COMMON CURRICULAM
FOR
FIRST YEAR
B. TECH DEGREE COURSES
IN
ENGINEERING & TECHNOLOGY

(Applicable from the academic session 2024-2025 onwards for the branches of ***CSE, CSE(AI&ML), CSE(DS), CSE(CS), CHE, BT, ME, AEIE, EE, ECE, IT, CE, FT, AE****)*

Haldia Institute of Technology
An Autonomous Institute, NAAC Accredited Grade 'A' Institute, NBA Accredited Departments

Approved by : All India Council for Technical Education (AICTE)

Affiliated to : Maulana Abul Kalam Azad University of Technology, West Bengal (Formerly Known as - WBUT)

Haldia, Purba Medinipur, West Bengal, India, 721657

A. **Definition of Credit**

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week	0.5 credits

B. **Range of credits**

All B. Tech. programs include a range of credits from 160 to 165.

C. **Mandatory Additional Requirement (MAR) for earning B. Tech Degree**

Every student, who is admitted to the 4 years B. Tech program from the academic year 2024-25 onwards, is required to earn *minimum 100* Activity Points, in addition to the required academic grades for getting B. Tech degree.

The MAR activities, (as per guideline of AICTE / affiliating University, MAKAUT) will provide necessary needs of modern industry and the society. Through this program, irrespective of one's technological field, each student develops the skill of active participation in the co-curricular and extra-curricular activities through SAWYAM based learning activities. Such activities enhance student's employability and global acceptances. Details are given in *Annexure-I*.

D. **MOOCs for B. Tech Honours**

A student will be eligible to get B. Tech Degree *with Honours*, if he/she completes an *additional 20 credits*, through Massive Open Online Courses (MOOCs). The complete description of the MOOCs relevant for the first-year course is given in *Annexure-II.*

E. **Guidelines regarding Mandatory Induction Program for the new students**

The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well-rounded individuals. Details are given in *Annexure-III*.

F. **Group division**

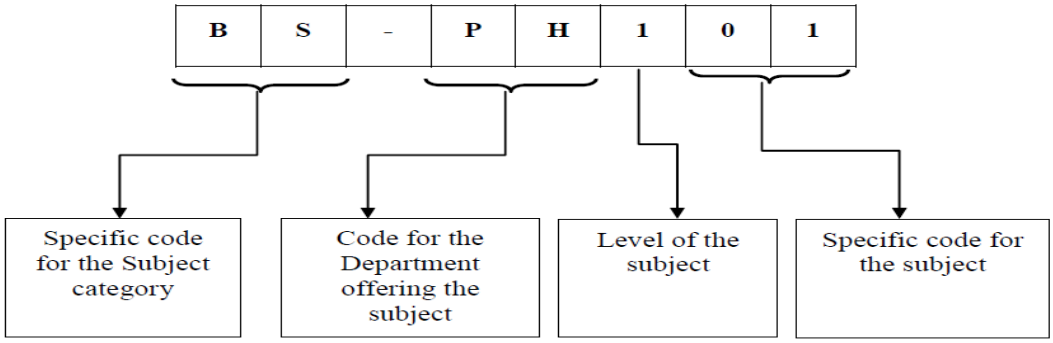
Group-A

All non-IT based programme like - Mechanical Engineering (ME), Chemical Engineering (CHE), Civil Engineering (CE), Electrical Engineering (EE), Applied Electronics & Instrumentation Engineering (AEIE), Biotechnology (BT), Food Technology (FT), Agriculture Engineering (AE), Electronics & Communication Engineering (ECE).

Group-B

All IT-based programme like – Computer Science & Engineering (CSE), Computer Science & Engineering (Cyber Security), Computer Science & Engineering (Data Science), Computer Science & Engineering (Artificial Intelligence & Machine Learning), Information Technology.

Subject Numbering Scheme:



COURSE CURRICULA

B.TECH, 1ST YR-1ST SEMESTER

Theory							
Sl No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Mathematics-I [Group-A & B]	BS-M 101	100	3	1	0	4
2	Physics-I [Group-A] /Chemistry-I [Group-B]	BS-PH 101/ BS-CH101	100	3	1	0	4
3	Basic Elec. & Electro. Engg. [Group-A] / Programming for Problem Solving [Group-B]	ES-EE 101/ ES-CS 101	100	3	1	0	4
4	Biology for Engineers [Group- A]/ Values, Ethics and Indian Knowledge System [Group- B]	ES-BT 101/ HS-MC 101	100	2	0	0	2
5	English Language and Technical Communication. [Group-B]	HM-HU 101	100	2	0	0	2
Total Marks: 400 Total Credit: 14.0 [Group-A] Total Marks: 500 Total Credit: 16.0 [Group-B]							
Practical							
6	Physics-I Lab [Group-A]/ Chemistry-I Lab [Group-B]	BS-PH 191/ BS-CH 191	100	0	0	3	1.5
7	Basic Elec. & Electro. Engg. Lab [Group-A] / Programming Lab [Group-B]	ES-EE 191/ ES-CS 191	100	0	0	3	1.5
8	Workshop Practice [Group-A]/ Engg. Drawing [Group-B]	ES-ME 191/ ES-ME 192	100	0	0	3	1.5
9	Language Lab [Group-B]	HM-HU 191	100	0	0	2	1
Extra-Curricular Activity							
10	NSS[Group-A]						
Total Marks: 300 &Total Credit: 4.5 [Group-A] Total Marks: 400 &Total Credit: 5.5 [Group-B]							

COURSE CURRICULA

B. TECH, 1ST YR-2ND SEMESTER

Theory							
Sl No.	Paper Name	Paper Code	Marks	L	T	P	Credit
1	Mathematics-II [Group-A & B]	BS-M 201	100	3	1	0	4
2	Chemistry-I [Group-A]/ Physics-I [Group-B]	BS-CH 201/ BS-PH 201	100	3	1	0	4
3	Programming for Problem Solving [Group-A]/ Basic Elec. & Electro. Engg. [Group-B]	ES-CS 201 / ES-EE 201	100	3	1	0	4
4	Values, Ethics and Indian Knowledge System [Group- A]/ Biology for Engineers [Group- B]	HS-MC 201/ ES-BT 201	100	2	0	0	2
5	English Language and Technical Communication [Group-A]	HM-HU 201	100	2	0	0	2
Total Marks: 500 Total Credit: 16.0 [Group-A] Total Marks: 400 Total Credit: 14.0 [Group-B]							
Practical							
6	Chemistry-I Lab [Group-A]/ Physics-I Lab [Group-B]	BS-CH 291/ BS-PH 291	100	0	0	3	1.5
7	Programming Lab [Group-A]/ Basic Elec. & Electro. Engg. Lab [Group-B]	ES-CS 291/ ES-EE 291	100	0	0	3	1.5
8	Engg. Drawing [Group-A] / Workshop Practice [Group-B]	ES-ME291 /ES-ME292	100	0	0	3	1.5
9	Language Lab [Group-A]	HM-HU 291	100	0	0	2	1
Extra-Curricular Activity							
10	NSS [Group-B]						
Total Marks: 400 &Total Credit: 5.5 [Group-A] Total Marks: 300 &Total Credit: 4.5 [Group-B]							

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Paper Name: Mathematics-I	Category: Basic Science Course
Paper Code: BS-M101	Semester: First
L-T-P: 3-1-0	Credit: 4

Total Lecture: 45L

Course Objectives:

- Providing the core concepts of higher Engineering Mathematics and describing the techniques, this works as an essential tool to solve the problems in their field of applications.

- To provide an overview of Differential Equations, Laplace Transform and Complex Analysis to engineers.

COURSE CONTENTS

Module-1 [8L]
Matrix & Determinant:
Elementary row and column operations over a matrix; Rank of a matrix; Rank and nullity; System of linear equations and its consistency; Cayley-Hamilton theorem; Eigen values and Eigen vectors; Diagonalization of matrices.

Module-2 [9L]
Differential Calculus & Integral Calculus:
Leibnitz's Theorem; Rolle's Theorem, Mean value theorem, Taylor's and Maclaurin's theorems with remainders; Improper integrals; Beta and Gamma functions and their properties; Convergence of improper integrals. Differentiation under integral sign.

Module-3 [8L]
Sequence and Series:
Basic concept of Convergence of sequence and series; Tests for convergence: Comparison test, Cauchy's Root test, D' Alembert's Ratio test (statements and related problems on these tests), Rabbe's test; Alternating series; Leibnitz's Test (statement only); Absolute convergence and Conditional convergence.

Module-4[10L]
Calculus of function of several variables:
Introduction to functions of several variables; Limit and continuity, Partial derivatives, Homogeneous functions and Euler's theorem up to three variables, Chain rules, Differentiation of implicit functions, Total differentials and their applications, Jacobians up to three variables Maxima, minima; Saddle points of functions; Lagrange Multiplier method and their applications; Concept of line integrals, Double and triple integrals.

Module-5[10L]
Vector Calculus:
Vector function of a scalar variable, Differentiation of a vector function, Scalar andvector point functions, Gradient of a scalar point function, divergence and curl of a vector point function,

Directional derivative. Related problems on these topics. Green's theorem, Gauss Divergence Theorem and Stoke's theorem (Applications only, proofs not required).

Course Outcomes (COs)

CO1: Represent, solve and formulate systems of linear equations, which are fundamental in engineering for modelling various physical problems; eigen values /eigen vectors to understand dynamic behavior of systems and analyze their stability, multivariate statistics system analysis.

CO2: Arrange and assess knowledge of characteristics of function at intermediate points, continuity pertaining to proper and improper integrals leading to convergence, convergency of sequence and series.

CO3: Model complex systems with several variables to understand their interactions; comprehend optimization in multidimensional spaces.

CO 4: Describe, analyze and compose physical phenomena that involve quantities with both magnitude and direction amalgamated with the concept of gradient, divergence, and curl to ascertain how quantities change in space and time.

Learning Resources:

1. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India.
2. B.S. Grewal (S. Chand & Co.), Engineering Mathematics.
3. John Bird, Higher Engineering Mathematics (4th Edition, 1st Indian Reprint 2006, Elsevier).
4. S. S. Sastry, Engineering Mathematics (PHI, 4PthP Edition, 2008).
5. M.C. Potter, J.L. Goldberg and E.F.Abonfadel, Advanced Engineering Mathematics, 3E: (OUP), Indian Edition.

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Paper Name: Mathematics-II	**Category: Basic Science Course**
Paper Code: BS-M201	**Semester: Second**
L-T-P: 3-1-0	**Credit: 4**

Total Lecture: 45L

Course Objectives

- Providing the core concepts of higher Engineering Mathematics and describing the Techniques, this works as an essential tool to solve the problems in their field of applications.

- To provide an overview of Differential Equations, Laplace Transform and Complex Analysis to engineers.

COURSE CONTENTS

Module -1 [8L]

Ordinary differential equations (ODE)- Linear and non-linear differential equations, Bernoulli's equation. General solution of ODE of first order and higher degree (different forms with special reference to Clairaut's equation). Solvable for x, solvable for y, solvable for p. Second order and first degree: General linear ODE of order two with constant coefficients, Method of variation of parameters, Cauchy-Euler equations. Simultaneous linear differential equations.

Module -2 [7L]

Basics of Graph Theory: Graphs, Digraphs, Weighted graph, Connected and disconnected graphs, Complement of a graph, Regular graph, Complete graph, Subgraph, Walks, Paths, Circuits, Euler Graph, Matrix representation of a graph, Adjacency and incidence matrices of a graph, Graph isomorphism, Bipartite graph. Shortest path and Dijkstra's algorithm. Floyd-Algorithm. Trees and Spanning Trees.

Module -3 [10L]

Laplace Transform: Introduction to integral transformation, functions of exponential order, Definition and existence of LT (Initial and final value theorems with applications, proofs not required), LT of elementary functions, Properties of Laplace Transformations, Evaluation of sine, cosine and exponential integrals, periodic and step functions using LT.

Definition and properties of inverse LT, Convolution Theorem (statement only) and its application to the evaluation of inverse LT, Solution of initial value problem using LT.

Module -4 [12L]

Complex Variable: Complex functions, Concept of Limit, Continuity and Differentiability. Analytic functions, Cauchy-Riemann Equations (statement only). Sufficient conditions for a function to be analytic. Harmonic function and Conjugate Harmonic function, related problems. Construction of Analytic functions, Milne Thomson method etc. Conformal mappings, Bilinear transformation and its applications.

Complex Integration: Concept of simple curve, closed curve, smooth curve & contour. Some elementary properties of complex Integrals. Line integrals along a piecewise smooth curve. Cauchy's theorem (statement only). Cauchy's integral formula and its applications.

Module -5 [8L]

Zeros and Singularities of an Analytic Function & Residue Theorem.

Zero of an Analytic function, Singularities of an analytic function. Different types of singularities. Poles. Examples on determination of singularities and their nature. Series of complex valued functions, Taylor's series, Laurent's series.

Residue, Cauchy's Residue theorem (statement only) and its applications, evaluation of definite integrals: $\int_0^{\infty} \frac{\sin x}{x} dx, \int_0^{2\pi} \frac{d\theta}{a+b\cos\theta+c\sin\theta}, \oint_C \frac{P(z)}{Q(z)} dz$ (elementary cases, P(z) & Q(z) are polynomials of 2nd order or less).

Course Outcomes (COs)

CO1: Comprehend and solve ODE as a mathematical tool necessary to model, analyze, design complex problems in engineering practice.

CO2: Get acclimatize and propose graph as powerful framework for modelling and analyzing complex systems of interconnected components to predict connectivity and reliability of networks.

CO3: Describe, analyze and compose LT as a mathematical tool for analyzing linear systems, solving differential equations, performing frequency domain analysis, and designing systems with desired performance characteristics.

CO4: Solve problems which are impossible to solve with real variables alone by encompassing contour integration, series expansions, singularities and the residue theorem for solving integrals, differential equations and inverse problems.

Learning Resources

1. Miller & Freund R.A.Johnson, Probability and Statistics for Engineers, Prentice Hall of India.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Eastern.
3. V. K. Balakrishnan, Graph Theory, Schaum's Outline, TMH.
4. B.S. Grewal, Engineering Mathematics, S. Chand & Co.
5. Daniel A. Murray, Introductory Course in Differential Equations, Longmans & Green.
6. N. Deo, Graph Theory, Prentice-Hall of India.
7. Sahajahan Ali Mollah, Numerical Analysis and Computational Procedures, Books & Allied Ltd.
8. Gupta & Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
9. Murray R. Spiegel, Schaum's Outlines: Laplace Transforms.

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Paper Name: Physics –I	**Category: Basic Science Course**
Paper Code: BS-PH 101 / BS-PH 201	**Semester: First / Second**
L-T-P: 3-1-0	**Credit: 4**

Total Lecture: 42L

Course Objectives

- To introduce the rudimental and relevant concepts of physics to different branches of Engineering and Technology.

- To compile all the knowledge acquired from the course and to apply in industry, academia and research keeping in the mind about ethical awareness and impact in the field of environmental (pollution), social (legal) and safety.

COURSE CONTENTS

Module-1 [7L]
Oscillations and Waves: Harmonic Oscillation -Simple Harmonic Motion –Damped Oscillation -Relaxation time& log decrement. Forced oscillation – Electromechanical Analogy between Mechanical Oscillator with Electrical circuit – Mechanical Impedance - Transient and Steady state oscillations – Resonance - Bandwidth – Quality factor - Sharpness of Resonance.

Module -2 [11L]
Optics

Wave Optics*:* Interference–- Superposition of waves, Division of wave front and division of amplitude, Interference in parallel and wedge-shaped film-Thin film Interference, Newton's rings - determination of wave length and thickness.
Diffraction– Fresnel and Fraunhofer diffraction - Single Slit, Double Slit and Garting (Qualitative discussion only)
Polarization – Introduction – States of Polarization – Brewster's law–Malus Law – Phase Retardation Plate.

Lasers– Characteristics of Laser –Spontaneous and Stimulated Emission-Population Inversion-Classification of Laser - construction and working -Einstein's coefficients – Example of Gas Laser (He-Ne), Solid state laser (Ruby) and LED and p-n junction semiconductor lasers-Quantum well Lasers (concept only) -Applications of Laser

Module -3 [9L]
Electromagnetism, Dielectric and Magnetic Properties of Material

Basic Electromagnetism- Gradient of a Scalar function, Divergence and Curl of Vector field, Vector Integration –Line, surface and volume integration - Divergence and Stoke's Theorem-Maxwell's equations of Electromagnetism.
Dielectric Properties- Dielectric polarization – Polar and Non-polar dielectric, Electronic, Ionic, Orientational and Space charge polarization (Qualitative overview) - Application of dielectric materials
Magnetic Properties- Introduction**,** Classification (Dia, Para, Ferro) of magnetic materials – Curie temperature – Hysteresis – hard and soft magnetic materials –Applications of Magnetic materials- Superconductivity (only concepts)

Module -4 [10L]
Quantum Mechanics: Blackbody Radiation –Planck's Radiation law, Compton Effect, Dual Nature of Matter – De' Broglie hypothesis – Heisenberg's Uncertainty Principle – Group velocity and Phase velocity, Wave function – Postulates of Quantum Mechanics – Quantum Mechanical operator –Eigen function and Eigen value - Schrödinger's time dependent and time independent wave equation-Particle in 1D box –Particle in 3D box – Concept of degeneracy-Stationary Perturbation (Concepts Only)

Module -5 [5L]
Statistical Mechanics: Phase Space (μ- and Γ- phase space) – Macro states and Microstates – Density of States -Statistical Ensemble and Thermodynamic Probability-Classical Statistical systems (Maxwell - Boltzmann statistics) and quantum statistical systems (Fermi-Dirac and Bose-Einstein Statistics) and their applications.

Course Outcomes (COs)

CO 1: Represent, solve and formulate the phenomena of Simple Harmonic Motion, Damped & Forced oscillations and realize the problem of simple mechanical systems and their electrical analogy.

CO 2: Understand and correlate interference, diffraction, polarization of light and analyze the mechanism of LASER along with their applications.

CO 3: Use the knowledge of vector calculus to describe and analyze electromagnetic fields and apply them in dielectric and magnetic properties of matter.

CO 4: Formulate principles of quantum mechanics to analyze radiation and to solve problems of particle in infinite potential well with the concept of wave function. In abreast a student must compose statistical methods and probability theory to study the behaviour of systems consisting of a large number of particles.

Learning Resources:

1. M. R. Spiegel, Vector Analysis.
2. N. K. Bajaj, Waves and Oscillation.
3. David Halliday, Robert Resnick Jearl Walker, Principles of Physics, 10ed, Wiley.
4. A .K. Ghatak, Optics, McGraw Hill Education India Private Limited.
5. J. R. Taylor, C.D. Zafiratos and M. A. Dubson, Modern Physics for Scientists and Engineers, 2nd Ed., Pearson (2007).
6. J. J. Sakurai, Modern Quantum Mechanics, Cambridge University Press.

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Paper Name: Chemistry-I	**Category: Basic Science Course**
Paper Code: BS-CH-101 / BS-CH-201	**Semester: First / Second**
L-T-P: 3-1-0	**Credit: 4**

Total Lecture: 42L

Course Objective

- To develop the interest among the students regarding chemistry and their applications in engineering
- To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field.

COURSE CONTENTS

Module I (8 L)

Thermodynamics (4L): First Law of Thermodynamics (general discussion, and numerical), Second Law, Engine; Carnot's Cycle; Entropy, Entropy change; Entropy of system/surrounding/Universe; Free Energy, Free energy expression; Gibbs-Helmholtz equation;

Clausius-Clapeyron equation; TdS relationship, Maxwell relationship.

Electrochemistry and Corrosion (4L): Cell construction; Primary and Secondary Cell; Nernst Equation (without derivation); Relationship with ΔG, ΔH and ΔS; Standard Hydrogen Electrode (SHE), pH of Cell; Fuel Cell (Hydrogen fuel), Batteries (Lithium-ion battery).
Electrochemical theory of corrosion, Types of corrosion (dry, wet), Rust formation, Pitting corrosion, Crevice corrosion, Galvanic series, Stress corrosion cracking, Caustic embrittlement, Prevention from Corrosion (Electroplating, Anodization, Biofilm coatings) Sacrificial anode, Passivation.

Module II (6L)

Atomic structure (3L): Bohr's atomic model-Sommerfeld's extension of atomic structure; Electronic configuration and Quantum numbers; Shapes of s, p, d, f orbitals - Pauli's exclusion principle - Hund's Rule of maximum multiplicity- Aufbau principle. Atomic emission and absorption spectra, line and band spectra; Hydrogen spectrum (Numerical only); de-Broglie's theory; Heisenberg's uncertainty principle – wave nature of electron – Schrodinger wave equation (No derivation). Eigen values and Eigen functions.

Chemical bonding and Coordination Chemistry (3L): Theory of Chemical Bonding, Molecular orbital and Bond order of H_2, N_2, He_2, O_2, N_2, CO, HF. Pi-molecular orbital of ethylene and butadiene. Crystal field theory of coordination compounds- magnetism, spin and orbital contribution: d-d transitions, C-T transition, Colour (w.r.t. MnO_4^-, and CrO_4^{2-}).

Module III (6L)

Stereochemistry (3L): Stereoisomerism; concept of chirality and optical activity (up to two carbon atoms); elements of symmetry (plane and centre); interconversion of Fischer and Newman representations; threo and erythro, D and L, CIP Rules: R/S (up to 2 chiral carbon atoms), E/Z nomenclature. Conformational analysis of ethane, n-butane.

Green Chemistry Approach to Organic Reactions (3L): Green chemistry Principle, oxidation of p-Xylene to PTA, Jones Oxidation, Use of KMnO4; Reduction reactions of organic compounds using NaBH4, LAH. Some name reactions: Wittig reaction), Suzuki, and Heck Coupling, Synthesis of Immidazolium salt (1-Methyl immidazole with Chloro pyridine.

Module IV (7L)
Organic Spectroscopy:

UV-Vis Spectroscopy (3L): Types of electronic transitions, chromophores and auxochromes; Bathochromic and Hypochromic shifts; intensity of absorptions (Hyper-/Hypochromic effects); application of Lambert-Beers law (no derivation, only numerical), Absorbency and Transparency, Woodward's Rules for calculation of λ_{max} for conjugated diene, relative positions of λ_{max} considering conjugative effect, solvent effect. Fluorescence, phosphorescence (Jablonski diagram) and their application.

IR Spectroscopy (2L): Introduction; modes of molecular vibrations (fundamental and nonfundamental); IR active/inactive molecules.

NMR Spectroscopy (2L): Basic principles of Proton Magnetic Resonance; NMR active molecules; equivalent and non-equivalent protons with example; chemical shift.

Module V (7L)

Chemical Kinetics (3L): Rate equation; Activation Theory; Collision Theory; Transition state theory; Consecutive reaction (explanation and example only, derivation not required); Homogeneous and Heterogeneous Catalysis; Enzyme Catalysis; Michaelis Menten equation.

Polymer (4L): Introduction, Molecular weight of Polymers (number average, weight average), Polymerization processes (addition and condensation polymerization), Mechanism of addition polymerization. (w.r.t polyethylene), Poly dispersity index (PDI), degree of polymerization, stereo-regularity of polymer (tacticity). Synthesis and use of Polyethylene, Polypropylene, Bakelite and PET. Synthesis of rubber, Vulcanization of rubber. Conducting polymers (Polyaniline, polythiophene). Polymer and Environment; Biodegradable polymers (Poly lactic acid, Polyurethane).

Module VI (8L)

Water Treatment (3L): Hardness of water, Water treatment (surface and waste), Alkalinity, Scale-sludge, Phosphate Conditioning and its application to Boiler and Laundry, Reaction involved in DO analysis, BOD and COD analysis.

Elementary Chemical Biology (3L): Origin of Life and Chemical Elements; Trace and Ultrarace elements and their importance; Biological system and roles of metal ions (with special reference to function of Fe in Haemoglobin and Myoglobin and Cu to Hemocyanin). Heavy metal Toxicity of Hg, As, Pb, Cd.

Some commonly used drug molecules (2L): Synthesis, Structure and use of Aspirin, Paracetamol and Metronidazole, and structure and use of Fluoroquinolone, penicillin, cis-platin, doxorubicin

Course Outcomes (COs)

CO1: Formulate the concept of work, energy and their interchangeability, thermodynamic parameters, cells and batteries, gradual deterioration of materials by chemical or electrochemical reactions in the environment, to substantiate respective engineering fields of applications.

CO2: Comprehend the physical and chemical properties of materials, such as strength, conductivity and durability, from the knowledge of atomic and molecular structure, bonding and reactivity; by understanding reaction rates.

CO3: Arrange and assess the structure and conformation of molecules to identify the substances by using various spectroscopic techniques, and also to correlate the molecular

structure and properties of polymers to substantiate with the concept of polymerization reactions, encompassing the views of its applications.

CO4: Synthesize some selective molecules efficacious on biological systems and also to study the essence of water treatment processes to remove contaminants and pollutants, assessing the environmental impact.

Learning Resources

1. P.C.Rakshit, Physical Chemistry Sarat Book House.
2. S. Pahari, Physical Chemistry New Central Book Agency.
3. P. W. Atkins, & Paula, J. de Atkins', Physical Chemistry, Oxford University Press.
4. J. D. Lee, Concise Inorganic Chemistry, 5th Ed., Wiley India Pvt. Ltd.
5. F.A. Cotton, G. Wilkinson, and P.L. Gaus, Basic Inorganic Chemistry 3rdEd.; Wiley India.
6. J. E. Huheey, E. A. Keiter, & R. L. Keiter, Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson,2006.
7. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, Second edition, Oxford University Press.
8. S. Sen Gupta, Reaction Mechanisms in Organic Chemistry, Oxford University Press.
9. L. Finar, Organic Chemistry (Volume 1) Pearson Education.
10. R. N. Morrison, & R. N. Boyd, Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
11. D. Nasipuri, Stereochemistry of Organic Compounds, Wiley Eastern Limited.
12. E. L. Eliel, & S. H. Wilen, Stereochemistry of Organic Compounds, Wiley: London, 1994.
13. Sharma, Industrial Chemistry (including Chemical Engineering), GOEL Publishing House.

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Paper Name: English Language and Technical Communication	**Category: Humanities and Social Sciences including Management course**
Paper Code: HM-HU 101/HM-HU201	**Semester: First / Second**
L-T-P: 2-0-0	**Credit: 2**

Total Lecture: 32L

Course Objectives

- To acquire language skills
- To develop linguistic and communicative competencies for Engineering students.
- To study academic subjects more effectively using the theoretical and practical components of English syllabus, and hence will develop study skills and communication skills in formal and informal situations.

COURSE CONTENTS

Module 1: Theories of Communication [6L]

Theories and Principles of Communication: Definition, Process, Model (Linear model, Interactive model and Transactional model), Types of Communication – Verbal and Non-verbal communication, Flows of communication
Barriers to communication
Workplace/ Business Communication which can have the following items:

a) Scope of Oral Communication
b) Oral Business Communication: Introducing oneself in a professional setup - brevity, context, understatement, body language –
Task: Introducing others - introducing a junior professional to a senior professional, introducing an employee to a customer, introducing a colleague from your firm to anemployee of another firm.
c) Telephone (audio and video) communication: choice of words, body language, paralinguistic elements of speech, enunciation, brevity, clarification, effective closure

Module 2 : Applied Grammar [9L]
Common Errors in English

- Subject-verb agreement
- Tenses
- Noun-pronoun agreement
- Articles and Prepositions
- Misplaced or dangling modifiers
- Redundancies
- Cliché

Transformation of Sentences

- Active and Passive voice
- Direct and Indirect speech
- Degrees of Comparison
- Use of phrases and clauses in sentences
- Synthesis of Sentences: Simple, Complex and Compound

Module 3 Vocabulary Building [3L]
The concept of word formation: Compounding, Backformation, Clipping and Blending
Root words from foreign languages and their use in English
Acquaintance with prefixes and suffixes from foreign languages in English to formderivatives.
Synonym, antonym, phrasal verbs, one word substitution and standard abbreviation

Module 4 Basic Writing Skills [4L]

Documenting: definition, meaning, basic concept of documenting (print and online media), types of technical documents
Importance of proper punctuation
Writing Drafts and Revising: drafting, drafting process, first draft, revising, writing the final draft

Editing and Proofreading: types of editing, editing process, proofreading, differences between editing and proofreading

Techniques for writing precisely

Module 5 Professional Writing Skills [10L]

Technical Report Writing: Types and formats

Comprehension, Précis and Expansion Writing, Essay Writing, Writing Statement of Purpose and Project Proposals. Business Letters; Cover letter & CV

Office Correspondence:

- Notice
- Agenda
- Minutes
- Circular
- E-mail

Course Outcomes (COs)

CO1: Apply the basic principles, types and prominent methods and models of communication.

CO2: Synthesize flawless sentence structures incorporating tense, active and passive voices, degrees of comparison, transformation of sentences and speech indices.

CO3: Cultivate strategies for mastering vocabulary, etymology, phrasal verbs, idioms and other tools to enhance sentence coherence.

CO4: Develop essential skills for drafting, documenting, editing and proof reading technical work to hone writing and correspondence skills.

Learning Resources

1. Debashis Bandyopadhyay and MalathyKrishnan, Connect: A Course in Communicative English, Cambridge University Press. 2018.
2. Sanjay Kumar and Pushp Lata, Communication Skills, Oxford University Press. 2015.
3. Nira Konar, Communication Skills for Professionals, Prentice Hall of India 2nd edition,New Delhi, 2011.
4. Wren and Martin, High School English Grammar.
5. S.Prasad & K.P.Thakur, Common Errors in English, Bharti Bhhawan Publishers.
6. R.C. Sharma and Krishna Mohon, Business Correspondence and Report Writing, Tata McGraw-Hill Publishing company Ltd., New Delhi.
7. McCarthy, English Vocabulary in Use.
8. E. Sureshkumar and P. Sreehari, Communicative English, Orient Blackswan , 2007.
9. Jeremy Comfort, Speaking Effectively**,** Developing Speaking Skills for Business English, Cambridge University Press, 1994
10.Michael Swan, Practical English Usage, OUP. 1995.
11.F.T. Wood, Remedial English Grammar, Macmillan.2007.

12. A.J. Thomson, A.V. Martinet, A Practical English Grammar, Oxford University Press.
13.David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey, New York, 2004.

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Paper Name: **Programming for Problem Solving**	**Category: Engineering Science Course**
Paper Code: ES-CS-101/ES-CS -201	**Semester: First / Second**
L-T-P: 3-1-0	**Credit: 4**

Total Lecture: 40L

Course Objectives

- To introduce students to the field of programming using language.
- To enhance their analyzing and problem-solving skills.

COURSE CONTENTS

Module 1 [12L]
Unit 1: Introduction to Programming (4 L)

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) Overview of Number system and its conversion: Binary, Octal & HEX

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples.

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code

Unit 2: Arithmetic expressions and precedence (**2 L**)
Unit 3: Conditional Branching and Loops (**6 L**)
Writing and evaluation of conditionals and consequent branching; Iteration and loops

Module 2 [10L]
Unit 1: Arrays (**4 L**)
Arrays (1-D, 2-D), Character arrays and Strings
Unit 2: Basic Algorithms (**6 L**)
Searching algorithm (Linear & Binary search), Basic Sorting Algorithms (Bubble, Selection), notion of order of complexity through example programs (no formal definition required)

Module 3 [8L]

Unit 1: Function (**4 L**)

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 2: Recursion (**4 L**)

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Tower of Hanoi problem.

Module 4 [10 L]

Unit 1: Structure & Union (**4 L**)

Basic concepts of Structures & Union; Array of Structures, Structure-Union comparison with implementation.

Unit 2: **Pointers** (**4 L**)

Concept of pointers, Pointer arithmetic, array of pointers, passing pointer to function, function returning pointer, Array-pointer relationship-basic idea.

Unit 3: File handling (**2 L)**

Basic idea about read, write, append in file operation. Sample file creating and reading a file.

Course Outcomes (COs)

CO1: Understand and remember the basic concepts of C programming.

CO2: Apply control structures such as loops and conditionals to develop and solve problems.

CO3: Apply concept of array, strings, pointers for efficient data storage and manipulation.

CO4: Design complex data structures and manage file operations.

Learning Resources

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers .
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill.
3. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill.
4. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

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Paper Name: Basic Electrical and Electronics Engineering	Category: Engineering Science Courses
Paper Code: ES-EE101 / ES-EE201	Semester: First / Second
L-T-P: 3-1-0	Credit: 4

Total Lecture: 48L

Course Objectives

- To introduce the basic concepts of electrical and electronics engineering

COURSE CONTENTS

DC Circuits: (8 L)
Introduction to circuit elements; independent and dependent current and voltage sources; Kirchhoff's laws; mesh and node analysis; source transformations; network theorems: Superposition Theorem, Thevenin's and Norton's Theorem, Maximum power transfer theorem; star-delta transformation; steady state and transient response of R-L and R-C and R-L-C circuits.

AC Circuits: (12 L)
Production of alternating voltage, RMS and average values for different wave shapes, Concept of phasor, phasor representation of circuit elements; analysis of series and parallel AC circuits; concept of real, reactive and apparent powers; resonance in RLC series and parallel circuits; balanced three phase circuit: voltage, current and power relations for star and delta arrangement; analysis of balanced and unbalanced circuits; three phase power measurement using three- wattmeter and two-wattmeter methods.

Magnetic circuits: (14 L)
Analogy between electric and magnetic circuits; series and parallel magnetic circuits; operating principles of electrical appliances: single-phase transformer and rotating machines (3-φIM); tests and performance of single-phase transformer.

Electronic Devices: (8 L)
Semiconductor, p-n junction diode: V-I characteristics of diode, Operation of Bipolar Junction Transistor, CB and CE configuration, Transistor as a switch, Basic concepts of FET.

Operational Amplifier Circuits: (6 L)
The ideal operational amplifier, the inverting, non-inverting amplifiers, Op-Amp Characteristics, Applications of Op-amp summing amplifier, differentiator and integrator.

Course Outcomes (COs)

CO 1: Remember the concepts of basic mathematical operations including complex algebra and phasor operations to understand and find solutions to different problems.

CO 2: Understand the concepts of basic laws of electricity, network theorems, magnetic circuits and its applications.

CO 3. Apply relevant theorems and electromagnetic concepts to provide efficient solutions of electrical circuit and machine related problems.

CO 4. Analyze electrical and magnetic circuits to break them into fundamental concepts for simplification.

Learning Resources:

1. Hughes, E., Smith, I.M., Hiley, J. and Brown, K., Electrical and Electronic Technology, Prentice Hall (2008) 10th ed.
2. Nagrath, IJ. and Kothari, D.P., Basic Electrical Engineering, Tata McGraw Hill (2002).
3. Boylestad, R.L. and Nashelsky, L., Electronic Devices & Circuit Theory, Perason (2009).
4. Chakraborti, A., Basic Electrical Engineering, Tata McGraw-Hill (2008).
5. Del Toro, V., Electrical Engineering Fundamentals, Prentice-Hall of India Private Limited (2004).
6. David Bell, Electronics Devices and Circuits, Oxford Publications (2009).

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Paper Name: Values, Ethics & Indian Knowledge System	**Category: Humanities & Social Sciences**
Paper Code: HS-MC 101/ HS-MC 201	**Semester: First / Second**
L-T-P : 2 -0-0	**Credit: 2.0**

Total Lecture: 20 L

Course objectives:

- To find out how ethics guides one's moral action and judgments.
- How the value system in work culture builds a sustainable organization.
- To students explore the essence of personal, social and environmental responsibility and Global Warming.
- To gain an insight about the impact of moral philosophies in business activities, wellbeing and promoting peace and harmony.

COURSE CONTENTS

Understanding Values & Ethics (6 L)
Ethics, Ethical values, Moral values, Virtue theory, Civic virtue, Empathy, Trustworthiness, Harmony, Maslow's need hierarchy theory, Societal values, Aesthetic values, Value spectrum of a good life, Value education, Changing value system in contemporary society

Professional Ethics (4 L)
Ethical principles in Workplace, Ethical Leadership, Good corporate governance, Corporate social responsibility, Role of CSR in enhancing brand reputation

Engineering Ethics and Global Issues (4 L)

Ethical duties and responsibilities of an engineer, Conflict between business deal and professional ideal, Whistle blowing, Environmental and Sustainability Ethics, Research Ethics, Bio-Ethics.

Indian Knowledge System (6 L)

Introduction and Importance of Indian Knowledge System, Indian Knowledge System – Contribution to the world- Zero and Decimal System, Ayurveda medicine, Philosophical concepts of the four Vedas, Yoga, etc. Psychological aspects of Health and wellness, Knowledge Triangle.

Course Outcomes (COs):

CO1: Recognize the professional Code of Ethics and to remain committed to it.

CO2: Integrate ethical vision while implementing Technologies and Management to create harmony at workplace.

CO3: Categorize and calculate the moral reasoning and to lessen the moral dilemma in decision making.

CO4: Imbibing moral values through philosophy propounded by the Indian Knowledge System and formulating the spectrum of quality life in the 21st Century.

Learning Resources:

1. B Mahadevan, IIM Bengaluru, Textbook on IKS.
2. A. Mishra, W. Biswas, A Giri, Ethics, Values and Indian Ethos, New Age publishers, 2022.
3. Kapur K and Singh A. K (Eds) 2005). Indian Knowledge Systems, Vol. 1. Indian Institute of Advanced Study, Shimla. Tatvabodh of Sankaracharya, Central Chinmay Mission Trust, Bombay, 1995.
4. Reshmi Ramdhoni, Ancient Indian Culture and Civilisation, Star Publication, 2018.

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Paper Name: Biology for Engineers	Category: Engineering Science
Paper Code: ES-BT101/ ES-BT201	Semester: First / Second
L-T-P : 2 -0-0	Credit: 2.0

Total Lecture: 24 L

Course objectives:

- To familiarize the students with the basic biological concepts and their engineering applications.

- To provide the students with an insight of how biological systems can be redesigned as substitute products for natural systems.

- To motivate the students to develop the multidisciplinary vision of biological engineering

COURSE CONTENTS

Introduction to Biological Sciences (5 L)
Introduction to Biology: Science and comparison with other disciplines. Differences between Science & Engineering and Biologist & Biological Engineer.
The concept of biomimicry and its modern-day applications. The interdisciplinary nature of biological sciences.
Diversity of the living world, Taxonomy, Nomenclature, Taxonomic hierarchy, Biological classification.
Cell: Basic unit of life - Prokaryotes and Eukaryotes, Cell theory.

Biomolecules (7 L)
Introduction to Biomolecules: Sources, Structure, Characteristics and functions of the biomolecules (Carbohydrates, Proteins, Lipids and Nucleic acids).
Enzymology: Properties of enzymes, Enzyme structure, Classification and functions, Mechanism of enzyme reaction, Enzyme activity, Factors affecting enzyme activity.
Introduction to Metabolism in biological systems

Molecular aspects of life (7 L)
Molecular basis of Information Transfer: Central dogma, Replication, Transcription, Genetic code, Translation.
Immunity to Infection - Innate and Acquired immunity, Organs and cells of the immune system, Classification of antibodies. Microbes as Infectious Agents: Examples from human diseases

Biology and its Industrial Applications (5 L)
Applications of Biology: Agriculture, Medicine, Industry, Environment, Bio-robotics, 3D bio-printing, Biosensors, Bioinformatics etc. New generation bio-fabricated products and future challenges

Course Outcomes (COs):

CO1: Remember and understand the biological concepts from an engineering perspective

CO2: Understand the classification, structure and functions of various Biomolecules

CO3: Perception of the various biomolecular aspects of life

CO4: Apply and implement biological principles for the development of next generation technologies

Learning Resources:

1. Gabi Nindl Waite, Lee Waite, Applied Cell and Molecular Biology for Engineers, McGraw-Hill Education, 2007.
2. Arthur T. Johnson, Biology for Engineers, Second Edition, CRC Press, 2019.
3. Campbell, J. B. Reece, L. Urry, M. L. Cain and S. A. Wasserman, —Biology: A global approach, Pearson Education Ltd, 2014.
4. G. S. Stent and R. Calendar, —Molecular Genetics, Freeman and company, 1978.

Web Reference:

NPTEL: https://onlinecourses.nptel.ac.in/noc19_ge31/preview

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Paper Name: Basic Electrical and Electronics Engineering Laboratory	**Category: Engineering Science Courses**
Paper Code: ES-EE191 / ES-EE291	**Semester: First / Second**
L-T-P :0-0-3	**Credit: 1.5**

Course objectives:

- To understand the concept of circuit laws and network theorems and apply them to laboratory measurements.

Name of the Experiments:

1. Network theorems: Thevenin, Norton and Superposition
2. AC series circuit
3. Three phase power measurement
4. Magnetic circuit: tests on transformer
5. Resonance in AC circuit
6. p n-junction diode characteristics
7. Diode use as rectifies.
8. BJT characteristics.
9. FET characteristics.
10. OPAMP Application (Adder, Subtractor and Amplifier)

Course Outcomes (COs):

CO1: Understand the use of various electrical measuring devices.

CO2: Practice different types of wiring and devices connections keeping in mind technical and economical safety issues.

CO3: Evaluate and judge whether the solutions obtained are correct and matches the required parameters and characteristics.

CO4: Choose the proper type and specification of measuring procedure and measuring instruments for different industrial/commercial/domestic applications.

Text Books:

1. D.P Kothari & I.J Nagrath, TMH, Basic Electrical engineering, Second Edition.
2. V.N Mittle & Arvind Mittal, TMH, Basic Electrical Engineering, Second Edition.
3. Nath & Chakraborti, Basic Electrical Engineering.
4. Surinder Pal Bali, Electrical Technology, Vol-I,Vol-II, Pearson Publication.
5. B.L. Theraja, A.K.Theraja, A Text Book of Electrical Technology, Vol. I & II, S. Chand & Company.

Reference Books:

1. Vincent Del Toro, Prentice-Hall, Electrical Engineering Fundamentals.
2. H. Cotton, Advance Electrical Technology, Reem Publication.
3. R.A. Natarajan, P.R. Babu, Basic Electrical Engineering, Sictech Publishers.
4. N.K. Mondal, Dhanpat Rai, Basic Electrical Engineering.

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Paper Name: **Physics Laboratory –I**	**Category: Basic Science Course**
Paper Code: (BS-PH-191 & BS-PH-291)	**Semester: First / Second**
L-T-P: 0-0-3	**Credit: 1.5**

Periods: 36P

Course Objectives

- To provide exposure to the students with hand on experience for data acquisition, precession, statistical data analysis, graph plotting calculation of fundamental quantities and error estimation of different fundamental physics experiments relevant to various engineering discipline.

All students have to perform total 10 experiments taking at least one from Optics, Electricity & Magnetism, Quantum Mechanics, Miscellaneous experiments and Innovative experiment sections. (One Innovative experiment is mandatory)

List of Experiments

Optics Experiments

1. Determination of dispersive power of the material of a prism
2. Determination of wavelength of a monochromatic light by Newton's ring

3. Determination of wavelength of a monochromatic light by Fresnel's bi-prism
4. Determination of wavelength of the given laser source by diffraction method
5. Determination of numerical aperture, angle of acceptance and bending energy losses of an optical fiber

Electricity & Magnetism Experiments

1. Determination of thermo electric power of a given thermocouple.
2. Determination of specific charge (e/m) of electron by J.J. Thompson's method.
3. Determination of dielectric constant of a given dielectric material.
4. Determination of Hall coefficient of a semiconductor by four probe method.
5. Determination of resistance of ballistic galvanometer by half deflection method and study of variationof logarithmic decrement with series resistance.
6. Determination of unknown resistance using Carey Foster's bridge
7. Study of Transient Response in LR, RC and LCR circuits using Exp EYES
8. Generating sound from electrical energy using Exp EYES

Quantum Physics Experiments

1. Determination of Stefan-Boltzmann constant.
2. Determination of Planck constant using photocell.
3. Determination of Lande-g factor using Electron spin resonance spectrometer.
4. Determination of Rydberg constant by studying Hydrogen spectrum.
5. Determination of Band gap of semiconductor.
6. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell.

Miscellaneous Experiments

1. To determine the moment of inertia of a body about an axis passing through its centre of gravity.
2. Determination of modulus of rigidity of the material of a rod by static method
3. Determination of rigidity modulus of the material of a wire by dynamic method
4. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure
5. Determination of bending moment and shear force of a rectangular beam of uniform cross-section
6. Determination of coefficient of viscosity by Poiseuille's capillary flow method
7. Measurement of wavelength and velocity of Ultrasonic wave by using Ultrasonic Interferometer**.**

Innovative Experiments

1. Studies on Bandgap measurement of thin film using UV-VIS spectrophotometer.
2. Basic UV-VIS absorbance study of organic dyes.
3. Basic UV-VIS study of nano-particles (NPs) and quantum dots (Q Dots).
4. Basic photoluminescence study of organic dyes.
5. Basic photoluminescence study of nano-particles (NPs) and quantum dots (Q Dots).
6. Studies on Basics of Vacuum system and Vacuum measurements.
7. Fabrication of RC and LC Filters.

Course Outcomes (COs)

CO 1: Describe and understand the working formulas, uses of instruments, and apparatus used in diverse experiments.

CO 2: Apply theoretical concepts to effectively execute experiments and record experimental data.

CO 3: Analyze experimentally collected data, validate it through calculations, graphical representation, and error estimation, while adhering to necessary precautions.

CO 4: Integrate acquired knowledge and apply it across various engineering disciplines.

Learning Resources

1. C.L. Arora, B.Sc. Practical Physics.
2. Harnam Singh and Dr. P.S.Hemne, B.Sc. Practical Physics.

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Paper Name: Chemistry Laboratory –I	**Category: Basic Science Course**
Paper Code: (BS-CH-191 & BS-CH-291)	**Semester: First / Second**
L-T-P: 0-0-3	**Credit: 1.5**

Periods: 36P

Course Objective

- To be able to design, carry out, record and analyze the results of chemical experiments.
- To demonstrate creative and independent thinking in both learning and work environments.
- To be able to use modern instrumentation and classical techniques, to design experiments and to properly record the results of their experiments.
- The students will be able to understand the safety features in chemistry lab and MSDS.

Name of the Experiments

1. Standardization of NaOH solution with standard Oxalic acid solution.
2. Standardization of KMnO4 solution by standard Oxalic acid solution
3. Conductometric and pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution.
4. Determination of the partition coefficient of a substance between two immiscible liquids.
5. Determination of chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
6. Determination of dissolved oxygen present in a given water sample.
7. Complexometric titration for determination of calcium and magnesium hardness of water.

Course Outcomes (COs)

CO1: Demonstrate the preparation and standardization of secondary standard solutions by using primary standard solutions employing conventional titration methodology.

CO2: Assess the concentration, purity and impurity of chemical substances correlating with potentiometric acid vs. base titration in view of industrial applications.

CO3: Apply the Nernst's distribution law to determine partition coefficient of a substance between two immiscible liquids.

CO4: Implement and validate experimental methods of chloride ion, dissolved oxygen and hardness estimation for water quality assessment.

Learning Resources

1. A. I. Vogel, Elementary Practical Organic Chemistry, Part 2: Qualitative Organic Analysis, CBS Publishers and Distributors.
2. A. K. Nad, B. Mahapatra, A. Ghoshal, An Advanced Curse in Practical Chemistry, New Central Book Agency; 3rd edition.
2. University Hand Book of Undergraduate Chemistry Experiments, edited by Mukherjee, G. N. University of Calcutta, 2003.
3. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R. Practical Organic Chemistry, 5th Ed.,Pearson (2012).
4. H. T. Clarke, A Handbook of Organic Analysis (Qualitative and Quantitative), Fourth Edition, CBS Publishers and Distributors (2007).
5. Practical Workbook Chemistry (Honours), UGBS, Chemistry, University of Calcutta, 2015.

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Paper Name: Programming for Problem Solving	**Category: Engineering Science Course**
Paper Code: ES-CS-191/ES-CS -291	**Semester: First / Second**
L-T-P: 0-0-3	**Credit:1.5**

Periods: 36P

Course Objectives

- To formulate and test simple algorithms for arithmetic and logical problems, execute the programs and correct syntax and logical errors for implementing conditional branching, iteration and recursion.

The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given

Tutorial 1: Problem solving using computers, Variable types and type conversions

Lab1: Familiarization with programming environment; Simple computational problems using arithmetic expressions
Tutorial 2: Branching and logical expressions:
Lab 2: Problems involving if-then-else structures
Tutorial 3: Loops, while and for loops:
Lab 3: Iterative problems e.g., sum of series
Tutorial 4: 1D Arrays: searching, sorting:
Lab 4: 1D Array manipulation
Tutorial 5: 2D arrays and Strings
Lab 5: Matrix problems, String operations
Tutorial 6: Functions, call by value:
Lab 6: Simple functions
Tutorial 7: Recursion, structure of recursive calls
Lab 7**:** Recursive functions
Tutorial 8: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8: Programming for solving Numerical methods problems
Tutorial 9: Pointers, structures and dynamic memory allocation
Lab 9: Pointers and structures
Tutorial 10: File handling:
Lab 10: File operations
Course Outcomes (COs)

CO1: Demonstrate the ability to write. Compile and execute basic C program.

CO2: Develop algorithms and solve problems using control structures.

CO3: Implement programs that utilize array, string, pointers for storage, memory access amd manipulation.

CO4: Use structures and unions to create, manipulate complex data type and perform file operational for reading and writing data.

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Paper Name: Workshop Practice	**Category: Engineering Science Course**
Paper Code: ES-ME191 / ES-ME291	**Semester: First / Second**
L-T-P: 0-0-3	**Credit: 1.5**

Periods: 39P

Course Objectives

- To gives the basic working knowledge required in various engineering-based constructions, function, use and application of different working tools, equipment, and machines as well as the technique of manufacturing a product from its raw material.

[Before practice, background lectures will be delivered on the topics. Tool specifications and their materials will be described. Brief reports on the work done will be submitted by the students and evaluation will be made on the basis of examination of the report and viva, conducted by the teachers.]

Theory

1. Carpentry (Wood Working): Timber, Seasoning and Preservation, Plywood and Plyboards, Carpentry Tools, Engineering applications. Different Joints

2. Metal Joining: Definitions of welding, brazing and soldering processes, and their applications. Oxy-acetylene gas welding process, equipment and techniques. Types of flames and their applications. Manual metal arc welding technique and equipment. AC and DC welding, electrodes, constituents and functions of electrodes. Welding positions. Types of weld joint. Common welding defects such as cracks, slag inclusion and porosity.

3. Bench work and Fitting: Tools for laying out, chisels, files, hammers, hand hacksaw, their specifications and uses.

4. Metal Cutting: Introduction to machining and common machining operations. Cutting tool materials, geometry of cutting tool, cutting fluid. Definition of machine tools, specification and block diagram of lathe, shaper, milling, drilling machine and grinder. Common lathe operations such as turning, facing and chamfering and parting. Difference between drilling and boring. Use of measuring instruments like micrometer / verniercaliper.

5. Tin Smithy: Sheet metal introduction, tools and operations, Shearing and Bending of sheets, types of joints

Jobs to be made in the Workshop

Group A (6 P)

Carpentry Shop: T-Lap joints and Dovetail joints

Group B (6 P)

a. Gas Welding practice on mild steel flat/sheet (up to 3mm thick)
b. Lap joint by Gas Welding (up to 3mm thick)
c. Manual Metal Arc Welding practice (up to 5mm thick)
d. square butt joint by MMA Welding
e. Lap joint by MMA Welding

Group C
Fittings work: Sawing and Finishing by Filing. (6 P)

Group D
a. Jobs on lathe with turning, facing, chamfering and parting operations (6 P)
b. Job on shaper and milling machine for finishing two sides of a job (6 P)
c. Drilling of holes of size 5- and 12-mm diameters on the jobs / External threads making by dies, Tap size drill hole/ hand tapping operations

Group E
Smithy - making simple products on sheet metal (6 P)

Learning Resources

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
2. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.
3. Gowri P. Hariharan and A. Suresh Babu, "Manufacturing Technology – I" Pearson Education, 2008.
4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

Course Outcomes (COs)

CO1: Train the students in metal joining process like welding, soldering, etc

CO2: Impart skill in fabricating simple components using sheet metal

CO3: Cultivate safety aspects in handling of tools and equipment.

CO4: Define, describe and determine the types and nature of the physical parameters like cutting speed, feed, depth of cut etc applied on mechanical manufacturing systems.

CO5: Classify and explain the effects of the above physical parameters as applied on mechanical manufacturing systems for proper comprehension.

CO6: Develop the collective skill and potentiality and leadership quality to work in a group or team.

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Paper Name: Engineering Drawing	**Category: Engineering Science Course**
Paper Code: ES-ME192 / ES-ME292	**Semester: First / Second**
L-T-P: 0-0-3	**Credit: 1.5**

Periods: 42P

Course Objectives

- To teach students to communicate using **graphic** techniques.
- To accomplish the principles and standards of mechanical **drawing** and dimensioning.

[Sessional work should be completed in the class. Problems sheet will be provided. Students should attempt to solve the problems given in the Problem Sheet. Home assignments will be given. Evaluation will be made on the basis of seasonal work and viva-voce examination.]

Scales (3P)

Plain scales, Diagonal scales, Vernier scales

Geometrical Construction and Curves (3P): Conic Section: Parabola, Hyperbola, Ellipse

Projection of Points, Lines, Surfaces (9P): Orthographic Projection – First angle and third angle projection More no. of problems should be practiced in first angle projection. Projection of lines inclined to the planes Projection of surfaces Pentagon, Hexagon

Projection of Solids (12P): Cube, Pyramid, Prism, Cylinder, Cone, Frustums

Isometric View and Isometric Projection (6 P): Prism, Pyramid, Cylinder, Cone and examples of simple solid objects / models.

Sectional Views of Solids, True Shape of a Section (6 P)

Development of Surfaces (3 P): Cube, Prism, Cylinder, Truncated Cone

Learning Resources:

1. Pradeep Jain, AnkitaMaheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House.
2. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House.
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
4. Shah, M.B. &Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.
5. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
6. Corresponding set of CAD Software Theory and User Manuals.

Course Outcomes (COs)

CO1: To represent pictorially different elements and components using basic engineering drawing guidelines.

CO2: To gain significance of scaling pertinent to engineering drawing problems. The incumbents should also have knowledge about analytical curves and their relevance to understand different higher level mechanical engineering problems.

CO3: To understand the concept of projections for 1D, 2D and 3D object representation.

CO4: To develop an idea and ability to view complex interior sections of a solid object, and they will also be able to analyze and explain how different surfaces are generated when a solid object is cut along a plane and its surfaces are stretched out.

CO5: To draw isometric to orthographic views and vice versa.

CO6: To apply comprehensive knowledge to develop the surface of a solid.

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Paper Name: Language Laboratory	Category: Humanities and Social Sciences including Management
Paper Code: HM-HU 191/ HM-HU291	Semester: First / Second
L-T-P: 0-0-2	Credit: 1

Periods: 22P

Course Objectives

- To provide advanced skills of Technical Communication in English through various activities performed in the Language Lab Practice Sessions to 1st Semester U.G. students of Engineering and Technology.

- To instill confidence in them so that they can competently communicate in English language in all spheres.

- To make them efficient enough to communicate about day-to day events and experiences of life, comprehend lectures delivered in English, read and understand relevant materials written in English and also to write grammatically correct English.

- To make them capable of shedding their fear of communication and public speaking.

List of Experiments

1. Developing active 'Listening Skill' and its sub skills through Language Lab Audio device; (Listening to conversations, passages, stories, news bulletin, speeches by famous personalities – Listening for general and specific information etc.,) (3P)

2. Developing 'Speaking Skill' and its sub skills; (Interpersonal Communication, Oral Presentations –– Debate –Extempore – Speech Presentation– Conversational Practice – Face to Face / Telephonic Conversation) (5P)
3. Developing 'Reading Skills' and its sub skills through reading excerpts from plays, poetry, news and various technical/non technical passages using Visual / Graphics/Diagrams /Chart Display etc. and using Literary text(s):
The Kabuliwallah by R. N. Tagore and The Night Train at Deoli by Ruskin Bond (4P)
4. Developing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions (Analytical essay writing, dialogue writing, story writing, etc.) (3P)
5. Pronunciation: Basic Rules (with emphasis on Accent Neutralisation)Organs of Speech (2P)
6. Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success; GD practice sessions (unstructured and structured) (4P)
7. SWOT analysis (1P)

Learning Resources:

1. Nira Konar: English Language Laboratories, A Comprehensive Manual, PHILearning Pvt. Ltd.
2. Dr. D. Sudharani: Manual for English Language Laboratory. Pearson Education (WB edition),2010.

3. Board of Editors: Contemporary Communicative English for TechnicalCommunication, Pearson Longman, 2010.
4. T. Balasubramanian, A Textbook of English Phonetics for Indian Students, Macmillan India Ltd.
5. E. Sureshkumar and P. Sreehari, Communicative English, Orient Blackswan , 2007.
6. Jeremy Comfort, Speaking Effectively, Developing Speaking Skills for Business English, Cambridge University Press , 1994.
7. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN 0312406843).

Course Outcomes (COs)

CO1: Construct English sentence structures with (neutralized accents) appropriate grammar rules and vocabulary.

CO2: Enhance pronunciation, intonation and language fluency by utilizing language laboratory resources.

CO3: Build active listening ability to respond effectively in various real-life situations.

CO4: Develop real life communication skills by taking part in language laboratory activities to mitigate various industrial communication needs.

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Paper Name: NSS	**Category: Universal Human Value**
Paper Code: XC-181	**Semester: First / Second**
L-T-P: 0-0-2	**Credit: 0**

Periods: 24P

Course Objectives

- To create awareness for women's education, old age education saving of girl child. Medical issue-blood donation and Thalassemia test.
- To realize, synthesize, and evaluate their personal readiness for leadership by group work, communicating effectively and to overcome & eliminate different constraints those may arises in their academic and daily life.

1. **Creating Awareness in Social Issues**

Blood Donation Camp, Road Safety Awareness, Poster Competition (Saving of Girl child, saving of water and fuel for future, Pollution and control, Global warming, Equal education for girls),Thalassemia awareness Programme, Eye Check-Up Camp.

2. **Participating in Mass-Education Programme**

a. Poster Presentation on Education for All
b. Elocution competition, SA writing on education for all
c. National Education Day celebration (11th Nov)

3. Proposal for Local Slum Area Development

a. Road and Costal Side Cleaning Programme
b. Local Hospital Area Cleaning Programme (with collaboration Haldia Minicipality)
c. Campus Cleaning Programme

4. Environmental Awareness Programme

a. Resource Conversation (By Poster Competition)
   i. Water
   ii. Energy
b. Poster Competition on Global warming
c. Plantation Programme (5th September)
d. Fire Safety Awareness Programme (With Haldia Fire Station)

5. Relief and Rehabilitation work during Natural Calamities

Course Outcomes (COs)

CO1. To Create awareness for women's education, old age education saving of girl child. Medical issue-blood donation and Thalassemia test.

CO2. To Realize, synthesize, and evaluate their personal readiness for leadership by group work, communicating effectively and to overcome & eliminate different constraints those may arises in their academic and daily life.

CO3. To Define and correlate different kind of social, cultural and ethical issue in light of saving of girl child, women education, saving of fuel. Manifest an ethics and service to the nation as a fundamental duty by organizing seminar symposia, workshop, essay writing, poster presentation etc.

CO4. To Apply problem solving skills by taking on volunteer and community service in their professional and social life and show interest to think about eco-friendly projects for the betterment of the society.

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Annexture-I

Mandatory Additional Requirement (MAR) for earning B. Tech Degree

The additional requirement of MAR points applies to - every student, who is admitted to the 4 years B.Tech program under Autonomy, as per following:

Level of Entry in B. Tech Course	Total duration for earning Points	Minimum Points
1st Year from the academic year 2024-25 onwards	1st to 4th Year	100
2nd Year from the academic year 2024-25 onwards (Lateral Entry)	2nd to 4th Year	75

Mandatory Additional Requirement is compulsory for acquiring B.Tech./B.Tech. (Honours) degree for all the students under autonomy.

Total hundred (100) points are required in different fields mentioned in the MAR table in syllabus to achieve B.Tech./B.Tech. (Honours) degree in the four years of study. For lateral entry students the total MAR points will be 75.

These 100 (75 for 3 years B.Tech/Lateral Entry) points are equally divided in four/three (for lateral entry) years of study, i.e., students have to acquire minimum 25 points in each and every year. If any candidate is failed to achieve the minimum MAR points, it will be treated as backlog and he/she should clear it in the immediate next year. For final year students, no degree will be conferred if he/she has unable to achieve total 100/75 (for 3 years B.Tech/ Lateral Entry) points from MAR.

Certification and awarding on the activities of MAR for outstanding activities/special achievements in these areas would be considered.

Students may achieve more than maximum admissible points and total MAR points would be reflected in the final certificate.

These points must be earned on the basis of active participation in co-curricular and extracurricular activities spanning through all the semesters of study. Every student may choose, as per his/her liking, activities in order to achieve the mandatory points (as per Table- I, depending on his/her entry level), before becoming eligible for award of the Degree. These activities can be spread over the years, as per convenience of the student.

Notes:

- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary
- proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each
- student before entering them into the Online Point Entry System of the Institute
- Every student has to earn at least 100 / 75 (for lateral) activity points. The points students have earned will be reflected in the student's mark sheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

Table I provides a List of Activity Heads and Sub-Activity Heads along with their capping of the Activity Points that can be earned by the students during the entire B.Tech duration.

Sl. No.	Name of the Activity	Points	Maximum Points Allowed
1.	**MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course)**	2 weeks: 5 4 weeks: 10 8 weeks: 16	40

		12 weeks: 20	
2.	**Tech Fest/Teachers Day/Freshers Welcome**		
	Organizer	5	10
	Participants	3	6
5.	**Rural Reporting**	5	10
6.	**Tree Plantation (per tree)**	1	10
7.	**Participation in Relief Camps**	20	40
8.	**Participation in Debate/Group Discussion/ Tech quiz/Seminar/Workshop**	10	20
9.	**Publication of Wall magazine in institutional level (magazine/article/internet)**	10	20
10.	**Publication in News Paper, Magazine & Blogs**	10	20
11.	**Research Publication (per publication)**	15	30
12.	**Innovative Projects (other than course curriculum)**	30	60
13.	**Blood donation**	8	16
	Blood donation camp Organization	10	20
15.	**Participation in Sports/Games**		
	College level	5	10
	University Level	10	20
	District Level	12	24
	State Level	15	30
	National/International Level	20	20
21.	**Cultural Programme (Dance, Drama, Elocution, Music etc.)**	10	20
22.	**Member of Professional Society**	10	20
23.	**Student Chapter**	10	20
24.	**Relevant Industry Visit & Report**	10	20
25.	Photography activities in different Club (Photography club, Cine Club, Gitisansad)	5	10
26.	Participation in Yoga Camp (Certificate to be submitted)	5	10
27.	Self-Entrepreneurship Programme	20	20
28.	Adventure Sports with Certification	10	20
29.	Training to under privileged/Physically challenged	15	30
30.	Community Service & Allied Activities	10	20

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MOOCs for B. Tech. (Honours) Degree:

The additional 20 (12 for 3 years B.Tech/Lateral Entry) credits (for obtaining B. Tech with Honours) are to be achieved through MOOCs. The complete description of the MOOCS relevant for the first year to fourth year course is given in the respective syllabus.

Total 20 credits will be divided as under:

1st year:: 4-8credits; 2nd year:: 4-8 credits
3rd year: 4-8 credits; 4th year:: 4 credits

A student of first year has to cover courses from at least three skills:

1. Computer Programming with Python / R
2. Soft skills

3. Values and Ethics

Students of all streams are to be equipped with Programming skill in the language that is in high demand worldwide in the first year itself so that they can apply this skill in the subsequent semesters in their different areas including their core area of study.

Soft skill is very essential for grooming of the student and student must be exposed to it in the very beginning of the 4-year long program.

Ethics is something that one should practice. Students are to be made aware of the ethics right in the beginning of the 4-year long program so that they can practice at least some of the ethical norms as applicable to Institutional environment and society, and be prepared to practice ethics in their working life.

All of the MOOCs courses are to be taken **any MOOCS platform as per following scheme of credit points. There would not be any concept of fixed basket anymore. However, during choosing courses in the online platform students would essentially avoid the courses taught / offered through the curriculum in the offline / classroom mode.**

For NPTEL / Swayam platform: Credit points as specified in the platform

For other MOOCS platforms like Coursera, edX, Udemy etc.

Courses of 4 weeks to 7 weeks:	1 credit point
Courses of 8 weeks to 11 weeks:	2 credit point
Courses of 12 weeks to 15 weeks:	3 credit point
Courses of 16 weeks or more:	4 credit point

Where duration of MOOCs courses is available in hours

For every 8 hours of course: 1 credit point

However, for the courses with duration less than 8 hours, multiple courses could be taken together (preferably in the same area) to consider 1 credit point. But where duration is available in week, count of hours will not be applicable.

The above structure is indicative only. And BOS / DC concerned may propose credit points of the courses offered through MOOCS platform based on the content and level beginner/ intermediate/ advanced) of the courses.

Credit Transfer of MOOCS:

University / Institute had already introduced provision of credit transfer through MOOCS courses. Therefore, different courses of curriculum could be taken from MOOCS platform and credits could be transferred, if offered through online and credits are earned. However, to offer courses of curriculum through MOOCS platform like NETEL/SWAYAM / Coursera / edX / Simplilearn etc, offering institute must get the course mapping (Mapping between the University / Institute course and that offered from the online platform) approved from the University for appropriate Credit Transfer Scheme.

If student of the university is unable to attend a theory course due to attending internship or any other justified reason, the student may be allowed with special permission of the University / Institute to pursue equivalent MOOCs for against the theory course. However, content mapping to be completed preferably by BoS or appropriate authority is essential before opting the

courses in MOOCS platform. More than one MOOCS courses may be necessary to be mapped to cover the syllabus of the theory course and the student has to complete all the MOOCS to cover the course. Credits earned in total in all the courses will be considered for equivalence and credit transfer.

Evaluation of the MOOCs courses:

Evaluation of the MOOCS courses would be done by the organization by whom it is being offered. In extraordinary circumstances, the modality of evaluation through certified personnel, online or offline will be decided by the appropriate authority.

Uploading of MOOCS Data:

Every UG Department has to upload the details of MOOCS data in respect of each student time to time in Institute's examinations portal and/or hard / soft copy as per instruction of the Controller of Examinations of the Institute.

MOOCs for Mandatory Additional Requirements (MAR):

MOOCs in MAR is provided for encouraging every student to enter in Digital Content form of Education from well-known Universities or organizations.

Students can choose any MOOCs course as per their interest area. There is no credit system for MOOCs in MAR as points could be earned as specified **in** the scheme and the MOOCS courses which are taken for earning credits for Honours degree will not be considered in MAR purpose.

The validity of uploaded certificates in the University portal is subject to acceptance of appropriate committee/expert review.

Colleges interested to deliver any course(s) online through MOOCS platform, should get vetted from the University regarding mapping of course for credit transfer / assessment process.

Annexture- II

MOOCS list for B.Tech (Hons) 1st Yr
(Credit based courses are only opt by students from this bucket, which may change time to time as on the basis of availability of online courses)

Module	Courses	Provider	Duration (Weeks/ Hours)	Credits
Ethics	Ethics in Engineering Practice	NPTEL	8	2
	Moral Thinking: An Introduction to Values and Ethics	NPTEL	4	1
	Data Science Ethics	edX	4	1
	A Life of Happiness and Fulfilment	Coursera	27 Hrs	3
	Moralities of Everyday Life	Coursera	24 Hrs	3
	Introduction to Philosophy	Coursera	19 Hrs	2
	The Science of Well-Being	Coursera	19 Hrs	2
	Business Communication and Ethics in Organizations	Udemy	22 Hrs	2

Soft Skills	Enhancing Soft Skills and Personality	NPTEL	8	2
	Soft Skill Development	NPTEL	8	2
	Public Speaking	NPTEL	12	3
	Soft Skills	NPTEL	12	3
	Feminist Writings	NPTEL	12	3
	The Science of Happiness and Wellbeing	NPTEL	8	2
	Body Language: Key to Professional Success	edX	4	1
	Working in Teams: A Practical Guide	edX	4	1
	Writing in the Sciences	Coursera	30 Hrs	3
	Interpersonal Communication for Engineering Leaders	Coursera	22 Hrs	2
	Successful Career Development	Coursera	19 Hrs	2
	Listening Skills - The Ultimate Workplace Soft Skills	Udemy	30.5 Hrs	3
	Soft Skills: The 11 Essential Career Soft Skills	Udemy	34 Hrs	4
	Soft Skills Masterclass - 5 in 1, Communication, Leadership	Udemy	31.5 Hrs	3
	The Complete Communication Skills Master Class for Life	Udemy	31 Hrs	3
Programming Skills	Joy of computing using Python	NPTEL	12	3
	Programming, Data Structures and Algorithm Using Python	NPTEL	8	2
	An Introduction to Programming Through C++	NPTEL	12	3
	Scientific Computing using Python	NPTEL	12	3
	Python for Data Science	NPTEL	4	1
	Problem Solving Through Programming in C	NPTEL	12	3
	Foundations of R Software	NPTEL	12	3
	Getting Started with Competitive Programming	NPTEL	12	3
	Programming in Java	NPTEL	12	3
	IBM: Introduction to Statistics for Data Science using Python	edX	4	1
	Introduction to Computer Science and Programming Using Python	edX	9	2
	Introduction to R for Data Science	edX	4	1
	University of Cape Town: Data Science with Python	edX	8	2
	Introduction to Programming with MATLAB	Coursera	35 Hrs	4

	Java Programming: Solving Problems with Software	Coursera	17 Hrs	2
	Responsive Website Basics: Code with HTML, CSS, and JavaScript	Coursera	25 Hrs	3
	Python Basics	Coursera	26 Hrs	3
	Crash Course on Python	Coursera	32 Hrs	4
	The Complete Python Developer	Udemy	30 Hrs 53Mins	3
	Python Programming: The Complete Python Bootcamp 2024	Udemy	28 Hrs 13Mins	3
	The Complete Python Bootcamp From Zero to Hero in Python	Udemy	22 Hrs 13Mins	2

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Annexture-III

Guidelines regarding Mandatory Induction Program for the new students

Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns. The aim of the Induction Programme is to acclimatize the students to the environment of their engineering institution, give them a flavour of the exciting new world of education that they are entering, provide them with mentoring schemes, and make them aware of their neighbourhood, society and people. This will allow them to evolve as well-rounded individuals.

Institute follow the AICTE guideline to implement the three weeklong Induction Programme.

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Haldia Institute of Technology

Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2025-26)

Curriculum Structure

Semester III (Second year)							
Sl. No.	**Type of course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
Theory							
1	Engineering Science Course	ESC-IT 301	Digital Electronics	3	0	0	3
2	Professional Core Courses	PCC-IT 301	Data Structure & Algorithms	3	0	0	3
3	Professional Core Courses	PCC-IT 302	Object Oriented Programming	3	0	0	3
4	Professional Core Courses	PCC-IT 303	Database Management System	3	0	0	3
5	Basic Science course	BSC-IT301	Mathematics-III (Probability & Statistics)	3	0	0	3
6	Humanities & Social Sciences including Management courses	HSMC-IT 301	Economics for Engineers (Humanities-II)	3	0	0	3
7	Mandatory Courses	MC-IT301	Environmental Sciences	1	-	-	0
Practical							
8	Engineering Science Course	ESC-IT 391	Digital Electronics Lab	0	0	4	2
9	Professional Core Courses	PCC-IT 391	Data Structure & Algorithms Lab	0	0	4	2
10	Professional Core Courses	PCC-IT 392	Object Oriented Programming Lab	0	0	4	2
11	Professional Core Courses	PCC-IT 393	Database Management System	0	0	4	2
			Total Credit				**26**

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Semester IV (Second year)							
Sl. No.	**Type of course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
Theory							
1	Basic Science course	BSC-IT401	Discrete Mathematics	3	0	0	3
2	Professional Core Courses	PCC-IT 402	Computer Organization & Architecture	3	0	0	3
3	Professional Core Courses	PCC- IT403	Formal Language & Automata Theory	3	0	0	3
4	Professional Core Courses	PCC- IT404	Design & Analysis of Algorithms	3	0	0	3
5	Professional Core Courses	PCC- IT405	Operating System	3	0	0	3
6	Professional Core Courses	PCC- IT406	S/W Engineering	3	0	0	3
Practical							
7	Professional Core Courses	PCC-IT 492	Computer Organization & Architecture Lab	0	0	4	2
8	Professional Core Courses	PCC-IT 494	Algorithms Lab	0	0	4	2
9	Professional Core Courses	PCC-IT 495	Operating System Lab	0	0	4	2
9	Engineering Core Courses	ESC- IT491	**IT Workshop I** (SciLab/MATLAB/ Python/R)	0	0	4	2
			Total Credit				**26**

Semester V (Third year)							
Sl. No.	**Type of course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional Core Courses	PCC- IT 501	Computer Networks	3	0	0	3
2	Professional Core Courses	PCC- IT 502	Image Processing	3	0	0	3
3	Professional Core	PCC- IT 503	Artificial	3	0	0	3

	Courses		Intelligence				
4	Humanities &Social Sciences including Management courses	HSMC-IT 501	Introduction to Industrial Management (Humanities III)	3	0	0	3
5	Professional Elective courses	PEC-IT 501A/B/C	(Elective-I) Compiler Design/ Micro-electronics and VLSI Design / Bioinformatics	3	0	0	3
6	Mandatory Courses	MC- IT501	Constitution of India/ Essence of Indian Knowledge Tradition	1	-	-	0
Practical							
7	Professional Core Courses	PCC-IT 591	Computer Networks Lab		0	4	2
8	Professional Core Courses	PCC- IT593	Artificial Intelligence Lab		0	4	2
9	Professional Core Courses	PCC- IT596	Web Technology Lab		0	4	2
			Total Credit				**21**

Semester VI (Third year)							
Sl. No.	**Type of course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional Core Courses	PCC- IT 601	Machine Learning	3	0	0	3
2	Professional Core Courses	PCC- IT 602	Cryptography and Network Security	3	0	0	3
3	Professional Core Courses	PCC- IT 603	Cloud and Edge Computing	3	0	0	3
4	Professional Core Courses	PCC-IT 604	Internet of Things	3	0	0	3
5	Professional Elective courses	PEC- IT 601 A/B/C/D	(Elective-II) Blockchain Technology/ Computer Vision / Natural Language Processing /Embedded System	3	0	0	3
6	Open Elective	OEC-	(Open Elective-I)	3	0	0	3

	courses	IT601A/B	Operations Research /Introduction to Philosophical Thoughts/Soft Skill & Interpersonal Communication				
Practical							
6	Professional Core Courses	PCC-IT 691	Machine Learning Lab	0	0	4	2
7	Professional Core Courses	PCC-IT 693	Cloud and Edge Computing Lab	0	0	4	2
8	Professional Core Courses	PCC-IT 694	Internet of Things Lab	0	0	4	2
			Total Credit				**24**

Semester VII (Fourth year)							
Sl. No.	**Type of course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional Elective Courses	PEC-IT701A/B/C/D	(Elective-III) Big Data Analytics/ Cyber Physical System / Deep Learning / Human Computer Interaction	3	0		3
2	Humanities &Social Sciences including Management courses	HSMC-IT 701	Project Management and Entrepreneurship	2	1	0	3
3	Professional Sessional Courses	PSC IT 781	Industrial Training-I/ Internship-I				3
4	Project	PROJ-IT 781	Project-I	0	0	12	6
			Total Credit				**15**

Semester VIII (Fourth year)							
Sl. No.	**Type of course**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
Theory							
1	Professional	PEC-IT801A/B	(Elective-IV) Augmented & Virtual	3	0	0	3

	Elective courses	/C/D	Reality/Cyber Security and Ethical Hacking / Computational Geometry/ Social Network Analysis				
2	Professional Sessional Courses	PSC IT 881	Industrial Training-II/ Internship-II				3
3	Project	PROJ-IT 881	Project-II	0	0	12	6
			Total Credit				**12**

Year wise Credit Point Distribution

YEAR	CREDIT POINT
1st YEAR	**40**
2nd YEAR	**52**
3rd YEAR	**45**
4th YEAR	**27**
TOTAL CREDIT POINT	**164**

SEMESTER – III

Digital Electronics Code:
ESC-IT301
Contact: 3L

Name of the Course:	**Digital Electronics**		
Course Code: ESC-IT301	Semester: III		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam : 70 Marks	
Credit Points:	3		
Objective:			
1	To acquire the basic knowledge of different analog components and their applications		
2	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.		
3	To prepare students to perform the analysis and design of various digital electronic circuits		
Pre-Requisite:			
1	Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs,.		
2	Basic concept of the working of P-N diodes, Schottky diodes,		
3	Basic FETs and OPAMP as a basic circuit component. Concept of Feedback		

Unit	Content	Hrs/Unit	Marks/Unit
1	Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer.	9	
2	Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic	11	

	expressions by algebraic method. Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator		
3	Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops, Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter Basic concept of Synchronous and Asynchronous counters (detail design of circuits excluded), Design of Mod N Counter	10	
4.	A/D and D/A conversion techniques – Basic concepts (D/A :R-2-R only [2L] A/D: successive approximation [2L]) Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L)	6	

Text book and Reference books:

1. I.G.Nagrath, Analog Electronics, PHI
2. Analog Electronics, A.K. Maini, Khanna Publishing House
3. Microelectronics Engineering –Sedra & Smith-Oxford.
4. Principles of Electronic Devices & circuits—B L Thereja & Sedha—S Chand
5. Digital Electronics – Kharate – Oxford
6. Digital Electronics – Logic & Systems by J.Bigmell & R.Donovan; Cambridge Learning.
7. Digital Logic and State Machine Design (3rd Edition) – D.J.Comer, OUP
8. Electronic Devices & Circuit Theory – Boyelstad & Nashelsky - PHI
9. Bell-Linear IC & OP AMP—Oxford
10. P.Raja- Digital Electronics- Scitech Publications
11. Morries Mano- Digital Logic Design- PHI
12. R.P.Jain—Modern Digital Electronics, 2/e ,McGraw Hill
13. H.Taub & D.Shilling, Digital Integrated Electronics- McGraw Hill.
14. D.RayChaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
15. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson
16. J.Bignell & R.Donovan-Digital Electronics-5/e- Cenage Learning.
17. Leach & Malvino—Digital Principles & Application, 5/e, McGraw Hill
18. Floyed & Jain- Digital Fundamentals-Pearson.

Course Outcomes:

ESC-IT 301.1	Define the fundamental Analog circuits such as Amplifiers, Wein Bridge Oscillator, Multivibrators, Schimtt Trigger, and 555 timers.
ESC-IT 301.2	Distinguish between analog and digital system with the basic about binary number system and Boolean algebra.
ESC-IT 301.3	Demonstrates the fundamental combinational and sequential logic circuits; and counters and registers.
ESC-IT 301.4	Discuss the basic concepts of logic families and realize the basic A/D and D/A conversion techniques.
ESC-IT 301.5	Formulate the combinational and sequential circuit design and minimization techniques.
ESC-IT 301.6	Validate the circuit design theory for model development of logic circuits.

Data Structure & Algorithm
Code: PCC-IT301
Contacts: 3L

Name of the Course:	**Data Structure & Algorithm**	
Course Code: PCC-IT301	Semester: III	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**

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Theory: 3 hrs./week			Mid Semester exam: 15
Tutorial: NIL			Assignment and Quiz: 10 marks
			Attendance : 5 marks
Practical: hrs./week			End Semester Exam :70 Marks
Credit Points:		3	
Objective:			
1	To learn the basics of abstract data types.		
2	To learn the principles of linear and nonlinear data structures.		
3	To build an application using sorting and searching		
Pre-Requisite:			
1	CS 201 (Basic Computation and Principles of C		
2	M101 & M201 (Mathematics), basics of set theory		

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.	10	
2	Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.	9	
3	Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.	6	
4	Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis	8	
5	Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: BasicTerminologies and	9	

	Representations, Graph search and traversal algorithms and complexity analysis.		

Text book and Reference books:

1. "Data Structures and Program Design In C", 2/E by Robert L. Kruse, Bruce P. Leung.
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Data Structures" by R.S. Salaria, Khanna Publishing House
6. "Data Structures through C" by Yashwant Kanitkar, BPB House
7. "Data Structures Using C" by Reema Thareja.
8. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
9. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein

Course Outcomes:

PCC IT301.1	Describe various data structure and physical storage structure in computer memory
PCC IT301.2	Explain the concept of recursion, recursion algorithms and the use of linear data structure in recursion problems.
PCC IT301.3	Relate various data structures like stack, queue, linked list etc. and use them to solve problems.
PCC IT301.4	Differentiate different tree data structures like binary tree, binary search tree, AVL tree etc. and use them to solve problems.
PCC IT301.5	Design algorithm for sorting and formulate their complexity.
PCC IT301.6	Conclude with several graph data structure like DFS, BFS, etc. and use them to solve problems.

Object Oriented Programming
Code: PCC-IT302
Contacts: 3L

Name of the Course:	Object Oriented Programming	
Course Code: PCC-IT302	Semester: III	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam:70 Marks
Credit Points:	3	

Object Oriented Programming
Code: PCC-IT302
Lecture Hours: 36

UNIT - I Object oriented design [10 L]
Concepts of object oriented programming language, Major and minor elements, Object, Class, relationships among objects, aggregation, links, relationships among classes-association, aggregation, using, instantiation, meta-class, grouping constructs.
UNIT - II Object oriented concepts [4 L]
Difference between OOP and other conventional programming – advantages and disadvantages. Class, object, message passing, inheritance, encapsulation, polymorphism
UNIT - III Basic concepts of object oriented programming using Java [22 L]
Implementation of Object oriented concepts using Java.
Language features to be covered: Class & Object proprieties [6L]
Basic concepts of java programming – advantages of java, byte-code & JVM, data types, access specifiers, operators, control statements & loops, array, creation of class, object, constructor, finalize and garbage collection, use of method overloading, this keyword, use of objects as parameter & methods returning objects, call by value & call by reference, static variables & methods, garbage collection, nested & inner classes, basic string handling concepts- String (discuss charAt() , compareTo(), equals(), equalsIgnoreCase(), indexOf(), length() , substring(), toCharArray() , toLowerCase(), toString(), toUpperCase() , trim() , valueOf() methods) & StringBuffer classes (discuss append(), capacity(), charAt(), delete(), deleteCharAt(), ensureCapacity(), getChars(), indexOf(), insert(), length(), setCharAt(), setLength(), substring(), toString() methods), concept of mutable and immutable string, command line arguments, basics of I/O operations – keyboard input using BufferedReader & Scanner classes.
Reusability properties[6L] –
Super class & subclasses including multilevel hierarchy, process of constructor calling in inheritance, use of super and final keywords with super() method, dynamic method dispatch, use of

abstract classes & methods, interfaces. Creation of packages, importing packages, member access for packages.

Exception handling & Multithreading [6L] –
Exception handling basics, different types of exception classes, use of try & catch with throw, throws & finally, creation of user defined exception classes. Basics of multithreading, main thread, thread life cycle, creation of multiple threads, thread priorities, thread synchronization, inter-thread communication, deadlocks for threads, suspending & resuming threads.

Applet Programming (using swing) [4L] –
Basics of applet programming, applet life cycle, difference between application & applet programming, parameter passing in applets, concept of delegation event model and listener, I/O in applets, use of repaint(), getDocumentBase(), getCodeBase() methods, layout manager (basic concept), creation of buttons (JButton class only) & text fields.

Text book and Reference books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – Mc Graw Hill
3. Patrick Naughton, Herbert Schildt – "The complete reference-Java2" – TMH
4. R.K Das – "Core Java For Beginners" – VIKAS PUBLISHING
5. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson
6. Ivor Horton's Beginning Java 2 SDK – Wrox
7. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Outcome:

PCC IT302.1	To understand the principles and practice of object oriented analysis and design in the construction of robust, maintainable programs which satisfy their requirements.
PCC IT302.2	To identify classes, objects, members of a class and the relationships among them needed for a specific problem.
PCC IT302.3	To acquire the concept of OOP as well as the purpose and usage principles of inheritance, polymorphism, encapsulation and method overloading.
PCC IT302.4	To implement, compile, test and run Java programs comprising more than one class, to address a particular software problem to a given set of requirements
PCC IT302.5	To create Java application programs using sound OOP practices (e.g., interfaces and APIs) and proper program structuring (e.g., by using access control identifies, exception handling, package, Java standard class library)
PCC IT302.6	To develop java programs using the Java AWT and Java I/O as well as the Java standard class library to meet the customer's requirements and sustainable development with effective project management.

Database Management System Code:
PCC IT303
Contact: 3L

Name of the Course:	**Database Management System**		
Course Code: PCC-IT303	**Semester:** III		
Duration:6 months	**Maximum Marks:**100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		**Mid Semester exam:** 15	
Tutorial: NIL		**Assignment and Quiz:** 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		**End Semester** Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To understand the different issues involved in the design and implementation of a database system.		
2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models		
3	To understand and use data manipulation language to query, update, and manage a database		
4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.		
5	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.		
6	To understand the different issues involved in the design and implementation of a database system.		

Unit	Content	Hrs/Unit	Marks/Unit
1	**Database system architecture:** Data Abstraction, Data Independence, Data Definition Language(DDL),Data Manipulation Language (DML). **Data models:** Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.	**9**	

2	**Relational query languages:** Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQLserver. **Relational database design:** Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Losslessdesign. **Query processing and optimization:** Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	**13**	
3	**Storage strategies:** Indices, B-trees, hashing.	**3**	
4.	**Transaction processing:** Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	**5**	
5	**Database Security:** Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	**3**	
6	**Advanced topics:** Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	**3**	

Text book and Reference books:

1. "Database System Concepts" , 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan,McGraw-Hill.
2. "Principles of Database and Knowledge – Base Systems", Vol 1 by J. D. Ullman, Computer SciencePress.
3. "Fundamentals of Database Systems" , 5th Edition by R. Elmasri and S. Navathe, 4.PearsonEducation "Foundations of Databases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley
5. Database Management Systems, R.P. Mahapatra, Khanna Publishing House

Course Outcome

PCC-IT303.1	Define a Problem at the view level & ability to Understand the physical structure of the database to handle data.
PCC-IT303.2	Implement the logic by using tools like ERD.
PCC-IT303.3	Formulate using relational algebra, Solutions to a broad range of query and data update problems.

PCC-IT303.4	Formulate SQL query with data
PCC-IT303.5	Understand the Knowledge of functional dependencies to Design and Normalize the database & Analyze the internal data structure.
PCC-IT303.6	Understand the Knowledge of transaction system & could extract data efficiently.

Mathematics-III (Probability & Statistics) Code: BSC-IT301
Contacts: 3L

Name of the Course:	**Mathematics-III (Probability & Statistics)**	
Course Code: BSC-IT301	Semester: III	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Probability spaces, Axiomatic definition of Probability, Conditional probability, Independent events, Bayes theorem (Proof not required). Probability Distributions: Discrete and continuous and their properties, Distribution functions and densities, Expectation and Variance, Binomial, Poisson, Uniform, Exponential, Normal distributions. Binomial and Poisson approximation to Normal distribution. t, χ^2 and F-distribution (Definition only). Transformation of random variables. Central Limit Theorem, Law of large numbers (statement only) and their applications. Tchebychev inequalities (statement only) and its application.	12	
2	Bivariate Distributions: Two dimensional random variable, Distribution function and its properties: Discrete and continuous, Marginal distribution , Conditional distribution , Mathematical expectation of bi-variate distribution, Conditional expectation , Correlation and regression - Rank correlation coefficient, Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves.	10	

3	Random sampling, Parameter, Statistic and its Sampling distribution. Standard error of statistic. Sampling distribution of sample mean and variance in random sampling from a normal distribution (statement only) and related problems. Estimation of parameters: Unbiased and consistent estimators. Point estimation. Interval estimation. Maximum likelihood estimation of parameters (Binomial, Poisson and Normal). Confidence intervals and related problems.	8	
4	Simple and Composite hypothesis. Critical region. Level of significance. Type I and Type II errors. One sample and two sample tests for means and proportions. χ 2 - test for goodness of fit.	6	

Suggested Text/Reference Books

(i) Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
(ii) Kapoor, V. K and Gupta, S.C.: Fundamental of Mathematical Statistics, Sultan Chand and Sons.
(iii) S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
(iv) W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
(v) N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
(vi) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
(vii) Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.
(viii) Spiegel M R., Schiller J.J. and Srinivasan R.A. : Probability and Statistics (Schaum's Outline Series), TMH

Course Outcomes:

BSC-IT 301.1	Recite concept of permutation and combination, concept of statistics.
BSC-IT 301.2	Discuss the concept probability distribution, statistical inference and hypothesis testing.
BSC-IT 301.3	Demonstrate computational modelling of biological phenomena and applies techniques from areas such as artificial intelligence, data base, software engineering, machine learning, image processing.
BSC-IT 301.4	Illustrate physical scenario and classify them to recognize the best fit physical and logical models.
BSC-IT 301.5	Compare different mathematical results during the process of problem analysis.
BSC-IT 301.6	Design models to demonstrate industrial problem for emerging trend in information technology.

Course Name: Economics for Engineers (Humanities II)	**Category:** Humanities & Social Sciences including Management courses
Course Code: HSMC IT 301	**Semester: 3rd**
L-T-P: 3-0-0	**Credit: 3**
Teaching Scheme Theory: 3 hrs./ week	**Maximum Marks: 100**
Total Lectures: 30	**Examination Scheme** Continuous Assessment: 30 Marks(**Mid semester exam 15+Assignment and quiz 10+Attendance5)** End Semester Exam: 70 Marks
Pre-requisites: Analytical and mathematical skills	
Course Objectives:	
1. Understand basic economic concepts and their relevance to engineering decision-making. 2. Apply economic principles to analyse engineering projects and assess their feasibility. 3. Develop skills in cost estimation, project evaluation, and risk analysis. 4. Gain insights into the economic implications of engineering decisions on society and the environment.	

Course Outcomes (CO):	
CO 1	Students will recall and explain fundamental concepts of engineering economics.
CO 2	Students will apply economic principles and techniques to analyze engineering projects and make informed decisions based on economic criteria.
CO 3	Students will analyze project cost structures, estimate costs using appropriate methods, and evaluate cost-effectiveness of the engineering projects using NPV, IRR, BCR etc.
CO 4	Students will integrate economic sustainability considerations into engineering design and decision-making processes by assessing project risk through sensitivity analysis.
CO 5	Students will engage in critical analysis of economic challenges, synthesizing information to devise innovative solutions for engineering problems.
CO 6	Students will be grounded in ethical considerations, addressing both economic constraints and societal needs.

Details of Syllabus

Unit	Content	Hrs/ Unit
1.	**Introduction to Engineering Economy:**Origin of Engineering Economy, Principles of Engineering Economy, Role of Engineers in Decision Making **Inflation And Price Change:** Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.	**10**
2.	**Time Value of Money :** .Introduction to Time Value of Money, Simple Interest, Compound Interest, Nominal Interest rate, Effective Interest rate, Continuous Compounding, Economic Equivalence, Development of Interest Formulas, The Five Types of Cash flows, Single Cash flow Formulas, Uneven Payment Series, Equal Payment Series	**7**
3.	**Methods of comparison of alternatives:** NPV, Profitability Index or Benefit Cost Ratio, Payback Period Method, Equivalent Worth Methods, Present Worth Method, Future Worth Method, Annual Worth Method, Rate of Return Methods (IRR and ARR)	**7**
4.	**Engineering Costs & Estimation:** Elements of cost (Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs) and cost estimation models (Per-Unit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve), Concept of Revenue, Break even analysis, Cost sheet.	**6**

References:
1. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
2. R. Paneer Seelvan: Engineering Economics, PHI
3. Sullivan and Wicks: Engineering Economy, Pearson
4. John A. White, Kenneth E. Case, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
5. James L. Riggs, David D. Bedworth, Sabah U. Randhawa: Economics for

Engineers 4e,Tata Mc Graw - Hill

Environmental Sciences
Code: MC-IT301
Contacts: 1L

Name of the Course:	**Environmental Sciences**		
Course Code: MC-IT301	Semester: III		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:1hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz : 10 marks	
		Attendance : 5 marks	
Practical: NIL		End Semester Exam :70 Marks	
Credit Points:	1		

Objective:	
1	Be able to understand the natural environment and its relationships with human activities.
2	Be able to apply the fundamental knowledge of science and engineering to assess environmental and health risk.
3	Be able to understand environmental laws and regulations to develop guidelines and procedures for health and safety issues.
4	Be able to solve scientific problem-solving related to air, water, noise & land pollution
Pre-Requisite:	
1	Basic knowledge of Environmental science

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L) Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentiallyrenewable, effect of excessive use vis-à-vis population growth, Sustainable Development.(1L) Environmental degradation: Natural environmental Hazards Anthropogenic degradation, Nature and scope of Environmental Science and Engineering. (1L)	3	

2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L) Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.(1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(1L)	3	
3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget(1L) Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(1L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutantsSmogPhotochemical smog, andLondonsmog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification.(1L) Standards and control measures: Industrial,commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement withbrief reference). (1L)	4	
4.	Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (1L) River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) Lake: Eutrophication [Definition, source and effect]. (1L) Ground water: Aquifers, hydraulic gradient, ground water flow	8	

	(Definition only)(1L) Standard and control: Waste water standard[BOD, COD, Oil,Grease], Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L)		
5	Lithosphere; Internal structure of earth, rock and soil (1L)	1	

Text books/ reference books:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice- Hall of India Pvt.Ltd.,1991.
2. ErachBharucha, Environmental Studies, University Press
3. M.P. Poonia, Environmental Studies, Khanna PublishingHouse
4. De, A. K., "Environmental Chemistry", New AgeInternational
5. Rajagopalan, Environmental Studies, Oxford UniversityPress

Course Outcome:

On completion of this course, the student will be able to

MC-IT 301.1	**Articulate** the interconnected and interdisciplinary nature of environmental studies
MC-IT 301.2	**Demonstrate** an integrative approach to environmental issues with a focus on sustainability
MC-IT 301.3	**Use** critical thinking, problem-solving, and the methodological approaches in environmental problem solving
MC-IT301.4	**Communicate** complex environmental information to both technical and non-technical audiences.
MC-IT 301.5	**Understand and evaluate the** global scale of environmental problems.
MC-IT 301.6	**Reflect** critically on their roles, responsibilities, and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Haldia Institute of Technology

Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2025-26)

PRACTICAL
SYLLABUS
Semester III

Digital Electronics Lab

Lab Code: ESC-IT391
Contacts: 4P

Name of the Course:	**Digital Electronics Lab**
Course Code: ESC-IT391	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
ESC-391.1	**Acquired knowledge about basics of digital electronics**
ESC-391.2	**Explain about how to solve problems related to number systems and Boolean algebra.**
ESC-391.3	**Ability to identify, analyze and design combinational circuits.**
ESC-391.4	**Design and implement code conversion circuit.**
ESC-391.5	**Compare various synchronous and asynchronous sequential circuits**
ESC-391.6	**Able to analyze sequential digital circuits like flip-flops, registers, counters.**
Pre-Requisite:	
Pre-requisites as in ESC-301	

Laboratory Experiments:	
Digital Electronics	
1	Introduction to basic gates
2	Realization of basic gates using universal gates like NAND and NOR
3	Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.
4	Design a 4 bit parallel adder
5	Construction of simple Decoder & Multiplexer circuits using logic gates.
6	Realization of RS / JK / D flip flops using logic gates
7	Design of Shift Register using J-K / D Flip Flop
8	Realization of Synchronous Up/Down counter
9	Design of MOD- N Counter
10	Study of DAC

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Data Structure & Algorithm Lab
Code: PCC-IT391
Contacts: 4P

Name of the Course:	**Data Structure & Algorithm Lab**
Course Code: PCC-IT391	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
PCC-IT391.1	**Implement appropriate data structure for simple algorithms including Stack and Queue.**
PCC-IT391.2	**Design and implement the both array based and linked-list based data structures, including singly, doubly, and circular linked-lists.**
PCC-IT391.3	**Design general tree data structures, including binary tree, both array based and linked list.**
PCC-IT391.4	**Create and implement algorithms for advance tree such as binary search tree, AVL tree etc.**
PCC-IT391.5	**Programming and complexity analysis for several sorting and searching algorithm.**
PCC-IT391.6	**Create and implement several graph data structures, like BFS and DFS.**
Pre-Requisite:	
Pre-requisites as in PCC-IT301	

Laboratory Experiments:	
Linear Data Structure	
1	Implementation of array operations
2	Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements
3	Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:
4	Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queues using linked lists
5	Polynomial addition, Polynomial multiplication
Non Linear Data Structure	
6	Recursive and Non-recursive traversal of Trees
7	Threaded binary tree traversal. AVL tree implementation
8	Application of Trees. Application of sorting and searching algorithms
9	Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Object Oriented Programming Lab
Code: PCC-IT392
Contacts: 4P

Name of the Course:	**Object Oriented Programming Lab**
Course Code: PCC-IT392	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
PCC-IT392.1	**Implement Object Oriented programming concept using basic syntaxes of controls Structures, strings and function for developing skills of logic building activity.**
PCC-IT392.2	**Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem.**
PCC-IT392.3	**Demonstrates how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved.**
PCC-IT392.4	**Demonstrate understanding and use of different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.**
PCC-IT392.5	**Identify and describe common abstract user interface components to design GUI in Java using Applet & AWT along with response to events**
PCC-IT392.6	**Identify, Design & develop a Graphical user interfaces using principal of Java and JDBC**
Pre-Requisite:	
Pre-requisites as in PCC-IT302	

Laboratory Experiments:	
1	Assignments on class, constructor, overloading, inheritance, overriding.
2	Assignments on wrapper class, arrays.
3	Assignments on developing interfaces- multiple inheritance, extending interfaces.
4	Assignments on creating and accessing packages.
5	Assignments on multithreaded programming.
6	Assignments on applet programming.

Database Management System
Lab Code: PCC-IT393
Contacts: 4P

Name of the Course:	**Database Management System Lab**

Course Code: PCC IT393	Semester: III
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

Course Outcomes:	
PCC IT393.1	Understand through laboratory activities to solve problems related to key concepts taught in the classroom.
PCC-IT393.2	Create and populate a RDBMS, using SQL.
PCC-IT393.3	Write queries in SQL to retrieve any type of information from a data base.
PCC-IT393.4	Design conceptual models of a database using ER modeling for real life applications and also construct queries in Relational Algebra.
PCC-IT393.5	Create and maintain tables using PL/SQL
PCC-IT393.6	Construct problem definition statements for real life applications and implement a database for the same.

Laboratory Experiments:

Structured Query Language

1. Creating Database

Creating a Database
Creating a Table
Specifying Relational Data Types
Specifying Constraints
Creating Indexes

2. Table and Record Handling

INSERT statement
Using SELECT and INSERT together
DELETE, UPDATE, TRUNCATE statements
DROP, ALTER statements

3. Retrieving Data from a Database

The SELECT statement
Using the WHERE clause
Using Logical Operators in the WHERE clause
Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING
Clause
Using Aggregate Functions
Combining Tables Using JOINS
Subqueries

4. Database Management

Creating Views
Creating Column Aliases
Creating Database Users
Using GRANT and REVOKE

Cursors in Oracle PL / SQL

Writing Oracle PL / SQL Stored Procedures

Any experiment specially designed by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance.)

SEMESTER – IV

Discrete Mathematics
Code: BSC-IT401
Contacts: 3L

Name of the Course:	**Discrete Mathematics**	
Course Code: BSC-IT401	Semester: IV	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: 1 hour/week		Assignment and Quiz : 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Objective:	
1	Use mathematically correct terminology and notation.
2	Construct correct direct and indirect proofs.
3	To know Syntax, Semantics, Validity and Satisfiability, Graphs and Trees
4	Use counterexamples. Apply logical reasoning to solve a variety of problems.
Pre-Requisite:	
1	Some concepts from basic math – algebra, geometry

Unit	Content	Hrs/Unit	Marks/Unit
1	Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.	8	
2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination	5	
3	Propositional Logic: Syntax, Semantics, Validity and	8	

	Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. Proof Techniques: Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.		
4.	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	7	
5	Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.	8	

Course Outcomes:	
BSC-IT401.1	Express a logic sentence in terms of predicates, quantifiers, and logical connectives. Upon completion of the course, the student will be able to use logical notation.
BSC-IT401.2	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference. Apply recursive functions and solve recurrence relations.
BSC-IT401.3	Classify its algebraic structure for a given a mathematical problem. Describe useful standard library functions, create functions, and declare parameters.
BSC-IT401.4	Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra. Design and evaluate Euler and Hamilton circuits. Able to apply algorithms to problems including searching algorithms, base conversion algorithms and the Euclidean algorithm.
BSC-IT401.5	Develop the given problem as graph networks and solve with techniques of graph theory. And calculate discrete probabilities. Students will be able to apply Recursion and advanced counting technique problem solution.

BSC-IT401.6	Use graphs and trees. Apply basic and advanced principles of counting. Simplify and evaluate basic logic statements including compound statements, implications, Inverses, converses, and contra-positives using truth tables and the properties of logic.

Text book and Reference books:

1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH
5. J.K. Sharma, Discrete Mathematics, Macmillan
6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
7. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
8. Douglas B. West, Introduction to graph Theory, PHI
9. C. L. Liu, Elements of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 2000.
10. R. C. Penner, Discrete Mathematics: Proof Techniques and Mathematical Structures, World Scientific, 1999.
11. R. L. Graham, D. E. Knuth, and O. Patashnik, Concrete Mathematics, 2nd Ed., Addison-Wesley, 1994.
12. N. Deo, Graph Theory, Prentice Hall of India, 1974.
13. S. Lipschutz and M. L. Lipson, Schaum's Outline of Theory and Problems of Discrete Mathematics, 2nd Ed., Tata McGraw-Hill, 1999.
14. J. P. Tremblay and R. P. Manohar, Discrete Mathematics with Applications to Computer Science, Tata McGraw-Hill, 1997.
15. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
16. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
17. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
18. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH

Computer Organization & Architecture
Code: PCC-IT402
Contacts: 3L

Name of the Course:	Computer Organization & Architecture	
Course Code: PCC-IT402	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam: 70 Marks
Credit Points:	3	
Objective:		
1	To prepare students to perform the analysis and design of various digital electronic circuits.	
2	To know how Computer Systems work & its basic principles	
3	To know how I/O devices are being accessed and its principles etc	
4	To learn the basics of stored program concepts.	
5	To learn the principles of pipelining	
6	To learn mechanism of data storage	
7	To distinguish between the concepts of serial, parallel, pipeline architecture.	
Pre-Requisite:		
1	Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures. Boolean Algebra	
2	Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Computer and Computer Arithmetic:** Von Neumann and Harvard Architecture, Computer organization vs Computer Architecture, Instruction format, Addressing modes, Addition and subtraction with signed magnitude, Half adder, Full adder, Ripple carry adder, Carry Look-ahead adder, Multiplication algorithm, Division algorithm, Floating point number representation, IEEE 754 standard and ALU design.**[11L]**	11	

2	**Memory Organization and I/O techniques:** Memory organization, static and dynamic memory, memory hierarchy, associative memory. Inclusion, coherence and locality properties, Cache memory organization, Memory replacement policies, Techniques for reducing cache misses, Virtual memory organization, Mapping and management techniques, Modes of transfer, Handshaking and DMA.**[10L]**	11	
3	**Pipeline and ILP:** Quantitative techniques in computer design, Introduction to pipeline, Instruction pipeline, Arithmetic pipeline, processor pipeline, Types of Pipeline hazards and its countermeasures, Super-pipeline, Superscalar and VLIW architecture. Introduction to ILP and techniques to improve ILP, Array and Vector processor.**[10L]**	11	
4.	**Multiprocessor Architecture and Control Unit:** Taxonomy of parallel architectures, Types of Multiprocessor architectures, Cache inconsistency, Centralized and Distributed shared memory architecture, Memory Consistency models, Cluster computer, Data flow architecture, RISC and CISC architecture. Introduction to Control unit, Hardwired CU and Micro programmed CU**.[11L]**	11	

Course Outcomes:

PCC IT402.1	Describe and explain the difference between computer organization and computer architecture .
PCC IT402.2	Design the ALU for different arithmetical and logical problems and apply the knowledge of different multiplication and division algorithm.
PCC IT402.3	Formulate design methodology for using various types of instructions.
PCC IT402.4	Differentiate between different Memory hierarchy(Primary, Secondary, Cache). Able to solve different kind of numericals based on memory technologies and page replacement techniques.
PCC IT402.5	Differentiate between types of pipeline, hazards and selecting remedial techniques to handle the hazards. able to distinguish between parallel architectures. Compare performance parameters of pipelines and deduce derivations to demonstrate change in performance parameters when branching is introduced. Able to solve numericals based on pipeline concepts
PCC IT402.6	Comparing techniques of ILP, types of CU, types of shared memory architectures. Distinguish between different multiprocessor architectures, Data Flow architecture, RISC and CISC architecture

Formal Language & Automata Theory
Code: PCC-IT403
Contacts: 3L

Name of the Course:	**Formal Language & Automata Theory**	
Course Code: PCC-IT403	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	
Objective:		
1	Be able to construct finite state machines and the equivalent regular expressions.	
2	Be able to prove the equivalence of languages described by finite state machines and regular expressions	
3	Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars.	
4	Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines	
Pre-Requisite:		
1	Grammar and its classification (Context Free Grammar)	

Unit	Content	Hrs/Unit	Marks/Unit
1	Review of Mathematical Theory: Sets, Functions, Logical statements, Proofs, relations, languages, Mathematical induction, strong principle, Recursive definitions	6	
2	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	5	

3	Regular languages and finite automata: Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata)	6	
4	Context-free languages and pushdown automata: Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic push down automata, closure properties of CFLs.	6	
5	Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	6	
6	Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsas enumerators	6	
7	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages	5	

Text books/ reference books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.
2. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
3. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.
6. Dr. R.B. Patel, Theory of Computation, Khanna Publishing House
7. Mishra, Theory of Computers, PHI Publications

Course Outcomes:

PCC IT403.1	Define the mathematical principles behind theoretical computer science
PCC IT403.2	Differentiate and construct different types of automata like finite automata, push down automata, linear bounded automata and Turing machine.
PCC IT403.3	Obtain minimized DFA and conversion of automata to regular expressions and regular expression to automata and proving languages are not regular using pumping lemma.
PCC IT403.4	Able to Write CFG's, construction of parse trees, demonstrate ambiguity in grammars, designing problems on Pushdown Automata.
PCC IT403.5	Conversion of grammar to CNF ,GNF, conversion of grammar to PDA and proving that languages are not context free using pumping lemma.
PCC IT403.6	Designing Turing machines, understanding the working of various types of Turing machines and solving post correspondence problems

Design and Analysis of Algorithms
Code: PCC-IT404
Contacts: 3L

Name of the Course:	**Design and Analysis of Algorithms**	
Course Code: PCC-IT404	Semester: IV	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam: 70 Marks
Credit Points:	3	
Objective:		
1	The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them	

2	Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood.
Pre-Requisite:	
1	To know data-structure and basic programming ability

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem	8	
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8	
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6	
4.	Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P,NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	10	
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	4	

Text books/ reference books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
2. Fundamentals of Algorithms – E. Horowitz et al.
4. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
5. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
6. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA
7. Gajendra Sharma, Design & Analysis of Algorithms, Khanna Publishing House, Delhi

Course Outcomes of PCC-IT404

PCC IT404.1	To **understand** and **develop** the ability to analyze the running time and verify the correctness of basic algorithms.
PCC IT404.2	To **implement** major algorithm paradigms such as divide and conquer, greedy method, dynamic programming, branch and bound and backtracking, to a variety of real-world problems to **design** a good algorithm.
PCC IT404.3	To **argue** the correctness and efficiency of algorithms such as DFS,BFS, Shortest path, Minimum Spanning Tree and Network Flow.
PCC IT404.4	To be able to **apply** and **design** efficient algorithms for moderately difficult computational problems, using various algorithm design techniques.
PCC IT404.5	To **assemble** the notions of P, NP, NP-complete, and NP-hard and to **compare** and differentiate with deterministic algorithms
PCC IT404.6	To be able to **develop** the concept of simple approximation algorithms.

Operating Systems Code:
PCC-IT405
Contacts: 3L

Name of the Course:		**Operating Systems**	
Course Code: PCC-IT405		Semester: IV	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme			**Examination Scheme**
Theory:3 hrs./week			Mid Semester exam: 15
Tutorial: NIL			Assignment and Quiz: 10 marks
			Attendance : 5 marks
Practical: hrs./week			End Semester Exam :70 Marks
Credit Points:		3	
Objective:			
1	To learn the mechanisms of OS to handle processes and threads and their communication		
2	To learn the mechanisms involved in memory management in contemporary OS		
3	To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols		
4	To know the components and management aspects of concurrency management		
Pre-Requisite:			
1	Computer Organization &Architecture		

Unit	Content	Hrs/Unit	Mark/ Unit

1	**Introduction:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	3	
2	**Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, **Process Scheduling:** Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; **Scheduling algorithms:** Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.	10	
3.	**Inter-process Communication**: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, **Classical IPC Problems**: Reader's & Writer Problem, Dinning Philosopher Problematic.	5	
4.	**Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, **Deadlock Avoidance:** Banker's algorithm, Deadlock detection and Recovery.	5	
5.	**Memory Management:** Basic concept, Logical and Physical address map, **Memory allocation:** Contiguous Memory allocation–Fixed and variable partition– Internal and External fragmentation and Compaction; **Paging:** Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. **Virtual Memory:** Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page fault, Working Set, Dirty page/Dirty bit , Demand paging, **Page Replacement algorithms:** Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used(LRU).	8	
6.	**I/O Hardware:** I/O devices, Device controllers, Direct memory access **Principles of I/O Software:** Goals of Interrupt handlers, Device drivers, Device independent I/O software, **Secondary-Storage Structure:** Disk structure, Disk scheduling algorithms **File Management:** Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF,	6	

	SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks		

Text book and Reference books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
3. Operating System Concepts, Ekta Walia, Khanna Publishing House, New Delhi (AICTE Recommended Textbook – 2018)
4. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
5. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison- Wesley
6. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
7. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Outcomes:

PCC-IT405.1	Describes the general architecture along with different structures of computers and operating system.
PCC-IT405.2	Explain the process management policies; predicts the requirement for process synchronization and coordination handled by operating system.
PCC-IT405.3	Demonstrates and computes Scheduling algorithms and formulate solutions for critical section problem.
PCC-IT405.4	Computes System model for deadlock, Methods for handling deadlocks and Describe; analyze the memory management and its allocation policies.
PCC-IT405.5	Design File, directory and Constructs various Access methods and implementation
PCC-IT405.6	Justifies the tradeoffs in design and implementation concepts used in the development of various Operating Systems.

Software Engineering

Code: PCC-IT406
Contact: 3L

Name of the Course:	**Software Engineering**	
Course Code: **PCC-IT406**	Semester: III	
Duration:6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: hrs./week		End Semester Exam:70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model ,Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model. [10L]	10	
2	System Design – Context diagram and DFD, Problem Partitioning, Top-Down And Bottom-Up design; Decision tree,decision table and structured English; Functional vs. Object- Oriented approach. [5L]	5	
3	Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. [4L] Testing – Levels of Testing, Unit Testing, Path Testing, Integration Testing, System Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control. [8L]	12	
4.	Software Project Management – Project Scheduling, Staffing, Software Configuration Management, Quality Assurance, Project Monitoring. [7L]	7	
5	Static and dynamic models, why modeling, UML diagrams: Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram. [10 L]	10	

Text book and Reference books:

Pressman, Software Engineering : A practitioner's approach– (TMH)
Pankaj Jalote, Software Engineering- (Wiley-India)
N.S. Gill, Software Engineering – (Khanna Publishing House)
Rajib Mall, Software Engineering- (PHI)
Agarwal and Agarwal, Software Engineering – (PHI)
Sommerville, Software Engineering – Pearson

Course Outcome

PCC-IT406.1	Identify an effective software engineering process, based on knowledge of widely used development lifecycle models.
PCC-IT406.2	Define the basic concepts and importance of Software project management concepts like cost estimation, scheduling and reviewing the progress, identification and implementation of the software metrics.
PCC- IT406.3	Work effectively alone or in a team to analyze the requirements of a complex software system, and solve problems by creating appropriate designs that satisfies these requirements.
PCC- IT406.4	Capture, document and analyze requirements and translate a requirements specification into an implementable design, following a function-oriented or object-oriented approach.
PCC- IT406.5	Formulate a testing strategy for a software system, employing techniques such as unit testing, test driven development and functional testing.
PCC- IT406.6	Analyze software risks and risk management strategies and defining the concepts of software quality and reliability on the basis of International quality standards.

PRACTICAL SYLLABUS
Semester IV

Computer Organization & Architecture Lab

Code: PCC-IT492
Contacts: 4P

Name of the Course:	**Computer Organization & Architecture Lab**
Course Code: PCC-IT492	Semester: IV
Duration:6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
PCC-IT492.1	To apply concepts and methods of digital system design techniques through hands-on projects.
PCC-IT492.2	To analyze the results of logic and timing simulations and to use these simulation results to debug digital systems.
PCC-IT492.3	To learn to design combinational and sequential digital systems starting from a word description that performs a set of specified tasks and functions.
PCC-IT492.4	To develop skills, techniques and learn state-of-the art engineering tools (such as VHDL, Xilinx ISE simulator etc) to design, implement and test modern day digital systems on FPGAs.
PCC-IT492.5	To learn by using Xilinx Foundation tools and Hardware Description Language (VHDL).
PCC-IT492.6	To learn through hands-on experimentation the Xilinx tools for FPGA design as well as the basics of VHDL design and simulate digital systems.
Pre-Requisite:	
The hardware based design has been done in 1.the Analog & Digital Electronics laboratory	

Laboratory Experiments:	
1	HDL introduction.
2	Basic digital logic base programming with HDL
3	8-bit Addition, Multiplication, Division
4	8-bit Register design
5	Memory unit design and perform memory operations.
6	8-bit simple ALU design
7	8-bit simple CPU design
8	Interfacing of CPU and Memory.

Design & Analysis Algorithm Lab
Code: PCC-IT494
Contact: 4P

Name of the Course:	**Design & Analysis Algorithm Lab**
Course Code: PCC-IT494	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
PCC-IT494.1	To analyze the complexities of various problems in different domains and to prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains.
PCC-IT494.2	To understand methods for analyzing the efficiency and correctness of algorithms (such as exchange arguments, recurrence, induction, and complexity analysis)
PCC-IT494.3	To design algorithms using the divide and conquer, dynamic programming, greedy method, Backtracking algorithms, etc that employ this strategy.
PCC-IT494.4	To compare, contrast, and choose appropriate algorithmic design techniques to present an algorithm that solves a given problem.
PCC-IT494.5	To develop the efficient algorithms for the new problem with suitable designing techniques.
PCC-IT494.6	To know the appropriate algorithmic design technique to specific problems.
Pre-Requisite:	
Pre-Requisite as in : PCC-IT404	

Laboratory Experiments:	
Divide and Conquer:	
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm
Brunch and Bound:	
6	Implement 15 Puzzle Problem
Backtracking:	

7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
Greedy method	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
Graph Traversal Algorithm:	
11	Implement Breadth First Search (BFS) Implement Depth First Search (DFS)

Operating System Lab
Code: PCC-IT495
Contacts: 4P

Name of the Course:	**Operating System Lab**
Course Code: PCC-CS495	Semester:IV
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

Course Outcomes:	
PCC-IT495.1	Describes the concept of Unix and Linux operating system and its associate's commands.
PCC-IT495.2	Explains the accessibility of files, create and change the permissions associated with files and several other tasks.
PCC-IT495.3	Develop and demonstrate shell script programming for several problems.
PCC-IT495.4	Design the programs of process creation, replacing or duplicating a process image.
PCC-IT495.5	Understand and constructs the concept mutual exclusion in semaphore in modern operating system.
PCC-IT495.6	Construct the program for inter process communication

Laboratory Experiments:
1 1. **Managing Unix/Linux Operating System [8P]:** Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions,commands). Partitions, Swap space, Device files, Raw and Block files, Formatting disks, Making file systems, Superblock, I-nodes, File system checker, Mounting file systems,Logical Volumes, Network File systems, Backup schedules and methods Kernel loading, init and the in it tab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups.
Process [4P]: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process. 2. **Signal [4P]**: signal handling, sending signals, signal interface, signal sets. 3. **Semaphore [6P]**: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v). 4. **POSIX Threads [6P]**: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel) 5. **Inter-process communication [6P]**: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), 6. message passing & shared memory(IPC version V).

IT Workshop
Code: PCC-IT496
Contacts: 4P
Python Programming

Name of the Course:	**IT Workshop**
Course Code: PCC-IT496	Semester: IV
Duration: 6 months	Maximum Marks: 100
Teaching Scheme:	
Theory: NIL	Continuous Internal Assessment
Tutorial: NIL	External Assesement: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Course Outcomes:	
PCC-IT496.1	Understand principles of Python
PCC-IT496.2	Understand the pros and cons on scripting languages vs. classical programming languages (at a high level)
PCC-IT496.3	To master an understanding of scripting & the contributions of scripting languages
PCC-IT496.4	Design real life problems and think creatively about solutions

PCC-IT496.5	Apply a solution in a program using R/Matlab/Python.
PCC-IT496.6	To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.

Pre-Requisite:	
1.	Knowledge of Programming Logic
2.	Experience with a high level language (C/C++,) is suggested.
3.	Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.

Laboratory Experiments:	
1	Introduction: History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.
2	**Types, Operators and Expressions:** Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elseif-else, for, while, break, continue, pass.
3	**Data Structures** Lists - Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences. Comprehensions.
4	**Functions -** Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variable-length arguments, Anonymous Functions, Fruitful Functions(Function Returning Values), Scope of the Variables in a Function - Global and Local Variables. **Modules:** Creating modules, import statement, from. Import statement, name spacing, **Python packages** Introduction to PIP, Installing Packages via PIP, Using Python Packages.
5	**Object Oriented Programming OOP in Python:** Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Datahiding, **Error and Exceptions:** Difference between an error and Exception, Handling Exception, try except block, Raising Exceptions, User Defined Exceptions.
6	**Brief Tour of the Standard Library** - Operating System Interface - String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics **Testing:** Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

SEMESTER – V

Computer Networks
Code: PCC-IT501

Contact: 3L

Name of the Course:	**Computer Networks**		
Course Code: PCC-IT501	Semester: V		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: hrs./week		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To develop an understanding of modern network architectures from a design and performance perspective.		
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).		
3	To provide an opportunity to do network programming		
4	To provide a WLAN measurement ideas.		

Unit	Content	Hrs/Unit	Marks/Unit
1	**Data communication Components:** Representation of data and its flow Networks,Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN **Techniques for Bandwidth utilization:** Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum	9	
2	**Data Link Layer and Medium Access Sub Layer**: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, SlottedALOHA,CSMA/CD,CDMA/CA	8	
3	**Network Layer:** Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and	14	

	Unicast Routing protocols.		
4.	**Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	8	
5	**Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	8	

Text book and Reference books:

1. B. A. Forouzan - "Data Communications and Networking (3rd Ed.) " – TMH
2. A. S. Tanenbaum - "Computer Networks (4th Ed.)" - Pearson Education/PHI
3. W. Stallings - "Data and Computer Communications (5th Ed.)" - PHI/ Pearson Education
4. B. Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House. (AICTE Recommended)
5. Zheng & Akhtar, Network for Computer Scientists & Engineers, OUP
6. Black, Data & Computer Communication, PHI 6. Miller, data Communication & Network, Vikas

Course Outcomes:

PCC-IT501.1	Describes the utility of layered architecture with OSI and TCP/IP models and identify the responsibility of each layer.
PCC-IT501.2	Explain different data link layer utilities, functions, control and protocols and Describe with their uses and applications.
PCC-IT501.3	Demonstrate network layer routing algorithms and Classify the congestion control algorithms. Implementation of the routing protocols is also taken care.
PCC-IT501.4	Relates the Session layer design issues and Transport layer services.
PCC-IT501.5	Estimates the functions of Application layer and Presentation layer paradigms and Protocols.
PCC-IT501.6	Justifies network security, cryptography, data integrity working concept.

Subject: Image Processing
Code: PCC IT502
Lecture Hours: 39

Introduction

Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display. [3L]

Digital Image Formation

A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization – Uniform & Non uniform. [4L]

Mathematical Preliminaries

Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two-Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & Sine Transform. [9L]

Image Enhancement

Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear &Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Lowpass Filtering; Image Sharpening. High- pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High-pass filtering. [8L]

Image Restoration

Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained &Constrained; Constrained Least Square Restoration, Restoration by homo-morphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation [8L]

Image Segmentation

Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & BoundaryDetection - Local Processing, Global Processing via The Hough Transform;
Thresholding -Foundation, Simple Global Thresholding, Optimal Thresholding; Region Oriented Segmentation- Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging. [7L]

Artificial Intelligence
Code: PCC-IT503
Contacts: 3L

Name of the Course:	**Artificial Intelligence**	
Course Code: PCC-IT503	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		End Semester Exam :70 Marks
Credit Points:	3	

Unit	Content	Hrs/ Unit	Marks/ Unit

1	**Introduction [2]** Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. **Intelligent Agents [2]** Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. **Problem Solving [2]** Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs.	6	
2.	**Search techniques [5]** Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies. **Heuristic search strategies [5]** Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems: Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems, local search for constraint satisfaction problems. **Adversarial search [3]** Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.	13	
3	**Knowledge & reasoning [3]** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	**3**	
4	**Using predicate logic [2]** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. **Probabilistic reasoning [4]** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	**6**	
5	**Natural Language processing [2]** Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. **Learning [2]** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, Introduction to neural network & genetic Algorithm. **Expert Systems [2]** Representing and using domain knowledge, expert system shells, knowledge acquisition.	**6**	

Text book and Reference books:

1. Artificial Intelligence, Ritch & Knight, TMH
2. Artificial Intelligence A Modern Approach, Stuart Russel Peter Norvig Pearson
3. Artificial Intelligence, A Classical Approach, Munish Chandra Trivedi, Khanna Publishing
4. Introduction to Artificial Intelligence & Expert Systems, Patterson, PHI
5. Poole, Computational Intelligence, OUP
6. Logic & Prolog Programming, Saroj Kaushik, New Age International
7. Expert Systems, Giarranto, VIKAS

Course Outcomes:

PEC IT 503.1	To **understand** and **develop** the fundamental concepts of AI with the ability of problem solving.
PEC IT 503.2	To **classify** the basic search techniques with examples and to **investigate** valid solutions for problems involving different search techniques.
PEC IT 503.3	**To formulate** valid solutions for problems involving uncertain inputs or outcomes by using decision making techniques.
PEC IT 503.4	To **understand** and **evaluate** different probabilistic reasoning and NLP applications referring AI and ML technique for this process.
PEC IT 503.5	**To Examine** the issues involved in knowledge bases, reasoning systems and to **design** intelligent expert models for perception and prediction from intelligent environment.
PEC IT 503.6	To **formulate** complex problems and able to solve them using various AI techniques.

Course Name: Introduction to Industrial Management (Humanities III)	**Category:** Humanities & Social Sciences including Management courses
Course Code: HSMC-IT-501	**Semester:** V
L-T-P: 3-0-0	**Credit:** 3
Teaching Scheme Theory: 3 hrs./ week	**Maximum Marks:** 100
Total Lectures: 30	**Examination Scheme:** Continuous Assessment: 30 Marks (**Mid semester exam 15+Assignment and quiz 10+Attendance5)** End Semester Exam: 70 Marks
Pre-requisites: Mathematical and analytical ability	
Course Objectives:	
1. Gain a comprehensive understanding of industrial systems, management principles, and key concepts such as production planning, quality management, and supply chain operations. 2. Develop practical skills in operations management, leadership, decision-making, and	

communication to effectively manage industrial processes, teams, and resources. 3. Stay updated on emerging trends, technologies, and best practices in industrial management to adapt, innovate, and lead change initiatives in dynamic industrial environments.

Course Outcomes (CO):	
CO 1	Students will be able to understand and recall the fundamental concepts, principles, and theories of industrial management.
CO 2	Students will be able to apply different industrial management tools and techniques by utilizing software and implementing quality management strategies.
CO 3	Students will be able to evaluate the benefits and weaknesses of different industrial management strategies and approaches as well as they will be able to assess the market trends.
CO 4	Students will be able to assess whether the strategies are effective in the line of organizational goal.
CO 5	Students will be able to create innovative solutions to face the market challenges.
CO 6	Students will be able to develop fundamental knowledge of Industrial management to implement in real-time and supplement the lifelong learning

Details of Syllabus

Unit	Content	Hrs/ Unit
1.	**Introduction to Industrial Management:** Industrial Management – Concept Meaning and Definitions, Scope of Industrial Management, School of management thoughts – H. Fayol &F.W.Taylor	**4**
2.	**Production, Planning and Control:** Concept and Meaning of PPC , Job shop scheduling	**4**
3.	**Plant Location, Plant Layout and Work Study:** Product design process, Process selection, Types of production system (Job, Batch and Mass Production), Concept and Meaning of Plant Location, Theories of Plant Location, Plant location-factors-Urban & Rural sites comparison, Concept and Meaning of Plant Layout, Factors Affecting Plant Layout, Advantages of Plant Layout, Techniques of Plant	**6**

	Layout, Types of plant layouts, Work study.	
4.	**Statistical Quality Control:** Variables - attributes, Shewart control chart for variables - X chart, R chart, - Attributes-Defective-Defect Charts for attributes-p chart, c chart (simple problems).	**4**
5.	**Material Management and Purchase Management:** A) Material management-definition, functions, importance, relationship with other departments. B) Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. C) Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. D) Inventory control: i. Definition. ii. Objectives. iii. Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. E) Material Requirement Planning (MRP) concept, applications and brief details about software packages available in market.	**8**
6.	**Recent trends in Industrial Management:** A)ERP (Enterprise resource planning) - concept, features and applications. B) Important features of MS Project. C) Logistics- concept, need and benefits. D) Just in Time (JIT)-concept and benefits. E) Supply chain management-concept and benefits.	**4**

References:
O. P. Khanna – "Industrial Engineering & Management", Dhanpat Rai Publications
S.C. Sharma - "Engineering Management – Industrial Engineering & Management", Khanna Book Publishing Company, New Delhi
3. A.P. Verma and K.L. Maheshwari – "Industrial Engineering and Management", Sultan Chand & Sons
4. N. Nair – "Materials Management", Tata McGraw Hill Education

Compiler Design
Code: PEC-IT501A
Contact: 3L

Name of the Course:	**Compiler Design**		
Course Code: **PEC-IT501A**	Semester:V		
Duration:6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:	3		
Objective:			
1	To understand and list the different stages in the process of compilation.		
2	Identify different methods of lexical analysis		
3	Design top-down and bottom-up parsers		
4	Identify synthesized and inherited attributes		
5	Develop syntax directed translation schemes		
6	Develop algorithms to generate code for a target machine		

Unit	Content	Hrs/ Unit	Marks/Unit
1	**Introduction to Compiling** [3L] Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler.	3	
2	**Lexical Analysis** [6L] The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token,Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex). ****Demonstration of LEX Analysis during classes**.	6	
3	**Syntax Analysis** [9L] The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non- recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery Strategies for different parsing techniques. **** Demonstration of YACC during classes**	9	

4	**Syntax directed translation** [5L] Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.	5	
5	**Type checking** [4L] Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions	4	
6	**Run time environments** [5L] Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.	5	
7	**Intermediate code generation** [4L] Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).	4	
8	**Code optimization** [5L] Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.	5	
9	**Code generations [4L]** Issues in the design of code generator, a simple code generator, Register allocation & assignment.	4	

Text book and Reference books:

1. Aho, Sethi, Ullman - "Compiler Principles, Techniques and Tools" - Pearson Education.
2. Holub - "Compiler Design in C" - PHI.

Course Outcomes:

PEC-IT501A.1	Describe the different phases of compiler and identify different possible errors detected by different phases.
PEC-IT501A.2	Explain the mean of token and distinguish between the NFA and DFA. Recommend a DFA to recognize partial keywords of programming language.
PEC-IT501A.3	Demonstrate the role of a parser. Understand the top-down and bottom-up parsing techniques and its design issues.
PEC-IT501A.4	Differentiate the role of semantic analysis phase to syntax analysis phase.

	Be aware of how data type issues are handled in semantic analysis phase.
PEC-IT501A.5	Constructs the significance of intermediate code generation phase. Revise the different ways of intermediate code generation techniques and run-time environment issues in compilation
PEC-IT501A.6	Discriminates the knowledge of code optimization and code generation issues. Make DAG representation of basic blocks and flow graphs.

Micro-electronics and VLSI Design
Code: PEC-IT501B
Contact: 3L

Name of the Course:	**Micro-electronics and VLSI**
Course Code: PEC-IT501B	Semester: V
Duration:6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points: 3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers. [6L]	6	
2	Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule [10L] .	10	
3	Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable	8	

	interconnect, and Reprogramable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioural Synthesis, RTL synthesis [8L]		
4.	Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays. [5L]	5	
5	Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability. [5L]	5	
6	Overview of VHDL [5L]	5	

Text Book:

1.“Digital Integrated Circuit”, J.M.Rabaey, Chandrasan, Nicolic, Pearson
2. “CMOS Digital Integrated Circuit”, S.M.Kang & Y.Leblebici,
TMH 3.”Modern VLSI Design” Wayne Wolf, Pearson
4.“Algorithm for VLSI Design & Automation”, N.Sherwani,
Kluwer 5.”VHDL”, Bhaskar, PHI

References:

1. “ Digital Integrated Circuits” Demassa & Ciccone, Willey Pub.
2. “Modern VLSI Design: system on silicon” Wayne Wolf; Addison Wesley Longman Publisher
3. “Basic VLSI Design” Douglas A. Pucknell & Kamran Eshranghian; PHI
4. “CMOS Circuit Design, Layout & Simulation”, R.J.Baker, H.W.Lee, D.E. Boyee, PHI

Course Outcomes:

PEC-IT501B.1	Explain the principle of design of VLSI circuits
PEC-IT501B.2	Explain different MOS structure with characteristics
PEC-IT501B.3	Apply different processes for VLSI fabrication
PEC-IT501B.4	Use programming language for the design of logic circuits
PEC-IT501B.5	Draw the stick diagram and layout for simple MOS circuits
PEC-IT501B.6	

Bio Informatics
Code: PEC-IT501C
Contacts: 3L

Name of the Course:	**Bio Informatics**
Course Code: PEC-IT501C	Semester: V
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	**INTRODUCTION TO MOLECULAR BIOLOGY** Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways.	5	
2	**Sequence Databases** Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;	2	
3	**DNA SEQUENCE ANALYSIS** DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.	14	

4.	**Introduction Probabilistic models used in Computational Biology** Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics.	8	
5.	**Biological Data Classification and Clustering** Assigning protein function and predicting splice sites: Decision Tree	6	

Course Outcomes:

PEC-IT501C.1	Understand the basic concept of Molecular Biology.
PEC-IT501C.2	Understand the theoretical basis behind bioinformatics
PEC-IT501C.3	Search databases accessible on the WWW for literature relating to molecular biology and Information Technology
PEC-IT501C.4	Manipulate DNA and protein sequences using stand-alone PC programs and programs available on the WWW. Able to write program for solving Biological Problems.
PEC-IT501C.5	Find homologues, analyze sequences, construct and interpret evolutionary trees.
PEC-IT501C.6	Apply the knowledge of Information Technology in Bioinformatics

Constitution of India
Code: MC-IT501
Contacts: 3L

Name of the Course:	**Constitution of India**	
Course Code: MC-IT501	Semester: V	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical: NIL		
Credit Points:	0	

Unit	Content	Hrs/Unit	Marks/ Unit

1	**Introduction:** Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	3	
2	**Union Government and its Administration :** Structure of the Indian Union: Federalism, Centre- State relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha	6	
3.	**State Government and its Administration Governor:** Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions	6	
4.	**Local Administration District's Administration head:** Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different 4.departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	8	
5.	**Election Commission Election Commission:** Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women		

Text book and Reference books:

1. 'Indian Polity' by Laxmikanth
2. 'Indian Administration' by Subhash Kashyap
3. 'Indian Constitution' by D.D. Basu
4. 'Indian Administration' by Avasti and Avasti

PRACTICAL SYLLABUS

Computer Networks
Lab Code: PCC-IT591
Contacts: 4P

Name of the Course**:**	**Computer Networks Lab**
Course Code: PCC-IT591	Semester: V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
COURSE OUTCOME	
PCC-IT591.1	Defines hardware types related to computer network.
PCC-IT591.2	Explains and evaluate network based commands and demonstrate their use.
PCC-IT591.3	Demonstrate the performance of network protocol such as message queue, IPC.
PCC-IT591.4	Implement the socket programming for client server architecture.
PCC-IT591.5	Design and compares flow control mechanism stop and wait, Go back N etc.
PCC-IT591.6	Design and Understand Setup /Configuration for several protocols.

Laboratory Experiments:
1) NIC Installation & Configuration (Windows/Linux)
2) Understanding IP address, subnet etc Familiarization with • Networking cables (CAT5, UTP) • Connectors (RJ45, T-connector) • Hubs, Switches

3) TCP/UDP Socket Programming • Simple, TCP based, UDP based • Multicast & Broadcast Sockets • Implementation of a Prototype Multithreaded Server
4) Implementation of Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window) Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)
5) Server Setup/Configuration FTP, TelNet, NFS, DNS, Firewall

Artificial Intelligence Lab
System Lab Code: PCC-IT593

Contacts: 4P

Name of the Course:	**Artificial Intelligence Lab**
Course Code: PCC-IT593	Semester: V
Duration:6 months	Maximum Marks:100
Programming Language	Python
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

Course Outcomes:	
PCC IT593.1	Students will demonstrate the ability to solve problems collaboratively.
PCC-IT593.2	Students will demonstrate knowledge of artificial intelligence concepts.
PCC-IT593.3	An understanding of fundamental concepts and methods of searching Strategy with its applications.
PCC-IT593.4	An ability to analyze and evaluate simple algorithms with the coding of Python programming language.
PCC-IT593.5	An ability to design simple algorithms for probabilistic reasoning and Fuzzy operation with Python programming language and test them with benchmark data sets.
PCC-IT593.6	Practically establish, refine and implement strategies to take the idea in to students and faculty fraternity.

Basic search strategies	Tic-Tac-Toe game, 8-Puzzle problem, Water Jug Problem, Crypt-arithmetic problem (Applicable from the academic session 2021-22)
Heuristic search	Best First Search, A* search, Genetic algorithm, Hill Climbing Search, constraint satisfaction problems
Adversarial search	Minimax algorithm, Alpha-Beta pruning
Probabilistic reasoning	Build naïve Bayes model, Implement Bayesian networks and perform inferences
Fuzzy Logic	Fuzzy set basic operation, Dempster-Shafer theory
Mini Project	

Web Technology Lab
Code: PCC-IT596
Contacts: 4P

Name of the Course**:**	**Advanced Java & Web Technology Lab**
Course Code: PCC-IT596	Semester: V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
COURSE OUTCOME	
PCC-IT596.1	Create and Mange static web pages for given scenario
PCC-IT596.2	Apply server side technologies to establish dynamic applications
PCC-IT596.3	To develop a dynamic webpage by the use of java script and DHTML.
PCC-IT596.4	To create and write a well formed / valid XML document.
PCC-IT596.5	Implement web applications with effective data management
PCC-IT596.6	Develop secure web applications with session management API‟s

Laboratory Experiments:

Unit 1: To practice HTML fundamental constructs.

1. Headings
2. Links
3. Paragraph
4. Images

5. Tables

Unit 2: To practice HTML fundamental constructs.

1. Frames
2. Forms and HTML controls
3. Project on HTML fundamentals Unit

Unit 3: To practice Cascading style sheets

1. Internal
2. External
3. Inline

Unit 4: To practice JavaScript and DHTML

1. Simple Programs
2. Handling Events
3. Objects in JavaScript
4. Project on DHTML

Unit 5: To practice XML

Presenting XML using XSLT

Unit 6: To practice JDBC connectivity

1. Statement
2. PreparedStatement

Unit 7: To practice Servlet programming

1.Simple servlet Programming
2.Understanding Life cycle Methods

Unit 8: To practice Servlet programming

1. Working with initialization parameters
2. RequestDispatcher interface

Unit 9: To practice JSP

1.JSP basic tags
2.Implicit objects
3. Working with Action tags

Unit 10: Microservice architectute with Java

Learning Resource

Text Books

1. Web Technologies, Black Book, Kogent Learning Solutions Inc, Dreamtech Press.

2. JDBC, Servlets, and JSP, New Edition, Santhosh Kumar K, Kogent Learning Solutions Inc, Dreamtech Press.

SEMESTER – VI

Machine Learning
Code: PCC-IT601
Contacts: 3L

Name of the Course:	**Machine Learning**
Course Code: PCC-IT601	Semester: VI
Duration: 6 months	Maximum Marks: 100

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: Nil	End Semester Exam: 70 Marks
Credit Points: 3	

COURSE OBJECTIVE	
To learn the concept of how to learn patterns and concepts from data without being explicitly programmed	
To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.	
Explore supervised and unsupervised learning paradigms of machine learning.	
To explore Deep learning technique and various feature extraction strategies.	

Unit		**Hrs/ unit**	**Marks/ unit**
1	**Introduction** Learning Problems, Well-posed learning problems, Designing learning systems.	2	
2	**Concept Learning** Concept learning task, Inductive hypothesis, Ordering of Hypothesis, General-to specific ordering of hypotheses, Version spaces, Inductive Bias.	4	
3	**Supervised Learning** Regression: Linear regression, Notion of the cost function, Least squared error hypothesis, Logistic Regression, The Cost function for	12	

	logistic regression, Bayes Theorem, Naïve Bayes classifier, Bayesian Network, Decision tree Learning, Random Forest, Bagging and Boosting, Support Vector Machine. K-Nearest Neighbor Algorithm, Radial Basis Function,		
4	**Unsupervised learning** Clustering: K-means clustering, Hierarchical clustering. PCA	4	
5	**Neural networks** Single and Multilayer Layer Perceptron, Hebb net, Back-propagation, Recurrent Network, Self Organizing Map	8	
6	Over fitting and Under fitting, Regularization, Preventing Overfitting, Concept of Ensemble Learning.	4	

References:

1.Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012

2.Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)

3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

4. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

Course Outcomes:

PCC-IT601.1	Recognize the characteristics of Machine Learning techniques that enable to solve real world problems
PCC-IT601.2	Recognize the characteristics of machine learning strategies
PCC-IT601.3	Apply various supervised learning methods to appropriate problems
PCC-IT601.4	Identify and integrate more than one techniques to enhance the performance of learning
PCC-IT601.5	Create probabilistic and unsupervised learning models for handling unknown pattern
PCC-IT601.6	Analyze the co-occurrence of data to find interesting frequent patterns.

Cryptography and Network Security
Code: PCC-IT602
Contact: 3L

Name of the Course:	**Cryptography and Network Security**	
Course Code: PCC-IT602	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam : 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit

1	Attacks on Computers & Computer Security Introduction, Need for Security, Security approaches, Principles of Security, Types of attack.	5	
2	Cryptography: Concepts & Techniques- Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	7	
3	Symmetric Key Algorithm - Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.	8	
4.	Asymmetric Key Algorithm, Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	5	
5	Internet Security Protocols, User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	6	
6	Electronic Mail Security - Basics of mail security, Pretty Good Privacy, S/MIME.	4	
7	Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network	3	

Text book and Reference books:

1. "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
2. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.
4. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.
5. "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Books
6. "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
7. "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly
8. "Cryptography and Network Security", V.K. Jain, Khanna Publishing House, 2017.

Course Outcomes:

PCC-IT602.1	Recognize the various cryptographic techniques including private and public key cryptography, hashes and message digests
PCC-IT602.2	Realize about existing cryptographic utilities, digital signature and its applications
PCC-IT602.3	Identify with about classical encryption techniques and secure data communication.
PCC-IT602.4	Explore the design issues and working principles of various authentication protocols, different types of attacks and their characteristics.
PCC-IT602.5	Explore various communication standards as student may get knowledge about new strategies to secure data communication.
PCC-IT602.6	Survey the idea of cryptographic utilities and authentication mechanisms to design secure applications.

Subject: CLOUD AND EDGE COMPUTING

Code: PCC IT 603

Lecture Hours: 38

Introduction - Fundamentals of Cloud Computing

Concept of Cloud computing, Characteristics, Features and Applications, Cloud Architecture, Service models, Deployment models, Role of Cloud in Data Science domain. [4]

Cloud Computing Architecture - Cloud computing stack Service Models (XaaS): Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service(SaaS) Deployment Models: Public cloud, Private cloud, Hybrid cloud. Data Center Architecture. [10]

Infrastructure Services on Cloud

Introduction to Infrastructure, Virtualization, Hypervisors, Server virtualization, Storage Virtualization, Data Center Fundamentals, DB Cluster, Compute, Network and Storage Infrastructure, Database Services, Virtual Firewall and Security Groups, Load Balancing and auto-scaling. [10]

Cloud Infrastructure:
Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). [4]

Cloud Security - Cloud Security Risks, Trust, Operating System Security, VM Security, Security of Virtualization, Security Risks Posted by Shared Images, Security Risks Posted by Management OS, Data privacy and security Issues, Identity & Access Management, Access Control, Authentication in cloud computing, Case Study - Microsoft Azure, Amazon EC2 [4]

Edge Computing

Need and Model, Use cases, Drivers and Barriers, Edge Platforms & Computing Latency, Edge computing hardware architectures, Edge node architecture, Edge computing frameworks, Edge-to-Cloud Communication, Use Cases and Applications [6]

Text book and Reference books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson
6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Course Outcomes:

PCC-IT603.1	Understand various basic concepts related to cloud computing technologies.
PCC-IT603.2	Explain the architecture and concept of different cloud models: IaaS, PaaS, SaaS.
PCC-IT603.3	Demonstrate different cloud programming platforms and tools.
PCC-IT603.4	Differentiate the underlying principle of cloud virtualization, cloud storage, data management and data visualization.
PCC-IT603.5	Create application by utilizing cloud platforms such as Google app Engine and Amazon Web Services (AWS).
PCC-IT603.6	Justify scalable applications using AWS features.

Internet of Things
Code: PCC-IT604
Contacts: 3L

Course Code	**PCC-IT604**
Course Name	**Internet of Things**
Credits	3
Pre-Requisites	Computer Networks, Cloud Computing
COURSE OBJECTIVE	
Able to understand the application areas of IOT	
Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks	
Able to understand building blocks of Internet of Things and characteristics	

References:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing
3. Jeeva Jose, Internet of Things, Khanna Publishing House, 2018.

Unit 1: Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples. Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability	6
Unit 2: Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	8
Unit 3: Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	10
Unit 4: IOT APPLICATIONS - IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms /middleware, IoT- A, Hydra etc.	7
Unit 5: Challenges in IoT Design challenges: Development Challenges, Security Challenges, Other challenges IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	5

4. Internet of Things, Arsheep Bahga and Vijay Madisetti

Course Outcomes:

PCC-IT604.1	Explain the definition and usage of the term “Internet of Things” in different contexts
PCC-IT604.2	Understand the key components that make up an IoT system
PCC-IT604.3	Differentiate between the levels of the IoT stack and be familiar with the key technologies and protocols employed at each layer of the stack
PCC-IT604.4	Apply the knowledge and skills acquired during the course to build and test a complete, working IoT system involving prototyping, programming and data analysis
PCC-IT604.5	Understand where the IoT concept fits within the broader ICT industry and possible future trends .
PCC-IT604.6	Appreciate the role of big data, cloud computing and data analytics in a typical IoT system

Subject: BLOCK CHAIN TECHNOLOGY
Code: PEC IT601A
Lecture Hours: 36

UNIT - I History: Digital Money to Distributed Ledgers -Design Primitives: Protocols, Security, Consensus, Permissions, Privacy- : Block chain Architecture and Design-Basic crypto primitives: Hash, SignatureHash chain to Block chain-Basic consensus mechanisms. [6]

UNIT - II Requirements for the consensus protocols-Proof of Work (PoW)-Scalability aspects of Block chain consensus protocols: Permissioned Block chains-Design goals-Consensus protocols for permissioned Block chains. [8]

UNIT - III Decomposing the consensus process-Hyper ledger fabric components-Chain code Design and Implementation: Hyper ledger Fabric II:-Beyond Chain code: fabric SDK and Front End-Hyper ledger composer tool. [8]

UNIT - IV Block chain in Financial Software and Systems (FSS): -Settlements, -KYC, -Capital markets-InsuranceBlock chain in trade/supply chain: Provenance of goods, visibility, trade/supply chain finance, invoice management/discounting. [8]

UNIT - V Block chain for Government: Digital identity, land records and other kinds of record keeping between government entities, public distribution system / social welfare systems: Block chain Cryptography: Privacy and Security on Block chain. [6]

Subject: COMPUTER VISION
Code: PEC IT601B
Lecture Hours: 38

UNIT I
Introduction : Image Processing, Computer Vision and Computer Graphics , What is Computer Vision - Low-level, Mid-level, High-level , Overview of Diverse Computer Vision Applications: Document Image, Analysis, Bio-metrics, Object Recognition, Tracking, Medical Image Analysis, Content-Based Image Retrieval, Video Data Processing, Multimedia, Virtual Reality and Augmented Reality. [6]

UNIT II
Image Formation Models : Monocular imaging system , Orthographic & Perspective Projection, Camera model and Camera calibration, Binocular imaging systems, Multiple views geometry, Structure determination, shape from shading , Photometric Stereo, Depth from Defocus , Construction of 3D model from images.[8]

UNIT III

Image Processing, Feature Extraction, and Motion Estimation: Image pre-processing, Image representations (continuous and discrete) , Edge detection, Regularization theory , Optical computation ,Stereo Vision , Motion estimation , Structure from motion.[7]

UNIT IV

Shape Representation and Segmentation: Contour based representation, Region based representation, De-formable curves and surfaces, Snakes and active contours, Level set representations , Fourier, and wavelet descriptors , Medial representations , Multi-resolution analysis, Object recognition. [9]

UNIT V

Image Understanding and Computer Vision Applications: Pattern recognition methods, Face detection, Face recognition, 3D shape models of faces Application: Surveillance – foreground-background separation –human gait analysis Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians. [8]

Subject: Natural Language Processing
Code: PEC IT601C
Lecture Hours: 38

UNIT-I Introduction

Origins and challenges of nlp – language modeling: grammar-based lm, statistical lm – regular expressions, finite-state automata – english morphology, transducers for lexicon and rules, tokenization, detecting and correcting spelling errors, minimum edit distance

UNIT-II Word Level Analysis

Unsmoothed n-grams, evaluating n-grams, smoothing, interpolation and backoff – word classes, part-of-speech tagging, rule-based, stochastic and transformation-based tagging, issues in pos tagging – hidden markov and maximum entropy models.

UNIT-III Syntactic Analysis

Context free grammars, grammar rules for english, treebanks, normal forms for grammar – dependency grammar – syntactic parsing, ambiguity, dynamic programming parsing – shallow parsing – probabilistic cfg, probabilistic cyk, probabilistic lexicalized cfgs – feature structures, unification of feature structures.

UNIT-IV Semantics And Pragmatics

Requirements for representation, first-order logic, description logics – syntax-driven semantic analysis, semantic attachments – word senses, relations between senses, thematic roles, selectional restrictions – word sense disambiguation, wsd using supervised, dictionary & thesaurus, bootstrapping methods – word similarity using thesaurus and distributional methods.

UNIT-V Basic Concepts of Speech Processing

Speech fundamentals: articulatory phonetics – production and classification of speech sounds; acoustic phonetics – acoustics of speech production; review of digital signal processing concepts; short-time fourier transform, filter- bank and lpc methods.

UNIT-VI Speech-Analysis,Speech Modeling

Features, feature extraction and pattern comparison techniques: speech distortion measures– mathematical and perceptual – log–spectral distance, cepstral distances, weighted cepstral distances

and filtering, likelihood distortions, spectral distortion using a warped frequency scale, lpc, plp and mfcc coefficients, time alignment and normalization – dynamic time warping, multiple time – alignment paths. Hidden markov models: markov processes, hmms – evaluation, optimal state sequence – viterbi search, baum-welch parameter re-estimation, implementation issues.

Subject: Embedded System
Code: PEC IT601D
Lecture Hours: 36

Module No.	Unit No.	Topics	No.of Class
1		**Fundamentals of Embedded System**	4
	1.1	Core of the embedded system, Memory, Sensors (resistive, optical, position, thermal) and Actuators (solenoid valves, relay/switch, opto-couplers), Communication Interface, Embedded firmware (RTOS, Drivers, Application programs), Power-supply (Battery technology, Solar), PCB and Passive components, Safety and reliability, environmental issues. Ethical practice.	
	1.2	Characteristics and quality attributes(Design Metric)of embedded system. Real time system's requirements, real time issues, interrupt latency.	
	1.3	Embedded Productd development life cycle, Program modeling concepts: DFG, FSM, Petri-net, UML	
2		**Embedded Hardware and Design**	8
	2.1	Introduction to ARM-v7-M(Cortex-M3), ARM-v7-R(CortexR4) and comparison in between them	
3		**Embedded Serial Communication**	10
	3.1	Study of basic communication protocols like SPI, SCI (RS232, RS485), I2C, CAN, Field-bus(Profibus),USB(v2.0),Bluetooth, Zig Bee, Wireless sensor network	
4		**Embedded Software, Firmware Concepts and Design**	14
	4.1	Embedded C-programming concepts (from embedded system point of view): Optimizing for Speed/Memory needs, Interrupt service routines, macros, functions, modifiers, data types, device drivers, Multithreading programming.	
	4.2	Basic embedded C programs/applications for ARM-v7, using ARM-GCC- tool-chain, Emulation of ARM-v7 (e.g. using QEMU), and Linux porting on ARM-v7 (emulation) board CASESTUDY:1)Medical monitoring systems, 2) Process control system(temp, pressure) 3) Soft real time: Automated vending machines, 4) Communication: Wireless (sensor) networks.	
	4.3	Real time operating system: POSIX Compliance , Need of RTOS in Embedded system software, Foreground/Background systems, multitasking, context switching, IPC, Scheduler policies, Architecture of kernel, task scheduler, ISR, Semaphores, mailbox, message queues, pipes, events, timers, memory management, RTOS services in contrast with traditional OS.	

	4.4	Introduction to μCOS-II RTOS, study of kernel structure of μCOS-II, Synchronization in μCOS-II, Inter-task communication in μCOS-II, Memory management in μCOS-II,porting of RTOS on ARM-v7(emulation)board, Application developments using μCOS-II.	
	4.5	Introduction Linux OS, Linux IPC usage, basic device(drivers)usage.	

Operation Research

Code: OEC-IT601A
Contact: 3L

Name of the Course:	**Operation Research**
Course Code: OEC-IT601A	Semester: VI
Duration: 6 months	Maximum Marks: 100

Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic LPP and Applications; Various Components of LP Problem Formulation. Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.	17	
2	Network Analysis:Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control:Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.	9	

3	Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance	5	
4.	Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	5	

Text book and Reference books:

1. H. A. Taha, "Operations Research", Pearson
2. P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House
3. Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency
4. Ravindran, Philips and Solberg - "Operations Research", WILEY INDIA

Course Outcomes:

Course Outcomes:	
OEC-IT601A	Students should be proficient in the application of the laws of logic to mathematical statements.
OEC-IT601A	Select appropriate OR methods like Simplex, TP, TS, TSP, Network Analysis to apply to various types of problems in engineering and science inconsideration of the mathematical operations involved, accuracy requirements, and available computational resources.
OEC-IT601A	Prepare students for realization of journal papers outcomes, and expose them to the world of research. Illustrate the current research works and publications of the subjects in different fields adopted by the students as per course curriculum in various journals and literature.
OEC-IT601A	To explore and enhance research potential explain how the ideas those are adopted can be implemented through projects and demonstrate various models, recent project proposals executing the knowledge adopted from the course.
OEC-IT601A	An ability to function on multi-disciplinary teams. Lighten on the latest and modern developments in the fields.
OEC-IT601A	An understanding of professional, ethical, legal, security and social issues and responsibilities. An ability to analyze the local and global impact of computing on individuals, organizations, and society.

Introduction to Philosophical Thoughts
Code: OEC-IT601B
Contact: 3L

Name of the Course:	**Introduction to Philosophical Thoughts**	
Course Code: OEC-IT601B	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Nature of Indian Philosophy : Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views : Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta,Rna,	17	
2	Carvaka school : its epistemology, metaphysics and ethics. Mukti	9	
3	Jainism : Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation.		
4	5. Buddhism : theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism : Vaibhasika, Sautrantrika, Yogacara, Madhyamika.	5	
5	6. Nyaya : theory of Pramanas; the individual self and its liberation ; the idea of God and proofs for His existence.	5	

Text book and Reference books:

M. Hiriyanna : Outlines of Indian Philosophy.
C.D.Sharma : A Critical Survey of Indian Philosophy.
S.N.Das Gupta : A History of Indian Philosophy Vol – I to V.
S.Radhakrishnan : Indian Philosophy Vol – I & II.

T.R.V.Murti : Central Philosophy of Buddhism.
J.N.Mahanty : Reason and Tradition of Indian Thought.
R.D.Ranade : A Constructive Survey of Upanisadic Philosophy.
P.T.Raju : Structural Depths of Indian Thought.
K.C.Bhattacharya : Studies in Philosophy Vol – 1.
Datta and Chatterjee : Introduction of Indian Philosophy

Course Outcomes:

OEC-IT601B.1	Students read primary sources in philosophy and understand main arguments.
OEC-IT601B.2	Students compare and contrast the core of a philosophical problem, issue, or question by referencing the inquiry to a system (history, topic, philosophers, etc.).
OEC-IT601B.3	Students defend a philosophical position, view, or theory from more than one perspective.
OEC-IT601B.4	Students develop and defend student's own philosophical point of view.
OEC-IT601B.5	Students demonstrate a basic understanding of methods of philosophy
OEC-IT601B.6	Students identify/recognize consistencies and inconsistencies of specific philosophical theories or worldviews.

Soft Skills & Interpersonal Communication
Code: OEC-IT601C
Contact: 3L

Name of the Course:	**Soft Skills & Interpersonal Communication**	
Course Code: OEC-IT601C	Semester: VI	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit

1	**1. Soft Skills**: An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurment of Soft Skill Development. **2. Self-Discovery**: Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. **3. Positivity and Motivation**: Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.	12	
2	**Interpersonal Communication**: Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. **2. Public Speaking**: Skills, Methods, Strategies and Essential tips for effective public speaking. **3. Group Discussion**: Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. **4. Non-Verbal Communication:** Importance and Elements; Body Language. Teamwork and Leadership Skills: Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.	12	
3	1**. Interview Skills**: Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. 2**. Presentation Skills**: Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. 3. Etiquette and Manners – Social and Business. **4. Time Management** – Concept, Essentials, Tips. **5. Personality Development** – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.	12	

Text book and Reference books:

1. Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

Course Outcomes:

OEC-IT601C.1	Communication: Students will maintain open, effective, and professional communications.
OEC-IT601C.2	Professionalism: Students will demonstrate appropriate workplace demeanor and behavior
OEC-IT601C.3	Problem-solving: Students will demonstrate flexibility, desire to meet challenges, and ability to find solutions.
OEC-IT601C.4	Teamwork: Students will develop and maintain constructive working relationships.
OEC-IT601C.5	Demonstration: Demonstrate acknowledgment and validation of the feelings, opinions, and contributions of others.
OEC-IT601C.6	Application: Effectively apply active listening skills.

PRACTICAL SYLLABUS

Machine Learning Lab
Code: PCC-IT691

Contacts: 4P

Name of the Course**:**	**Machine Learning Lab**
Course Code: PCC-IT691	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
COURSE OUTCOME	
PCC-IT691.1	
PCC-IT691.2	
PCC-IT691.3	
PCC-IT691.4	
PCC-IT691.5	
PCC-IT691.6	

Laboratory Experiments:
1. Basics of neural networks and related problems
2. Solving regression problems
3.Supervised learning for classification
4.Feature selection techniques and applications

5.Unsupervised learning – clustering
6. Ensemble techniques - Bagging and Boosting
7.Bayesian network
8. Mini Project

Cloud and Edge Computing Lab

Code: PCC-IT693

Contacts: 4P

Name of the Course**:**	Cloud and Edge Computing Lab
Course Code: PCC-IT693	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

1: Introduction to Virtualization (Windows)

1. Install **VMware** or **VirtualBox** on Windows.
2. Create and configure virtual machines (VMs) with **Linux or Windows OS**.
3. Explore VM settings (CPU, memory, storage, and network configurations).

2: Setting up Development Environment on VM (Windows)

1. Install **GCC (MinGW)** and **Code::Blocks** or **Visual Studio Code** on the virtual machine.
2. Write, compile, and execute a basic C/C++ program.
3. Understand debugging in **Code::Blocks/Visual Studio**.
4. Practice command-line compilation using `gcc`.

3: Introduction to Cloud Platforms and Google App Engine (GAE)

1. Install **Google Cloud SDK** on the virtual machine.
2. Set up **Google App Engine (GAE)** for Python or Java.
3. Create and deploy a basic web application (e.g., "Hello World") on GAE.
4. Learn the basics of GAE deployment, scaling, and cloud configuration.

4: Git and GitHub for Version Control (Windows)

1. Install **Git** for Windows.
2. Set up a Git repository locally and perform basic operations (add, commit, push, pull).
3. Create a **GitHub** account, push repositories, and collaborate on a group project.
4. Explore branches, merges, and pull requests for collaboration.

5: CloudSim Installation and Basic Simulation

1. Download and install **CloudSim** on the virtual machine.
2. Set up a Java environment with **JDK** to run CloudSim.
3. Perform basic simulations using CloudSim to understand cloud resource allocation, VM management, and network topology.
4. Implement simple experiments simulating virtual cloud environments (resource provisioning, VM allocation, etc.).

Week 11: Advanced Web Application Development and Deployment on GAE

1. Develop a dynamic web application using **Python (Flask)/Java** on GAE.
2. Incorporate features like **user authentication**, **form handling**, and **database integration** using **Google Cloud Datastore** or **Firestore**.
3. Deploy the enhanced web application to GAE.
4. Understand GAE logs and monitoring tools.

Week 12: Final Project and Submission

1. Design and develop a cloud-based application, integrating concepts like virtualization, cloud deployment, and GitHub collaboration.
2. Perform cloud resource management simulations using CloudSim.
3. Submit project documentation via GitHub and deploy the application to GAE for final presentation.

Internet of Things Lab
Code: PCC-IT694

Contacts: 4P

Name of the Course**:**	**Internet of Things Lab**
Course Code: PCC-IT694	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: hrs./week	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2

1. Basic understanding of the sensors
2. Build a stream reasoner over HTTP/FTP/MQTT
3. Basic circuit on Aurdino using bread board
4. Basic circuit on Rasbery Pi using bread board
5. Convert Time series data obtained from temperature sensor into XML
6. Convert Time series data obtained from temperature sensor into JSON
7. Store time series data (temperature of college) to cloud
8. Design of time series analysis algorithms (3 methods)
9. Switch on LED based on temparature
10. Send SMS from R-Pi/Aurdino based on temperature threshold.

SEMESTER – VII

Name of the Course:	**Big Data Analytics**	
Course Code: PEC-IT701A	Semester:VII	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

COURSE OBJECTIVE	
Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools	
LECTURE WITH BREAKUP	**NO. OF LECTUR**

Unit 1: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8
Unit 2: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8
Unit 3: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9
Unit 4: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10
Unit 5:	7
Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	
Unit 6: Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	6

References:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.

8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
Alan Gates, "Programming Pig", O'Reilley, 2011

Course Outcomes:

PEC-IT701A.1	Identify Big Data and its Business Implications.
PEC-IT701A.2	List the components of Hadoop and Hadoop Eco-System
PEC-IT701A.3	Manage Job Execution in Hadoop Environment
PEC-IT701A.4	Develop Big Data Solutions using Hadoop Eco System
PEC-IT701A.5	Analyze Info sphere Big Insights Big Data Recommendations.
PEC-IT701A.6	Apply Machine Learning Techniques using R

Cyber Physical System

Code: PEC-IT701B
Contacts: 3L

Name of the Course:	Cyber Physical System	
Course Code: PEC-IT701B	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance : 5 marks
Practical:NIL		End Semester Exam :70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit

1	Introduction: Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS, Industry 4.0, IIOT implications, Smart Manufacturing, Smart transport, Smart City.	3	
2	CPS Platform components: CPS HW platforms, Processors, Sensors and Actuators, CPS Network - Wireless, CAN, Automotive Ethernet, Scheduling Real Time CPS tasks, Synchronous Model and Asynchronous Model, 5C Architecture, Self X Capabilities.	5	
3	Automated Control Design: Dynamical Systems and Stability, Controller Design Techniques, Stability Analysis: CLFs, MLFs, stability under slow switching, Performance under Packet drop and Noise	6	
4	Communication Protocols: Networking protocols, Communication protocols, Communication standards, Comparative analysis, Semantic ontology, Interoperability	4	
5	Implementation: Embedded System vs IoT vs CPS, Features to software components, mapping software components to ECUs, Performance Analysis - effect of scheduling, bus latency, sense and actuation faults on control performance, network congestion, Control, Bus and Network Scheduling using Truetime	5	
6	Modeling and Design: Design of CPS, OPC-UA/MT Connect, Digital twins of physical system, Computational system, Tools and techniques, Design & Fundamental requirements.	5	
7	Security of Cyber: Physical Systems: Introduction to CPS Securities, Basic Techniques in CPS Securities, Cyber Security Requirements, Attack Model and Countermeasures, Advanced Techniques in CPS Securities.	4	
8	CPS Application: Health care and Medical Cyber-Physical Systems, Smart grid and Energy Cyber-Physical Systems, WSN based Cyber-Physical Systems, Smart Cities, CPPS & Agent based system for implementation.	4	

Text book and Reference books:

Deep Learning

Code: PEC-IT701C
Contacts: 3L

Name of the Course:	**Neural Networks and Deep Learning**	
Course Code: PEC-IT701C	Semester: VII	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz : 10 marks
		Attendance: 5 marks
Practical:		End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction**: Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.	3	
2	**Feed forward neural network**: Artificial Neural Network, activation function, multi-layer neural network. Cardinality, operations, and properties of fuzzy relations.	6	
3	**Training Neural Network**: Risk minimization, loss function, back propagation, regularization, model selection, and optimization.	6	
4.	**Conditional Random Fields**: Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	9	
5	**Deep Learning**: Deep Feed Forward network, regularizations, training deep models, dropouts, Convolution Neural Network, Recurrent Neural Network, Deep Belief Network.	6	
6	**Deep Learning research:** Object recognition, sparse coding, computer vision, natural language	6	

Text book and Reference books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.

2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
6. Rajiv Chopra, Deep Learning, Khanna Publishing House, 2018.

Course Outcomes:

PEC-IT701C.1	Understand intuitively the mathematical and geometrical basis of how NN work and learn
PEC-IT701C.2	Critically review the performance and applications of neural network and deep learning techniques.
PEC-IT701C.3	Implement a systematic approach to design and evaluate neural network architecture.
PEC-IT701C.4	Interpret relevant mathematical equations or statistical methodologies in terms of neural network architecture and deep learning methods.
PEC-IT701C.5	Investigate and apply knowledge discovery processes and associated models to innovate deep learning applications considering the importance of data privacy and professional ethics to support and provide business solutions.
PEC-IT701C.6	Extrapolate knowledge and skills to design, develop, and evaluate a variety of deep learning tasks: modelling, clustering, dimensionality reduction, regression or classification.

Human Computer Interaction
Code: PEC-IT701D
Contacts: 3L

Name of the Course:		**Human Computer Interaction**	
Course Code: PEC-IT701D		Semester: VII	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme			**Examination Scheme**
Theory:3 hrs./week			Mid Semester exam: 15
Tutorial: NIL			Assignment and Quiz: 10 marks
			Attendance : 5 marks
Practical: NIL			End Semester Exam :70 Marks
Credit Points:	3		
Objective:			
1	Learn the foundations of Human Computer Interaction		
2	Be familiar with the design technologies for individuals and persons with disabilities		
3	Be aware of mobile Human Computer interaction		
4	Learn the guidelines for user interface.		

Pre-Requisite:	
1	Computer Organization &Architecture

Unit	Content	Hrs/Unit	Marks/ Unit
1	Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	9	
2	Interactive Design basics – process – scenarios – navigation – screen design –Iteration and prototyping. HCI in software process – software life cycle–usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	11	
3.	Cognitive models –Socio-Organizational issues and stake holder requirements–Communication and collaboration models-Hypertext, Multimedia and WWW.	8	
4.	Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8	
5.	Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	8	
6.	Recent Trends: Speech Recognition and Translation, Multimodal System	3	

Text book and Reference books:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett

2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Course Outcomes:

PEC-IT701D.1	Describe and apply core theories, models and methodologies from the field of HCI.
PEC-IT701D.2	Describe what the user-centered design cycle is and explain how to practice this approach to design interactive software system.
PEC-IT701D.3	Analyze one after another the main features of interactive systems, and explain how to gauge the usability of digital environments, tools and interfaces
PEC-IT701D.4	Conduct user and task analysis
PEC-IT701D.5	Implement graphical user interfaces with modern software tools

PEC-IT701D.6	Critique and evaluate interactive software using guidelines from human factor theories

Project Management and Entrepreneurship
Code: HSMC -IT701
Contact: 2L+1T

Name of the Course:	Project Management and Entrepreneurship
Course Code: HSMC 701	Semester: VII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: 1hr	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	2

ENTREPRENEURSHIP

1. Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks [2L]
2. Entrepreneurship – An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur [2L]
3. Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand-supply analysis [4L]
4. Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies [2L]
5. Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures – bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation – SISI, KVIC, DGFT, SIDBI, Defense and Railways [4L]
6. Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L]
7. Applications and Project Reports Preparation [4L]

8. **PROJECT MANAGEMENT** : Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L]

9. Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of

Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L]

10. Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L]
11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L]
12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]
13. Case Studies with Hands-on Training on MS-Project [4L]

Text Books and References

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI

Course Outcomes:

HSMC-IT 701.1	Understand project characteristics and various stages of a project.
HSMC-IT 701.2	Understand the conceptual clarity about project organization and feasibility analyses
HSMC-IT 701.3	Analyze the learning and understand techniques for Project planning, scheduling and Execution Control
HSMC-IT 701.4	Apply the risk management plan and analyze the role of stakeholders.
HSMC-IT 701.5	Understand the contract management, Project Procurement, Service level Agreements and productivity.
HSMC-IT 701.6	Understand the How Subcontract Administration and Control are practiced in the Industry.

Project-1
Code: PROJ-IT781
Contact: 12

Name of the Course:	**Project-1**
Course Code: PROJ-IT 781	Semester: VII
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	**Examination Scheme**
	Assessment of Supervisor: 40 marks
Practical: 12 hrs/week	End semester viva, presentation and

		project report:	70 Marks
Credit Points:	6		

Course Outcomes:

PROJ-IT 781.1	Demonstrate a sound technical knowledge of their selected project topic.
PROJ-IT 781.2	Undertake problem identification, formulation and solution.
PROJ-IT 781.3	Design engineering solutions to complex problems utilising a systems approach.
PROJ-IT 781.4	Conduct an engineering project.
PROJ-IT 781.5	Communicate with engineers and the community at large in written an oral forms.
PROJ-IT 781.6	Demonstrate the knowledge, skills and attitudes of a professional engineer.

SEMESTER – VIII

PEC-IT801A
Augmented & Virtual Reality
Lecture Hours: 36

UNIT I: Introduction of Virtual Reality: Fundamental Concept and Components of Virtual Reality - Primary Features and Present Development on Virtual Reality - Multiple Models of Input and Output Interface in Virtual Reality: Input - Tracker - Sensor - Digital Glove - Movement Capture - Video-based Input - 3D Menus & 3DScanner – Output - Visual /Auditory / Haptic Devices. [8]

UNIT II: Visual Computation in Virtual Reality: Fundamentals of Computer Graphics - Software and Hardware Technology on Stereoscopic Display - Advanced Techniques in CG: Management of Large Scale Environments & Real Time Rendering. [6]

UNIT III: Interactive Techniques in Virtual Reality: Body Track - Hand Gesture - 3D Manus - Object Grasp. Development Tools and Frameworks in Virtual Reality: Frameworks of Software Development Tools in VR. X3D Standard; Vega - MultiGen - Virtools. [8]

UNIT IV: Application of VR in Digital Entertainment: VR Technology in Film and TV Production - VR Technology in Physical Exercises and Games - Demonstration of Digital Entertainment by VR. [6]

UNIT V: Augmented and Mixed Reality: Taxonomy - technology and features of augmented reality - difference between AR and VR - Challenges with AR - AR systems and functionality - Augmented reality methods - visualization techniques for augmented reality - wireless displays in educational augmented reality applications - mobile projection interfaces - marker-less tracking for augmented reality - enhancing interactivity in AR environments - evaluating AR systems. [8]

Subject: CYBER SECURITY AND ETHICAL HACKING
Code: PEC IT 801B
Lecture Hours: 38

MODULE – I : Introduction: Hacking Impacts, The Hacker Framework: Planning the test, Sound Operations, Reconnaissance, Enumeration, Vulnerability Analysis, Exploitation, Final Analysis, Deliverable, Integration Information Security Models: Computer Security, Network Security, Service Security, Application Security, Security Architecture Information Security Program: The Process of Information Security, Component Parts of Information Security Program, Risk Analysis and Ethical Hacking [9]

MODULE – II : The Business Perspective: Business Objectives, Security Policy, Previous Test Results, Business Challenges Planning for a Controlled Attack: Inherent Limitations, Imposed Limitations, Timing is Everything, Attack Type, Source Point, Required Knowledge, Multi-Phased Attacks, Teaming and Attack Structure, Engagement Planner, The Right Security Consultant, The Tester, Logistics, Intermediates, Law Enforcement [10]

MODULE – III : Preparing for a Hack: Technical Preparation, Managing the Engagement Reconnaissance: Social Engineering, Physical Security, Internet Reconnaissance [4]

MODULE – IV : Enumeration: Enumeration Techniques, Soft Objective, Looking Around or Attack, Elements of Enumeration, Preparing for the Next Phase Exploitation: Intutive Testing, Evasion, Threads and Groups, Operating Systems, Password Crackers, RootKits, applications, Wardialing, Network, Services and Areas of Concern [8]

MODULE -V : Deliverable: The Deliverable, The Document, Overal Structure, Aligning Findings, Presentation Integration: Integrating the Results, Integration Summary, Mitigation, Defense Planning, Incident Management, Security Policy, Conclusion [7]

Subject: Computational Geometry
Code: PEC IT 801C
Lecture Hours: 30

Module 1

Introduction (collinear points, closest pair of points)
Geometric primitives (area of triangle, orientation, segment intersection) [6]

Module II

Convex hulls in 2D (naive, gift wrapping, quickhull, Graham scan, incremental, divide-and-conquer; lower bound)
Convex hulls in 3D [6]

Module III

Segment intersection (Bentley-Ottman sweep)

Art gallery problem. Fisk's sufficiency proof.

Polygon triangulation (quadratic, based on ear removal algorithm; triangulation of monotone polygons; polygon triangulation in O(n lg n) via trapezoidalization). [8]

Module IV

Geometric searching (orthogonal range searching with kd-trees and range trees).

Voronoi diagrams and Delaunay triangulations.

Combinatorial motion planning in 2D (C-space and C-obstacles; planning via graph search; visibility graph)

Heuristical motion planning (grid-based techniques, sampling, PRM, RRT) [10]

PEC-IT801D
Social Network Analysis
Lecture Hours: 36

Unit-I: INTRODUCTION: Introduction to Semantic Web: Limitations of current Web – Development of Semantic Web – Emergence of the Social Web – Social Network analysis: Development of Social Network Analysis – Key concepts and measures in network analysis – Electronic sources for network analysis: Electronic discussion networks, Blogs and online communities – Web-based networks – Applications of Social Network Analysis. [6]

Unit-II: MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION Ontology and their role in the Semantic Web: Ontology-based knowledge Representation – Ontology languages for the Semantic Web: Resource Description Framework – Web Ontology Language – Modelling and aggregating social network data: State-of-the-art in network data representation – Ontological representation of social individuals – Ontological representation of social relationships – Aggregating and reasoning with social network data – Advanced representations.

[8]

Unit-III: EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS

Extracting evolution of Web Community from a Series of Web Archive – Detecting communities in social networks – Definition of community – Evaluating communities – Methods for community detection and mining – Applications of community mining algorithms – Tools for detecting communities social network infrastructures and communities – Decentralized online social networks – Multi-Relational characterization of dynamic social network communities. **[6]**

Unit-IV: PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES

Understanding and predicting human behavior for social communities – User data management – Inference and Distribution – Enabling new human experiences – Reality mining – Context – Awareness – Privacy in online social networks – Trust in online environment – Trust models based on subjective logic – Trust network analysis – Trust transitivity analysis – Combining trust and reputation – Trust derivation based on trust comparisons – Attack spectrum and counter measures.

[8]

Unit-V: VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS

Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix representation – Visualizing online social networks, visualizing social networks with matrix-based representations – Matrix and Node-Link Diagrams – Hybrid representations – Applications – Cover networks – Community welfare – Collaboration networks – Co-Citation networks. [8]

TEXT BOOKS:

1. Peter Mika, ―Social Networks and the Semantic Web, First Edition, Springer 2007.
2. Borko Furht, ―Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010.

REFERENCES:

1. Guandong Xu ,Yanchun Zhang and Lin Li,-Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011.
2. Dion Goh and Schubert Foo,-Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.
3. Max Chevalier, Christine Julien and Chantal Soulé-Dupuy, Collaborative and Social Information Retrieval and Access: Techniques for Improved user Modelling, IGI Global Snippet, 2009.
4. John G. Breslin, Alexander Passant and Stefan Decker, -The Social Semantic Web, Springer, 2009.