CO Statements and Course Articulation Matrix for

B. Tech. (IT)

COURSE BOOKLET FOR B.TECH (IT)

FIRST YEAR

SEMESTER – I
THEORY

Course Title: Mathematics –IA	**Code: BS- M101**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 1st	**Contact Hours: 3L+1T/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Higher Secondary Mathematics.

COURSE OBJECTIVE:

- Understand different types of matrix, their eigen values and eigen vectors and rank which are essential for understanding of physical and engineering problems. In particular, apart from other uses eigen values and eigenvectors are particularly useful to determine natural frequencies (or eigen frequencies) of vibration, shapes of those vibrational modes and its stability.
- Understand transient nature of the physical world with the help of differential calculus, integral calculus, vector calculus as well as differential equation.
- Understand Mathematical tools such as successive derivate, series expansion of functions and evaluation of integrals by analytic techniques that are required for engineering problems and learn to reduce the computational complexity in problems of various engineering disciplines with the series expansion of functions.
- Understand the utility of integral transforms for solutions of circuit problems, control theories, data processing etc.
- Apply the knowledge to solve the real life problems prevalent in nature and physical world which comprises of several variables or attributes and identify extreme points of different surfaces of higher dimension and achieve skill on calculus of functions of several variables which are essential for engineering curriculums.
- Apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines through the application of different convergence tests and solve various problems of statics and dynamics related to engineering subjects by acquiring the knowledge of vector algebra and vector calculus.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
BS-M-101.CO1	**Learn** the basic mathematical tools to deal with problems of engineering sciences.	Remembering (Level I)
BS-M-101.CO2	**Understand** properties and application of Calculus and Linear Algebra.	Understanding (Level II)
BS-M-101.CO3	**Analyze** of physical or engineering problems.	Analyzing (Level IV)
BS-M-101.CO4	**Acquire** problem solving skills related to engineering science.	Understanding (Level II)
BS-M-101.CO5	**Apply** Calculus and Linear Algebra in real life problems.	Applying (Level III)
BS-M-101.CO6	**Classify** ensembles and differentiate between Calculus and Linear Algebra.	Analyzing (Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	0	0	0	0	0	0	0	0	0	2	2	-
CO2	2	3	3	0	0	0	0	0	0	0	0	0	2	2	-
CO3	2	3	3	0	0	0	0	0	0	0	0	0	2	2	-
CO4	3	1	3	0	0	0	0	0	0	0	0	0	2	2	-
CO5	3	2	1	0	0	0	0	0	0	0	0	0	2	2	-
CO6	3	2	2	0	0	0	0	0	0	0	0	0	2	2	-
AVG.	2.67	2.33	2.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	2.00	0

University Syllabus:

Unit	Content	Hrs/Unit
1	Calculus (Integration): Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	Calculus (Differentiation): Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	Matrices: Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	Vector Spaces: Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	Vector Spaces (Continued): Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

RESOURCE:

1. Higher Engineering Mathematics-Das & Pal
2. Engineerring Mathematics-Kar & Karmakar
3. Engineering Mathematics-B.S. Grewal
4. Fundamental of Engineering Mathematics: Mukherjee & Bej

Course Title: Physics-I	**Code: BS-PH101**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 1st	**Contact Hours: 3L+1T/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer:Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Basic Physics at 10+2 level.

COURSE OBJECTIVE:

- Once the student has successfully completed this course, he/she must be able to answer the following questions or perform/demonstrate the following:
- Knowledge on vector calculus. Theorems and applications of vector calculus. Computation of Line integral, Surface integral and Volume integral.
- Solving various kinds of problems related to Mechanics. Rigid body problems, harmonic oscillation related problems
- Solving different kinds of problems related to diffraction and polarization
- Differentiate between different types of light spectrum like single slit, double slit and plane transmission grating
- Solving various kinds of problems related to LASER
- Applying different application of LASER in daily day life of modern society
- Maxwell's equations and characteristics of time varying electromagnetic field.
- Derivation of wave equation for plane progressive electromagnetic wave and the properties of EM waves in different medium when the medium is perfect dielectric, perfect conductor or free space.
- Pointing vector and pointing theorem related to the flow of electromagnetic energy.
- Properties of different kinds of magnetic materials and their application, characteristic of para, ferro and dia magnetic substances
- Basic concept of Quantum mechanics
- Solving various kinds of quantum mechanical problems using Schrödinger Wave equation.
- Important application of Wave-Particle Duality in quantum mechanics.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
BS-PH101.CO1	**Apply** basic concepts of mechanics	Applying (Level III)
BS-PH101.CO2	**Discuss** Physical optics and study principles of lasers with applications	Creating (Level VI)
BS-PH101.CO3	**Categorize** di electric and magnetic properties of materials	Analyzing(Level IV)
BS-PH101.CO4	**Distinguish** between Classical Physics and Quantum Physics by introducing Planck's law	Analyzing(Level IV)
BS-PH101.CO5	**Apply** wave particle duality in real life problems followed by simple quantum mechanics calculations	Applying (Level III)
BS-PH101.CO6	**Explain** tthe mechanism of classical and Quantum statistical mechanics	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	-	-
CO2	1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	2	-	-
CO4	1	3	2	-	-	-	-	-	-	-	-	-	2	-	-
CO5	1	3	2	0	-	-	-	-	-	-	-	-	2	-	-
CO6	-	1	3	2	-	-	-	-	-	-	-	-	2	-	-
AVG.	1.80	2.33	1.83	1.00	0	0	0	0	0	0	0	0	2.00	0	0

University Syllabus:

Unit	Content	Hrs/Unit
1	Mechanics (7L) Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function F = -grad V, equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.	7
2	Optics (5L) Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits (only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications. Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity. Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .	5
3	Electromagnetism and Dielectric Magnetic Properties of Materials (8L) Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics. Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.	8
4	Quantum Mechanics (16L) Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.	16
5	Statistical Mechanics (8L) Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.	8

RESOURCE:

1. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker, Wiley
2. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
3. Textbook of Physical Optics, B. Ghosh, Laxmi Publications
4. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
5. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
6. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
7. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
8. Optics, Ghatak, McGraw Hill Education India Private Limited
9. Concepts of Modern Physics, A. Beiser,McGraw Hill Education; Seventh edition
10. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors

Course Title: Basic Electrical Engineering	**Code: ES-EE101**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 1st	**Contact Hours: 3L+1T/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Nil

COURSE OBJECTIVE:

- This course provides the student with the fundamental skills to understand the basic of semiconductor and components like diode, transistor, FET, MOSFET and operational amplifier.
- It will build mathematical and numerical background for design of electronics circuit & component value.
- Students equipped with the knowledge and training provided in the course will be able to participate in design, development and operation in the different area of electronics system.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
ES-EE101.CO1	**Understand** and analyze basic electric and magnetic circuits.	Understanding (Level II)
ES-EE101.CO2	**Apply** the working principles of electrical machines and power converters.	Applying (Level III)
ES-EE101.CO3	**Introduce** the components of low voltage electrical installations.	Remembering (Level I)
ES-EE101.CO4	**Analyze** the general structure of electrical power system.	Analyzing (Level IV))
ES-EE101.CO5	**Understand**the construction and operation of single-phase transformer.	Understanding (Level II)
ES-EE101.CO6	**Explain** the working principle of power converters.	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	-	2	1	-	-	2	1	-	2	3	1	1
CO2	3	3	3	-	2	1	-	-	2	1	-	1	2	2	1
CO3	3	3	3	-	1	1	-	-	2	-	-	2	3	2	1
CO4	3	3	3	-	3	2	-	-	2	1	-	2	3	2	2
CO5	3	3	3	-	3	2	-	-	2	-	-	1	3	3	2
CO6	3	3	3	-	3	2	-	-	2	1	-	1	3	2	1
AVG.	3.00	3.00	3.00	0	2.33	1.50	0	0	2.00	1.00	0	1.50	2.83	2.00	1.33

University Syllabus:

Unit	Content	Hrs/Unit
1	DC Circuits (8 hours) Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.	8
2	AC Circuits (8 hours) Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.	8

3	Transformers (6 hours) Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.	6
4	Electrical Machines (8 hours) Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.	8
5	Power Converters (6 hours) DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation	6
6	Electrical Installations (6 hours) Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.	6

RESOURCE

1. Sedra & Smith: Microelectronics Engineering.
2. Millman & Halkias: Integrated Electronics.
3. Malvino: Electronic Principle.
4. Schilling & Belove: Electronics Circuits.
5. Millman & Grabal: Microelectronics.
6. Salivahanan: Electronics Devices & Circuits.

SEMESTER I
PRACTICAL

Course Title: Physics-I Laboratory	**Code: BS-PH191**
Type of Course: Practical	**Course Designation: Compulsory**
Semester: 1st	**Contact Hours: 3P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Basic Physics and Mathematics

COURSE OBJECTIVE

1. The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipment.
3. Design of circuits using new technology and latest components and to develop practical applications of engineering materials and use of principle in the right way to implement the modern technology.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
BS-PH191.CO1	**Observe** and read data in slide calliper's, screw gauge. Calculate different modulus of elasticity to apply basic knowledge Physics of Elasticity and apply viscosity principle of streamline motion of water to calculate its viscosity coefficient required in fluid mechanics	Remembering (Level I)
BS-PH191.CO2	**Arrange** sequential connection in electrical experiment to verify principles of Kirchhoff's law to verify passive elements of electrical circuit	Applying (Level III)
BS-PH191.CO3	**Operate** optical instruments to illustrate physical properties of light and to observe spectral lines of light to verify medium specific characteristics. Calculate Rydberg constant by studying Hydrogen spectrum to visualize visible spectra and to assess this empirical fitting parameter as a fundamental physical constant	Applying (Level III)
BS-PH191.CO4	**Determine** Band Gap and Hall coefficient of a given intrinsic semiconductor and distinguish between different intrinsic semiconductors. Determine the dielectric constant of different capacitors to correlate their usage like insulator and limitation of their usage as a dielectric material.	Evaluating (Level V)
BS-PH191.CO5	**Apply** concepts of quantum mechanics to verify Bohr's atomic orbital theory.	Applying (Level III)
BS-PH191.CO6	**Determine** Planck's constant and Stefan's constant applying modern Physics.	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	-	-	-	-	-	-	-	-	2	-	-
CO2	2	3	1	1	-	-	-	-	-	-	-	-	2	-	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-	2	-	-
CO4	2	3	1	2	-	-	-	-	-	-	-	-	2	-	-
CO5	2	2	3	1	-	-	-	-	-	-	-	-	2	-	-
CO6	2	1	3	2	-	-	-	-	-	-	-	-	2	-	-
AVG.	2.00	2.33	2.00	1.33	0	0	0	0	0	0	0	0	2.00	**0**	**0**

University Syllabus:

Unit	Content
1	Experiments in Optics 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
2	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. To study current voltage characteristics, load response, areal characteristic and spectral response of a photovoltaic solar cell. 6. Determination of resistance of ballistic galvanometer by half deflection method and study of variation of logarithmic decrement with series resistance. 7. Determination of unknown resistance using Carey Foster's bridge 8. Study of Transient Response in LR, RC and LCR circuits using expeyes 9. Generating sound from electrical energy using expeyes
3	Experiments in Quantum Physics 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.
4	Miscellaneous experiments 1. Determination of Young's modulus of elasticity of the material of a bar by the method of flexure 2. Determination of bending moment and shear force of a rectangular beam of uniform cross-section 3. Determination of modulus of rigidity of the material of a rod by static method 4. Determination of rigidity modulus of the material of a wire by dynamic method 5. To determine the moment of inertia of a body about an axis passing through its centre of gravity and to determine the modulus of rigidity of the material of the suspended wire 6. Determination of coefficient of viscosity by Poiseulle's capillary flow method

RESOURCES

1. Practical Physics, Prof. B. Ghosh

Course Title: Basic Electrical Engineering Lab	**Code: ES-EE191**
Type of Course: Practical	**Course Designation: Compulsory**
Semester: 1st	**Contact Hours: 2P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Basic knowledge of circuit design.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
ES-EE191.CO1	**Calibrate** Ammeter and Wattmeter	Applying (Level III)
ES-EE191.CO2	**Demonstrate** the measuring instrument and electrical machines	Applying (Level III))
ES-EE191.CO3	**Conduct** open circuit and short circuit test of single-phase transformer	Understanding (Level II)
ES-EE191.CO4	**Measure** 3 phase power using two watt meters	Evaluating (Level V)
ES-EE191.CO5	**Identify** the components of LT switchgear	Remembering (Level I)
ES-EE191.CO6	**Understand** the characteristic of RLC series and parallel circuit	Understanding (Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	1	-	-	-	2	2	-	2	2	1	-
CO2	3	3	3	3	1	-	-	-	1	1	-	1	2	1	-
CO3	3	3	3	2	2	-	-	-	1	2	-	1	3	2	-
CO4	3	3	3	3	1	-	-	-	1	2	-	1	3	2	-
CO5	3	3	2	3	1	-	-	-	2	2	-	1	2	1	-
CO6	3	3	3	2	2	-	-	-	1	2	-	1	3	2	-
AVG.	3.00	3.00	2.83	2.67	1.33	0	0	0	1.33	1.83	0	1.17	2.50	1.50	0

University Syllabus:

Choose 10 experiments from the following:

Unit	Content
1	First activity: Introduction to basic safety precautions and mentioning of the do's and Don'ts. Noting down list of experiments to be performed, and instruction for writing the laboratory reports by the students. Group formation. Students are to be informed about the modalities of evaluation.
2	Introduction and uses of following instruments : (a) Voltmeter (b) Ammeter (c) Multimeter (d) Oscilloscope Demonstration of real life resistors, capacitors with color code, inductors and autotransformer.
3	Demonstration of cut-out sections of machines: DC machine, Induction machine, Synchronous machine and single phase induction machine.
4	Calibration of ammeter and Wattmeter.
5	Determination of steady state and transient response of R-L, R-C and R-L-C circuit to a step change in voltage.
6	Determination of steady state response of R-L and R-C and R-L-C circuit and calculation of impedance and power factor.
7	Determination of resonance frequency and quality factor of series and parallel R-L-C circuit.
8	(a) Open circuit and short circuit test of a single-phase transformer (b) Load test of the transformer and determination of efficiency and regulation

9	Demonstration of three phase transformer connections. Voltage and current relationship, phase shifts between the primary and secondary side.
10	Measurement of power in a three phase unbalanced circuit by two wattmeter method.
11	Determination of Torque –Speed characteristics of separately excited DC motor.
12	Determination of Torque speed characteristics and observation of direction reversal by change of phase sequence of connection of Induction motor.
13	Determination of operating characteristics of Synchronous generator.
14	Demonstration of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor.
15	Demonstration of components of LT switchgear.

Course Title: Workshop	**Code:ES-ME192**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 1st	**Contact Hours: 1L+4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Basic knowledge on Mathematics, physics

COURSE OBJECTIVE:

- Students will be able to manufacture components with their own hands.
- Accustomed with different manufacturing processes
- Able to make hardware (mechanical) part of their research work.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
ES-ME192.CO1	**Understanding** the applications of hand tools and machine tools.	Understanding (Level II)
ES-ME192.CO2	**Comprehend** the safety measures required to be taken while using the tools.	Understanding (Level II)
ES-ME192.CO3	**Select** the appropriate tools required to manufacture an object of predetermined shape and size considering least wastage and cost.	Understanding (Level II)
ES-ME192.CO4	**Fabricate** components with their own hands	Creating (Level VI)
ES-ME192.CO5	**Practical** knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes	Creating (Level VI)
ES-ME192.CO6	**Produce** small devices of their interest, by assembling different components,	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	-	-	-	-	-	-	-	-	-	1	-	1
CO2	1	-	-	-	-	1	-	1	-	-	1	-	1	-	1
CO3	1	-	-	-	-	1	-	1	1	-	2	-	1	-	1
CO4	1	-	-	-	-	-	2	-	2	1	1	-	-	1	1
CO5	1	-	-	-	-	-	2	-	2	1	1	1	1	-	1
CO6	1	-	-	-	-	-	2	-	2	1	2	1	-	1	1
AVG.	1.00	0	0	0	0	1.00	2.00	1.00	1.75	1.00	1.40	1.00	1.00	1.00	1.00

University Syllabus:

Unit	Content
1	**Lectures & videos: Detailed contents:** 1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods 2. CNC machining, Additive manufacturing 3. Fitting operations & power tools 4. Electrical &Electronics 5. Carpentry 6. Plastic moulding, glass cutting 7. Metal casting 8. Welding (arc welding & gas welding), brazing
2	**Workshop Practice:** **Machine shop (8 hours)** Typical jobs that may be made in this practice module: To make a pin from a mild steel rod in a lathe. To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine. Fitting shop (8 hours) Typical jobs that may be made in this practice module: To make a Gauge from MS plate. **Carpentry (8 hours)** Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like. **Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))** Typical jobs that may be made in this practice module: ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding. GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding. **Casting (8 hours)** Typical jobs that may be made in this practice module: One/ two green sand moulds to prepare, and a casting be demonstrated. **Smithy (4 hours)** Typical jobs that may be made in this practice module: A simple job of making a square rod from a round bar orlike. **Plastic moulding & Glass cutting (4 hours)** Typical jobs that may be made in this practice module: For plastic moulding, making at least one simple plastic component should be made. For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made. Electrical &**Electronics (8 hours)** **Familiarization with LT switchgear elements, making its sketches and noting down its specification.** Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable. Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point. Simple wiring exercise to be executed to understand the basic electrical circuit. Simple soldering exercises to be executed to understand the basic process ofsoldering. Fabrication of a single-phase full wave rectifier with a step down transformer using four diodes and electrolytic capacitor and to find its volt-ampere characteristics to understand basic electronic circuit fabrication.

RESOURCES:

1. M.L.BegemanandB.H.Amstead,"ManufacturingProcess"JohnWiley,1968
2. W.A.J.ChapmanandE.Arnold,"WorkshopTechnology"Vol.1,2&3
3. B.S.Rghuwanshi, "WorkshopTechnology"Vol.1&2–DhanptRaiandSons.
4. S.K.HajraChoudhury, "ElementsofWorkshopTechnology"MediaPromotersofPublishers
5. Khanna,O.P."WorkshopTechnology"DhanpatRaiPublications
6. S.Crawford"BasicEngineeringProcesses"Hodder&Stoughton

SEMESTER – II
THEORY

Course Title: Chemistry-1	**Code: BS-CH201**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 2nd	**Contact Hours: 3L+1T/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Overall knowledge of basic concepts of Chemistry as covered in Std XI & XII,Analytical & mathematical approach towards Chemistry

COURSE OBJECTIVE:

- Be able to understand principles of thermodynamics and thermochemical behavior of a reaction
- Be able to apply the fundamental knowledge of science and engineering to assess better fuel and design eco-friendly, efficient electrochemical cells.
- Be able to understand the reaction kinetics, types of defects in solid crystals, structure and reactivity of organic molecules, and polymeric structure to develop innovative technology
- Be able to solve scientific problem related to engineering chemistry

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
BS-CH201.CO1	**Apply** first and second law of thermodynamics to different chemical and physical processes under specified condition to determine the equilibrium condition, spontaneity and thermo-chemical behaviour of a reaction.	Applying (Level III)
BS-CH201.CO2	**Using** the concept of conductance of ions analyze the design and working principle of different electrochemical cells.	Applying (Level III)
BS-CH201.CO3	**Derive** rate of a reaction at a specified temperature under different medium	Analyzing (Level IV)
BS-CH201.CO4	**Explain** the mechanism considering the structure of the molecules and type of electronic effect present in them.	Evaluating (Level V)
BS-CH201.CO5	**Analyze** different types of fuels for industrial application.	Analyzing (Level IV)
BS-CH201.CO6	**Distinguish** different types of polymer for diverse application.	Analyzing (Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	1	1	1	-	-	-	-	-	-	-	-	1	-	-
CO6	3	1	1	1	-	-	-	-	-	-	-	-	1	-	-
AVG.	3.00	1.67	1.00	1.00	0	0	0	0	0	0	0	0	1.00	0	0

University Syllabus:

Unit	Content	Hrs/Unit
1	**Atomic and molecular structure (10 lectures)** Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.	10
2	**Spectroscopic techniques and applications (8 lectures)** Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.	8
3	**Intermolecular forces and potential energy surfaces (4 lectures)** Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena	4
4	**Use of free energy in chemical equilibria (8 lectures)** First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams	8
5	**Periodic properties (4 Lectures)** Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries	4
6	**Stereochemistry (4 lectures)** Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compound	4
7	**Organic reactions and synthesis of a drug molecule (4 lectures)** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.	4

RESOURCES:

1. Physical Chemistry, P. C. Rakshit, Sarat Book
2. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, De
3. Fuels and Combustion, Sarkar Samir
4. Engineering Chemistry (TMH WBUT Series), Paladhi,TMH
5. Engineering Chemistry, Sunita Ratan

Course Title: Mathematics –IIA	**Code: BS-M201**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 2nd	**Contact Hours: 3L+1T/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Basic Calculus.

COURSE OBJECTIVE:

- To teach different methods for solving ODE of first order first degree and first order higher degree and model many model many core engineering problems with applications of ODE and their solutions.
- Familiar with some basic properties of different types of graphs and applications in different models.
- Explain many core engineering topics with relevant mathematical theories using higher order and simultaneous linear differential equations and use of different algorithmic approach in graph theory.
- Familiar with the evaluation of some standard improper integrals and utility of Integral transforms (Laplace transform) for solutions of circuit problems, control theories, data processing etc.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
BS-M-201.CO1	**Learn** the basic mathematical tools to deal with problems of engineering sciences.	Remembering (Level I)
BS-M-201.CO2	**Understand** properties and application of Linear Algebra, Ordinary Differential Equations (ODE) and numerical analysis.	Understanding (Level II)
BS-M-201.CO3	**Analyze** of physical or engineering problems.	Analysing (Level IV)
BS-M-201.CO4	**Acquire** problem solving skills related to engineering science.	Understanding (Level II)
BS-M-201.CO5	**Apply** Linear Algebra, Ordinary Differential Equations (ODE) and Numerical analysis in real life problems.	Applying (Level III)
BS-M-201.CO6	**Classify** ensembles and differentiate among Linear Algebra, Ordinary Differential Equations (ODE) and numerical analysis.	Analysing (Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	3	1	-	-	-	-	-	-	-	3	1	-	-
CO2	2	2	3	1	-	-	-	-	-	-	-	3	2	-	-
CO3	3	3	3	1	-	-	-	-	-	-	-	3	1	-	-
CO4	3	2	3	2	-	-	-	-	-	-	1	3	3	1	-
CO5	3	2	3	2	-	-	-	-	-	-	2	3	3	1	-
CO6	3	2	3	2	-	-	-	-	-	-	2	3	3	2	-
AVG.	2.83	2.17	3	1.5	0	0	0	0	0	0	1.67	3.00	2.17	1.33	0

University Syllabus:

Unit	Content	Hrs/Unit
1	**Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11
2	**Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4
3	**Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5
4	**Basic Statistics:** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation	8
5	**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8
6	**Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4

RESOURCE

1. Advanced Engineering Mathematics, Erwin Kreyszig, (Wiley Eastern)
2. Graph Theory: V. K. Balakrishnan, (Schaum's Outline, TMH)
3. A first course at Graph Theory: J. Clark and D. A. Holton (Allied Publishers LTD)
4. Introduction to Graph Theory: D. B. West (Prentice-Hall of India)
5. Graph Theory: N. Deo (Prentice-Hall of India)
6. Engineering Mathematics: B.S. Grewal (S. Chand & Co.)

Course Title: English	**Code: HM-HU201**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 2nd	**Contact Hours: 2L/week**
Continuous Assessment:25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Nil

COURSE OBJECTIVE:

- To inculcate a sense of confidence in the students.
- To help them become good communicators both socially and professionally.
- To assist them to enhance their power of Technical Communication.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
HM-HU201.CO1	**Understand** and apply English Speech Sounds for enhancing English Communication	Understanding (Level II)
HM-HU201.CO2	**Apply** English Language Presentation Skill in Academic and in Professional Communication	Understanding (Level II)
HM-HU201.CO3	**Apply** Receptive Skills of English in Academics and in Engineering Profession	Developing (Level III))
HM-HU201.CO4	**Develop**Writing Skill of English in Academics and in Profession	Creating (Level VI)
HM-HU201.CO5	**Formulate**Grammar Skill of English in Academic and in Professional Communication	Developing (Level III)
HM-HU201.CO6	**Analyze** Critical Thinking Skill of English in Academic and in professionional Communication	Analyzing(Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO2	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO3	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO4	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO5	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO6	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
AVG.	2	2	2	2	2	2	0	2	0	3	0	2	1	1	0

University Syllabus :

Unit	Content
1	**Vocabulary Building** 1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending. 1.2 Root words from foreign languages and their use in English 1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. 1.4 Synonyms, antonyms, and standard abbreviations: Acronyms
2	**Basic Writing Skills** 2.1 Sentence Structures & Types: Simple, Compound, Complex 2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration 2.3 Importance of proper punctuation 2.4 Creating coherence: Arranging paragraphs & Sentences in logical order 2.5 Creating Cohesion: Organizing principles of paragraphs in documents 2.6 Techniques for writing precisely
3	**Identifying Common Errors in Writing** 3.1 Subject-verb agreement 3.2 Noun-pronoun agreement 3.3 Misplaced modifiers 3.4 Articles 3.5 Prepositions 3.6 Redundancies 3.7 Clichés
4	**Nature and Style of sensible Writing** 4.1 Describing 4.2 Defining 4.3 Classifying 4.4 Providing examples or evidence 4.5 Writing introduction and conclusion
5	**Writing Practices** 5.1 Comprehension 5.2 Précis Writing 5.3 Essay Writing 5.4 Business Letter, Cover Letter & CV; E-mail

RESOURCES:

1. Nira Konar: English Language Laboratory: A Comprehensive Manual PHI Learning, 2011
2. D. Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing
3. Pearson Education (W.B. edition), 2011
4. Adrian Duff et. al. (ed.): Cambridge Skills for Fluency
    a. Speaking (Levels 1-4 Audio Cassettes/Handbooks)
    b. Listening (Levels 1-4 Audio Cassettes/Handbooks) Cambridge University Press 1998
5. Mark Hancock: English Pronunciation in Use
        i. 4 Audio Cassettes/CD'S OUP 2004

Course Title: Programming for Problem Solving	**Code: ES-CS201**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 2nd	**Contact Hours: 3L+1T/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Basic knowledge on computer.

COURSE OBJECTIVE:

- The course is designed to provide complete knowledge of C language.
- Students will be able to develop logics which will help them to create programs, applications in C.
- Also by learning the basic programming constructs they can easily switch over to any other language in future.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
ES-CS201.CO1	**Formulate** simple algorithms for arithmetic and logical problems and translating the algorithms to programs	Creating (Level VI)
ES-CS201.CO2	**Test** and executing the programs and chooseing correct syntax and logical errors.	Analysing (Level IV)
ES-CS201.CO3	**Implement** conditional branching, iteration and recursion.	Creating (Level VI)
ES-CS603.CO4	**Decompose** a problem into functions and synthesize a complete program using divide and conquer approach.	Analysing (Level IV)
ES-CS201.CO5	**Apply** arrays, pointers and structures to formulating the algorithms and the programs.	Applying(Level III)
ES-CS201.CO6	**Apply** programming to solve matrix addition and multiplication problems and searching and sorting problems.	Applying(Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	2	-	2	3	-	1	1	3	1	1
CO2	3	1	1	1	3	-	-	2	3	-	2	-	3	1	2
CO3	3	2	3	1	-	-	-	2	3	3	1	-	3	1	1
CO4	3	2	3	2	-	2	-	3	3	-	1	2	3	3	1
CO5	3	1	1	1	-	-	-	2	3	-	2	-	3	1	1
CO6	3	2	3	3	1	2	2	3	3	-	2	2	3	3	2
AVG.	3.00	1.50	2.00	1.50	2.00	2.00	2.00	2.33	3.00	3.00	1.50	1.67	3.00	1.67	1.33

University Syllabus:

Unit	Content	Hrs/Unit
1	**Introduction to Programming** (4 lectures) Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - (1 lecture). Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. (1 lecture) From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- (2 lectures)	8
2	**Arithmetic expressions and precedence** (2 lectures)	2
3	**Conditional Branching and Loops** (6 lectures) Writing and evaluation of conditionals and consequent branching (3 lectures) Iteration and loops (3 lectures)	6
4	**Arrays** (6 lectures) Arrays (1-D, 2-D), Character arrays and Strings	6
5	**Basic Algorithms** (6 lectures) Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)	6
6	**Function** (5 lectures) Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference	5
7	**Recursion** (4 -5 lectures) Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.	5
8	**Structure** (4 lectures) Structures, Defining structures and Array of Structures	4
9	**Pointers** (2 lectures) Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)	2
10	**File handling** (only if time is available, otherwise should be done as part of the lab)	

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 C”
4. Kanetkar Y. “Let us C”
5. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

SEMESTER – II
PRACTICAL

Course Title: Chemistry-I Lab	**Code: BS-CH291**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester:2nd	**Contact Hours: 3P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Overall Knowledge about the basic concepts of chemistry as covered in class 11th& 12th Standard. Analytical & mathematical approach towards Chemistry.

COURSE OBJECTIVE:

- Be able to understand basic principles of chemical analysis
- Be able to apply the fundamental knowledge of science and engineering and skill to solve scientific problems

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
BS-CH291.CO1	**Determine** the strength of an acid using volumetric, method.	Evaluating (Level V)
BS-CH291.CO2	**Define** the strength of an acid using conductometric method.	Remembering (Level I)
BS-CH291.CO3	**Measure** the strength of an acid using pH-metric methods	Evaluating (Level V)
BS-CH291.CO4	**Explain** some physical property like partition coefficient of a compound and viscosity of a solution at room temperature	Evaluate (Level V)
BS-CH291.CO5	**Estimate** the amount of an ion present in a given solution using permanganometric and argentometric methods	Creating (Level VI)
BS-CH291.CO6	**Evaluate** alkalinity (in terms of CaCO3 equivalent), hardness (in ppm) and amount of dissolved oxygen (in mg/l) present in a given water sample using volumetric method	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	-	1	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	1	-	-
CO5	3	1	1	1	-	-	-	-	-	-	-	-	1	-	-
CO6	3	1	1	1	-	-	-	-	-	-	-	-	1	-	-
AVG.	3.00	1.67	1.00	1.00	0	0	0	0	0	0	0	0	1.00	0	0

University Syllabus:

Choose 10 experiments from the following:

Unit	Content
1	Conductometric titration for determination of the strength of a given HCl solution by titration against a standard NaOH solution.
2	pH- metric titration for determination of strength of a given HCl solution against a standard NaOH solution
3	Determination of dissolved oxygen present in a given water sample
4	To determine chloride ion in a given water sample by Argentometric method (using chromate indicator solution)
5	Determination of surface tension and viscosity
6	Thin layer chromatography
7	Ion exchange column for removal of hardness of water
8	Determination of the rate constant of a reaction
9	Determination of cell constant and conductance of solutions`
10	Potentiometry - determination of redox potentials and emfs
11	Saponification/acid value of an oil
12	Chemical analysis of a salt
13	Determination of the partition coefficient of a substance between two immiscible liquids
14	Adsorption of acetic acid by charcoal
15	Use of the capillary viscosimeters to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

RESOURCES:

1. Quantitative and qualitative analysis, by A.I. Vogel
2. Engineering Chemistry Practical by Sudha Rani

Course Title: Language Laboratory	**Code: HM-HU291**
Type of Course: Practical	**Course Designation: Compulsory**
Semester: 2nd	**Contact Hours: 2P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Nil

COURSE OBJECTIVE:

- To inculcate a sense of confidence in the students.
- To help them become good communicators both socially and professionally.
- To assist them to enhance their power of Technical Communication.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
HM-HU291.CO1	**Understand** and apply English Speech Sounds for enhancing English Communication	Understanding (Level II)
HM-HU291.CO2	**Apply** English Language Presentation Skill in Academic and in Professional Communication	Understanding (Level II)
HM-HU291.CO3	**Apply** Receptive Skills of English in Academics and in Engineering Profession	Developing (Level III))
HM-HU291.CO4	**Develop** Writing Skill of English in Academics and in Profession	Creating (Level VI)
HM-HU291.CO5	**Formulate** Grammar Skill of English in Academic and in Professional Communication	Developing (Level III)
HM-HU291.CO6	**Analyze** Critical Thinking Skill of English in Academic and in professionional Communication	Analyzing(Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO2	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO3	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO4	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO5	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
CO6	2	2	2	2	2	2	-	2	-	3	-	2	1	1	-
AVG.	2	2	2	2	2	2	0	2	0	3	0	2	1	1	0

University Syllabus:

Unit	Content
1	Honing 'Listening Skill' and its sub skills through Language Lab Audio device;
2	Honing 'Speaking Skill' and its sub skills
3	Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech
4	Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode)
5	Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success
6	G D Practice Sessions for helping them internalize basic Principles (turn- taking, creative intervention, by using correct body language, courtesies & other soft skills) of GD
7	Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non Technical Passages Learning Global / Contextual / Inferential Comprehension;
8	Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions

RESOURCES:

1. Nira Konar: English Language Laboratory: A Comprehensive Manual PHI Learning, 2011
2. D. Sudharani: Advanced Manual for Communication Laboratories & Technical Report Writing
3. Pearson Education (W.B. edition), 2011
4. Adrian Duff et. al. (ed.): Cambridge Skills for Fluency
    A) Speaking (Levels 1-4 Audio Cassettes/Handbooks)
    B) Listening (Levels 1-4 Audio Cassettes/Handbooks) Cambridge University Press 1998
5. Mark Hancock: English Pronunciation in Use
    i. 4 Audio Cassettes/CD'S OUP 2004

Course Title: Programming for Problem Solving	**Code: ES-CS291**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 2nd	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: basic knowledge on computer

COURSE OBJECTIVE:

- Use the fundamentals of C programming in trivial problem solving
- Enhance skill on problem solving by constructing algorithms.
- Identify solution to a problem and apply control structures and user defined functions for solving the problem
- Apply skill of identifying appropriate programming constructs for problem solving

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
ES-CS291.CO1	**Translate** given algorithms to a working and correct program.	Understanding (Level II)
ES-CS291.CO2	**Identify** and correct syntax errors or logical errors encountered at combile time or run time.	Remembering (Level I)
ES-CS291.CO3	**Write** iterative programs.	Creating (Level VI)
ES-CS291.CO4	**Build** program using function and recursion.	Developing (Level III)
ES-CS291.CO5	**Implement** different Operations on arrays, string, pointers.	Creating (Level VI)
ES-CS291.CO6	**Apply** structures, unions and files to solve a problem.	Developing (Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	2	-	2	3	-	1	1	3	1	1
CO2	3	1	1	1	3	-	-	2	3	-	2	-	3	1	2
CO3	3	2	3	1	-	-	-	2	3	3	1	-	3	1	1
CO4	3	2	3	2	-	2	-	3	3	-	1	2	3	3	1
CO5	3	1	1	1	-	-	-	2	3	-	2	-	3	1	1
CO6	3	2	3	3	1	2	2	3	3	-	2	2	3	3	2
AVG.	3.00	1.50	2.00	1.50	2.00	2.00	2.00	2.33	3.00	3.00	1.50	1.67	3.00	1.67	1.33

University Syllabus:

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

Unit	Content
1	Tutorial 1: Problem solving using computers: Lab1: Familiarization with programming environment
2	Tutorial 2: Variable types and type conversions: Lab 2: Simple computational problems using arithmetic expressions
3	Tutorial 3: Branching and logical expressions: Lab 3: Problems involving if-then-else structures
4	Tutorial 4: Loops, while and for loops: Lab 4: Iterative problems e.g., sum of series
5	Tutorial 5: 1D Arrays: searching, sorting: Lab 5: 1D Array manipulation
6	Tutorial 6: 2D arrays and Strings Lab 6: Matrix problems, String operations
7	Tutorial 7: Functions, call by value: Lab 7: Simple functions
8	Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration): Lab 8 and 9: Programming for solving Numerical methods problems
9	Tutorial 10: Recursion, structure of recursive calls Lab 10: Recursive functions
10	Tutorial 11: Pointers, structures and dynamic memory allocation Lab 11: Pointers and structures
11	Tutorial 12: File handling: Lab 12: File operations

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 C”
4. Kanetkar Y. “Let us C”
5. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Course Title: Engineering Graphics & Design	**Code: ES-ME292**
Type Of Course: Sessional	**Course Designation: Compulsory**
Semester: 2nd	**Contact Hours: 1L+4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Basic knowledge on drawing.

COURSE OBJECTIVE:

- Engineering drawing being the principle method of communication for engineers, the objective is to introduce the students, the techniques of constructing the various types of polygons, curves and scales.
- The objective is also to visualize and represent the 3D objects in 2D planes with proper dimensioning, scaling etc.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
ES-ME292.CO1	**Understand** the applications of hand tools and machine tools.	Understanding(Level II)
ES-ME292.CO2	**Comprehend** the safety measures required to be taken while using the tools.	Creating(Level VI)
ES-ME292.CO3	**Select** the appropriate tools required to manufacture an object of predetermined shape and size considering least wastage and cost.	Evaluate (Level V)
ES-ME292.CO4	**Fabricate** components with their own hands.	Creating(Level VI)
ES-ME292.CO5	**Confident** on practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	Understanding(Level II)
ES-ME292.CO6	**Produce** small devices of their interest by assembling different components.	Creating(Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	2	-	1	1	-	2	2	-	-	-	1	1	-
CO2	2	2	2	-	1	1	-	-	-	-	-	-	1	1	-
CO3	2	2	2	-	-	-	-	2	2	-	-	-	1	-	-
CO4	-	2	2	-	1	1	-	2	2	-	-	-	-	1	-
CO5	-	2	2	-	1	1	-	2	2	-	-	-	1	-	-
CO6	-	1	2	-	-	-	-	-	2	-	-	-	-	1	-
AVG.	2.00	2.00	2.00	0	1.00	1.00	0	2.00	2.00	0	0	0	1.00	1.00	0

University Syllabus:

Unit	Content
1	**INTRODUCTION TO ENGINEERING DRAWING** Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes
2	**LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales.
3	**GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral.
4	**PROJECTION OF POINTS, LINES, SURFACES** Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle, pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.
5	**PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).
6	**COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.
7	**ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;
8	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)
9	**OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION& CAD DRAWING** listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;
10	**ANNOTATIONS, LAYERING & OTHER FUNCTIONS** applying dimensions to objects, applying annotations to drawings; 10 Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;
11	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid- modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM)

COURSE BOOKLET FOR B.TECH (IT)

SECOND YEAR

SEMESTER – III
THEORY

Course Title: Analog & Digital Electronics	**Code:ESC 301**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Class XII Mathematics, Physics, Basic knowledge of Computer, Basic Electronics, Basic Electrical.

COURSE OBJECTIVE:

- Explain the principles of analog and digital systems.
- Compare the performance of the digital system over the analog system.
- Prepare analog as well as digital logic circuits.
- Creating a hardware module with some specific application.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
ESC301.CO1	**Demonstrate** the concepts of digital circuits	Understanding (Level II)
ESC301.CO2	**Discuss** between analog and digital system.	Creating (Level VI)
ESC301.CO3	**Develop** the analog circuits to determine for a given outputs.	Creating (Level VI)
ESC301.CO4	**Explain** the different model of analog and digital logic circuits.	Evaluating (Level V)
ESC301.CO5	**Analyze** the outputs for given inputs for particular analog and digital circuits.	Analysing (Level VI)
ESC301.CO6	**Explain** the principle of different analog and digital electronics circuits.	Understanding (Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	2	2	3	2	3	-	2	3	3	2
CO2	3	2	1	1	2	-	-	3	3	1	1	3	3	2	3
CO3	3	2	3	1	1	-	-	2	3	2	2	2	3	2	3
CO4	3	3	3	2	-	-	-	3	3	2	2	2	3	2	3
CO5	3	2	1	1	3	-	-	2	3	1	2	2	3	2	2
CO6	3	2	2	1	-	-	-	2	2	-	2	1	3	2	1
AVG.	3.00	2.00	1.83	1.17	2.00	2.00	2.00	2.50	2.67	1.80	1.80	2.00	3.00	2.17	2.33

University Syllabus:

Unit	Content	Hrs/Unit
1	**Introduction** 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 expressions by algebraic method. Combinational circuits - Adder and Subtractor circuits (half & full adder & subtractor); Encoder, Decoder, Comparator, Multiplexer, DeMultiplexer and Parity Generator.	11
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 A/D: successive approximation. Logic families- TTL, ECL, MOS and CMOS - basic concepts.	6

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Encoder, Decoder, Comparator, Multiplexer, DeMultiplexer and Parity Generator.	Unit 2
Sequential Circuits	Unit 3
A/D and D/A conversion techniques – Basic concepts (D/A: R-2-R only A/D: successive approximation. Logic families- TTL, ECL, MOS and CMOS - basic concepts.	Unit 4

RESOURCES:

1. 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

Course Title: Data Structure & Algorithm	**Code: PCC-CS301**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: ES-CS 201 (Basic Computation and Principles of C), BS-M101 &BS-M201 (Mathematics), basics of set theory

COURSE OBJECTIVE:

- To understand data structures and its utility
- To learn the implementation of data structure concepts in C programming
- To understand the importance of run time analysis
- To apply appropriate algorithm for proficiently solving a problem

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS301.CO1	**Examine** proposed algorithm and compare run time performance with suitable contemporary methods.	Analyzing (Level IV)
PCC-CS301.CO2	**Explain** a pseudo code using specific data structure.	Understanding (Level II)
PCC-CS301.CO3	**Compare** and **analyze** the different sorting techniques.	Analyzing (Level IV)
PCC-CS301.CO4	**Select** most suitable method for a particular problem solving.	Applying (Level III)
PCC-CS301.CO5	**Recall** the steps of an algorithm to calculate the intermediate result.	Remembering (Level I)
PCC-CS301.CO6	**Develop** new methods by incorporating suitable data structure for problem solving.	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	2	-	-	-	2	-	3	2	-	1	2	-	3
CO3	3	2	2	-	3	-	1	-	-	1	-	-	-	2	-
CO4	3	2	2	3	1	1	-	-	3	-	-	-	-	2	-
CO5	3	2	2	2	2	2	2	1	3	1	-	-	2	3	1
CO6	3	3	3	2	2	2	-	1	3	-	2	-	3	-	1
AVG.	3.0	2.17	2.17	2.33	2.0	1.67	1.67	1.0	3.0	1.33	2.0	1.5	2.33	2.33	1.67

University Syllabus :

Unit	Content	Hrs/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 Technique sand 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. 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	10
4	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 Representations, Graph search and traversal algorithms and complexity analysis.	9

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Programming in C. Recursion. Arrays,	Unit 1
Stacks, Queues	Unit 2
Trees, binary search trees, binary heaps, graphs	Unit 3

RESOURCES:

1. “DataStructuresAndProgramDesign In C”,2/E byRobertL. Kruse, BruceP. Leung.
2. “FundamentalsofDataStructuresofC”byEllisHorowitz,SartajSahni,SusanAnderson-freed.
3. “DataStructuresinC”byAaron M. Tenenbaum.
4. “DataStructures”byS. Lipschutz.
5. “DataStructuresUsingC”byReemaThareja.
6. “DataStructureUsingC”,2/ebyA.K.Rath,A.K. Jagadev.
7. “IntroductiontoAlgorithms”byThomasH.Cormen,CharlesE.Leiserson,RonaldL.Rivest,CliffordStein.

Course Title: Computer Organization	**Code: PCC-CS302**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: ES-CS 201 Introduction to Computing, ES-EE 101 Basic Electronics Engineering.

COURSE OBJECTIVE:

- Explain the organization of basic computer, its design.
- Demonstrate the working of central processing unit and RISC and CISC Architecture.
- Understand the principles of combinational and sequential logic circuits to design basic components
- Illustrate addressing modes, instruction formats, instruction sets, instruction cycle, and instruction pipeline with different hazards.

- Compare the performance of different levels components in memory hierarchy with respect to average memory access time.
- Illustrate I/O interface, different asynchronous I/O data transfer- strobe and handshaking, various modes of I/O-programmed I/O, interrupt driven I/O, and DMA.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS302.CO1	**Explain** the structural and functional organization of a computer system.	Understanding (Level II)
PCC-CS302.CO2	**Discuss** the integer and floating point number representations and the operations applied on it.	Analysing (Level IV)
PCC-CS302.CO3	**Demonstrate** different circuit designs using basic gates and hardware architectures.	Applying (Level III)
PCC-CS302.CO4	**Define** the addressing modes, instruction formats, and instruction pipeline.	Remembering (Level I)
PCC-CS302.CO5	**Analyze** various components of memory hierarchy in terms of access time, cost.	Analysing (Level IV)
PCC-CS302.CO6	**Explain** the concept of I/O interfacing and various taxonomy of I/O data transfer.	Understanding (Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	-	-	-	-	-	-	1	3	2	1
CO2	3	3	2	2	1	-	-	-	-	-	-	1	3	2	1
CO3	3	2	3	2	1	-	-	-	-	-	-	1	3	2	2
CO4	3	3	2	1	-	-	-	-	-	-	-	1	3	1	1
CO5	3	2	1	1	-	-	-	-	-	-	-	1	3	1	1
CO6	3	2	2	1	-	-	-	-	-	-	-	1	3	1	1
AVG.	3.00	2.17	1.83	1.33	1.00	0	0	0	0	0	0	1.00	3.00	1.50	1.17

University Syllabus:

Unit	Content	Hrs/Unit
1	Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. [7L] Commonly used number systems. Fixed and floating point representation of numbers. [1L]	8
2	Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. [3L] Design of ALU. [1L] Fixed point multiplication -Booth's algorithm. [1L] Fixed point division - Restoring and non-restoring algorithms. [2L] Floating point - IEEE 754 standard. [1L]	8
3	Memory unit design with special emphasis on implementation of CPU-memory interfacing. [2L] Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L] Cache memory, Virtual memory. Data path design for read/write access. [5L]	10

4	Design of control unit - hardwired and micro-programmed control. [3L] Introduction to instruction pipelining. [2L] Introduction to RISC architectures. RISC vs CISC architectures. [2L] I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA. [3L]	10

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Machine instructions and addressing modes	Unit 1
ALU	Unit 2
Memory hierarchy: cache, main memory and secondary storage;	Unit 3
Data-path and control unit. Instruction pipelining. I/O interface (interrupt and DMA mode)	Unit 4

RESOURCES:

1. Mano, M.M., "Computer System Architecture", PHI.
2. Behrooz Parhami " Computer Architecture", Oxford University Press
3. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher, "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers" OUP
6. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
7. P N Basu- "Computer Organization & Architecture" , Vikas Pub

Course Title: Mathematics-III	**Code: BSC 301**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 2L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer:Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: BS-M201 Mathematics-2.

COURSE OBJECTIVE:

- To know basic Concept of probability and distribution.
- To know the sampling distribution and maximum likelihood estimation of statistical parameters.
- To know testing of hypothesis for small samples.
- To know basic Concept of graph theory, graph coloring.
- To understand the basic algebraic structures and their elementary properties.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
BSC 301.CO1	**Demonstrate** the concept of convergence of infinite series in many approximation techniques in engineering disciplines.	Understanding (Level II)
BSC 301.CO2	**Explain**the tools of power series and Fourier series to analyze engineering problems and apply it to solve different problems by expressing functions in suitable series form.	Evaluating (Level V)
BSC 301.CO3	**Apply** the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.	Applying (Level III)
BSC 301.CO4	**Demonstrate** the knowledge of double and triple integral in different fields of Engineering to find area, volume and shape of different objects and also to get some physical properties like centre of gravity, moment of inertia, etc.	Understanding (Level II)
BSC 301.CO5	**Solve** and model many core engineering problems with application of ODE of 1st order and higher order, Simultaneous Linear Differential Equation, Improper Integral and Laplace Transform.	Applying (Level III)
BSC 301.CO6	**Identify** and solve different type of graphs and Analyze/Model application of Graph Theory in Information Science.	Applying (Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	-	1
CO2	3	3	3	-	-	-	-	-	-	-	2	-	3	-	1
CO3	3	3	3	-	-	-	-	-	-	-	1	-	2	-	1
CO4	3	3	3	-	-	-	-	-	-	-	2	-	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	1	-	2	-	1
CO6	3	2	2	-	-	-	-	-	-	-	-	-	3	-	1
AVG.	3.00	2.67	2.50	0	0	0	0	0	0	0	1.50	0	2.50	0	1.00

University Syllabus:

Unit	Content	Hrs/Unit
1	Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.	8
2	Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems.	7
3	Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems	8
4	First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's form, general & singular solution. [5L] Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. [4L]	9
5	Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree.	8

RESOURCES:

Text Books:

1. Banerjee A., De S.K. and Sen S.: Mathematical Probability, U.N. Dhur & Sons.
2. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
3. Mapa S.K. :Higher Algebra (Abstract & Linear), Sarat Book Distributors.
4. Sen M.K., Ghosh S. and Mukhopadhyay P.: Topics in Abstract Algebra, University Press.
5. West D.B.: Introduction to Graph Theory, Prentice Hall.

References:

1. Babu Ram: Discrete Mathematics, Pearson Education.
2. Balakrishnan: Graph Theory (Schaum's Outline Series), TMH.
3. Chakraborty S.K and Sarkar B.K.: Discrete Mathematics, OUP.
4. Das N.G.: Statistical Methods, TMH.
5. Deo N: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall.
6. Khanna V.K and Bhambri S.K. : A Course in Abstract Algebra, Vikas Publishing House.
7. Spiegel M R., Schiller J.J. and Srinivasan R.A. : Probability and Statistics (Schaum's Outline Series), TMH.
8. Wilson: Introduction to graph theory, Pearson Edication.

Course Title: Economics for Engineers (Humanities-II)	**Code: HSMC 301**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: N.A.

COURSE OBJECTIVES:

- Understanding the Decisionmakingprocess.
- Knowing about Inflation And Price Change.
- Calculating PresentWorthAnalysis, Return Analysis.
- Understanding Accounting.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
HSMC 301.CO1	**Recall** the concepts of Accounting and Recognize different systems used in industrial applications.	Remembering (Level I)
HSMC 301.CO2	**Discuss** on the design of appropriate accounting tool required for real life problems.	Creating (Level VI)
HSMC 301.CO3	**Demonstrate** the use of Economical concepts.	Understanding (Level II)
HSMC 301.CO4	**Analyze** and Simulate a sequential accounting tool for a system or process appropriate for required accuracy.	Analyzing (Level IV)
HSMC 301.CO5	**Design** a sequential economic policy that can work according to the required specifications.	Creating (Level VI)
HSMC 301.CO6	**Justify** a specific accounting technique for a specific purpose.	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	3.00	3.00	3.00	0.00	3.00	0	1.00	0.00	1.00	0.00	0.00	0.00	0	0	0

University Syllabus:

Unit	Content	Hrs/Unit
1	1. Economic Decisions Making – Overview, Problems, Role, Decision making process. 2. Engineering Costs & Estimation – Fixed, Variable, Marginal & Average Costs, Sunk Costs, Opportunity Costs, Recurring And Nonrecurring Costs, Incremental Costs, Cash Costs vs Book Costs, Life-Cycle Costs; Types Of Estimate, Estimating Models - PerUnit Model, Segmenting Model, Cost Indexes, Power-Sizing Model, Improvement & Learning Curve, Benefits.	9
2	3. Cash Flow, Interest and Equivalence: Cash Flow – Diagrams, Categories & Computation, Time Value of Money, Debt repayment, Nominal& Effective Interest. 4. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods; Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks.	9
3	5. 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. 6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives. 7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options.	9
4	8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances. 9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems. 10. Accounting – Function, Balance Sheet, Income Statement, Financial Ratios Capital Transactions, Cost Accounting, Direct and Indirect Costs, Indirect Cost Allocation.	9

RESOURCES:

1. JamesL.Riggs,DavidD.Bedworth,SabahU.Randhawa:EconomicsforEngineers4e,TataMcGraw-Hill
2. DonaldNewnan,TedEschembach,JeromeLavelle:EngineeringEconomicsAnalysis,OUP
3. JohnA.White,KennethE.Case,DavidB.Pratt:PrincipleofEngineeringEconomicAnalysis,JohnWiley
4. SullivanandWicks:EngineeringEconomy,Pearson
5. R.PaneerSeelvan:EngineeringEconomics,PHI
6. MichaelRLindeburg:EngineeringEconomicsAnalysis,ProfessionalPub

SEMESTER-III
PRACTICAL

Course Title: Analog and Digital Electronics lab	**Code:ES-CS391**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment committee (PAC)**

Pre-requisites: Class XII Mathematics, Physics, Basic knowledge of Computer, Basic Electronics, Basic Electrical.

COURSE OBJECTIVE:

- Explain the principles of analog and digital systems.
- Compare the performance of the digital system over the analog system.
- Prepare analog as well as digital circuits.
- Creating a hardware module with some specific application.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
ES-CS391.CO1	**Demonstrate** the concepts of circuits	Understanding (Level II)
ES-CS391.CO2	**Discuss** between analog and digital system.	Creating (Level VI)
ES-CS391.CO3	**Develop** the analog circuits to determine for a given outputs.	Creating (Level VI)
ES-CS391.CO4	**Explain** the different model of analog and digital circuits.	Evaluating (Level V)
ES-CS391.CO5	**Analyze** the outputs for given inputs for particular analog and digital circuits.	Analysing (Level VI)
ES-CS391.CO6	**Explain** the principle of different analog and digital circuits.	Understanding (Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	-	-	-	-	-	-	1	3	3	2
CO2	3	3	3	2	3	-	-	2	-	-	-	2	3	1	3
CO3	3	3	3	2	3	-	-	2	1	-	-	2	3	2	3
CO4	3	3	3	2	3	-	-	2	-	-	1	2	3	3	3
CO5	3	3	3	2	3	-	-	1	1	-	1	2	3	3	2
CO6	3	3	2	1	1	-	-	-	1	-	-	1	3	3	1
AVG.	3.00	3.00	2.83	1.67	2.33	0	0	1.75	1.00	0	1.00	1.67	3.00	2.50	2.33

University Syllabus:

Unit	Content	Hrs/Unit
ANALOG: At least any two of the following		
1	DesignaClassAamplifier.-Analog	3
2	DesignaPhase-ShiftOscillator.-Analog	3
3	DesignofaSchmittTriggerusing555timer. –Analog	3
DIGITAL : At least any five of the following		
4	DesignaFullAdderusingbasicgatesandverifyitsoutput/DesignaFullSubtractorcircuitusingbasicgatesandverifyits output. - Digital	3
5	ConstructionofsimpleDecoder&Multiplexercircuitsusinglogicgates. - Digital	3
6	RealizationofRS /JK/Dflip flopsusinglogicgates. - Digital	3
7	DesignofShiftRegisterusingJ-K/DFlipFlop. - Digital	3
8	RealizationofSynchronousUp/Downcounter. - Digital	3
9	Design ofMOD-NCounter. - Digital	3
10	StudyofDAC- Digital	3

RESOURCES:

1. 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.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers.
15. Tocci, Widmer, Moss- Digital Systems,9/e- Pearson.

Course Title: Data Structure & Algorithm	**Code: PCC-CS391**
Type of Course: Practical	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: ES-CS 201 (Basic Computation and Principles of C)

COURSE OBJECTIVE:

- To understand data structures and its utility
- To understand roles of linear and nonlinear data patterns
- To implement data structure concepts in C programming
- To apply appropriate data structure in in different problem solving

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCCCS391.CO1	**Develop** and **test** C programs to implement searching and sorting	Creating (Level VI)
PCCCS391.CO2	**Make use of** appropriate two dimensional data structures for solving a given problem	Applying (Level III)
PCCCS391.CO3	**Analyze** various operations using stack and queue	Analyzing (Level IV)
PCCCS391.CO4	**Analyze** problems to use the variants of linked list and solve real life problems	Analyzing (Level IV)
PCCCS391.CO5	**Demonstrate** the use of non-linear data structures for a given problem solving	Understanding (Level II)
PCCCS391.CO6	**Select** appropriate hash functions that result in a collision free scenario for data storage and retrieval	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	3	-	-	3
CO2	3	1	1	1	-	-	-	-	2	2	-	3	2	2	3
CO3	3	2	2	-	-	-	1	-	-	1	-	-	3	2	2
CO4	3	3	2	3	2	3	2	1	2	-	-	3	3	3	2
CO5	3	-	2	3	-	-	2	1	2	1	-	3	2	3	3
CO6	3	1	2	2	2	-	-	1	2	-	2	-	2	3	3
AVG.	3.0	1.6	1.67	2.25	2.0	3.0	1.67	1.0	2.0	1.33	2.0	3.0	2.4	2.6	2.67

University Syllabus:

Unit	Content
1	**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
2	**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.

RESOURCES:

1. "DataStructuresAndProgramDesign In C",2/E byRobertL. Kruse, BruceP. Leung.
2. "FundamentalsofDataStructuresofC"byEllisHorowitz,SartajSahni,SusanAnderson-freed.
3. "DataStructuresinC"byAaron M. Tenenbaum.
4. "DataStructures"byS. Lipschutz.
5. "DataStructuresUsingC"byReemaThareja.

6. "DataStructureUsingC",2/ebyA.K.Rath,A.K. Jagadev.
7. "IntroductiontoAlgorithms"byThomasH.Cormen,CharlesE.Leiserson,RonaldL.Rivest,CliffordStein.

Course Title: Computer Organization Lab	**Code: PCC-CS392**
Type of Course: Practical	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: EC 191 Basic Electronics Engineering and PCC-CS302 Computer Organization

COURSE OBJECTIVE:

- Analyze the behavior of various logic gates.
- Design the combinational circuits for basic components of computer system and applications.
- Analyze the operational behavior and applications of various flip-flops.
- Design Arithmetic logic units and different types of memory blocks.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
CS393.CO1	**Demonstrate** the behaviour of various integrated chips (IC): multiplexer, decoder, encoder, comparator and verify corresponding truth tables.	Understanding (Level II)
CS393.CO2	**Design** of an adder/subtractor composite unit.	Creating (Level VI)
CS393.CO3	**Develop** the design of a BCD adder.	Applying (Level III)
CS393.CO4	**Construct** the design of a carry-look ahead-adder.	Applying (Level III)
CS393.CO5	**Experiment with** an arithmetic and logic units using multiplexer unit for single bit and multi bit arithmetic operations.	Applying (Level III)
CS393.CO6	**Examine** read write operation using RAM IC and cascade two RAM ICs for vertical and horizontal expansion.	Analying (Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	-	-	-	2	-	-	1	3	1	-
CO2	3	3	2	1	1	-	-	1	2	-	-	2	3	1	-
CO3	3	3	2	1	1	-	-	1	2	-	-	2	3	1	-
CO4	3	3	2	1	1	-	-	1	2	-	1	2	3	1	-
CO5	3	3	2	2	1	-	-	1	2	-	1	2	3	2	-
CO6	3	3	2	2	1	-	-	1	2	-	-	1	3	2	-
AVG.	**3.00**	**2.83**	**1.83**	**1.33**	**1.00**	**0**	**0**	**1.00**	**2.00**	**0**	**1.00**	**1.67**	**3.00**	**1.33**	**0**

University Syllabus

Unit	Content
1.	FamiliaritywithIC-chips,e.g. a)Multiplexer, b)Decoder, c)Encoder b) ComparatorTruthTableverificationandclarificationfromData-book.
2.	DesignanAdder/Subtractorcompositeunit.
3.	DesignaBCDadder.
4	Designofa'Carry-Look-Ahead'Addercircuit.
5.	Useamultiplexerunittodesign acompositeALU.
6	UseALUchipformultibitarithmeticoperation.
7.	ImplementreadwriteoperationusingRAMIC
8.	(a)&(b)CascadetwoRAMICsforverticalandhorizontalexpansion.

RESOURCES:

1. Mano, M.M., "Computer System Architecture", PHI.
2. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
3. P N Basu- "Computer Organization & Architecture" , Vikas Pub

Course Title: IT Workshop	**Code:PCC-CS393**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 3rd	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment committee (PAC)**

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

COURSE OBJECTIVE:

- To master an understanding of scripting & the contributions of scripting languages
- Design real life problems and think creatively about solutions
- Apply a solution in a program using R/Matlab/Python.
- To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS393.CO1	**Interpret** the basic syntax of python variables, datatype and operator in python	Understanding (Level II)
PCC-CS393.CO2	**Write**, test and debug python programs	Creating (Level VI)
PCC-CS393.CO3	**Implement** use of conditionals and loops statement in python programs.	Applying (Level III)
PCC-CS393.CO4	**Use** functions and represent Compound data using Lists, Tuples and Dictionaries	Applying (Level III)
PCC-CS393.CO5	**Define**the use of string and list datatype in proficiency level.	Evaluating (Level V)
PCC-CS393.CO6	**Articulate**the concepts of object oriented programming like exception handling.	Applying(Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	-	-	-	1	3	3	2
CO2	3	3	3	2	2	-	-	1	-	-	-	2	3	1	3
CO3	3	3	3	2	2	-	-	1	1	-	-	2	3	2	3
CO4	3	3	3	2	2	-	-	1	-	-	1	2	3	3	3
CO5	3	3	3	2	2	-	-	1	1	-	1	2	3	3	2
CO6	3	3	2	2	2	-	-	-	1	-	-	1	3	3	1
AVG.	3.00	3.00	2.83	2.00	2.00	0	0	1.00	1.00	0	1.00	1.67	3.00	2.50	2.33

University Syllabus:

Programming with Python

Unit	Content
1	Introduction History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator
2	Conditional Statements If, If- else, Nested if-else, Looping, For, While, Nested loops
3	Control Statements Break, Continue, Pass
4	String Manipulation Accessing Strings, Basic Operations, String slices, Function and Methods
5	Lists Introduction, Accessing list, Operations, Working with lists, Function and Methods
6	Tuple Introduction, Accessing tuples, Operations, Working, Functions and Methods
7	Dictionaries Introduction, Accessing values in dictionaries, Working with dictionaries, Properties
8	Functions Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables
9	Modules Importing module, Math module, Random module, Packages, Composition, Input-Output Printing on screen, Reading data from keyboard, Opening and closing file, Reading and writing files, Functions
10	Exception Handling Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions.

SEMESTER – IV
THEORY

Course Title: Discrete Mathematics	**Code: PCC-CS401**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 3L+1T/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: BS-M201 (Mathamatics)

COURSE OBJECTIVE:

- To know basic Concept of probability and distribution.
- To know the sampling distribution and maximum likelihood estimation of statistical parameters.
- To know testing of hypothesis for small samples.
- To know basic Concept of graph theory, graph coloring.
- To understand the basic algebraic structures and their elementary properties.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS401.CO1	**Define** fundamental mathematical concepts such as sets, relations, functions, and integers.	Remembering (Level I)
PCC-CS401.CO2	**Demonstrate** induction hypotheses and simple induction proofs.	Understanding (Level II)
PCC-CS401.CO3	**Solve** numbers of possible outcomes of elementary combinatorial processes such as permutations and combinations.	Applying (Level III)
PCC-CS401.CO4	**Explain** a logic sentence in terms of predicates, quantifiers, and logical connectives.	Understanding (Level II)
PCC-CS401.CO5	Classify algebraic structure for a given mathematical problem.	Creating (Level VI)
PCC-CS401.CO6	**Apply** graph theory models of data structures and state machines to solve problems of connectivity and constraint satisfaction.	Applying (Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	-	-	-	-	-	-	2	-	1
CO2	3	3	3	-	-	-	-	-	-	-	2	-	3	-	1
CO3	3	3	3	-	-	-	-	-	-	-	1	-	2	-	1
CO4	3	3	3	-	-	-	-	-	-	-	2	-	3	-	-
CO5	3	3	2	-	-	-	-	-	-	-	1	-	2	-	1
CO6	3	2	2	-	-	-	-	-	-	-	-	-	3	-	1
AVG.	**3.00**	**2.67**	**2.50**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1.50**	**0**	**2.50**	**0**	**1.00**

University Syllabus:

Unit	Content	Hrs/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 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	8
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

RESOURCES:

Text Books:

6. Banerjee A., De S.K. and Sen S.: Mathematical Probability, U.N. Dhur & Sons.
7. Gupta S. C and Kapoor V K: Fundamentals of Mathematical Statistics, Sultan Chand & Sons.
8. Mapa S.K. :Higher Algebra (Abstract & Linear), Sarat Book Distributors.
9. Sen M.K., Ghosh S. and Mukhopadhyay P.: Topics in Abstract Algebra, University Press.
10. West D.B.: Introduction to Graph Theory, Prentice Hall.

References:

9. Babu Ram: Discrete Mathematics, Pearson Education.
10. Balakrishnan: Graph Theory (Schaum's Outline Series), TMH.
11. Chakraborty S.K and Sarkar B.K.: Discrete Mathematics, OUP.
12. Das N.G.: Statistical Methods, TMH.
13. Deo N: Graph Theory with Applications to Engineering and Computer Science, Prentice Hall.
14. Khanna V.K and Bhambri S.K. : A Course in Abstract Algebra, Vikas Publishing House.
15. Spiegel M R., Schiller J.J. and Srinivasan R.A. : Probability and Statistics (Schaum's Outline Series), TMH.
16. Wilson: Introduction to graph theory, Pearson Edication.

Course Title: Computer Architecture	**Code: PCC-CS402**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Basic Electronics, Introduction to Computing, Analog &Digital Electronics and Computer Organization.

COURSE OBJECTIVE:

- Explain the principles and modules of computer architecture.
- Compare performance of machines in computer architecture.
- Produce solutions to different problems in computer architecture.
- Illustrate different concepts such as pipelining, memory management, and different architectures in computer architecture.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS402.CO1	**Demonstrate** different concepts of computer architecture to improve the performance of a computer.	Understanding (Level II)
PCC-CS402.CO2	**Apply** different methods for proper organization of memory in computer architecture.	Applying (Level III)
PCC-CS402.CO3	**Analyze** different architectures to improve the performance of a computer.	Analyzing (Level IV)
PCC-CS402.CO4	**Define** a number of architectures of a computer and compare it.	Remembering (Level I)
PCC-CS402.CO5	**Interpret** an architectural problem to use accurate method to solve it.	Understanding (Level II)
PCC-CS402.CO6	**Evaluate** interpolation performance of a pipeline, data hazard, and memory performance.	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	-	2	1	1	2	3	1	2	3	3	1
CO2	3	2	1	2	2	-	-	-	2	1	-	2	3	2	1
CO3	3	2	3	1	-	-	-	1	2	2	-	2	3	2	1
CO4	3	2	2	2	-	-	-	-	2	2	-	2	3	2	1
CO5	3	2	1	2	3	-	-	-	2	1	-	2	3	2	1
CO6	3	2	3	2	-	-	-	-	2	-	-	1	3	2	1
AVG.	3	1.83	2	1.83	2.5	1	1	1	1.5	1.8	1	1.83	3.00	2.17	1

University Syllabus :

Unit	Content	Hrs/Unit
1	**Introduction [3L]** Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. **Pipelining:** Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and	12

	structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)	
2	**Hierarchical memory technology:** Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L)	8
3	**Instruction-level parallelism:** basic concepts, techniques for increasing ILP, superscalar, super pipelined and VLIW processor architectures. Array and vector processors. (6L)	6
4	**Multiprocessor architecture [8L]** Taxonomyofparallelarchitectures;Centralizedshared-memoryarchitecture: synchronization, memoryconsistency,interconnectionnetworks.Distributed shared-memory architecture Cluster computers. **Non von Neumann architectures [4L]** Data flow computers, reduction computer architectures, systolic architectures	12

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Machine instructions and addressing modes. ALU, data-path and control unit.	Unit 1
Instruction pipelining, pipeline hazards.	Unit 1
Memory hierarchy: cache, main memory and secondary storage; I/O interface (interrupt and DMA mode)	Unit 2

RESOURCES:

1. Computer Architecture and Organization. John. P.Hayes Magraw- Hill.
2. Computer system Architecture. M.Moris Mano. Pearson.

Course Title: Formal Language & Automata Theory	**Code: PCC-CS403**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer : Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Elementary discrete mathematics

COURSE OBJECTIVE:

- Understand basic properties of formal languages and formal grammars.
- Understand basic properties of deterministic and nondeterministic finite automata
- Understand the minimization of deterministic and nondeterministic finite automata.
- Understand the Context free languages and grammars, and also Normalizing CFG.
- Understand the concept of Pushdown automata and its application.
- Understand basic properties of Turing machines and computing with Turing machines.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS403.CO1	**Explain** the concept of abstract machines and their power to recognize the languages	Understanding(Level II)

PCC-CS403.CO2	**Design** Finite state machines and the equivalent regular grammars	Creating(Level VI)
PCC-CS403.CO3	**Create** context free grammars for formal languages	Creating(Level VI)
PCC-CS403.CO4	**Apply** minimization techniques on Finite state machines and grammars of Context Free Languages	Applying(Level III)
PCC-CS403.CO5	**Elaborate** Pushdown automata for any Context-Free Language	Creating(Level VI)
PCC-CS403.CO6	**Illustrate** the power of the Turing Machine for abstract automation	Understanding(Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	2	1	-	-	-	-	-	-	-	-	1	1	2	1
CO2	2	2	2	-	-	-	-	-	-	-	-	1	1	1	2
CO3	2	2	2	-	-	-	-	-	-	-	-	1	1	1	2
CO4	2	2	2	-	-	-	-	-	-	-	-	2	1	2	1
CO5	2	2	2	-	-	-	-	-	-	-	-	1	1	1	2
CO6	2	2	1	-	-	-	-	-	-	-	-	1	1	1	1
AVG.	1	2	1	-	-	-	-	-	-	-	-	1	1.00	1.33	1.50

University Syllabus:

Unit	Content	Hrs/Unit
1	Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages.	6
2	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)	7
3	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
4	Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	6
5	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
6	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages	6

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Finite automata	Unit 1
Regular expression, Regular grammar and, pumping lemma.	Unit 2
Context-free languages, Context-free grammars and push-down automata.	Unit 3
Turing machines and undecidability.	Unit 4

RESOURCES:

1. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson education.
2. "Theory of Computer Science ", Automata Languages and computation", Mishra and Chandrashekaran, 2nd edition, PHI.
3. "FormalLanguages andAutomataTheory",C.K.Nagpal,Oxford
4. "Switching&FiniteAutomata",ZVIKohavi,2ndEdn.,TataMcGrawHill
5. "IntroductiontoComputerTheory",DanielI.A.Cohen,JohnWiley
6. "IntroductiontolanguagesandtheTheoryofComputation",JohnCMartin,TMH
7. "ElementsofTheoryofComputation",LewisH.P. &PapadimitrouC.H.Pearson,PHI.

Course Title: Environmental Sciences	**Code: MC-401**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 1L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
BSC 401.CO1	**Resolve** different open-ended problems related to air pollution acquiring the detailed knowledge about source, effect and mechanism of the pollution.	Applying(Level III)
BSC 401.CO2	**Solve** various societal problems related to land pollution after detailed understanding about source, effect and mechanism of the pollution	Applying(Level III)
BSC 401CO3	**Conceive** the basic of the need of natural resource management, environmental protection and population control. Extend the knowledge as well as the consciousness related to environmental issues to the society considering the related laws, acts and legislations	Understanding(Level II)
BSC 401.CO4	**Acquire** skills for scientific problem-solving related to air, water, noise& land pollution.	Remember (Level I)
BSC 401.CO5	**Determine** the issues related to noise pollution after studying the existing situation in detail.	Evaluate (Level V)
BSC 401.CO6	**Develop** awareness about the geographical feature of the country considering biodiversity and the variety of ecological systems present in the nature.	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	1	-	-	1	2	-	-	-	-	-	-	-
CO2	-	2	1	-	-	1	2	-	-	-	-	-	-	-
CO3	-	2	2	-	-	2	1	-	-	-	-	-	-	-

CO4	-	2	1	-	-	1	2	-	-	-	-	-	-	-
CO5	-	2	1	-	-	1	2	-	-	-	-	-	-	-
CO6	-	1	1	-	-	1	1	-	-	-	-	-	-	-
AVG.	0	1.83	1.17	0	0	1.17	1.67	0	0	0	0	0	0	0

University Syllabus:

Unit	Content	Hrs/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, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development. (2L) Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L) Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L)	6
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.(2L) Biogeochemical Cycle-definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur].(1L) Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.(2L)	6
3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L) Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.(1L) 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).(2L) Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L) Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria pollutant. Sources and effect of different air pollutants- Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. 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 with brief reference). (1L)	11
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. (2L) 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 (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)	9
5	Lithosphere; Internal structure of earth, rock and soil (1L) Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes; Recovery and	3

	disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)	
6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L) Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, L10 (18hr Index) ,n Ld.Noise pollution control. (1L)	3
7	Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L)	2

SEMESTER-IV
PRACTICAL

Course Title: Computer Architecture	**Code: PCC-CS492**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 3P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: CS-291 Basic Computation & Principles of Computer Programming Lab, CS-392 Data structure Lab and Computer Organization Lab

COURSE OBJECTIVE:

- Specify simple abstract data types and design implementations, using VHDL
- Recognize features of HDL to design different components of a computer.
- Generate the timing signal for different components.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS492.CO1	**Design** complex circuits to achieve complex logical results.	Creating (Level VI)
PCC-CS492.CO2	**Knowledge** of new circuits that may be effective for complex computation.	Applying (Level III)
PCC-CS492.CO3	**Create** basic components of a machine using VHDL	Creating (Level VI)
PCC-CS492.CO4	**Explain** the interconnection between different hardware components.	Understanding (Level II)
PCC-CS492.CO5	**Apply** software tools to generate hardware components.	Applying (Level III)
PCC-CS492.CO6	**Develop** programs to compare the performance of different hardware components.	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	-	-	-	-	1	1	1	3	-	1
CO2	1	1	1	1	1	-	-	-	-	1	-	1	3	-	1
CO3	2	1	1	1	1	-	-	-	-	1	-	1	3	-	1
CO4	1	1	1	1	1	-	-	-	-	1	-	1	3	-	1
CO5	1	1	1	1	1	-	-	-	-	1	-	1	3	-	1

CO6	1	1	3	1	3	-	-	-	2	2	2	1	3	1	1
AVG.	1.33	1	1.5	1	1.33	0	0	0	2	1.17	1.5	1	3.00	1.00	1

University Syllabus:

Unit	Content
1	HDL introduction
2	Basic digital logic base programming with HDL
3	8-bit Addition, Multiplication, Division 4 5 6 7 8
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

RESOURCES:

1. Computer Architecture and Organization. John. P.Hayes Magraw- Hill.
2. Computer system Architecture. M.Moris Mano. Pearson

Course Title: Design& Analysis of Algorithm	**Code:PCC-CS494**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: CS302-Data structure.

COURSE OBJECTIVE:

- Explain the principles and modules of Algorithm.
- Compare performance of different algorithms.
- Produce algorithmic solutions to various kind of problems.
- Illustrate operating system concepts such as process management, synchronization, networked processes and file systems

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS494.CO1	Define the concept of Divide and Conquer approach and learn where it has to be used.	Remembering (Level I)
PCC-CS494.CO2	Understand the concept of Dynamic Programming and can be able to apply that in problem solving.	Understanding(Level II)
PCC-CS494.CO3	Apply the knowledge of branch and bound in different puzzle related problems.	Applying (Level III)
PCC-CS494.CO4	Examine the concept of Backtracking in problem solving and learn how to implement it	Analyzing (Level IV)
PCC-CS494.CO5	Explain the programming knowledge using Greedy method and learn the process of solving different problems	Evaluating(Level V)
PCC-CS494.CO6	Construct programming concept on Graph Traversal Algorithm	Creating(Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	1	1	-	-	-	-	-	-	1	3	3	-
CO2	3	3	3	2	3	-	-	2	-	-	-	2	3	1	-
CO3	3	3	3	2	3	-	-	2	1	-	-	2	3	2	-
CO4	3	3	3	2	3	-	-	2	-	-	1	2	3	3	-
CO5	3	3	3	2	3	-	-	1	1	-	1	2	3	3	-
CO6	3	3	2	1	1	-	-	-	1	-	-	1	3	3	-
AVG.	3.00	3.00	2.83	1.67	2.33	0	0	1.75	1.00	0	1.00	1.67	3.00	2.50	0

University Syllabus:

Unit	Content
1	**Divide and Conquer :** • Implement Binary Search using Divide and Conquer approach • Implement Merge Sort using Divide and Conquer approach • Implement Quick Sort using Divide and Conquer approach • Find Maximum and Minimum element from an array of integer using Divide and Conquer approach

	• Find the minimum number of scalar multiplication needed for chain of matrix • Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) • Implement Traveling Salesman Problem • Implement Single Source shortest Path for a graph (Dijkstra, Bellman Ford Algorithm)
2	**Brunch and Bound :** • Implement 15 Puzzle Problem
3	**Backtracking :** • Implement 8 Queen problem • Graph Coloring Problem • Hamiltonian Problem
4	**Greedy method**(implement any one of the following problem) : Knapsack Problem • Job sequencing with deadlines • Minimum Cost Spanning Tree by Prim's Algorithm • Minimum Cost Spanning Tree by Kruskal's Algorithm
5	**Graph Traversal Algorithm :** • Implement Breadth First Search (BFS) • Implement Depth First Search (DFS)

COURSE BOOKLET FOR B.TECH (IT)

THIRD YEAR

SEMESTER – V
THEORY

Course Title: Software Engineering	**Code: ESC501**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Basic knowledge on software and Information system

COURSE OBJECTIVE:

- Understand common lifecycle processes including waterfall (linear), incremental approaches (such as Unified process), and agile approaches.
- Design a solution to a given problem using one or more design patterns and implement the design in a programming language
- Apply software testing and quality assurance techniques at the module level, and understand these techniques at the system and organization level.
- Discover the role of project management including planning, staffing, scheduling, monitoring etc.
- Model the structure and behaviour a software system using the UML diagrams

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
ESC501.CO1	**Understand** software lifecycle processes including traditional and modern approaches.	Understanding (Level II)
ESC5013.CO2	**Design** software using requirement model	Creating (Level VI)
ESC501.CO3	**Apply** software testing and quality assurance techniques at the modular, system and organizational level.	Applying (Level III)
ESC501.CO4	**Explain** role of SDLC in Software project development.	Evaluating (Level V)
ESC501.CO5	**Develop** project schedule and network diagram for different projects.	Creating (Level VI)
ESC501.CO6	**Analyze** the structure and behaviour of a software system using the UML diagrams	Analyzing (Level IV)

Mapping of COs with Pos and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	2	-	-	-	2	-	2	2	1	-
CO2	2	-	3	1	2	-	-	-	2	1	1	1	1	2	-
CO3	2	2	1	-	3	-	-	-	1	1	1	-	1	2	-
CO4	2	-	-	-	2	-	-	1	2	1	2	-	1	2	-
CO5	2	-	3	1	3	-	1	-	2	1	2	1	1	1	1
CO6	2	3	1	-	3	-	-	-	1	1	1	-	1	1	1
AVG.	2.00	2.00	1.80	1.00	2.60	2.00	1.00	1.00	1.60	1.17	1.40	1.33	1.17	1.50	1.00

University Syllabus:

Unit	Content	Hrs/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, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification 12 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

RESOURCES:

1. Software Engineering, Rogers G. Pressman, MH
2. Fundamentals of Software Engineering,2nd Ed. ,Ghezzi,PHI
3. Software Engineering, Pankaj Jalote, PHI.

Course Title: Compiler Design	**Code: PCC-CS501**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS302 Computer Organisation, PCC-CS-301 Data structure, PCC-CS403 Formal Language and Automata Theory.

COURSE OBJECTIVE:

- To realize basics of compiler design and apply for real time applications.
- To understand the basic principles of compiler design, its various constituent parts, algorithms and data structures required to be used in the compiler
- To understand relations between computer architecture and how its understanding is useful in design of a compiler.
- To know about compiler generation tools and techniques

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS501.CO1	**Explain** different components of a compiler and their functioning.	Understanding (Level II)
PCC-CS501.CO2	**Explain** the role of lexical analyser, use of regular expression and finite automata to design programming languages.	Understanding (Level II)
PCC-CS501.CO3	**Construct** parser and identify the similarities and differences among various parsing techniques.	Applying (Level III)
PCC-CS501.CO4	**Explain** the role Syntax directed translation, Type checking, and Run time environments.	Understanding (Level II)
PCC-CS501.CO5	**Apply** various intermediate code generation and code optimization techniques to improve the performance of a program in terms of speed & space.	Applying (Level III)
PCC-CS501.CO6	**Apply** instruction scheduling and register allocation techniques during the code generation.	Applying (Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO2
CO1	1	1	1	-	-	-	-	-	-	-	-	2	1	1	1
CO2	1	1	2	-	-	-	-	-	-	-	-	2	1	1	1
CO3	2	1	2	-	-	-	-	-	-	-	-	2	1	1	1
CO4	1	1	1	-	-	-	-	-	-	-	-	2	1	1	1
CO5	2	1	2	-	-	-	-	-	-	-	-	2	1	1	1
CO6	2	1	2	-	-	-	-	-	-	-	-	2	1	1	1
AVG.	**1.50**	**1.00**	**1.67**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**2.00**	**1.00**	**1.00**	**1.00**

University Syllabus:

Unit	Content	Hrs/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)..	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	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

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Lexical analysis	Unit 2
Parsing	Unit 3
Syntax-directed translation	Unit 4
Runtime environments	Unit 6
Intermediate code generation	Unit 7

RESOURCES:

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

Course Title: Operating System	**Code PCC-CS502**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS301 Data structure, PCC-CS302 Computer Organization,

COURSE OBJECTIVE:

- Explain the different types and structure of Operating Systems.
- Compare and contrast the performance of different CPU scheduling algorithms.
- Generate algorithmic solutions to process synchronization problems.
- Illustrate operating system concepts such as process management, deadlock handling, memory management, networked processes and file systems

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS502.CO1	**Define** operating system and**how** it works.	Remembering (Level I)
PCC-CS502.CO2	**Explain** the architecture and services of operating system.	Evaluating (Level V)
PCC-CS502.CO3	**Illustrate** program, process, system call and scheduler.	Understanding (Level II)
PCC-CS502.CO4	**Analyze** the system model for process, thread, deadlock and memory management.	Analyzing (Level IV)
PCC-CS502.CO5	**Identify** the problems associated with resource management.	Applying (Level III)
PCC-CS502.CO6	**Combine** existing algorithms for solving real life problems.	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1	1	-	-	-	-	2	2	2	1
CO2	3	2	1	1	2	-	-	-	-	1	-	2	2	2	1
CO3	3	2	3	1	1	-	-	-	-	1	-	2	3	2	1
CO4	3	3	3	3	2	1	1	-	-	2	-	2	3	3	2
CO5	3	2	1	1	3	1	-	-	-	1	-	2	3	3	2
CO6	3	2	2	1	-	-	-	-	-	1	-	2	2	2	1
AVG.	3	2	1.83	1.4	2.00	1.00	1.00	0.00	0.00	1.20	0.00	2.00	2.50	2.33	1.33

University Syllabus:

Unit	Content	Hrs/Unit
1	Introduction: Generations Concept of of Operating Operating systems, Systems, Types of 3 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 IPCProblems: Reader's & Writer Problem, Dinning Philosopher Problemetc.	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 andperformance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.	6

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
System calls	Unit 2
Processes, threads, inter-process communication, concurrency and synchronization. Deadlock. CPU and I/O scheduling.	Unit 3
Memory management and virtual memory. File systems.	Unit 4

RESOURCES:

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, EktaWalia, 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 Title: Object Oriented Programming	**Code: PCC-CS503**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: ES-CS201 Basic Computation & Principles of Computer Programming, PCC-CS301 Data Structure& Algorithm.

COURSE OBJECTIVE:

- Specify simple abstract data types and design implementations, using abstraction functions to document them.
- Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
- Name and apply some common object-oriented design patterns and give examples of their use.
- Design applications with an event-driven graphical user interface

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS503.CO1	**Discuss** simple abstract data types and implementationsusing the concepts of class, object, messagepassing, constructor, inheritance, encapsulation, and polymorphism.	Creating (Level VI)
PCC-CS503.CO2	**Explain** the knowledge of object-oriented programming language using Java	Understanding (Level II)
PCC-CS503.CO3	**Analyze** the basic concept of Java programming, various Stream classes, I/O operations	Analyzing (Level IV)
PCC-CS503.CO4	**Create** reusable programs using the concepts of multiple inheritance, extending interfaces and packages.	Creating (Level VI)
PCC-CS503.CO5	**Identify** the concepts of Multithreading and Exception handling.	Applying (Level III)
PCC-CS503.CO6	**Demonstrate** graphical User Interface using AWT and swing.	Understanding (Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	-	-	-	-	-	1	1	3	-	1
CO2	1	1	1	1	1	-	-	-	-	-	-	1	3	-	1
CO3	2	1	1	1	1	-	-	-	-	-	-	1	3	-	1
CO4	1	2	1	1	1	-	-	-	-	-	-	1	3	-	1
CO5	1	2	1	1	1	-	-	-	-	-	-	1	3	-	1
CO6	1	1	3	1	3	-	-	-	2	2	2	1	3	1	1
AVG.	1.33	1.33	1.33	1.00	1.33	0	0	0	2.00	2.00	1.50	1.00	3.00	1.00	1.00

University Syllabus:

Unit	Content	Hrs/Unit
1	Abstract data types and theirspecification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.	8
2	Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance	8
3	Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern.	6
4	Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management.	6
5	Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process	6

Resources:

Text 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

Reference books:

1. Deitel and Deitel – "Java How to Program" – 6th Ed. – Pearson

2. Ivor Horton's Beginning Java 2 SDK – Wrox

3. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Course Title: : Introduction to Industrial Management (Humanities III)	**Code: HSMC-501**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: HSMC 301 Economics for Engineers (Humanities-II)

COURSE OBJECTIVE:

- Interpret given organization structure, culture, climate and major provisions of factory acts and laws.
- Explain material requirement planning and store keeping procedure
- Plot and analyze inventory control models and techniques.
- Prepare and analyze CPM and PERT for given activities.
- List and explain PPC functions.
-

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	**CO statement**	**Knowledge Level of revised Bloom's Taxonomy**
HSMC-501.CO1	Recall the concepts of Accounting and Recognize different systems used in industrial applications.	Remembering (Level I)
HSMC-501.CO2	Discuss on the design of appropriate accounting tool required for real life problems.	Remembering (Level I)
HSMC-501.CO3	Apply and demonstrate the use of Economical concepts.	Apply (Level III)
HSMC-501.CO4	Analyze and Simulate a sequential accounting tool for a system or process appropriate for required accuracy.	Analyze (Level IV)
HSMC-501.CO5	Design a sequential economic policy that can work according to the required specifications.	Evaluating (Level V)
HSMC-501.CO6	Justify a specific accounting technique for an specific purpose.	Create (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	-	3	-	-	-	-	1	-	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-
AVG.	3	3	3	0	3	0	1	0	1	0	0	0	0	0	1

University Syllabus :

Unit	Content	Hrs/Unit
1	**Introduction System-** concept, definition, types, parameters, variables and behavior. Management – definition and functions. Organization structure: i. Definition. ii. Goals. iii. Factors considered in formulating structure. iv. Types. v. Advantages and disadvantages. vi. Applications. Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management. Organizational culture and climate – meaning, differences and factors affecting them. Moral-factors affecting moral. Relationship between moral and productivity. Job satisfaction- factors influencing job satisfaction. Important provisions of factory act and labor laws.	6
2	**Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT):** 2.1 CPM & PERT-meaning, features, difference, applications. 2.2 Understand different terms used in network diagram. Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples). Determination of critical path on network. Floats, its types and determination of floats. Crashing of network, updating and its applications.	8
3	**Materials Management:** Material management-definition, functions, importance, relationship with other departments. Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. Storekeeping-functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market.	6
4	**Production planning and Control (PPC):** Types and examples of production. PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. Scheduling- meaning and need for productivity and utilisation. Gantt chart- Format and method to prepare. Critical ratio scheduling-method and numeric examples. Scheduling using Gantt Chart (for at least 5-7 components having 5-6 machining operations, with processes, setting and operation time for each component and process, resources available, quantity and other necessary data), At least two examples. 4.7 Bottlenecking- meaning, effect and ways to reduce.	8
5	**Value Analysis (VA) and Cost Control:** 5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram. DARSIRI method of VA. Case study of VA-at least two.	4

	Waste-types, sources and ways to reduce them. Cost control-methods and important guide lines.	
6	**Recent Trends in IM:** ERP (Enterprise resource planning) - concept, features and applications. Important features of MS Project. Logistics- concept, need and benefits. Just in Time (JIT)-concept and benefits. Supply chain management-concept and benefits.	4

RESOURCES:

1. L.S.Srinath– "CPM & PERT principles and Applications".
2. S.C. Sharma – "Engineering Management".
3. Buffa – "Modern Production Management".
4. N. Nair – "Materials Management".
5. O. P. Khanna – " Industrial Engineering & Management".
6. Mikes – "Value Analysis".

Course Title: Artificial Intelligence	**Code: PEC-IT501B**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks **Attendance : 5 Marks**	**Final Exam: 70 Marks**
Writer:Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS301 Data Structure, PCC-CS404 Design & Analysis Algorithm.

COURSE OBJECTIVE:

- Explain the different types intelligent agent.
- Familiar with different Heuristic search techniques.
- Learn different types of knowledge representation techniques.
- Grasp some idea on programming languages like Prolog & Lisp.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PEC-IT501B.CO1	**Explain** the history of artificial intelligence (AI) and its foundations.	Understand (Level II)
PEC-IT501B.CO2	**Describe** real world problems in terms of Initial and Goal conditions.	Understand (Level II)
PEC-IT501B.CO3	**Implement** real life AI based problem using Prolog & Lisp.	Apply (Level III)
PEC-IT501B.CO4	**Design** production rule for real life AI based problems.	Create (Level VI)
PEC-IT501B.CO5	**Use** solution driver to logically derive solution based on probability theory and possibility theory (fuzzy logic).	Analyze (Level IV)
PEC-IT501B.CO6	**Compare** AI with human intelligence and traditional information processing and discuss its strengths and limitations as well as its application to complex and human-centered problems.	Apply (Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	2	-	-	2
CO2	3	3	2	1	1	-	-	-	-	-	-	2	1	1	2
CO3	3	3	2	2	3	-	-	-	-	-	-	2	3	1	3
CO4	3	1	3	3	2	-	-	-	-	-	-	2	2	1	2
CO5	3	3	2	2	2	-	-	-	-	-	-	2	1	2	3
CO6	3	1	1	1	-	-	-	-	-	-	-	2	1	1	2
AVG.	3.00	2.00	1.83	1.80	2.00	0	0	0	0	0	0	2.00	1.60	1.20	2.33

University Syllabus:

Unit	Content	Hrs/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, neural net learning & genetic learning. **Expert Systems** [2] Representing and using domain knowledge, expert system shells, knowledge acquisition.	6

RESOURCES:

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

Course Title: Computer Graphics	**Code: PEC-IT501D**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Nil

COURSE OBJECTIVE:

- To introduce the concepts of computer graphics.
- To give an overview of interactive computer graphics, two dimensional system and mapping.
- To get an idea on drawing algorithm, 2-D transformation; clipping, filling and an introduction to 3-D graphics.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PEC-IT501D.CO1	**Understand** the basics of computer graphics, different graphics systems and applications of computer graphics.	Understanding (Level II)
PEC-IT501D.CO2	**Discuss** various algorithms for scan conversion and filling of basic objects and their comparative analysis.	Understanding (Level II)
PEC-IT501D.CO3	**Use** of geometric transformations on graphics objects and their application in composite form.	Applying (Level III)
PEC-IT501D.CO4	**Extract** scene with different clipping methods and its transformation to graphics display device.	Creating (Level VI)
PEC-IT501D.CO5	**Explore** projections and visible surface detection techniques for display of 3D scene on 2D screen.	Analyzing (Level IV)
PEC-IT501D.CO6	**Render** projected objects to naturalize the scene in 2D view and use of illumination models for this.	Evaluating (LevelV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	-	-	-	-	-	2	-	-	1
CO2	3	3	2	1	1	-	-	-	-	-	-	2	1	1	1
CO3	3	3	2	2	3	-	-	-	-	-	-	2	3	1	1
CO4	3	1	3	3	2	-	-	-	-	-	-	2	2	1	1
CO5	3	3	2	2	2	-	-	-	-	-	-	2	1	2	1
CO6	3	1	1	1	-	-	-	-	-	-	-	2	1	1	1
AVG.	3.00	2.00	1.83	1.80	2.00	0	0	0	0	0	0	2.00	1.60	1.20	1.00

University Syllabus:

Unit	Content	Hrs/Unit
1	**Introduction to computer graphics & graphics systems [6L]**: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active &Passive graphics devices; **Computer graphics software. Scan conversion [8L]:** Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm. .	14
2	**2D transformation & viewing [15L]:** Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, **Cyrus-beck clipping method 3D transformation & viewing [5L]:** 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.	20
3	**Curves [3L]:** Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. **Hidden surfaces [3L]:** Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry. **Color & shading models [2L]**: Light & color model; interpolative shading model; Texture. Introduction to Ray-tracing: [3L] Human vision and color, Lighting, Reflection and transmission models.	6

RESOURCES:

1. Hearn, Baker – "Computer Graphics (C version 2nd Ed.)" – Pearson education
2. Z. Xiang, R. Plastock – " Schaum's outlines Computer Graphics (2nd Ed.)" – TMH
3. D. F. Rogers, J. A. Adams – "Mathematical Elements for Computer Graphics (2nd Ed.)" –TMH

Course Title: Constitution of India	**Code: MC- CS501**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Nil

COURSE OBJECTIVE:

- To realise the significance of constitution of India to students from all walks of life and help them to understand the basic concepts of Indian constitution.
- To identify the importance of fundamental rights aswell as fundamental duties.
- To understand the functioning of Union, State and Local Governments in Indian federal system.
- To learn procedure and effects of emergency, composition and activities of election commission and amendment procedure.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
MC- CS501.CO1	**Understand** Basic Structure of the Constitution of India	Understanding (Level II)
MC- CS501.CO2	**Apply** the understanding in Engineering Profession	Applying (Level III)
MC- CS501.CO3	**Apply** Constitutional Values in Engineering Education	Applying (Level III)
MC- CS501.CO4	**Apply** Constitutional Provisions in Policy matters of CSE	Applying (Level III)
MC- CS501.CO5	**Apply** Team Spirit and Constitutional Legislative Provisions for Industrial Design	Applying (Level III)
MC- CS501.CO6	**Analyze** Constitutional Valuesof Legislation, Executive & Judiciary in the light of the Professional requirements of Computer Science Engineering	Analyzing (Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	2	-	2	3	1	-	2	1	1	1
CO2	-	-	-	-	-	2	-	2	3	1	-	2	1	1	1
CO3	-	-	-	-	-	2	-	2	3	1	-	2	1	1	1
CO4	-	-	-	-	-	2	-	2	3	1	-	2	1	1	1
CO5	-	-	-	-	-	2	-	2	3	1	-	2	1	1	1
CO6	-	-	-	-	-	2	-	2	3	1	-	2	1	1	1
AVG.	0	0	0	0	0	2	0	2	3	1	0	2	1	1	1

University Syllabus:

Unit	Content	Hrs/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	6

	Council of ministers, State Secretariat: Organisation, Structure and Functions	
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	6

RESOURCES:

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

SEMESTER- V
PRACTICAL

Course Title: Software Engineering Lab	**Code: ESC591**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer:Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Design a project proposal which will be used throughout the lab for performing different experiments using CASE Tools.

COURSE OBJECTIVE:

- Introduce software project basic concepts.
- Illustrate various tools for Project.
- Design chosen software as case study.
- Develop the chosen software as a project.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
ESC591.CO1	**Define** the concepts of Software Development Life Cycle .	Remembering (Level I)
ESC591.CO2	**Explain** requirements for proposed project.	Understanding (Level II)
ESC591.CO3	**Apply** tools for project schedule preparation.	Applying (Level III)
ESC591.CO4	**Justify** real-life scenario using UML diagrams.	Evaluating (Level V)
ESC591.CO5	**Design** test plan for project.	Creating (Level VI)
ESC591.CO6	**Develop** the software project in full workable mode.	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	-	-	-	1	1	-	-	2	-	2	2	1	2	1
CO2	2	3	-	1	2	1	-	-	2	-	1	2	2	2	1
CO3	2	1	-	2	3	1	-	-	2	-	1	2	1	2	1
CO4	2	2	3	2	2	1	1	1	2	2	1	2	-	2	2
CO5	2	2	3	1	2	1	2	2	2	1	1	2	2	2	2
CO6	2	2	3	2	2	1	2	2	2	3	3	2	2	2	2
AVG.	2.00	2.00	3.00	1.60	2.00	1.00	1.67	1.67	2.00	2.00	1.50	2.00	1.60	2.00	1.50

University Syllabus :

Unit	Content
1	Laboratory Experiments: Problem Analysis and Project Planning -Thorough study of the problem – Identify Project scope, Objectives and Infrastructure.
2	Software Requirement Analysis – Describe the individual Phases/modules of the project and Identify

	deliverables. Identify functional and non-functional requirements.
3	Data Modeling – Use work products – data dictionary
4	Software Designing - Develop use case diagrams and activity diagrams, build and testclass diagrams, sequence diagrams and add interface to class diagrams.
5	Prototype model – Develop the prototype of the product The SRS and prototype model should be submitted for end semester examination

Course Title: Operating System Lab	**Code:PCC-CS592**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer:Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: ES-CS201 Programming for problem solving,PCC- CS302 Data Structure

COURSE OBJECTIVE:

- Explain the details structure of UNIX Operating Systems.
- Familiar with shell scripts
- Implement different operations of process and threads.
- Implementing the concept of semaphore, Process synchronization and Inter-process-communication(IPC).

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS592.CO1	**Describe** the history, file system and components of a UNIX operating system.	Remember (Level I)
PCC-CS592.CO2	**Explain** the different construct for writing shell scripts.	Understand (Level II)
PCC-CS592.CO3	**Execute** shell scripts to solve basic programming problems.	Apply (Level III)
PCC-CS592.CO4	**Implement** different operations of process and threads.	Apply (Level III)
PCC-CS592.CO5	**Design** Inter- process communication mechanism for process communication.	Create (Level VI)
PCC-CS592.CO6	**Finding** the programming solution for classical synchronization problem using semaphore.	Analyze (Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1	-	-	-	-	2	2	1	1	1
CO2	3	1	1	-	-	-	-	-	-	-	2	2	3	1	1
CO3	3	3	1	1	-	-	-	-	-	-	2	2	3	2	1
CO4	3	3	2	1	-	-	-	-	-	-	2	2	3	2	2
CO5	3	3	2	1	-	-	-	-	-	-	2	2	3	2	2
CO6	3	2	3	1	-	2	-	-	-	-	2	2	3	3	2
AVG.	3.00	2.17	1.67	1.00	0	1.50	0	0	0	0	2.00	2.00	2.67	1.83	1.50

University Syllabus :

Unit	Content
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 inittab 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.
2	**Process [4P]:** starting new process, replacing a process image, duplicating aprocess image, waiting for a process, zombie process.
3	**Signal [4P]:** signal handling, sending signals, signal interface, signal sets.
4	**Semaphore [6P]:** programming with semaphores (use functions semctl, semget,semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v).
5	**POSIX Threads [6P]:** programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6	**Inter-process communication [6P]:** pipes (use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

RESOURCES:

1. Das, Sumitava "YOUR UNIX :THE ULTIMATE GUIDE ", McGraw Hill.
2. Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.

Course Title: Object Oriented Programming Lab	**Code:PCC-CS593**
Type of Course: Practical	**Course Designation: Compulsory**
Semester: 5th	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: ES-CS291 Programming for Problem Solving, PCC-CS392 Data structure Lab.

COURSE OBJECTIVE:

- Specify simple abstract data types and design implementations, using abstraction functions to document them.
- Recognize features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
- Name and apply some common object-oriented design patterns and give examples of their use.
- Design applications with an event-driven graphical user interface

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS593.CO1	**Explain** simple abstract data types and abstraction functions.	Understanding (Level II)
PCC-CS593.CO2	**Apply** the knowledge of object-oriented paradigm and array in the Java programming language	Applying (Level III)
PCC-CS593.CO3	**Demonstrate** encapsulation, polymorphism features of object-oriented design.	Understanding (Level II)
PCC-CS593.CO4	**Create**reusable programs using the concepts of inheritance, multiple inheritances, extending interfaces and accessing package.	Creating (Level VI)
PCC-CS593.CO5	**Experiment with** Exception handling, Thread and composition of systems based on object identity	Applying (Level III)
PCC-CS593.CO6	**Design** applications with an event-driven graphical user interface using AWT and Swing.	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	1	-	-	-	-	1	1	1	3	-	1
CO2	1	1	1	1	1	-	-	-	-	1	-	1	3	-	1
CO3	2	1	1	1	1	-	-	-	-	1	-	1	3	-	1
CO4	1	1	1	1	1	-	-	-	-	1	-	1	3	-	1
CO5	1	1	1	1	1	-	-	-	-	1	-	1	3	-	1
CO6	1	1	3	1	3	-	-	-	2	2	2	1	3	1	1
AVG.	1.33	1.00	1.50	1.00	1.33	-	-	-	2.00	1.17	1.50	1.00	3.00	1.00	1.00

University Syllabus:

Unit	Content	Hrs/Unit
1	Assignments on class, constructor, overloading, inheritance, overriding.	12
2	Assignments on wrapper class, arrays.	3
3	Assignments on developing interfaces- multiple inheritance, extending interfaces.	6
4	Assignments on creating and accessing packages.	6
5	Assignments on multithreaded programming.	6
6	Assignments on applet programming.	3

RESOURCES:

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

SEMESTER – VI
THEORY

Course Title: Data Base Management System	**Code: PCC- CS601**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 6th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS502 Operating System, PCC-CS301 Data structure.

COURSE OBJECTIVE:

- To understand the different issues involved in the design and implementation of a database system.
- To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
- To understand and use data manipulation language to query, update, and manage a database
- 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.
- To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
- To understand the different issues involved in the design and implementation of a database system.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC- CS601.CO1	**Explain** the principles of database management systems	Understanding(II)
PCC- CS601.CO2	**Design** and develop data models.	Creating(VI)
PCC- CS601.CO3	**Illustrate** the features of relational database.	Understanding(II)
PCC- CS601.CO4	**Explain** and evaluate the use of SQL and relational algebra in relational database design.	Evaluating(V)
PCC- CS601.CO5	**Make** use of elementary and advanced concepts towards the ideal database design.	Applying(III)
PCC- CS601.CO6	**Examine** normalization, transaction processing and security approaches in different advanced database categories.	Analyzing(IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	1	1	-	-	-	-	1	3	-	-
CO2	3	3	2	2	2	-	1	-	-	-	-	2	3	1	-
CO3	3	2	3	2	1	-	-	-	-	1	1	2	3	1	-
CO4	3	2	3	2	2	-	-	-	-	1	1	2	3	1	-
CO5	3	2	-	-	-	1	-	-	-	-	-	1	3	-	1
CO6	3	2	-	-	-	1	-	-	-	-	1	1	3	-	1
AVG.	3	2.16	2.66	2	1.67	1.0	1	0	0	1.0	1.0	1.5	3.00	1.0	1

University Syllabus:

Unit	Content	Hrs/Unit
1	**Introduction [4L]** Concept & Overview of DBMS, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS.	4
2	**Entity-Relationship Model [6L]** Basic concepts, Design Issues, Mapping Constraints, Keys, Entity-Relationship Diagram, Weak Entity Sets, Extended E-R features.	6
3	**Relational Model [5L]** Structure of relational Databases, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Views, Modifications Of the Database.	5
4	**SQL and Integrity Constraints [8L]** Concept of DDL, DML, DCL. Basic Structure, Set operations, Aggregate Functions, Null Values, Domain Constraints, Referential Integrity Constraints, assertions, views, Nested Subqueries, Database security application development using SQL, Stored procedures and triggers.	8
5	**Relational Database Design [9L]** Functional Dependency, Different anamolies in designing a Database., Normalization using funtional dependencies, Decomposition, Boyce-Codd Normal Form, 3NF, Nomalization using multi-valued depedencies, 4NF, 5NF	9
6	**Internals of RDBMS [7L]** Physical data structures, Query optimization: join algorithm, statistics and cost bas optimization. Transaction processing, Concurrency control and Recovery Management: transaction model properties, state serializability, lock base protocols, two phase locking.	7
7	**File Organization & Index Structures [6L]** File & Record Concept, Placing file records on Disk, Fixed and Variable sized Records, Types of Single-Level Index (primary, secondary, clustering), Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree .	6

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Three Schema architecture of DBMS	Unit 1
Keys,Entity-RelationshipDiagram,WeakEntitySets,ExtendedE-Rfeatures.	Unit 2
Relational Algebra, Relational Calculus	Unit 3
Use of SQL	Unit 4
Transaction processing, Concurrency control and Recovery Management, state serializability, lock base protocols, two phase locking.	Unit 6
Primary Indexes, Multilevel Indexes, Dynamic Multilevel Indexes using B tree and B+ tree	Unit 7

RESOURCES:

TextBooks:

1. HenryF.KorthandSilberschatzAbraham,“DatabaseSystemConcepts”,Mc.GrawHill.
2. ElmasriRamezandNovatheShamkant,“FundamentalsofDatabaseSystems”,BenjaminCummingsPublishing. Company.
3. Ramakrishnan:DatabaseManagementSystem,McGraw-Hill
4. GrayJimandReuterAddress,“TransactionProcessing:ConceptsandTechniques”,MoraganKauffmanPublishers.

5. Jain:AdvancedDatabaseManagementSystemCyberTech
6. DateC.J.,"IntroductiontoDatabaseManagement",Vol.I,II,III,AddisonWesley.
7. UllmanJD.,"PrinciplesofDatabaseSystems", GalgottiaPublication.
8. JamesMartin,"PrinciplesofDatabaseManagementSystems",1985,PrenticeHallofIndia,NewDelhi
9. "FundamentalsofDatabaseSystems",RamezElmasri,ShamkantB.Navathe,AddisonWesleyPublishingEditi on
10. "DatabaseManagementSystems",ArunK.Majumdar,PritimayBhattacharya,TataMcGrawHill

Course Title: Computer Networks	**Code:PCC- CS602**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 6th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS502 Operating System, PCC-CS302 Computer Organization.

COURSE OBJECTIVE:

- To obtain a theoretical understanding of data communication and computer networks.
- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs) and local area networks (LANs).
- Illustrate various networking protocols such as HDLC, Ethernet, IP, etc.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS 602.CO1	**Outline** the basic concept of networking, types, networking topologies and layered architecture.	Understanding (Level II)
PCC-CS 602.CO2	**Explain** the representation of data and signals in data communication.	Evaluating (Level V)
PCC-CS 602.CO3	**Demonstrate** the physical layer and data link Layer functioning.	Understanding (Level II)
PCC-CS 602.CO4	**Examine** the MAC sub-layer and their operations.	Analyzing (Level IV)
PCC-CS 602.CO5	**Identify** the different types of protocols and their functions within a network.	Applying (Level III)
PCC-CS 602.CO6	**Design** and maintenance of individual networks.	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	1	-	2	2	1	-	3	-	2	1	3	3
CO2	3	2	1	1	2	-	-	-	-	1	1	3	3	2	1
CO3	3	2	3	1	1	-	-	-	-	2	2	2	3	2	2
CO4	3	3	3	2	-	-	-	2	-	2	2	2	1	2	1
CO5	3	2	1	1	3	-	-	2	-	1	2	2	3	2	2
CO6	3	2	2	1	-	-	2	2	3	-	2	3	1	2	1
AVG.	3.00	2.00	1.83	1.17	2.00	2.00	2.00	1.75	3.00	1.80	1.80	2.33	2.00	2.17	1.67

University Syllabus:

Unit	Content	Hrs/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, Slotted ALOHA,CSMA/CD,CDMA/CA	8
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.	14
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

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Error detection & correction methods; Flow control protocols, Multiple access protocols.	Module 2
Addressing, Routing, CongestionControl	Module 3
Cryptography	Module 4

RESOURCES:

1. B A Forouzan: Data Communications and Networking, TMH, 2003.
2. A S Tanenbaum: Computer Networks, PHI, 2004.
3. W Stallings: Data and Computer Communications, PHI/Pearson.

Course Title: Advanced Algorithm	**Code: PEC- IT601A**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 6th sem	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: PCC CS 404 (Design and Analysis of Algorithm), PCCCS301 (Data Structure and Algorithm)

COURSE OBJECTIVE:

- To learn advanced methods of designing and analyzing algorithms
- To choose appropriate algorithm for a specific task
- To familiarize students with different data structures needed to understand advanced algorithms
- To know different classes of problems concerning their computational difficulties
- To introduce the students to recent developments in the area of algorithmic design

COURSE OUTCOMES (COs)

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
PEC- IT601A.CO1	**Design** and analyse programming problem statements	Analyzing(Level IV)
PEC- IT601A.CO2	**Define** appropriate data structures and algorithms, understand the ADT/libraries, and use it to design algorithms for a specific problem	Remembering(Level I)
PEC- IT601A.CO3	**Describe** the necessary mathematical abstraction to solve problems	Understanding(Level II)
PEC- IT601A.CO4	**Compare** with analysis of efficiency and proofs of correctness	Analyzing(Level IV)
PEC-IT601D .CO5	**Implement** selected algorithm design approaches in a problem specific manner	Applying(Level III)
PEC- IT601A.CO6	**Select** best fit method for a problem solving	Evaluating(Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	-	-	-	-	-	-	-	-	2	-	-	-
CO2	3	3	2	-	-	-	2	-	3	2	-	1	2	-	3
CO3	3	2	2	-	3	-	1	-	-	1	-	-	-	2	-
CO4	3	2	2	3	1	1	-	-	3	-	-	-	-	2	-
CO5	3	2	2	2	2	2	2	1	3	1	-	-	2	3	1
CO6	3	3	3	2	2	2	-	1	3	-	2	-	3	-	1
AVG.	3.0	2.17	2.17	2.33	2.0	1.67	1.67	1.0	3.0	1.33	2.0	1.5	2.33	2.33	1.67

University Syllabus :

Unit	Content	Hours/ Unit
1	**Sorting:** Review of various sorting algorithms, topological sorting. **Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.	6
2	**Matroids:** Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. Graph **Matching:** Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	8
	Flow-Networks: Maxflow-mincut theorem, Ford Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. **Matrix Computations:** Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	9
3	**Shortest Path in Graphs:** Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. **Modulo Representation of integers/polynomials:** Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. **Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication	10

	algorithm	
4	**Linear Programming:** Geometry of the feasibility region and Simplex algorithm **NP-completeness:** Examples, proof of NP-hardness and NP-completeness. **One or more of the following topics based on time and interest** Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm	10
5	Recent Trends in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5

RESOURCES:

Text book and Reference books:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. “Design and Analysis of Algorithms” by Gajendra Sharma.

Course Title: Image Processing	**Code: PEC-IT601D**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 6th sem	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer:Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Study on Basic Knowledge on Image, Study on signal system

COURSE OBJECTIVE:

- Tostudy the image fundamentals and mathematical transforms necessary for image processing.
- To study the image enhancement techniques.
- To study image restoration procedures.
- To study the image compression procedures

COURSE OUTCOMES (COs)

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
PEC-IT601D.CO1	**Define** the fundamental concepts of a digital image processing system.	Remembering(Level I)
PEC-IT601D .CO2	**Compare** the different concepts of a digital image formation.	Understanding(Level II)
PEC-IT601D .CO3	**Analyze** the images in the frequency domain using various transforms.	Analyzing(Level IV)
PEC-IT601D .CO4	**Elaborate** the techniques for image enhancement.	Creating(Level VI)
PEC-IT601D .CO5	**Identify** the techniques for image restoration.	Applying(Level III)
PEC-IT601D .CO6	**Interpret** image segmentation and various representation techniques	Evaluating(Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	2	-	-	-	-	-	-	-	-	1	-	-
CO2	2	1	3	2	-	-	-	-	-	-	-	-	1	-	1
CO3	3	1	3	2	-	-	-	-	-	-	-	-	1	-	1
CO4	2	1	3	2	2	-	-	-	-	-	-	1	1	-	1
CO5	2	1	3	2	2	-	-	-	-	-	-	1	1	-	1
CO6	2	1	3	2	2	-	-	-	-	-	-	1	1	1	1
AVG.	2	1	3	2	2	-	-	-	-	-	-	1	1	1	1

University Syllabus:

Unit	Content	Hrs/Unit
1	**Introduction [3L]** Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	3
2	**Digital Image Formation [4L]** A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform.	4
3	**Mathematical Preliminaries[9L]** 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 & SineTransform.	9
4	**Image Enhancement [8L]** Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High- pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8
5	**Image Restoration [7L]** Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation	7
6	**Image Segmentation [7L]**	7

	Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection - 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.	

RESOURCES:

Text Books:

1. Ivor Horton's Beginning Java 2 SDK – Wrox
2. E. Balagurusamy – " Programming With Java: A Primer" – 3rd Ed. – TMH

Reference Books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India
2. Ali Bahrami – "Object Oriented System Development" – McGraw 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

Course Title: Numerical Methods	**Code: OEC-IT601A**
Type of Course: Theory	**Course Designation: Compulsory**
Semester: 6th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: C-Language, Data structure.

COURSE OBJECTIVE:

- Explain the principles and modules of numerical methods.
- Compare performance of different algorithms in numerical methods.
- Produce algorithmic solutions to different mathematical problems.
- Illustrate numerical methods concepts such as interpolation, integration, and root evaluation, solving of differential equation and solving a set of linear equations.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
OEC-IT601A.CO1	**Demonstrate** common numerical methods and how they are used to obtain approximate solutions to complex mathematical problems.	Understanding (Level II)
OEC-IT601A.CO2	**Apply** different numerical methods to solve real life mathematical problem.	Applying (Level III)
OEC-IT601A.CO3	**Analyze** different numerical algorithms to solve a particular problem.	Analyzing (Level IV)
OEC-IT601A.CO4	**Define** a mathematical problem with its assumption to solve it using numerical algorithm.	Remembering (Level I)
OEC-IT601A.CO5	**Interpret** a mathematical problem to use accurate numerical algorithm to solve it.	Understanding (Level II)
OEC-IT601A.CO6	**Evaluate** interpolation, integration, root evaluation, solving of differential equation and solving a set of linear equations.	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2	2	-	2	1	1	2	3	1	2	3	3	1
CO2	3	2	1	2	2	-	-	-	2	1	-	2	3	2	1
CO3	3	2	3	1	-	-	-	1	2	2	-	2	3	2	1
CO4	3	2	2	2	-	-	-	-	2	2	-	2	3	2	1
CO5	3	2	1	2	3	-	-	-	2	1	-	2	3	2	1
CO6	3	2	3	2	-	-	-	-	2	-	-	1	3	2	1
AVG.	3.00	1.83	2.00	1.83	2.50	2.00	1.00	1.00	2.00	1.80	1.00	1.83	3.00	2.17	1

University Syllabus:

Unit	Content	Hrs/Unit
1	Approximation in numerical computation: Truncation and rounding errors, Fixed and floatingpoint arithmetic, Propagation of errors	2
2	Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	8
3	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.	3
4	Numerical solution of a system of linear equations: Gauss elimination method, Matrix inversion, LU Factorization method, Gauss-Seidel iterative method.	8
5	Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method.	3
6	Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, PredictorCorrector methods and Finite Difference method.	2

RESOURCES:

1. C. Xavier:CLanguageandNumericalMethods.
2. Dutta&Jana:IntroductoryNumericalAnalysis.
3. J. B. Scarborough:NumericalMathematicalAnalysis.
4. Jain,Iyengar,&Jain:NumericalMethods(ProblemsandSolution).

Course Title: Parallel and Distributed Algorithms	**Code: PEC-IT602A**
Type of Course: Theory	**Course Designation: Elective**
Semester: 6th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

COURSE OBJECTIVE:

- To introduce the fundamentals of parallel and distributed computing paradigms.
- To understand the technologies, system architecture, and communication architecture that propelled the growth of parallel and distributed computing systems.
- To develop and execute basic parallel and distributed application using basic programming models and tools.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PECIT602A.CO1	**Explain** the basic architectures of parallel computers.	Understanding (Level II)
PECIT602A.CO2	**Discuss** various performance metrics of a parallel processing system.	Evaluating (Level V)
PECIT602A.CO3	**Analyze** different parallel programming algorithms designated for domain decomposition.	Analysing (Level IV)
PECIT602A.CO4	**Analyze** different parallel programming algorithms designated for functional decomposition.	Analysing (Level IV)
PECIT602A.CO5	**Discuss** various architectural issues of parallel computing and different algorithms to handle these issues.	Applying (Level III)
PECIT602A.CO6	**Demonstrate** different multiprocessor programming language constructs for specifying parallelism.	Understanding (Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	-	-	-	-	-	-	-	-	3	-	-
CO2	3	1	1	1	-	-	-	-	-	-	-	-	3	-	-
CO3	3	3	3	2	-	-	-	-	-	-	-	2	3	2	1
CO4	3	3	3	2	-	-	-	-	-	-	-	2	3	2	1
CO5	3	3	3	2	-	-	-	-	-	-	-	1	3	2	2
CO6	3	3	3	3	2	-	-	-	-	-	-	-	3	3	2
AVG.	**3.00**	**2.5**	**2.33**	**1.83**	**2.00**	**0**	**0**	**0**	**0**	**0**	**0**	**1.67**	**3.00**	**2.25**	**1.5**

University Syllabus:

Unit	Content	Hrs/Unit
1	Basic Techniques, Parallel Computers for increase Computation speed, Parallel & Cluster Computing.	8
2	Message Passing Technique- Evaluating Parallel programs and debugging, Partitioning and Divide and Conquer strategies examples.	8
3	Pipelining- Techniques computing platform, pipeline programs examples	8
4	Synchronous Computations, load balancing, distributed termination examples, programming with shared memory, shared memory multiprocessor, constructs for specifying parallelism, sharing data, parallel programming languages and constructs, open MP	11
5	Distributed shared memory systems and programming achieving constant memory, Distributed shared memory programming primitives, Algorithms – sorting and numerical algorithms.	9

Course Title: Pattern Recognition	**Code: PEC-IT602D**
Type Of Course: Theory	**Course Designation: Elective**
Semester:6thsem	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: Nil

COURSE OBJECTIVE:

- To understand some basic concepts of research and its methodologies
- To identify appropriate research topics
- To select and define appropriate research problem and parameters
- To prepare a project proposal (to undertake a project)
- To organize and conduct research (advanced project) in a more appropriate manner
- To write a research report and thesis
- To write a research proposal (grants)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
PEC-IT602D.CO1	**Describe**the basic concepts of pattern recognition (measuring objects, features and patterns, representation, per-processing, distance and similarity measures) and analyses bayes classifiers in terms of error probabilities, discriminant functions, decision surfaces, normal density and discriminant functions, discrete features	Remembering (Level I)
PEC-IT602D.CO2	**Explain**the parameter estimation methods using the maximum-likelihood estimation, gaussian mixture models, expectation-maximization method and bayesian estimation and the non-parametric techniques such as k-Nearest neighbours, parzen window for density estimation.	Understanding(Level II)
PEC-IT602D.CO3	**Analyze** the linear discriminant function based classifier design such as perceptron and support vector machines	Analyzing (Level IV)
PEC-IT602D.CO4	Illustrate hidden markov models for sequential pattern recognition	Understanding(Level II)
PEC-IT602D.CO5	**Exemplify**the Non-metric methods for pattern classification and formulate the dimension reduction methods such as principal component analysis, fischer's discriminant Analysis	Creating(Level VI)
PEC-IT602D.CO6	**Explain** unsupervised learning and clustering algorithms, and analyses their strengths and weakness	Understanding(Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	1	1	-	-	-	2	1	3	2	3
CO2	3	3	2	2	2	1	1	-	-	-	2	1	3	2	3
CO3	3	3	2	2	2	1	1	-	-		2	1	3	2	3
CO4	3	3	2	2	2	1	1	-	-	-	1	1	3	2	3
CO5	3	3	2	2	2	1	1	-	-	-	2	1	3	2	3
CO6	3	3	2	2	2	1	1	-	-	-	2	1	3	2	3
AVG.	3	3	2	2	2	1	1	0	0	0	1.833	1	3	2	3

University Syllabus:

Unit	Content	Hrs/Unit
1	Basics of pattern recognition	2
2	Bayesian decision theory 8L Classifiers, Discriminant functions, Decision surfaces Normal density and discriminant functions Discrete features	8
3	Parameter estimation methods 6L Maximum-Likelihood estimation Gaussian mixture models Expectation-maximization method Bayesian estimation	6
4	Hidden Markov models for sequential pattern classification 8L Discrete hidden Markov models Continuous density hidden Markov models	8
5	Dimension reduction methods 5.1. Fisher discriminant analysis 5.2Principal component analysis. Parzen-window method K-Nearest Neighbour method	3
6	Non-parametric techniques for density estimation	2
7	Linear discriminant function based classifier 5L Perceptron Support vector machines	5
8	Non-metric methods for pattern classification 4L Non-numeric data or nominal data Decision trees	4
9	Unsupervised learning and clustering 2L Criterion functions for clustering Algorithms for clustering: K-means, Hierarchical and other methods	2

RESOURCES:

Text Books:

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.

Reference Books:

3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

SEMESTER- VI
SESSIONAL

Course Title: Research Methodology	**Code: PROJ- CS601**
Type Of Course: Sessional	**Course Designation:Compulsory**
Semester: 6th sem	**Contact Hours: 3L/week**
Continuous Assessment: 60 Marks	**Final Exam: 40 Marks**
Writer:Course Coordinator	**Approved by Program Assessment Committee (PAC)**

Pre-requisites: NA

COURSE OBJECTIVE:

- To understand some basic concepts of research and its methodologies
- To identify appropriate research topics
- To select and define appropriate research problem and parameters
- To prepare a project proposal (to undertake a project)
- To organize and conduct research (advanced project) in a more appropriate manner
- To write a research report and thesis
- To write a research proposal (grants)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

CO Number	CO statement	Knowledge Level of revised Bloom's Taxonomy
PROJ- CS601.CO1	**Define** and understand the motivation and objectives of research work	Remembering (Level I)
PROJ- CS601.CO2	**Explain** how to define and formulate a research problem	Understanding(Level II)
PROJ- CS601.CO3	**Identify** the importance of literature review in a research work	Applying(Level III)
PROJ- CS601.CO4	**Examine** the appropriate statistical methods required for a particular research design and develop the appropriate research hypothesis for a research project	Analyzing (Level IV)
PROJ- CS601.CO5	**Explain** the ethical issues involved while undertaking research	Understanding(Level II)
PROJ- CS601.CO6	**Develop** the skill set to correctly present a research work by following the protocols of writing a standard research report.	Creating(Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	-	-	-	1	-	2	3	3	2	3
CO2	3	3	2	2	2	-	-	-	1	-	2	3	3	2	3
CO3	3	1	2	2	2	-	-	-	1	-	2	3	3	2	3
CO4	3	2	2	2	3	-	-	-	1	-	2	3	3	2	3
CO5	-	-	-	-	-	-	-	3	1	-	-	3	2	3	3
CO6	3	3	2	2	3	-	-	-	1	-	2	3	2	3	3
AVG.	3	2.4	2.2	2	2.4	0	0	3	1	0	2	3.00	2.66	2.33	3

University Syllabus :

Unit	Content	Hrs/Unit
1	RESEARCH FORMULATION AND DESIGN Motivation and objectives – Research methods vs. Methodology. Types of research – Descriptive vs. Analytical, Applied vs. Fundamental, Quantitative vs. Qualitative, Conceptual vs. Empirical, concept of applied and basic research process, criteria of good research. Defining and formulating the research problem, selecting the problem, necessity of defining the problem, importance of literature review in defining a problem, literature review-primary and secondary sources, reviews, monograph, patents, research databases, web as a source, searching the web, critical literature review, identifying gap areas from literature and research database, development of working hypothesis.	9
2	DATA COLLECTION AND ANALYSIS Accepts of method validation, observation and collection of data, methods of data collection, sampling methods, data processing and analysis strategies and tools,data analysis with statically package (Sigma STAT,SPSS for student t-test, ANOVA, etc.), hypothesis testing	9
3	RESEARCH ETHICS, IPR AND SCHOLARY PUBLISHING Ethics-ethical issues, ethical committees (human & animal); IPR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); scholarly publishing- IMRAD concept and design of research paper, citation and acknowledgement, plagiarism, reproducibility and accountability	9
4	INTERPRETATION AND REPORT WRITING Meaning of Interpretation, Technique of Interpretation, Precaution in Interpretation, Significance of Report Writing, Different Steps in Writing Project Report, Layout of the Project/Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Project/Research Report, Precautions for Writing Research Reports, Conclusions.	9

RESOURCES:

Text books :

1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K., 2002. An introduction to ResearchMethodology, RBSA Publishers.
2. Kothari, C.R., 1990. Research Methodology: Methods and Techniques. New Age International.418p.
3. Sinha, S.C. and Dhiman, A.K., 2002. Research Methodology, Ess Ess Publications. 2 volumes.

Reference books and Materials:

1. Trochim, W.M.K., 2005. Research Methods: the concise knowledge base, Atomic Dog Publishing. 270p.
2. Wadehra, B.L. 2000. Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
3. Anthony, M., Graziano, A.M. and Raulin, M.L., 2009. Research Methods: A Process of Inquiry, Allyn and Bacon.
4. Carlos, C.M., 2000. Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options. Zed Books, New York.

SEMESTER- VI
PRACTICAL

Course Title: Data Base Management System Lab	**Code:PCC-CS691**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 6th	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS391 Data structure & Algorithm Lab.

COURSE OBJECTIVE:

- To understand the practical applicability of database management system concepts.
- Working on existing database systems, designing of database, creating relational database, analysis of table design.
- provide practical knowledge to understand database applications using procedures, cursors and triggers

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS691	**Illustrate** the basic principles of database management systems	Understanding (Level II)
PCC-CS691	**Apply** SQL for designing and creating relational database.	Applying (Level III)
PCC-CS691	**Analyze** the use of SQL for table and record handling	Analyzing (Level IV)
PCC-CS691	**Explain** and evaluate the use of SQL for retrieving data using different clauses.	Evaluating (Level V)
PCC-CS691	**Elaborate** the concepts of view, grant, revoke etc.	Creating (Level VI)
PCC-CS691	**Develop** stored procedures, triggers and cursor using PL/SQL	Applying (Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	1	-	-	-	-	-	2	2	-	-
CO2	3	2	2	2	2	-	-	-	-	-	-	2	3	-	-
CO3	3	2	2	3	1	-	-	-	-	1	1	1	2	2	-
CO4	3	3	3	2	1	-	-	-	-	1	1	2	3	1	1
CO5	3	2	-	-	-	1	-	-	-	-	-	2	2	-	1
CO6	3	2	-	-	-	1	-	-	-	-	1	1	3	-	1
AVG.	3	3	-	-	-	1	0	0	0	1.00	1.00	1.67	2.50	1.50	1.00

University Syllabus:

Unit	Content
1	Structured Query Language • 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 1. The SELECT statement 2. Using the WHERE clause 3. Using Logical Operators in the WHERE clause 4. Using IN, BETWEEN, LIKE , ORDER BY, GROUP BY and HAVING Clause 5. Using Aggregate Functions 6. Combining Tables Using JOINS 7. Subqueries
4	Database Management Creating Views, Creating Column Aliases, Creating Database Users, Using GRANT and REVOKE
5	Cursors in Oracle PL / SQL Writing Oracle PL / SQL Stored Procedures

RESOURCES:

1. SQL,PL/SQL The programming language of ORACLE, I.Bayross, BPB Publication.
2. Oracle PL/SQL Programming,Steven Feuerstein, Bill Pribyl, O'Reilly.

Course Title: Computer Networking Lab	**Code: PCC-CS692**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 6th	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: ESCS-291 C Programming, Java Programming,PCC-CS592 Operating System Lab.

COURSE OBJECTIVE:

- To obtain a theoretical understanding of data communication and computer networks.
- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs) and local area networks (LANs).
- Illustrate various networking protocols such as HDLC, Ethernet, IP, etc.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PCC-CS692.CO1	**Explain** OSI Reference Model and in particular have a good knowledge of different networking commands and IP addressing.	Understanding (Level II)
PCC-CS692.CO2	**Observe** different networking components.	Understanding (Level II)
PCC-CS692.CO3	**Design** and test error detection and correction mechanism concepts.	Creating (Level VI)
PCC-CS692.CO4	**Apply** knowledge of socket programming to implement client-server architecture.	Applying (Level III)
PCC-CS692.CO5	**Develop** simple data transmission using networking concepts.	Applying (Level III)
PCC-CS692.CO6	**Analyze** the requirements for a given organizational structure and select the most appropriate networking architecture and implement them.	Analyzing (Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	-	-	-	-	1	1	-	3	-	2	1	3	3
CO2	3	2	2	1	3	-	-	1	1	1	1	3	3	2	3
CO3	3	3	3	1	1	-	-	-	2	2	2	2	3	2	2
CO4	3	2	2	2	1	2	1	2	2	2	2	2	3	2	3
CO5	3	2	-	-	2	-	-	2	-	1	-	2	1	2	1
CO6	3	3	2	3	2	2	2	2	3	2	2	3	3	2	3
AVG.	3	2.17	2.25	1.75	1.8	2	1.33	1.6	2	1.83	1.75	2.33	2.33	2.17	2.5

University Syllabus:

Module	Content	Hrs/Unit
1	NIC Installation & Configuration (Windows/Linux) Understanding IP address, subnet mask. **Different LAN Topologies**: Mesh, Bus, Star and Tree etc. and their advantages and disadvantages. **Different networking commands**: ipconfig, ping, tracert, nslookup and netstat.	3
2	**Familiarization with** : 1. Networking cables (CAT5, UTP) 2. Connectors (RJ45, T-connector). 3. Hubs, Switches. **Hands on**: Straight cable and cross cable connection using clamping tools. Connect two pc's using cross cable and connect more than two pc's using straight cable and switch.	3
3	**Data Link Layer Error Detection Mechanism** (Cyclic Redundancy Check) using C program.	3
4	**Data Link Layer Error Correction Mechanism** (Hamming Code) using C program.	3
5	**TCP/UDP Socket Programming Using Java** Multicast & Broadcast Sockets	3
6	**Java Socket Programming**: ECHO CLIENT, ECHO SERVER for single client.	3
7	**Java Socket Programming**: ECHO CLIENT, ECHO SERVER for multiple client support using java Thread class.	3
8	**Data Link Layer Flow Control Mechanism** (Stop & Wait, Sliding Window) using c program.	3
9	**Server Setup/Configuration**: FTP, TELNET, NFS, DNS, Firewall.	3

RESOURCES:

1. B A Forouzan : Data Communications and Networking, TMH, 2003.
2. W Richard Stevens; UNIX Network Programming (Vol-1), AWP, 2004.
3. H Schildt; Java: The Complete Reference, TMH, 2008.

COURSE BOOKLET FOR B.TECH (IT)

FOURTH YEAR

SEMESTER – VII
THEORY

Course Title: Internet Technology	**Code: PEC-IT701A**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 7th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer:Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Basic Programming and Computer Networks.

COURSE OBJECTIVE:

- Define the terms related to Internet.
- Understand how computers are connected to the Internet.
- Demonstrate the ability to used World Wide Web.
- Understand how webpages are designed and created.
- Understand and used common types of protocol, files found on the internet.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PEC-IT701A.CO1	**Demonstrate** the concept of computer networks and various protocols related to this.	Understanding (Level I)
PEC-IT701A.CO2	**Creating** a web page and identify its elements and attributes.	Creating (Level VI)
PEC-IT701A.CO3	**Develop** the concepts of Internet Telephony, Multimedia Applications and Search Engines.	Developing (Level III)
PEC-IT701A.CO4	**Explain** the protocols related to networking such as TCP/IP , FTP, HTTP etc.	Evaluating (Level V)
PEC-IT701A.CO5	**Apply**the concepts of Client-Server programming for a given problemand develop a solution using the technologies taught like PERL and Java.	Analyzing (Level VI)
PEC-IT701A.CO6	**Understand** the security issues while using different technologies for web programming.	Understanding (Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	3	2	1	3	3	3	-	2	2	2	1
CO2	2	3	1	2	2	1	-	1	2	1	1	3	2	2	1
CO3	2	2	3	1	1	-	1	2	3	2	2	1	2	3	1
CO4	2	2	3	2	1	3	3	3	3	2	2	2	3	2	1
CO5	2	3	1	3	3	1	2	1	3	1	2	2	3	2	1
CO6	3	1	2	1	1	-	1	2	2	1	2	2	3	2	1
AVG.	2.17	2.00	1.83	1.67	1.83	1.75	1.60	2.00	2.67	1.67	1.80	2.00	2.50	2.17	1.00

University Syllabus:

Unit	Content	Hrs/Unit
1	**Introduction (1L):** Overview, Network of Networks, Intranet, Extranet and Internet. World Wide Web (1L): Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP (1L): Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing (1L): Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables. Internet Routing Protocol (1L): Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail (1L): POP3, SMTP.	6
2	**HTML (3L):** Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Colorname, Colorvalue. Image Maps (1L): map, area, attributes of image area. Extensible Markup Language (XML) (4L): Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. CGI Scripts (1L): Introduction, Environment Variable, GET and POST Methods.	9
3	**PERL (3L):** Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. JavaScript (4L): Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Cookies (1L): Definition of cookies, Create and Store a cookie with example. Java Applets (2L): Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.	10
4	**Client-Server programming In Java (2L):** Java Socket, Java RMI. Threats (1L): Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Network security techniques (2L): Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH). Firewall (1L): Introduction, Packet filtering, Stateful, Application layer, Proxy.	4
5	**InternetTelephony(1L):** Introduction,VoIP. MultimediaApplications(2L): MultimediaoverIP:RSVP,RTP,RTCPandRTSP.Streaming media,CodecandPlugins,IPTV. SearchEngineandWebCrawler (2L): Definition,Metadata,WebCrawler,Indexing,Pagerank,overviewofSEO..	5

RESOURCES:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5,7,8,9).
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)

Course Title: Cloud Computing	**Code:PEC- IT701C**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 7th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Basic concept on Operating system and database.

COURSE OBJECTIVE:

- To learn how to use Cloud Services and applications.
- Apply Virtualization concepts on different cloud services
- Cloud infrastructure, services and application management

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PEC- IT701C.CO1	**Explain** the main concepts, key technologies, strengths and limitations of cloud computing	Understanding (Level II)
PEC- IT701C.CO2	**Discuss** the architecture, infrastructure and delivery models of cloud computing	Creating (Level VI)
PEC- IT701C.CO3	**Apply** suitable virtualization concept	Applying (Level III)
PEC- IT701C.CO4	**Analyze** the components of Google web, AWS and Microsoft cloud services	Analyzing (Level IV)
PEC- IT701C.CO5	**Discover** the core issues of cloud computing such as security, privacy and interoperability	Analyzing (Level IV)
PEC- IT701C.CO6	**Ability** to choose the appropriate services and technologies for the related issues.	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	1	2	-	-	1	1	-	1	1	2	1
CO2	3	2	2	1	2	1	-	2	2	1	1	1	1	1	1
CO3	3	2	2	2	2	2	1	1	2	1	1	2	-	1	2
CO4	3	2	1	2	2	2	1	1	2	1	1	2	-	1	2
CO5	3	2	2	-	1	1	2	1	1	2	1	2	1	2	1
CO6	3	2	2	3	2	2	2	1	1	1	2	2	2	-	3
AVG.	3.00	2.00	1.67	1.80	1.67	1.67	1.50	1.20	1.50	1.17	1.20	1.67	1.25	1.40	1.67

University Syllabus:

Unit	Content	Hrs/Unit
1	**Module1:DefinitionofCloudComputinganditsBasics(Lectures:9)** **DefinitionofCloudComputing:** Defining a Cloud, Cloud Types – NIST model, Cloud Cube model,Deployment models	9

	(Public , Private, Hybridand Community Clouds), Service models – Infrastructure as a Service, Platform as a Service, Software as aServicewithexamplesofservices/serviceproviders, CloudReferencemodel Characteristics of Cloud Computing – a shift in paradigm Benefits and advantagesof CloudComputing **CloudArchitecture:** A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols,Applications, ConnectingtotheCloudbyClients **ServicesandApplicationsbyType** IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silosPaaS–Basicconcept,toolsanddevelopmentenvironment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platformIdentityas aService(IDaaS) ComplianceasaService(CaaS)	
2	**<u>Module2:UseofPlatformsinCloudComputing(Lectures:12)</u>** **ConceptsofAbstractionandVirtualization** Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V,V2V,V2P,P2P,D2C,C2C,C2D,D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced loadbalancing(includingApplicationDeliveryControllerandApplicationDeliveryNetwork), MentionofTheGoogleCloud as anexampleofuseofloadbalancing Hypervisors: Virtual machine technology and types, VMware vSphereMachineImaging(includingmentionofOpenVirtualization Format–OVF) PortingofapplicationsintheCloud:ThesimpleCloudAPIandAppZeroVirtualApplicationappliance **ConceptsofPlatformasaService** Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com),Applicationdevelopment UseofPaaSApplicationframeworks **UseofGoogleWebServices** Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation,Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on GoogleToolkit(includingintroduction ofGoogleAPIsin brief), majorfeaturesofGoogle App Engineservice. **Use of AWS** Amazon Web Service components and services: Amazon Elastic Cloud, Amazon Simple Storage system, AmazonElasticBlockStore, AmazonSimpleDB and Relational DatabaseService **UseofMicrosoftCloudServices** Windows Azure platform: Microsoft's approach, architecture, and main elements,	12

	overview of Windows AzureAppFabric, Content DeliveryNetwork,SQL Azure,andWindows Liveservices	
3	**Module3:CloudInfrastructure(Lectures:7)** Typesofservicesrequiredinimplementation–Consulting,Configuration,CustomizationandSupport **CloudManagement** An overview of the features of network management systems and a brief introduction of related products fromlargecloudvendors,Monitoringofanentirecloud computingdeploymentstack–anoverviewwithmentionof someproducts,Lifecyclemanagementofcloudservices(sixstagesoflifecycle) **ConceptsofCloudSecurity** Cloudsecurityconcerns,Securityboundary,SecurityserviceboundaryOverviewofsecuritymapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing andcompliance Identitymanagement(awareness ofIdentityprotocolstandards)	7
4	**Module4:Concepts ofServices andApplications(Lectures:8)** **Service Oriented Architecture:** Basic concepts of message-based transactions, Protocol stack for an SOAarchitecture, Event-drivenSOA, EnterpriseServiceBus,Servicecatalogs **Applications in the Cloud:** Concepts of cloud transactions, functionality mapping, Application attributes, Cloudserviceattributes, Systemabstractionand Cloud Bursting,Applicationsand CloudAPIs **Cloud-basedStorage:**Cloudstoragedefinition–MannedandUnmanned **Webmail Services:** Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoomail, conceptsof Syndicationservices	8

RESOURCES:

1. Cloud ComputingBiblebyBarrieSosinsky, WileyIndiaPvt. Ltd,2013
2. MasteringCloudComputingbyRajkumarBuyya,ChristianVecchiola,S.ThamaraiSelvi,McGraw HillEducation (India)PrivateLimited,2013
3. Cloudcomputing:Apracticalapproach,AnthonyT.Velte,TataMcgraw-Hill
4. CloudComputing,Miller,Pearson
5. Buildingapplicationsincloud:Concept,PatternsandProjects,Moyer,Pearson

Course Title: Cyber Security	**Code: PEC-IT702F**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 8th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS602 Computer Networking.

COURSE OBJECTIVE:

- Explain the different types Cyber-crimes.
- Provide cyber-security awareness.
- Create counter measure against cyber-crimes
- Familiar with different cyber-crimes laws in India and outside.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PEC-IT702F.CO1	**Explain** the different types of cyber-crime on cyber space.	Understanding (Level II)
PEC-IT702F.CO2	**Recall** the different laws related to cyber-crimes.	Remembering (Level I)
PEC-IT702F.CO3	**Implement** cyber security solutions and use of cyber security, information assurance, and cyber/computer forensics software or tools.	Applying (Level III)
PEC-IT702F.CO4	**Design** and develop security architecture for an organization.	Creating (Level VI)
PEC-IT702F.CO5	**Find** solutions in cyber-crime investigations, evidence and applicable law for real world case studies.	Analyzing (Level IV)
PEC-IT702F.CO6	**Examine** the software vulnerabilities and security solutions to reduce the risk of exploitation.	Analyzing (Level IV)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1	1	3	1	-	-	2	1	2	1
CO2	1	1	1	-	-	2	1	2	-	-	-	2	1	2	1
CO3	3	3	3	1	3	2	2	2	-	-	-	2	3	3	2
CO4	3	2	3	2	3	1	1	2	-	-	-	2	3	3	2
CO5	3	1	1	3	2	2	-	2	-	-	-	2	2	3	2
CO6	3	3	3	1	2	2	-	2	-	-	-	2	2	3	2
AVG.	2.67	1.83	2.00	1.75	2.50	1.67	1.25	2.17	1.00	0.00	0.00	2.00	2.00	2.67	1.67

University Syllabus:

Unit	Content	Hrs/Unit
1	**Introduction:** Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyberwarfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cybersecurity - Organizational Implications.	6
2	**Hackers and Cyber Crimes**: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.	7
3	**Ethical Hacking and Social Engineering**: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modelling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defence Strategies.	8
4	**Cyber Forensics and Auditing**: Introduction to Cyber Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management.	10

	Introduction to ISO 27001:2013	
5	**Cyber Ethics and Laws:** Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec.	5

RESOURCES:

Text Books

1. Cyber security , Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House (AICTE Recommended - 2018)
3. Information Security and Cyber Laws, Pankaj Agarwal
4. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cyberdefense Program Against Advanced Threats, A-press

Reference Books

1. Hacking the Hacker, Roger Grimes, Wiley
2. Cyber Law By Bare Act, Govt Of india, IT Act 2000.

Course Title: Soft Skills & Interpersonal Communication	**Code: OEC-IT701C**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 7th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: HM- HU201(English)

COURSE OBJECTIVE:

- To encourage the all round development of students by focusing on soft skills.
- To make the engineering students aware of the importance, the role and the content of soft skills through instruction, knowledge acquisition, demonstration and practice.
- To develop and nurture the soft skills of the students through individual and group activities.
- To expose students to right attitudinal and behavioral aspects and to build the same through activities

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
OEC-IT701C.CO1	**Define**Soft Skills; Process, Importance and Measurment of Soft Skill Development.	Remembering (Level I)
OEC-IT701C.CO2	**Write** precise briefs or reports and technical documents.	Creating (Level VI)
OEC-IT701C.CO3	**Demonstrate**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.	Understanding (Level II)
OEC-IT701C.CO4	**Analyze**Skills, Methods, Strategies and Essential tips for effective public speaking.	Analyzing (Level VI)
OEC-IT701C.CO5	**Participate** in group discussion / meetings / interviews and prepare & deliver presentations	Creating (Level VI)
OEC-IT701C.CO6	**Discuss** on various Interview Skills,Presentation Skills,Etiquette and Manners,Time Management,Personality Development	Creating (Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	1	-	-	-	-	-	1	-	2	-	2	2	-	-
CO2	-	1	-	-	-	-	-	1	-	2	-	2	2	-	-
CO3	-	1	-	-	-	-	-	1	-	2	-	2	2	-	-
CO4	-	1	-	-	-	-	-	1	-	2	-	2	2	-	-
CO5	-	1	-	-	-	-	-	1	-	2	-	2	2	-	-
CO6	-	1	-	-	-	-	-	1	-	2	-	2	2	-	-
AVG.	0	1.00	0	0	0	0	0	1.00	0	2	0	2.00	2.00	0	0

University Syllabus:

Unit	Content	Hrs/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. 5. 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 Manner**s – Social and Business. 4. **Time Management –** Concept, Essentials, Tips. 5. **Personality Development –** Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.	12

RESOURCES:

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 Title: Project Management and Entrepreneurship	**Code: HSMC 701**
Type Of Course: Theory	**Course Designation: Compulsory**
Semester: 7th	**Contact Hours: 2L+1T/week**
Continuous Assessment: 25	**Final Exam: 70**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Subject knowledge on Computer science.

COURSE OBJECTIVE:

- To explain concepts of Entrepreneurship and build an understanding about business situations in which entrepreneurs act
- To qualify students to analyse the various aspects, scope and challenges under an entrepreneurial venture
- To explain classification and types of entrepreneurs and the process of entrepreneurial project development.
- To discuss the steps in venture development and new trends in entrepreneurship.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
HSMC 701.CO1	**Examine** role of entrepreneur in economic development	Applying(Level III)
HSMC 701.CO2	**Describe** the steps to establish an enterprise	Remembering (Level I)
HSMC 701.CO3	**Compare** and classify types of entrepreneurs	Analyzing(Level IV)
HSMC 701.CO4	**Evaluate** the entrepreneurial support in India	Evaluate (Level V)
HSMC 701.CO5	**Describe** Special institutions for entrepreneurial development and assistance in India	Remembering (Level I)
HSMC 701.CO6	**Explain** project Identification	Creating(Level VI)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	2	2	1	-	-	-	-	2	2	1	1	1
CO2	3	3	3	2	2	-	-	-	-	-	2	2	2	3	1
CO3	2	-	3	2	3	-	-	-	-	-	2	2	2	2	-
CO4	2	-	-	-	2	3	2	-	-	-	-	2	-	1	-
CO5	-	-	-	-	-	-	-	-	3	-	2	2	1	2	-
CO6	1	2	2	3	2	-	-	-	-	-	2	2	1	2	2
AVG.	2.00	2.33	2.50	2.25	2.20	2.00	2.00	0	3.00	0	2.00	2.00	1.40	1.83	1.33

University Syllabus:

Unit	Content	Hrs/Unit
1	ENTREPRENEURSHIP Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks [2L]	2
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]	2
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
4	Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies [2L]	2
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]	4
6	Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L]	2
7	Applications and Project Reports Preparation [4L]	4
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]	4
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]	2
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]	2
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]	6
12	Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]	2
13	Case Studies with Hands-on Training on MS-Project [4L]	4

RESOURCES:

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. Entrepreneurship: Roy Rajeev; OUP.
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

SEMESTER-VII
SESSIONAL

Course Title: Project-II	**Code: PROJ-IT781**
Type Of Course: Sessional	**Course Designation: Compulsory**
Semester: 7th	**Contact Hours: 12P/week**
Continuous Assessment: 60 Marks	**Final Exam: 40 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Knowledge of Information Technology related problems, tools and techniques.

COURSE OBJECTIVE:

- To understand the basic concepts & broad principles of Industrial and research related projects.
- To apply the theoretical concepts to solve problems with teamwork and multidisciplinary approach.
- Demonstrate professionalism with ethics; present effective communication skills and relate engineering issues to broader societal context.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO Statement	Knowledge Level of revised Bloom's Taxonomy
PROJ-IT781.CO1	**Identify** problems in the area of Information Technology	Applying (Level III)
PROJ-IT781.CO2	**Survey** the Research Methodologies and Field Study related to the problems	Analyzing (Level V)
PROJ-IT781.CO3	**Relate** the current technologies and tools to develop applications for the problems	Understanding (Level II)
PROJ-IT781.CO4	**Organize** as teams with effective coding, writing and communication skills	Applying (Level III)
PROJ-IT781.CO5	**Apply** the engineering and management principles to achieve the goal of the project	Applying (Level III)
PROJ-IT781.CO6	**Estimate** the phases of the project.	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	3	3	3	3	3	-	-	-	2	2	2	3	3
CO2	2	3	3	3	1	2	3	-	-	-	-	2	1	3	3
CO3	2	2	-	2	3	-	-	-	-	-	-	2	3	1	2
CO4	2	2	-	2	3	-	-	2	3	3	-	-	2	2	-
CO5	1	1	1	2	-	2	2	2	2	1	2	-	1	2	2
CO6	1	-	3	-	2	-	-	-	-	-	3	-	1	-	2
AVG.	2	2.5	3	2.5	2.5	2.5	3	2	3	3	2	2	1.67	2.2	2.4

University Syllabus :

Unit	Content
1	**Project work I** The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.
2	**Project Work II & Dissertation** The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include: 1. In depth study of the topic assigned in the light of the Report prepared under EC P1; 2. Review and finalization of the Approach to the Problem relating to the assigned topic; 3. Preparing an Action Plan for conducting the investigation, including team work; 4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed; 5. Final development of product/process, testing, results, conclusions and future directions; 6. Preparing a paper for Conference presentation/Publication in Journals, if possible; 7. Preparing a Dissertation in the standard format for being evaluated by the Department. 8. Final Seminar Presentation before a Departmental Committee.

SEMESTER – VIII
THEORY

Course Title: Cryptography & Network Security	**Code: PEC-IT801B**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 8th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS602 Computer Networking, PEC-IT701A Internet Technology.

COURSE OBJECTIVE:

- Understand basics of Cryptography and Network Security.
- Learning about how to maintain the Confidentiality, Integrity and Authenticity of a data.
- Explain various protocols for network security to protect against the threats in the networks.

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PEC-IT801B.CO1	**Acquire** background knowledge in security issues, services, targets and mechanism.	Understanding (Level II)
PEC-IT801B.CO2	**Understand** the fundamental concept of Cryptography and Network Security, their operational tools.	Understanding (Level II)
PEC-IT801B.CO3	**Appraise** the use Data encryption standard related to security of information.	Evaluating (Level V)
PEC-IT801B.CO4	**Analyze** the vulnerabilities in any computing system and hence be able to design a security solution.	Analyzing Level IV)
PEC-IT801B.CO5	**Evaluate** security mechanisms using rigorous approaches by key ciphers and Hash functions.	Evaluating (Level V)
PEC-IT801B.CO6	**Demonstrate** various network security applications, SSL protocol and Authentication, Firewall, Web Security, Email Security, S/MIME and Malicious software.	Applying (Level III)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	1	1	1	-	-	-	1	1	1	1
CO2	3	1	1	-	-	1	1	1	-	-	-	1	1	1	1
CO3	3	2	2	1	-	1	1	1	-	-	-	1	1	1	2
CO4	3	3	3	2	-	1	1	1	-	-	-	1	1	1	2
CO5	3	3	3	2	-	1	1	1	-	-	-	1	1	1	2
CO6	3	2	2	2	-	1	1	1	-	-	-	1	1	1	2
AVG.	3.00	2.00	2.00	1.75	0	1.00	1.00	1.00	0	0	0	1.00	1.00	1.00	1.67

University Syllabus :

Unit	Content	Hrs/Unit
1	Attacks on Computers & Computer Security - Introduction, Need for Security, Security approaches, Principles of Security, Types of attack	5
2	Cryptography: Concepts & TechniquesIntroduction, 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

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
Network security	Unit 1
Basics of public key and private key cryptography, digital signatures and certificates	Unit 2
Authentication Token, Certificate based Authentication, Biometric Authentication.	Unit 6

RESOURCES:

1. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson
2. "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Books

Course Title:E-Commerce & ERP	**Code: OEC-IT802A**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 7th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: PCC-CS503 OOP, PCC-CS602 Computer Network.

COURSE OBJECTIVE:

- Introduce e-commerce and its various categories.
- Explain EDI and its technical details.
- Illustrate legal and security aspects of e-commerce.
- Discuss ideas on ERP implementations and its benefits.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
OEC-IT802A.CO1	**Define** the concepts of e-commerce focusing on basic software and hardware requirements.	Remembering (Level I)
OEC-IT802A.CO2	**Develop** ideas on B2B, B2C, C2C websites and EDI.	Creating (Level VI)
OEC-IT802A.CO3	**Analyze** the security and legal aspects of e-commerce.	Analyzing (Level VI)
OEC-IT802A.CO4	**Discusson** various case studies focusing on payment interfaces.	Creating (Level VI)
OEC-IT802A.CO5	**Develop** ideas on ERP and its related technologies.	Creating (Level VI)
OEC-IT802A.CO6	**Demonstrate** pre and post implementation of ERP systems.	Understanding (Level II)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	2	1	-	1	1	2	2	2	2	2	2
CO2	3	3	3	3	3	1	1	1	1	3	2	2	2	2	2
CO3	3	2	2	-	2	1	-	1	1	2	2	2	-	2	2
CO4	3	2	2	3	2	1	1	1	1	2	2	2	2	2	2
CO5	3	3	3	3	3	1	1	1	1	3	2	2	3	2	2
CO6	3	3	3	3	3	1	1	1	1	2	2	2	3	2	2
AVG.	3.00	2.50	2.50	3.00	2.50	1.00	1.00	1.00	1.00	2.33	2.00	2.00	2.40	2.00	2.00

University Syllabus:

Unit	Content	Hrs/Unit
1	Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. [3 L]	3
2	Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . [5 L]	5
3	Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance. [2 L]	2
4	E – strategy : Overview, Strategic Methods for developing E – commerce. [2 L]	2
5	Four C's : (Convergence, Collaborative Computing, Content Management & Call Center). Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). [6 L]	6
6	Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power. [3 L]	3
7	E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. [1 L]	1
8	E – Marketing :. Home –shopping, E-Marketing, Tele-marketing [1 L]	1
9	Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L]	2
10	Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model,	2

	Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L]	
11	Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. [4 L]	4
12	Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, QualityManagement, Sales&DistributionERPPackage, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP [10]	10

GATE syllabus (If applicable for GATE):

GATE syllabus content	Mapping unit of university syllabus
RSA, DES, Digital Signature, SET protocol	Unit 4

RESOURCES:

1. DavidWhitley, "E-Commerce-Strategy,Technologies&Applications",TMH
2. KamleshK.Bajaj, "E-Commerce -Thecuttingedgeofbusiness",TMH
3. WClarke, "E-Commercethrough ASP",BPB
4. MathewReynolds, "BeginningE-Commerce with VB,ASP,SQLServer7.0&MTS",WroxPublishers
5. J.ChristopherWestlandandTheodoreH.KClark, "GlobalElectronicCommerce - TheoryandCaseStudies",UniversityPress

Course Title: Microelectronics & VLSI Design	**Code:OEC-IT802B**
Type Of Course: Theory	**Course Designation: Elective**
Semester: 7th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Analog & Digital Electronics (Code: ESC-301),Computer Architecture Lab(PCC-CS492)

COURSE OBJECTIVE:

- To introduce the principles of devices with emphasis to MOS and CMOS operations for designing VLSI circuits.
- To study the various processes of IC fabrication.
- To study the characteristics of CMOS inverter, interconnects, combinational and sequential circuits and knowledge on current fabrication technology/process.
- To illustrate the basic concepts of modern VLSI circuit design and describe the fundamental principles underlying digital design using CMOS logic and analyze the performance characteristics of these digital circuits.
- To gain knowledge on CMOS schematic design, layout techniques, automated design tools, netlist synthesis, placement and routing algorithms and perform fault analysis and timing verification.
- Design the synthesizable digital sub-system components using VHDL.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
OEC-IT802B.CO1	**Analyze** MOS structures to investigate the characteristics of MOSFETS and C-MOS based digital logic circuits.	Analyzing (Level-IV)
OEC-IT802B.CO2	**Discuss** different Microelectronic process in Silicon Semiconductor technology for chip fabrication.	Understanding (Level -II)
OEC-IT802B.CO3	**Report** different types of power dissipation to explore the performances of programmable and non-programmable devices especially in sub-micron regime.	Applying (Level-III)
OEC-IT802B.CO4	**Apply** suitable placement and routing algorithms and methods for effectively fabricating IC chips without compromising device performance.	Applying (Level-III)
OEC-IT802B.CO5	**Inspect** different fault analysis methods to effectively test the performance of digital logic circuits.	Analyzing (Level-IV)
OEC-IT802B.CO6	**Choose** basic VLSI design modeling styles using VHDL for demonstrating combinational and sequential circuits.	Evaluating (Level-V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	3	-	-	-	-	-	-	-	3	-	2	-
CO2	3	2	-	3	-	1	1	-	-	-	-	3	-	2	-
CO3	3	3	-	3	-	1	1	-	-	-	-	3	-	2	-
CO4	3	3	2	3	2	1	1	-	1	-	1	3	1	2	2
CO5	3	3	2	3	2	1	1	-	1	-	1	3	1	2	2
CO6	3	3	2	3	3	-	-	-	1	-	1	3	1	2	2
AVG.	3.00	2.83	2.00	3.00	2.33	1.00	1.00	0	1.00	0	1.00	3.00	1.00	2.00	2.00

University Syllabus:

Unit	Content	Hrs/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-Latchesand Registers.	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	10
3	**Power Dissipation:** Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reprogramable Gate Array: Xilinx Programmable Gate Array, Design	8

	Methods: Behavioural Synthesis, RTL synthesis	
4	**Placement:**Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays.	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.	5

RESOURCES

1. Digital Integrated Circuit,J.M.Rabaey, Chandrasan, Nicolic ,Pearson Education.
2. CMOS Digital Integrated Circuit, S.M .Kang &Y. Leblebici, TMH.
3. Modern VLSI Design,Wayne Wolf, Pearson Education.
4. VHDL,Bhaskar, PHI.
5. Advance Digital Design Using Verilog,MichelD. Celliti, PHI
6. Digital Integrated Circuits, Demassa & Ciccone, John Willey & Sons.
7. ModernVLSIDesign:systemonsilicon,WayneWolf;AddisonWesleyLongmanPublisher
8. Basic VLSI Design, Douglas A.Pucknell & Kamran Eshranghian, PHI
9. CMOSCircuitDesign,Layout&Simulation,R.J.Baker,H.W.Lee,D.E.Boyee,PHI.

SEMESTER- VIII
SESSIONAL

Course Title: Project-III	**Code: PROJ-CS881**
Type Of Course: Practical	**Course Designation: Compulsory**
Semester: 8th	**Contact Hours: 12P/week**
Continuous Assessment: 60 Marks	**Final Exam: 40 Marks**
Writer: Course Coordinator	**Approved by Program Assessment Committee(PAC)**

Pre-requisites: Knowledge of Information Technology related problems, tools and techniques.

COURSE OBJECTIVE:

- Demonstrate a sound technical knowledge of their selected project topic.
- Design engineering solutions to complex problems utilizing a systems approach.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

COURSE OUTCOMES (COs)
On completion of the course students will be able to

Course Outcomes	CO statement	Knowledge Level of revised Bloom's Taxonomy
PROJ-CS881.CO1	**Design** the modules with underlying technical concepts, theory and mathematical formulation	Creating (Level VI)
PROJ-CS881.CO2	**Build** the modules with hardware or software	Applying (Level III)
PROJ-CS881.CO3	**Analyze** the results and outcomes of the executable modules.	Analyzing (Level IV)
PROJ-CS881.CO4	**Combine** all the modules through effective team work after efficient testing.	Creating (Level VI)
PROJ-CS881.CO5	**Compile** the project report.	Creating (Level VI)
PROJ-CS881.CO6	**Defend**the completed project	Evaluating (Level V)

Mapping of COs with POs and PSOs (Course Articulation Matrix):

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	2	2	1	1	-	-	-	-	-	3	1	3
CO2	2	2	3	3	3	1	-	-	3	-	-	-	3	1	3
CO3	3	2	2	3	3	-	1	-	3	-	2	2	2	3	2
CO4	2	2	2	2	2	-	-	-	2	2	2	2	2	3	2
CO5	2	-	2	-	2	-	-	2	3	3	3	3	2	3	-
CO6	2	-	2	-	2	-	-	2	3	3	3	3	2	3	-
AVG.	2.16	2	2	2.5	2.33	1	1	2	2.8	2.67	2.5	2.5	2.33	2.33	2.5

University Syllabus:

Unit	Content
1	**Project work I** The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work.
2	**Project Work II & Dissertation** The object of Project Work II & Dissertation is to enable the student to extend further the investigative

	study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include: 1. In depth study of the topic assigned in the light of the Report prepared under EC P1; 2. Review and finalization of the Approach to the Problem relating to the assigned topic; 3. Preparing an Action Plan for conducting the investigation, including team work; 4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed; 5. Final development of product/process, testing, results, conclusions and future directions; 6. Preparing a paper for Conference presentation/Publication in Journals, if possible; 7. Preparing a Dissertation in the standard format for being evaluated by the Department. 8. Final Seminar Presentation before a Departmental Committee.