesn't contain single letter words. So you might want to add "I", "a", and the empty string.
14. Write a python code to read dictionary values from the user. Construct a function to invert its content. i.e., keys should be values and values should be keys.
15. Add a comma between the characters. If the given word is 'Apple', it should become 'A,p,p,l,e'
16. Remove the given word in all the places in a string?
17. Write a function that takes a sentence as an input parameter and replaces the first letter of every word with the corresponding upper case letter and the rest of the letters in the word by corresponding letters in lower case without using a built-in function?
18. Writes a recursive function that generates all binary strings of n-bit length
19. Write a python program that defines a matrix and prints
20. Write a python program to perform multiplication of two square matrices
21. How do you make a module? Give an example of construction of a module using different geometrical shapes and operations on them as its functions.
22. Use the structure of exception handling all general-purpose exceptions.
23. Write a function called draw_rectangle that takes a Canvas and a Rectangle as arguments and draws a representation of the Rectangle on the Canvas.
24. Add an attribute named color to your Rectangle objects and modify draw_rectangle so that it uses the color attribute as the fill color.
25. Write a function called draw_point that takes a Canvas and a Point as arguments and draws a representation of the Point on the Canvas.
26. Define a new class called Circle with appropriate attributes and instantiate a few Circle objects. Write a function called draw_circle that draws circles on the canvas.
27. Write a python code to read a phone number and email-id from the user and validate it for correctness.
28. Write a Python code to merge two given file contents into a third file.
29. Write a Python code to open a given file and construct a function to check for given words present in it and display on found.
30. Write a Python code to Read text from a text file, find the word with most number of occurrences
31. Write a function that reads a file *file1*and displays the number of words, number of vowels, blank spaces, lower case letters and uppercase letters.
32. Import numpy, Plotpy and Scipy and explore their functionalities.
33. Install NumPypackage with pip and explore it.
34. Write a program to implement Digital Logic Gates – AND, OR, NOT, EX-OR
35. Write a GUI program to create a window wizard having two text labels, two text fields and two buttons as Submit and Reset.

TEXT BOOKS:

1. Supercharged Python: Take your code to the next level, Overland 2. Learning Python, Mark Lutz, O'reilly

REFERENCE BOOKS:

1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Python Programming A Modular Approach with Graphics, Database, Mobile, and Web Applications, Sheetal Taneja, Naveen Kumar, Pearson
3. Introduction to Python Programming, Gowrishakar S, Veena A, CRC Press
4. Programming with Python, A User's Book, Michael Dawson, Cengage Learning, India Edition

2600BS06: Mathematical and Statistical Foundations

B.Tech. II Year I Sem. **L T P C**
2 1 0 3

Pre-requisites: Mathematics courses of first year of study.

Course Objectives: To learn
- The Number Theory basic concepts useful for cryptography etc.
- The theory of Probability, and probability distributions of single random variables.
- The sampling theory and testing of hypothesis and making inferences.
- The curve fitting, correlation and regression for the given data.

Course outcomes: After learning the contents of this paper, the student must be able to
- Apply the number theory concepts to cryptography domain.
- Apply the concepts of probability and distributions to some case studies.
- Correlate the material of one unit to the material in other units.
- Resolve the potential misconceptions and hazards in each topic of study.
- Fit the curve, correlation and regression for the given data.

UNIT-I: Basics of Number Theory **10 L**

Greatest Common Divisors and Prime Factorization: Greatest common divisors – The Euclidean algorithm – The fundamental theorem of arithmetic – Factorization of integers and the Fermat numbers. Congruences: Introduction to congruences – Linear congruences.

UNIT-II: Random Variables and Probability Distributions **8 L**

Concept of a Random Variable – Discrete Probability Distributions – Continuous Probability Distributions – Mean of a Random Variable – Variance of a Random Variable
Discrete Probability Distributions: Binomial Distribution – Poisson distribution

UNIT-III: Continuous Distributions and Sampling **10 L**

Uniform Distribution – Normal Distribution – Areas under the Normal Curve – Applications of the Normal Distribution – Normal Approximation to the Binomial Distributions. **Fundamental Sampling Distributions:** Random Sampling – Some Important Statistics – Sampling Distributions – Sampling Distribution of Means – Central Limit Theorem.

UNIT-IV: Tests of Hypotheses (Large and Small Samples) **10 L**

Statistical Hypotheses: General Concepts – Testing a Statistical Hypothesis. Single sample: Tests concerning a single mean. Two samples: Tests on two mean (Unknown for equal variance). One sample: Test on a single proportion. Two samples: Tests on two proportions.
Two- sample tests concerning variances: F-distribution

UNIT-V: Applied Statistics **10 L**

Curve fitting by the method of least squares – Fitting of straight lines – Second degree parabolas and more general curves – Correlation and Regression – Rank correlation.

TEXT BOOKS:

1. Kenneth H. Rosen, Elementary Number Theory & its Applications, sixth edition, Addison Wesley, ISBN 978 0-321-50031-1.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Keying Ye, Probability & Statistics for Engineers & Scientists, 9th Ed. Pearson Publishers.
3. S C Gupta and V K Kapoor, Fundamentals of Mathematical Statistics, Khanna publications.

REFERENCE BOOKS:

1. T.T. Soong, Fundamentals of Probability and Statistics for Engineers, John Wiley & Sons, Ltd, 2004.
2. Sheldon M Ross, Probability and statistics for Engineers and scientists, academic press.
3. S C Gupta and V K Kapoor, Fundamentals of Mathematical statistics, Khanna publications.

2605PC02: COMPUTER ORGANIZATION AND ARCHITECTURE

B.Tech. II Year I Sem. **L T P C**
3 0 0 3

Prerequisites: No prerequisites.
Co-requisite: A Course on "Digital Electronics".

Course Objectives:
- The purpose of the course is to introduce principles of computer organization and the basic architectural concepts.
- It begins with basic organization, design, and programming of a simple digital computer and introduces simple register transfer language to specify various computer operations.
- Topics include computer arithmetic, instruction set design, microprogrammed control unit, pipelining and vector processing, memory organization and I/O systems, and multiprocessors

Course Outcomes:
- Understand the basics of instruction sets and their impact on processor design.
- Demonstrate an understanding of the design of the functional units of a digital computer system.
- Evaluate cost performance and design trade-offs in designing and constructing a computer processor including memory.
- Design a pipeline for consistent execution of instructions with minimum hazards.
- Recognize and manipulate representations of numbers stored in digital computers

UNIT - I:
Boolean algebra and Logic Gates: Binary codes, Binary Storage and Registers, Binary logic.
Digital logic gates. Data Representation: Data types, Complements, Fixed Point Representation, Floating Point Representation
Digital Computers: Introduction, Block diagram of Digital Computer, Definition of Computer Organization, Computer Design and Computer Architecture.

UNIT - II:
Combinational Logic: Combinational Circuits, Analysis procedure Design procedure, Binary Adder-Subtractor Decimal Adder, Binary multiplier, magnitude comparator, Decoders, Encoders, Multiplexers, HDL for combinational circuits.
Sequential Logic: Sequential circuits, latches, Flip-Flops Analysis of clocked sequential circuits, state Reduction and Assignment, Design Procedure**.** Registers, shift Registers, Ripple counters, synchronous counters, other counters.

UNIT III
Register Transfer Language and Micro operations: Register Transfer language, Register Transfer, Bus and memory transfers, Arithmetic Micro operations, logic micro operations, shift micro operations, Arithmetic logic shift unit.
Basic Computer Organization and Design: Instruction codes, Computer Registers Computer instructions, Timing and Control, Instruction cycle, Memory Reference Instructions, Input – Output and Interrupt.

UNIT - IV

Microprogrammed Control: Control memory, Address sequencing, micro program example, design of control unit.

Central Processing Unit: General Register Organization, Instruction Formats, Addressing modes, Data Transfer and Manipulation, Program Control.

Computer Arithmetic: Addition and subtraction, multiplication Algorithms, Division Algorithms, Floating – point Arithmetic operations. Decimal Arithmetic unit, Decimal Arithmetic operations.

UNIT - V

Input-Output Organization: Input-Output Interface, Asynchronous data transfer, Modes of Transfer, Priority Interrupt Direct memory Access.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associate Memory, Cache Memory.

TEXT BOOKS:

1. Digital Design – M. Morris Mano, Third Edition, Pearson/PHI.
2. Computer System Architecture – M. Morris Mano, Third Edition, Pearson/PHI.

REFERENCE BOOKS:

1. Switching and Finite Automata Theory, ZVI. Kohavi, Tata Mc Graw Hill.
2. Computer Organization – Carl Hamacher, Zvonks Vranesic, SafeaZaky, 5th Edition, McGraw Hill.
3. Computer Organization and Architecture – William Stallings Sixth Edition, Pearson/PHI.
4. Structured Computer Organization – Andrew S. Tanenbaum, 4th Edition, PHI/Pearson.

2605PC03: OBJECT ORIENTED PROGRAMMING THROUGH JAVA

B.Tech. II Year I Sem. **L T P C**
3 0 0 3

Course Objectives:

- To Understand the basic object-oriented programming concepts and apply them in problem solving.
- To Illustrate inheritance concepts for reusing the program.
- To Demonstrate multitasking by using multiple threads and event handling
- To Develop data-centric applications using JDBC.
- To Understand the basics of java console and GUI based programming

Course Outcomes:

- Demonstrate the behavior of programs involving the basic programming constructs like control structures, constructors, string handling and garbage collection.
- Demonstrate the implementation of inheritance (multilevel, hierarchical and multiple) by using extend and implement keywords
- Use multithreading concepts to develop inter process communication.
- Understand the process of graphical user interface design and implementation using AWT or swings.
- Develop applets that interact abundantly with the client environment and deploy on the server.

UNIT - I

Object oriented thinking and Java Basics- Need for oop paradigm, summary of oop concepts, coping with complexity, abstraction mechanisms. History of Java, Java buzzwords, data types, variables, scope and lifetime of variables, arrays, operators, expressions, control statements, type conversion and casting, simple java program, concepts of classes, objects, constructors, methods, access control, this keyword, garbage collection, overloading methods and constructors, parameter passing, recursion, nested and inner classes, exploring String class.

UNIT - II

Inheritance, Packages and Interfaces – Hierarchical abstractions, Base class object, subclass, subtype, substitutability, forms of inheritance specialization, specification, construction, extension, limitation, combination, benefits of inheritance, costs of inheritance. Member access rules, super keyword uses, using final keyword with inheritance, polymorphism- method overriding, abstract classes, the Object class. Defining, Creating and Accessing a Package, Understanding CLASSPATH, importing packages, differences between classes and interfaces, defining an interface, implementing interface, applying interfaces, variables in interface and extending interfaces.

UNIT - III

Exception handling and Multithreading-- Concepts of exception handling, benefits of exception handling, Termination or resumptive models, exception hierarchy, usage of try, catch, throw, throws and finally, built in exceptions, creating own exception subclasses. Differences between multithreading and multitasking, thread life cycle, creating threads, thread priorities, synchronizing threads, inter thread communication, thread groups, daemon threads.

UNIT - IV

Exploring String class, Object class, Exploring java.util package, Exploring java.io package Event Handling: Events, Event sources, Event classes, Event Listeners, Delegation event model, handling

mouse and keyboard events, Adapter classes. graphics, layout manager – layout manager types – border, grid, flow, card and grid bag.

UNIT - V

Swing – Introduction, limitations of AWT, MVC architecture, components, containers, exploring swing-JFrame and JComponent, JLabel, ImageIcon, JTextField, JButton, JCheckBox, JRadioButton, JList, JComboBox, Tabbed Panes, Scroll Panes, Trees, and Tables.

Menu Basics, Menu related classes - JMenuBar, JMenu, JMenuItem, JCheckBoxMenuItem, JRadioButtonMenuItem, JSeperator. creating a popup menu

TEXT BOOKS:

1. Java the complete reference, 13th edition, Herbert schildt, Dr. Denny Coward, Mc Graw Hill.
2. Understanding OOP with Java, updated edition, T. Budd, Pearson education.

REFERENCE BOOKS:

1. An Introduction to programming and OO design using Java, J.Nino and F.A. Hosch, John Wiley & sons.
2. An Introduction to OOP, third edition, T. Budd, Pearson education.
3. Introduction to Java programming, Y. Daniel Liang, Pearson education.
4. An introduction to Java programming and object-oriented application development, R.A. Johnson-Thomson.
5. Core Java 2, Vol 1, Fundamentals, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education.
6. Core Java 2, Vol 2, Advanced Features, Cay.S. Horstmann and Gary Cornell, eighth Edition, Pearson Education
7. Object Oriented Programming with Java, R.Buyya, S.T.Selvi, X.Chu, TMH.
8. Java and Object Orientation, an introduction, John Hunt, second edition, Springer.
9. Maurach's Beginning Java2 JDK 5, SPD.

2605PC06: SOFTWARE ENGINEERING

B.Tech. II Year I Sem. **L T P C**
3 0 0 3

Course Objectives

- The aim of the course is to provide an understanding of the working knowledge of the techniques for estimation, design, testing and quality management of large software development projects.
- Topics include process models, software requirements, software design, software testing, software process/product metrics, risk management, quality management and UML diagrams

Course Outcomes

- Ability to translate end-user requirements into system and software requirements, using e.g.
- UML, and structure the requirements in a Software Requirements Document (SRD).
- Identify and apply appropriate software architectures and patterns to carry out high level design of a system and be able to critically compare alternative choices.
- Will have experience and/or awareness of testing problems and will be able to develop a simple testing report

UNIT - I

Introduction to Software Engineering: The evolving role of software, changing nature of software, software myths. A Generic view of process: Software engineering- a layered technology, a process framework, the capability maturity model integration (CMMI). Process models: The waterfall model, Spiral model, Incremental Process Models, Concurrent Models, Component based development and Agile Development.

UNIT - II

Software Requirements: Functional and non-functional requirements, user requirements, system requirements, interface specification, the software requirements document.
Requirements engineering process: Feasibility studies, requirements elicitation and analysis, requirements validation, requirements management.

UNIT - III

Design Engineering: Design process and design quality, design concepts, the design model. Creating an architectural design: software architecture, data design, architectural styles and patterns, architectural design, conceptual model of UML, basic structural modeling, use case diagrams, class diagrams, sequence diagrams, collaboration diagrams, activity diagrams and component diagrams.

UNIT - IV

Testing Strategies: A strategic approach to software testing, test strategies for conventional software, black-box and white-box testing, validation testing, system testing, the art of debugging.
Metrics for Process and Products: Software measurement, metrics for software quality.

UNIT - V

Risk management: Reactive Vs proactive risk strategies, software risks, risk identification, risk projection, risk refinement, RMMM. Quality Management: Quality concepts, software quality assurance, software reviews, formal technical reviews, statistical software quality assurance, software reliability, the ISO 9000 quality standards.

TEXT BOOKS:

1. Software Engineering, A practitioner's Approach- Roger S. Pressman, 6th edition, McGraw Hill International Edition.
2. Software Engineering- Sommerville, 7th edition, Pearson Education.
3. The unified modeling language user guide, Grady Booch, James Rumbaugh, Ivar Jacobson, Pearson Education.

REFERENCE BOOKS:

1. Software Engineering, an Engineering approach- James F. Peters, Witold Pedrycz, John Wiley.
2. Software Engineering principles and practice- Waman S Jawadekar, The McGraw-Hill Companies.
3. Fundamentals of object-oriented design using UML Meiler page-Jones: Pearson Education.
4. Fundamentals of Software Engineering-Rajib Mall, PHI.

2605PC05: DATABASE MANAGEMENT SYSTEM

B.Tech. II Year I Sem. **L T P C**
3 0 0 3

Prerequisites: A course on "Data Structures".

Course Objectives:
- To understand the basic concepts and the applications of database systems.
- To master the basics of SQL and construct queries using SQL.
- Topics include data models, database design, relational model, relational algebra, transaction control, concurrency control, storage structures and access techniques.

Course Outcomes:
- Gain knowledge of fundamentals of DBMS, database design and normal forms
- Master the basics of SQL for retrieval and management of data.
- Be acquainted with the basics of transaction processing and concurrency control.
- Familiarity with database storage structures and access techniques

UNIT - I
Database System Applications: A Historical Perspective, File Systems versus a DBMS, the Data Model, Levels of Abstraction in a DBMS, Data Independence, Structure of a DBMS
Introduction to Database Design: Database Design and ER Diagrams, Entities, Attributes, and Entity Sets, Relationships and Relationship Sets, Additional Features of the ER Model, Conceptual Design With the ER Model

UNIT - II
Introduction to the Relational Model: Integrity constraint over relations, enforcing integrity constraints, querying relational data, logical database design, introduction to views, destroying/altering tables and views.
Relational Algebra, Tuple relational Calculus, Domain relational calculus.

UNIT - III
SQL: QUERIES, CONSTRAINTS, TRIGGERS: form of basic SQL query, UNION, INTERSECT, and EXCEPT, Nested Queries, aggregation operators, NULL values, complex integrity constraints in SQL, triggers and active databases.
Schema Refinement: Problems caused by redundancy, decompositions, problems related to decomposition, reasoning about functional dependencies, FIRST, SECOND, THIRD normal forms, BCNF, lossless join decomposition, multivalued dependencies, FOURTH normal form, FIFTH normal form.

UNIT - IV
Transaction Concept, Transaction State, Implementation of Atomicity and Durability, Concurrent Executions, Serializability, Recoverability, Implementation of Isolation, Testing for serializability, Lock Based Protocols, Timestamp Based Protocols, Validation- Based Protocols, Multiple Granularity, Recovery and Atomicity, Log–Based Recovery, Recovery with Concurrent Transactions.

UNIT - V

Data on External Storage, File Organization and Indexing, Cluster Indexes, Primary and Secondary Indexes, Index data Structures, Hash Based Indexing, Tree based Indexing, Comparison of File Organizations, Indexes- Intuitions for tree Indexes, Indexed Sequential Access Methods (ISAM), B+ Trees: A Dynamic Index Structure.

TEXT BOOKS:

1. Database System Concepts, Silberschatz, Korth, McGraw hill, V edition.3rd Edition
2. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill

REFERENCE BOOKS:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate, Pearson Education
3. Introduction to Database Systems, C. J. Date, Pearson Education
4. Oracle for Professionals, The X Team, S.Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.
6. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

2605BS64: COMPUTATIONAL MATHEMATICS LAB Using Python
(Using Python/MATLAB software)

B.Tech. II Year I Sem. **L T P C**
0 0 2 1

Pre-requisites: Matrices, Iterative methods and ordinary differential equations

Course Objectives: To learn
- Solve problems of Eigen values and Eigen Vectors using Python/MATLAB.
- Solution of Algebraic and Transcendental Equations using Python/MATLAB
- Solve problems of Linear system of equations
- Solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients

Course outcomes: After learning the contents of this paper, the student must be able to
- Develop the code to find the Eigen values and Eigen Vectors using Python/MATLAB.
- Develop the code find solution of Algebraic and Transcendental Equations and Linear system of equations using Python/MATLAB
- Write the code to solve problems of First-Order ODEs Higher order linear differential equations with constant coefficients

* **Visualize all solutions graphically through programmes**

6P

UNIT - I: Eigen values and Eigenvectors:
Programs:
1. Finding real and complex Eigen values.
2. Finding Eigen vectors.

UNIT-II: Solution of Algebraic and Transcendental Equations **6P**
Bisection method, Newton Raphson Method
Programs:
3. Root of a given equation using Bisection method.
4. Root of a given equation Newton Raphson Method.

UNIT-III: Linear system of equations: **6P**
Jacobi's iteration method and Gauss-Seidal iteration method
Programs:
5. Solution of given system of linear equations using Jacobi's method
6. Solution of given system of linear equations using Gauss-Seidal method

UNIT-IV: First-Order ODEs **8P**
Exact and non-exact equations, Applications: exponential growth/decay, Newton's law of cooling.
Programs:
7. Solving exact and non-exact equations
8. Solving exponential growth/decay and Newton's law of cooling problems

UNIT-V: Higher order linear differential equations with constant coefficients 6P
Programs:

9. Solving homogeneous ODEs
10. Solving non-homogeneous ODEs

TEXT BOOKS:

1. MATLAB and its Applications in Engineering, Rajkumar Basal, Ashok Kumar Geo, Manoj Kumar Sharma, Pearson publication.
2. Kenneth A. Lambert, The fundamentals of Python: First Programs, 2011, Cengage Learnings.
3. Think Python First Edition, by Allen B. Downey, Orielly publishing.
4. Introduction to Python Programming, William Mitchell, Povel Solin, Martin Novak et al., NCLab Public Computing, 2012.
5. Introduction to Python Programming, ©Jacob Fredslund, 2007.

REFERENCE BOOKS:

1. An Introduction to Python, John C. Lusth, The University of Alabama, 2011.
2. Introduction to Python, ©Dave Kuhlman, 2008.

2605PC61: OBJECT ORIENTED PROGRAMMING THROUGH JAVA LAB

B.Tech. II Year I Sem. **L T P C**
0 0 2 1

Course Objectives:
- To write programs using abstract classes.
- To write programs for solving real world problems using the java collection framework.
- To write multithreaded programs.
- To write GUI programs using swing controls in Java.
- To introduce java compiler and eclipse platform.
- To impart hands-on experience with java programming.

Course Outcomes:
- Able to write programs for solving real world problems using the java collection framework.
- Able to write programs using abstract classes.
- Able to write multithreaded programs.
- Able to write GUI programs using swing controls in Java.

Note:
1. Use LINUX and MySQL for the Lab Experiments. Though not mandatory, encourage the use of the Eclipse platform.
2. The list suggests the minimum program set. Hence, the concerned staff is requested to add more problems to the list as needed.

List of Experiments:
1. Use Eclipse or Net bean platform and acquaint yourself with the various menus. Create a test project, add a test class, and run it. See how you can use auto suggestions, auto fill. Try code formatter and code refactoring like renaming variables, methods, and classes. Try debug step by step with a small program of about 10 to 15 lines which contains at least one if else condition and a for loop.

2. Write a Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -,*, % operations. Add a text field to display the result. Handle any possible exceptions like divided by zero.

3. Write a java program for following concepts
   a. Develop an applet in Java that displays a simple message.
   b. Develop an applet in Java that receives an integer in one text field, and computes its factorial

4. Value and returns it in another text field, when the button named “Compute” is clicked.

5. Write a Java program that creates a user interface to perform integer divisions. The user enters two numbers in the text fields, Num1 and Num2. The division of Num1 and Num 2 is displayed in the Result field when the Divide button is clicked. If Num1 or Num2 were not an integer, the program would throw a Number Format Exception. If Num2 were Zero, the program would throw an Arithmetic Exception. Display the exception in a message dialog box.

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

7. Write a Java program for the following:
   Create a doubly linked list of elements. Delete a given element from the above list.
   Display the contents of the list after deletion.

8. Write a Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "Stop" or "Ready" or "Go" should appear above the buttons in the selected color. Initially, there is no message shown.

9. Write a Java program to create an abstract class named Shape that contains two integers and an empty method named print Area (). Provide three classes named Rectangle, Triangle, and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method print Area () that prints the area of the given shape.

10. Suppose that a table named Table.txt is stored in a text file. The first line in the file is the header, and the remaining lines correspond to rows in the table. The elements are separated by commas.
11. Write a java program to display the table using Labels in Grid Layout.

12. Write a Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired (Use Adapter classes).

13. Write a Java program that loads names and phone numbers from a text file where the data is organized as one line per record and each field in a record are separated by a tab (\t). It takes a name or phone number as input and prints the corresponding other value from the hash table (hint: use hash tables).

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

15. Write a Java program to list all the files in a directory including the files present in all its subdirectories.

TEXT BOOKS:

1 Java for Programmers, P. J. Deitel and H. M. Deitel, 10th Edition Pearson education.
2 Thinking in Java, Bruce Eckel, Pearson Education.

REFERENCE BOOKS

1 Java Programming, D. S. Malik and P. S. Nair, Cengage Learning.
2 Core Java, Volume 1, 9th edition, Cay S. Horstmann and G Cornell, Pearson.

2605PC63: DATABASE MANAGEMENT SYSTEMS LAB

B.Tech. II Year I Sem. **L T P C**
0 0 2 1

Course Objectives:

- Introduce ER data model, database design and normalization Learn SQL basics for data definition and data manipulation

Course Outcomes:

- Design database schema for a given application and apply normalization
- Acquire skills in using SQL commands for data definition and data manipulation.
- Develop solutions for database applications using procedures, cursors and triggers

List of Experiments:

1. Concept design with E-R Model
2. Relational Model
3. Normalization
4. Practicing DDL commands
5. Practicing DML commands
6. A) Querying (using ANY, ALL, UNION, INTERSECT, JOIN, Constraints etc.)
   B) Nested, Correlated subqueries
7. Queries using Aggregate functions, GROUP BY, HAVING and Creation and dropping of Views.
8. Triggers (Creation of insert trigger, delete trigger, update trigger)
9. Procedures
10. Usage of Cursors

TEXT BOOKS:

1. Database Management Systems, Raghurama Krishnan, Johannes Gehrke, Tata Mc Graw Hill,3rd Edition
2. Database System Concepts, Silberschatz, Korth, McGraw Hill, V edition.

REFERENCES BOOKS:

1. Database Systems design, Implementation, and Management, Peter Rob & Carlos Coronel 7th Edition.
2. Fundamentals of Database Systems, Elmasri Navrate, Pearson Education
3. Introduction to Database Systems, C.J. Date, Pearson Education
4. Oracle for Professionals, The X Team, S. Shah and V. Shah, SPD.
5. Database Systems Using Oracle: A Simplified guide to SQL and PL/SQL, Shah, PHI.
6. Fundamentals of Database Management Systems, M. L. Gillenson, Wiley Student Edition.

SKILL DEVELOPMENT COURSE-1
2605SD01: NODE JS/ REACT JS/ DJANGO

B.Tech. II Year I Sem. **L T P C**
3 0 0 3

Prerequisites: Object Oriented Programming through Java, HTML Basics.

Course Objectives:
- To implement the static web pages using HTML and do client-side validation using JavaScript.
- To design and work with databases using Java
- To develop an end to end application using java full stack.
- To introduce Node JS implementation for server-side programming.
- To experiment with single page application development using React.

Course Outcomes: At the end of the course, the student will be able to,
- Build a custom website with HTML, CSS, and Bootstrap and little JavaScript.
- Demonstrate Advanced features of JavaScript and learn about JDBC 3. Develop Server – side implementation using Java technologies like
- Develop the server – side implementation using Node JS.
- Design a Single Page Application using React.

Exercises:
1. Build a responsive web application for shopping cart with registration, login, catalog and cart pages using CSS3 features, flex and grid.
2. Make the above web application responsive web application using Bootstrap framework.
3. Use JavaScript for doing client – side validation of the pages implemented in experiment 1 and experiment 2.
4. Explore the features of ES6 like arrow functions, callbacks, promises, async/await. Implement an application for reading the weather information from openweathermap.org and display the information in the form of a graph on the web page.
5. Develop a java stand alone application that connects with the database (Oracle / mySql) and perform the CRUD operation on the database tables.
6. Create an xml for the bookstore. Validate the same using both DTD and XSD.
7. Design a controller with servlet that provides the interaction with application developed in experiment 1 and the database created in experiment 5.
8. Maintaining the transactional history of any user is very important. Explore the various session tracking mechanism (Cookies, HTTP Session)
9. Create a custom server using http module and explore the other modules of Node JS like OS, path, event.
10. Develop an express web application that can interact with REST API to perform CRUD operations on student data. (Use Postman)
11. For the above application create authorized end points using JWT (JSON Web Token).
12. Create a react application for the student management system having registration, login, contact, about pages and implement routing to navigate through these pages.
13. Create a service in react that fetches the weather information from openweathermap.org and the display the current and historical weather information using graphical representation using chart.js
14. Create a TODO application in react with necessary components and deploy it into GitHub.

REFERENCE BOOKS:

1. Jon Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wrox Publications, 2010.
2. Bryan Basham, Kathy Sierra and Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2nd Edition, 2008.
3. Vasan Subramanian, Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node ,2nd Edition, APress.

2605PC01: DISCRETE MATHEMATICS

B.Tech. II Year II Sem.

L	T	P	C
2	1	0	3

Course Objectives:

- Introduces elementary discrete mathematics for computer science and engineering.
- Topics include formal logic notation, methods of proof, induction, sets, relations, algebraic structures, elementary graph theory, permutations and combinations, counting principles; recurrence relations and generating functions.

Course Outcomes:

- Understand and construct precise mathematical proofs
- Apply logic and set theory to formulate precise statements
- Analyze and solve counting problems on finite and discrete structures
- Describe and manipulate sequences
- Apply graph theory in solving computing problems

UNIT - I

Mathematical logic: Introduction, Statements and Notation, Connectives, Normal Forms, Theory of Inference for the Statement Calculus, The Predicate Calculus, Inference Theory of the Predicate Calculus.

UNIT - II

Set theory: Introduction, Basic Concepts of Set Theory, Representation of Discrete Structures, Relations and Ordering, Functions.

UNIT - III

Algebraic Structures: Introduction, Algebraic Systems, Semi groups and Monoids, Lattices as Partially Ordered Sets, Boolean Algebra.

UNIT - IV

Elementary Combinatorics: Basics of Counting, Combinations and Permutations, Enumeration of Combinations and Permutations, Enumerating Combinations and Permutations with Repetitions, Enumerating Permutation with Constrained Repetitions, Binomial Coefficient, The Binomial and Multinomial Theorems, The Principle of Exclusion.

UNIT - V

Graph Theory: Basic Concepts, Isomorphism and Subgraphs, Trees and their Properties, Spanning Trees, Directed Trees, Binary Trees, Planar Graphs, Euler's Formula, Multi-graphs and Euler Circuits, Hamiltonian Graphs, Chromatic Numbers, The Four-Color Problem.

TEXT BOOKS:

1. Discrete Mathematical Structures with Applications to Computer Science: J.P. Tremblay, R. Manohar, McGraw-Hill, 1st ed.
2. Discrete Mathematics for Computer Scientists & Mathematicians: Joe l. Mott, Abraham Kandel, Teodore P. Baker, Prentis Hall of India, 2nd ed.

REFERENCE BOOKS:

1. Discrete and Combinatorial Mathematics - an applied introduction: Ralph. P. Grimald, Pearson education, 5th edition.

2605PC04: OPERATING SYSTEMS

B.Tech. II Year II Sem. **L T P C**
3 0 0 3

Prerequisites:
- A course on "Computer Programming and Data Structures".
- A course on "Computer Organization and Architecture".

Course Objectives:
- Introduce operating system concepts (i.e., processes, threads, scheduling, synchronization, deadlocks, memory management, file and I/O subsystems and protection)
- Introduce the issues to be considered in the design and development of operating system
- Introduce basic Unix commands, system call interface for process management, interprocess communication and I/O in Unix

Course Outcomes:
- Will be able to control access to a computer and the files that may be shared
- Demonstrate the knowledge of the components of computers and their respective roles in computing.
- Ability to recognize and resolve user problems with standard operating environments.
- Gain practical knowledge of how programming languages, operating systems, and architectures interact and how to use each effectively.

UNIT - I
Operating System - Introduction, Structures - Simple Batch, Multiprogrammed, Timeshared, Personal Computer, Parallel, Distributed Systems, Real-Time Systems, System components, Operating System services, System Calls Process - Process concepts and scheduling, Operations on processes, Cooperating Processes, Threads

UNIT - II
CPU Scheduling - Scheduling Criteria, Scheduling Algorithms, Multiple –Processor Scheduling. System call interface for process management-fork, exit, wait, waitpid, exec Deadlocks - System Model, Deadlocks Characterization, Methods for Handling Deadlocks, Deadlock Prevention, Deadlock Avoidance, Deadlock Detection, and Recovery from Deadlock

UNIT - III
Process Management and Synchronization - The Critical Section Problem, Synchronization Hardware, Semaphores, and Classical Problems of Synchronization, Critical Regions, Monitors Interprocess Communication Mechanisms: IPC between processes on a single computer system, IPC between processes on different systems, using pipes, FIFOs, message queues, shared memory.

UNIT - IV
Memory Management and Virtual Memory - Logical versus Physical Address Space, Swapping, Contiguous Allocation, Paging, Segmentation, Segmentation with Paging, Demand Paging, Page Replacement, Page Replacement Algorithms.

UNIT - V

File System Interface and Operations -Access methods, Directory Structure, Protection, File System Structure, Allocation methods, Free-space Management. Usage of open, create, read, write, close, lseek, stat, ioctl system calls.

TEXT BOOKS:

1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley
2. Advanced programming in the UNIX environment, W.R. Stevens, Pearson education.

REFERENCE BOOKS:

1. Operating Systems- Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI
2. Operating System A Design Approach- Crowley, TMH.
3. Modern Operating Systems, Andrew S. Tanenbaum 2nd edition, Pearson/PHI
4. UNIX programming environment, Kernighan and Pike, PHI/ Pearson Education
5. UNIX Internals -The New Frontiers, U. Vahalia, Pearson Education.

2605PC09: Design and Analysis of Algorithms

B.Tech. II Year II Sem. **L T P C**
2 1 0 3

Prerequisites: Programming for problem solving and Data Structures

Course Objectives
- Develop proficiency in evaluating algorithms using asymptotic notations, including best-, average-, and worst-case time/space complexities, and solving related recurrence relations.
- Master various algorithmic strategies—divide-and-conquer, greedy, dynamic programming, backtracking, and branch-and-bound—identifying suitable use cases and demonstrating their application.
- Critically assess and contrast different algorithms in terms of efficiency, scalability, and correctness through rigorous analytical reasoning and empirical evaluation.
- Differentiate between tractable (polynomial-time) and intractable (super-polynomial or exponential-time) problems;
- Identify and classify problems as P, NP, NP-hard, or NP-complete, and assess their relationships through polynomial-time reductions and Cook's theorem.

Course Outcomes
- Able to Apply space and time complexity analysis using asymptotic notations.
- Able to Design divide-and-conquer algorithms and critically assess their runtime and space trade-offs.
- Able to Device backtracking and dynamic programming solutions.
- Able to Apply greedy methods and graph traversal algorithms
- Able to Analyse and Design branch-and-bound algorithms for NP-hard problems

UNIT - I
Introduction: Algorithm, Performance Analysis-Space complexity, Time complexity, Asymptotic Notations- Big oh notation, Omega notation, Theta notation, and Little oh notation.
Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication.

UNIT - II
Disjoint Sets: Disjoint set operations, union and find algorithms, Priority Queue- Heaps, Heapsort
Backtracking: General method, applications, n-queens problem, sum of subsets problem, graph coloring, Hamiltonian cycles.

UNIT - III
Dynamic Programming: General method, applications- Optimal binary search tree, 0/1 knapsack problem, All pairs shortest path problem, Traveling salesperson problem, Reliability design.

UNIT - IV
Greedy method: General method, applications- Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.
Basic Traversal and Search Techniques: Techniques for Binary Trees, Techniques for Graphs, Connected components, Biconnected components.

UNIT - V

Branch and Bound: General method, applications - Travelling salesperson problem, 0/1 knapsack problem - LC Branch and Bound solution, FIFO Branch and Bound solution. **NP-Hard and NP-Complete problems**: Basic concepts, non-deterministic algorithms, NP - Hard and NP-Complete classes, Cook's theorem.

TEXT BOOK:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni, and Rajasekaran, University Press.

REFERENCE BOOKS:

1. Design and Analysis of algorithms, Aho, Ullman, and Hopcroft, Pearson education.
2. Introduction to Algorithms, second edition, T. H. Cormen, C.E. Leiserson, R. L. Rivest, and C.Stein, PHI Pvt. Ltd./ Pearson Education.
3. Algorithm Design: Foundations, Analysis and Internet Examples, M.T. Goodrich and R. Tamassia, John Wiley and Sons.

2605PC07: COMPUTER NETWORKS

B.Tech. II Year II Sem. **L T P C**
3 0 0 3

Prerequisites
1. A course on "Programming for problem solving".
2. A course on "Data Structures".

Course Objectives
- Equip the students with a general overview of the concepts and fundamentals of computer networks.
- Familiarize the students with the standard models for the layered approach to communication between machines in a network and the protocols of the various layers.
- Elucidate the students about working and implementation of protocols at various layers in protocols stack.
- Appreciating the protocol working by observing and analysing outputs of the packet sniffer.

Course Outcomes
- Gain the knowledge of the basic computer network technology.
- Gain the knowledge of the functions of each layer in the ISO-OSI and TCP/IP reference model.
- Obtain the skills of subnetting and routing mechanisms.
- Familiarity with the essential protocols of computer networks, and how they can be applied in network design and implementation.
- Understanding working of the protocols through traces captured by a packet sniffer

UNIT - I
Introduction: The Internet, Protocol, Network Edge, Access Networks, Network Core, Packet Switching, Circuit Switching, Delay, Loss, and Throughput in Packet-Switched Networks, Protocol reference models: ISO-OSI, TCP/IP, Types of Network attacks, History of Computer Networking and the Internet.

UNIT-II
Application Layer: Principles of Network Applications, Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the Internet, Application-Layer Protocols, The Web and HTTP, File Transfer: FTP, Electronic Mail in the Internet, SMTP, DNS, Peer-to-Peer Applications, Socket Programming: Creating Network Applications.

UNIT - III
Transport Layer: Transport-Layer Services, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Principles of Reliable Data Transfer, Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go-Back-N (GBN), Selective Repeat (SR), Connection-Oriented Transport: TCP, The TCP Connection, Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control, TCP Congestion Control, Fairness.

UNIT - IV
Network Layer: Data and Control plane, Forwarding and Routing 308, Network Service Models, Virtual Circuit and Datagram Networks, Router working, The Internet Protocol (IP):
Forwarding and Addressing in the Internet, Datagram Format, IPv4 Addressing, Internet Control Message Protocol (ICMP), IPv6, IP Security, Routing Algorithms- The Link-State

(LS) Routing Algorithm, The Distance-Vector (DV) Routing Algorithm, Hierarchical Routing, Routing in the Internet-Intra-AS Routing in the Internet: RIP, Intra-AS Routing in the Internet: OSPF, Inter-AS Routing: BGP, Broadcast and Multicast Routing, Broadcast Routing Algorithms, Multicasting.

UNIT - V

The Link Layer: The Services Provided by the Link Layer, Error-Detection and -Correction Techniques-Parity Checks, Checksum Methods, Cyclic Redundancy Check (CRC), Hamming code, Multiple Access Links and Protocols, Channel Partitioning Protocols, Random Access Protocols, Taking-Turns Protocols, DOCSIS: The Link-Layer Protocol for Cable Internet
Access, Switched Local Area Networks, Link-Layer Addressing and ARP, Ethernet, LinkLayer Switches, Virtual Local Area Networks (VLANs), Link Virtualization-Multiprotocol Label Switching (MPLS), Data Center Networking, A Day in the Life of a Web Page Request. Wireless network characteristics, Wireless LAN.

TEXT BOOKS:

1. Computer Networking: A Top-Down Approach – James F.Kurose, Keith W. Ross, Pearson
2. Computer Networks -- Andrew S Tanenbaum, David. j. Wetherall, 5th Edition. Pearson/PHI

REFERENCE BOOK:

1. Data Communications and Networking – Behrouz A. Forouzan. Third Edition TMH.

2666PC01: MACHINE LEARNING

B.Tech. II Year II Sem. **L T P C**
2 1 0 3

Course Objectives:
- To introduce students to the basic concepts and techniques of Machine Learning.
- To have a thorough understanding of the Supervised and Unsupervised learning techniques
- To study the various probability-based learning techniques

Course Outcomes:
- Distinguish between, supervised, unsupervised and semi-supervised learning.
- Understand algorithms for building classifiers applied on datasets of non-linearly separable classes
- Design an ensemble model to increase the classification accuracy
- Understand the principles of RL evolutionary computing algorithms

UNIT - I
Introduction to Machine Learning: Types of Human learning, machine learning process, Wellposed learning problem, Types of machine learning and comparison, applications of machine learning.
Model Preparation, Evaluation and feature engineering: Machine learning activities, Types of data in machine learning, dataset understanding, plotting and exploration, checking data quality, remediation, data pre-processing, selecting a model, predictive and descriptive models, supervised learning model training, cross-validation and boot strapping, lazy vs eager learner, interpreting the model- underfitting, overfitting, bias-variance trade-off. Parameter for evaluating performance of classification, regression, and clustering model. Improving performance of a model.

UNIT - II
Feature Engineering: Feature transformation - feature construction, feature extraction by PCA, SVD, LDA. Feature subset selection – feature relevancy and redundancy measures. Feature selection process and approaches.
Review of Probability concepts: joint probability, conditional probability, bayes rule, Common discrete and continuous distributions, dealing with multiple random variables, central limit theorem. Bayes classifier, Multi-class Classification, Naïve Bayes classifier, Bayesian belief network.

UNIT - III
Supervised Learning - Introduction to supervised learning,
Regression: Introduction of regression, Regression algorithms: Simple linear regression, Multiple linear regression, Polynomial regression model, Logistic regression, Maximum likelihood estimation.
Classification: Classification model and learning steps, Classification algorithms: Naïve Bayes classifier, Distance measures, k-Nearest Neighbor (kNN), Decision tree, Support vector machines, Kernel trick, Random Forest.

UNIT - IV
Unsupervised Learning: Introduction to unsupervised learning, Unsupervised vs supervised learning, Application of unsupervised learning, Clustering and its types, Partitioning method:
k-Means and K-Medoids, Hierarchical clustering, Density-based methods – DBSCAN.

UNIT - V

Artificial Neural Network: Biological neuron, Artificial neuron, Activation functions, neural network architecture, perceptron, learning process in ANN, Back propagation.

Introduction to deep learning, overview of reinforcement learning, Representation learning, Evolutionary learning. Case-study of ML applications: Image recognition, Email spam filtering, Online fraud detection.

TEXT BOOKS:

1. Saikat Dutt, S. Chjandramouli, Das – Machine Learning, Frist Edition, Pearson.
2. M N Murty, Anathanarayana V S – Machine Learning, First Edition, University Press.
3. Tom M Mitchell, —Machine Learning, First Edition, McGraw Hill Education, 2013.

REFERENCE BOOKS:

1. Stephen Marsland, —Machine Learning – An Algorithmic Perspective, Second Edition,
2. Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

2605PC62: OPERATING SYSTEMS LAB

B.Tech. II Year II Sem. **L T P C**
0 0 2 1

Prerequisites:
- A course on "Programming for Problem Solving".
- A course on "Computer Organization and Architecture".

Co-requisite: A course on "Operating Systems".

Course Objectives:
- To provide an understanding of the design aspects of operating system concepts through simulation.
- Introduce basic Unix commands, system call interface for process management, interprocess communication and I/O in Unix.

Course Outcomes:
- Simulate and implement operating system concepts such as scheduling, deadlock management, file management and memory management.
- Able to implement C programs using Unix system calls.

List of Experiments:
1. Write C programs to simulate the following CPU Scheduling algorithms
   a) FCFS b) SJF c) Round Robin d) priority
2. Write programs using the I/O system calls of UNIX/LINUX operating system (open, read, write, close, lseek, stat, fork, exit)
3. Write a C program to simulate Bankers Algorithm for Deadlock Avoidance.
4. Write a C program to implement the Producer – Consumer problem using semaphores using UNIX/LINUX system calls.
5. Write C programs to illustrate the following IPC mechanisms
   a) Pipes b) FIFOs c) Message Queues d) Shared Memory
6. Write C programs to simulate the following memory management techniques
   a) Paging b) Segmentation
7. Write C programs to simulate Page replacement policies
   a) FCFS b) LRU c) Optimal

TEXT BOOKS:
1. Operating System Principles- Abraham Silberchatz, Peter B. Galvin, Greg Gagne 7th Edition, John Wiley.
2. Advanced programming in the Unix environment, W. R. Stevens, Pearson education.

REFERENCE BOOKS:
1. Operating Systems – Internals and Design Principles, William Stallings, Fifth Edition–2005, Pearson Education/PHI.
2. Operating System - A Design Approach-Crowley, TMH.
3. Modern Operating Systems, Andrew S Tanenbaum, 2nd edition, Pearson/PHI.
4. UNIX Programming Environment, Kernighan and Pike, PHI/Pearson Education.
   UNIX Internals: The New Frontiers, U. Vahalia, Pearson Education

2605PC65: COMPUTER NETWORKS LAB

B.Tech. II Year II Sem. **L T P C**
0 0 2 1

Course Objectives:
- To understand the working principle of various communication protocols.
- To understand the network simulator environment and visualize a network topology and observe its performance
- To analyze the traffic flow and the contents of protocol frames

Course Outcomes:
- Implement data link layer farming methods
- Analyze error detection and error correction codes.
- Implement and analyze routing and congestion issues in network design.
- Implement Encoding and Decoding techniques used in presentation layer
- To be able to work with different network tools

List of Experiments

1. Implement the data link layer framing methods such as character, character-stuffing and bit stuffing.
2. Write a program to compute CRC code for the polynomials CRC-12, CRC-16 and CRC CCIP
3. Develop a simple data link layer that performs the flow control using the sliding window protocol, and loss recovery using the Go-Back-N mechanism.
4. Implement Dijsktra's algorithm to compute the shortest path through a network
5. Take an example subnet of hosts and obtain a broadcast tree for the subnet.
6. Implement distance vector routing algorithm for obtaining routing tables at each node.
7. Implement data encryption and data decryption
8. Write a program for congestion control using Leaky bucket algorithm.
9. Write a program for frame sorting techniques used in buffers.
10. Wireshark
    a. Packet Capture Using Wire shark
    b. Starting Wire shark
    c. Viewing Captured Traffic
    d. Analysis and Statistics & Filters.
11. How to run Nmap scan
12. Operating System Detection using Nmap
13. Do the following using NS2 Simulator I. NS2 Simulator-Introduction
    a. Simulate to Find the Number of Packets Dropped
    b. Simulate to Find the Number of Packets Dropped by TCP/UDP
    c. Simulate to Find the Number of Packets Dropped due to Congestion V. Simulate to Compare Data Rate & Throughput.
    d. Simulate to Plot Congestion for Different Source/Destination
    e. Simulate to Determine the Performance with respect to Transmission of Packets

TEXT BOOK:

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

2666PC61: MACHINE LEARNING LAB

B.Tech. II Year II Sem. **L T P C**
0 0 2 1

Course Objective:

- The objective of this lab is to get an overview of the various machine learning techniques and can demonstrate them using python.

Course Outcomes:

- Understand modern notions in predictive data analysis
- Select data, model selection, model complexity and identify the trends
- Understand a range of machine learning algorithms along with their strengths and weaknesses Build predictive models from data and analyze their performance

List of Experiments:

1. Write a python program to compute Central Tendency Measures: Mean, Median, Mode, Measure of Dispersion: Variance, Standard Deviation
2. Study of Python Basic Libraries such as Statistics, Math, Numpy and Scipy
3. Study of Python Libraries for ML application such as Pandas and Matplotlib
4. Write a Python program to implement Simple Linear Regression
5. Implementation of Multiple Linear Regression for House Price Prediction using sklearn
6. Implementation of Decision tree using sklearn and its parameter tuning
7. Implementation of KNN using sklearn
8. Implementation of Logistic Regression using sklearn
9. Implementation of K-Means Clustering
10. Performance analysis of Classification Algorithms on a specific dataset (Mini Project)

TEXT BOOK:

1. Machine Learning – Tom M. Mitchell, - MGH.

REFERENCE BOOK:

1. Machine Learning: An Algorithmic Perspective, Stephen Marshland, Taylor & Francis. **2666SD02:**

SKILL DEVELOPMENT COURSE-2
2667SD01: DATA VISUALIZATION - R PROGRAMMING/ POWER BI

B.Tech. II Year II Sem. **L T P C**
0 0 2 1

Course Objectives:

- Effective use of Business Intelligence (BI) technology (Tableau) to apply data visualization To discern patterns and relationships in the data.
- To build Dashboard applications.
- To communicate the results clearly and concisely.
- To be able to work with different formats of data sets.

Course Outcomes: At the end of the course a student should be able to

- Understand How to import data into Tableau.
- Understand Tableau concepts of Dimensions and Measures.
- Develop Programs and understand how to map Visual Layouts and Graphical Properties.
- Create a Dashboard that links multiple visualizations.
- Use graphical user interfaces to create Frames for providing solutions to real world problems.

Lab Problems:

1. Understanding Data, What is data, where to find data, Foundations for building Data Visualizations, Creating Your First visualization?
2. Getting started with Tableau Software using Data file formats, connecting your Data to Tableau, creating basic charts(line, bar charts, Tree maps),Using the Show me panel.
3. Tableau Calculations, Overview of SUM, AVR, and Aggregate features, Creating custom calculations and fields.
4. Applying new data calculations to your visualizations, Formatting Visualizations, Formatting Tools and Menus, Formatting specific parts of the view.
5. Editing and Formatting Axes, Manipulating Data in Tableau data, Pivoting Tableau data.
6. Structuring your data, Sorting and filtering Tableau data, Pivoting Tableau data.
7. Advanced Visualization Tools: Using Filters, Using the Detail panel, using the Size panels, customizing filters, Using and Customizing tooltips, Formatting your data with colors.
8. Creating Dashboards & Storytelling, creating your first dashboard and Story, Design for different displays, adding interactivity to your Dashboard, Distributing & Publishing your Visualization.
9. Tableau file types, publishing to Tableau Online, Sharing your visualizations, printing, and Exporting.
10. Creating custom charts, cyclical data and circular area charts, Dual Axis charts.

REFERENCES:

1. Microsoft Power BI cookbook, Brett Powell, 2nd edition.
2. R Programming for Data Science by Roger D. Peng (References)
3. The Art of R Programming by Norman Matloff Cengage Learning India.

2600MC01: INDIAN KNOWLEDGE SYSTEM

B.Tech. II Year II Sem. **L T P C**
1 0 0 0

Bharat is considered one of the oldest civilizations of the world. Some of the archaeological evidences proved the existence of Indus Valley Civilization in 7000 B.C. Bhartiya traditions, culture, cultural activities, rituals, sacraments, painting, art of dancing, art of singing etc. is being practised till the modern times without knowing scientific approaches behind that. Eternity of Indian knowledge system proved itself that not only many rituals but also many traditions, many streams of knowledge like astrology, mathematics, physics, chemistry, biology, language studies, yoga and meditation had been following from the starting till now with some changes, in the form of traditions.

This course is for undergraduate students to inculcate Indian values. It will promote advance study and inter disciplinary research on all aspects of the Indian knowledge system.

Course Objectives: This course aims:
- To provide a tribune of the rich culture and traditions of Indian knowledge system to students of various disciplines.
- To introduce historical account on the education and scientific literature available in ancient Indian traditions and its connections with ancient Indian Philosophy
- To give insights about the applications of Bharatiya Jnana Parampara
- To introduce Indian approach towards health and wellbeing
- To elaborate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

Course Outcomes: Students will be able to:
- Understand nature, scope and related fields of Indian knowledge system.
- Demonstrate the scientific literature available in ancient Indian traditions
- Understanding the application of Bharatiya Jnana Parampara
- Understand Indian approach towards Wellbeing
- Appreciate vast contribution of ancient Indian researchers, engineers, scientists and architects to the modern world

Unit 1: **Introduction to Indian Knowledge Systems**
Meaning**,** Nature, Scope and Salient Aspects of Bharatiya Jnana Parampara - Introduction to Vedas, Upanishads, Vidya, Kala, Jnana, Shastra - Practices and Continuity of Tradition

Unit 2: Overview of History of Indian Education and Scientific Literature
Gurukul System - Role of Sanskrit in Natural Language Processing - Scientific Literature - Vedic Literature - Available Scientific Treatises - Interlinkings

Unit 3: Introduction to Scientific Theories from Pure Sciences from Ancient Indian Knowledge Systems
Overview of theories from available ancient Indian Literature about Physics, Chemistry and Mathematics - Interlinkings and applications

Unit 4: Introduction to Ancient Indian Wellness Systems
Concept of Wellness – Yoga System - Ayurveda System - Ancient Indian Aesthetics

Unit 5: Development of Engineering, Science, Technology & Fine Arts in India
Various Industries - Silk, Cotton and Ship Building - Evolution of Indian Fine Arts – Cave and Temple Architecture, Vastu - Vidya, Sculpture, Forts and Stepwells, Observatories and Paintings - Music and Natyakala - Cultural Traditions & Folk Arts

- **Pedagogy for Teachers: Apart from Class Room Instruction, the following Methods are Suggested.**
  1. Project based activities and learning.
  2. Presentation and case studies.
  3. Film screening and book reviews.
  4. Visit to historical places, archives centre, research centre or library nearby.

***Note**: Activities mentioned above are only suggestive. Teacher-educators should encourage students to be innovative.*

Suggested Readings:

1. B. Mahadevan, Bhat Vinayak and Nagendra Pavan R.N., (2022) '*Introduction to Indian Knowledge Systems: Concepts and Applications*' PHI learning PVT, New Delhi ISBN [9789391818203]
2. Dharmapal (1971) '*Indian Science and Technology in the Eighteenth Century*'. Other India Press, Goa.
3. Kapil Kapoor, Singh Avdhesh Kumar, (2005) '*Indian Knowledge Systems*' D.K. Printworld (P) Ltd. ISBN 10: 8124603367 / ISBN 13: 9788124603369 4. Chakradeo, Ujwala, Temples of Bharat, Aayu Publications, New Delhi, 2024.
5. D.N. Bose, S.N. Sen and B. V. Subbarayappa, *A Concise History of Science in India*, Indian National Science Academy, New Delhi, 2009.
6. Datta B. and A. N. Singh, *History of Hindu Mathematics: Parts I and II*, Asia Publishing House, Bombay, 1962.
7. Kapoor, K. (2021), *Indian Knowledge System: Nature, Philosophy, Character in Indian Knowledge System*, vol. 1, Pub. Indian Institute of Advanced Studies, Shimla
8. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Philosophical Systems, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.
9. Mahadevan, B., Bhat, V.R., Pavana, N. (2022), Knowledge: Framework and Classification, in Introduction to Indian Knowledge System, Pub. PHI Learning, New Delhi.

Video Resources:

1. Introductory lectures by Prof. Gauri Mahulikar
2. Introductory lectures by Prof. Kapil Kapoor

Websites:

1. https://iksin dia.org/index.php
2. Official Website of IKS- Indian Knowledge System
3. https://www.youtube.com/watch?v=uKcf-hSlcUE
4. Address by Prof Kapil Kapoor | Indian Institute of Advanced Study (FDP 2021)
5. https://www.youtube.com/watch?v=MDJTXNiH2_A
6. Mukul Kanitkar on Bharatiya Knowledge System
7. https://www.youtube.com/watch?v=uARMhv97pjk
8. https://www.youtube.com/watch?v=oTwgf56GbsA