Maulana Abul Kalam Azad University of Technology
(Formerly West Bengal University of Technology)
Syllabus and Curricular Mapping for B. Tech. in Computer Science and Engineering
Effective from Academic Session 2023-24

P23: <u>Mapping of Course Outcomes with Program Outcomes</u>

PROGRAM OUTCOME (POs)

Engineering Graduates will be able to:

1. **Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. **Problem analysis:** Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. **The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. **Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend andwrite effective reports and design documentation, make effective presentations, and giveand receive clear instructions.

11. **Project Management and Finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

MODEL PROGRAM SPECIFIC OUTCOMES (PSOs)

1. The Computer Science and Engineering graduates are able to analyze, design, develop, test and apply skills on the basis of mathematical and programming foundations in the development of computational solutions to design software and hardware.

2. Work with and communicate effectively with professionals in inter-disciplinary fields and pursue lifelong professional development in computing and identify research gaps and hence to provide solution to new ideas and innovations to satisfy the environmental and social issues.

CO Statements and CO-PO Mapping for Courses of New Syllabus:

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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
BS-M101.CO1	Learn the basic mathematical tools to deal with problems of engineering sciences.	Learn	Level I
BS-M101.CO2	Understand properties and application of Calculus and Linear Algebra .	Understand	Level II
BS-M101.CO3	Analyze of physical or engineering problems.	Analyze	Level IV
BS-M101.CO4	Acquire problem solving skills related to engineering science.	Acquire	Level II
BS-M101.CO5	Apply Calculus and Linear Algebra in real life problems.	Apply	Level III
BS-M101.CO6	Classify ensembles and differentiate between Calculus and Linear Algebra.	Classify	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
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO2	3	3	3	3	-	-	-	-	-	-	-	3	2	1
CO3	3	3	3	2	-	-	-	-	-	-	-	3	2	1
CO4	3	1	2	1	-	-	-	-	-	-	1	3	2	2
CO5	2	2	2	2	-	-	-	-	-	-	2	3	1	-
CO6	3	2	2	2	-	-	-	-	-	-	2	3	-	-
AVG.	2.83	2.33	2.5	2.33	0	0	0	0	0	0	1.6667	3	2	1.5

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 (Dif erentiation): 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

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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

Course Outcomes	Details	Action Verb	Knowledge Level
BS-PH101.CO1	Apply basic concepts of mechanics	Apply	K3
BS-PH101.CO2	Discuss Physical optics and analyze principles of lasers with applications	Discuss	K6
BS-PH101.CO3	Categorize di electric and magnetic properties of materials leading to Electromagnetic laws	Categorize	K4
BS-PH101.CO4	Differentiate between Classical Physics and Quantum Physics by introducing Planck's law	Differentiate	K5
BS-PH101.CO5	Apply wave particle duality in real life problems followed by simple quantum mechanics calculations	Apply	K3
BS-PH101.CO6	Classify ensembles and differentiate between classical and Quantum statistical mechanics	Classify	K4

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	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	1	3	2	-	-	-	-	-	-	-	-	-	-	-
CO5	1	3	2	0	-	-	-	-	-	-	-	-	-	-
CO6	-	1	3	2	-	-	-	-	-	-	-	-	-	-
AVG.	1.80	2.33	1.83	1.00	0	0	0	0	0	0	0	0	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

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 HoD (convenor of DAB)**	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ES-EE101.CO1	Understand and analyze basic electric and magnetic circuits.	Understand	K2
ES-EE101.CO2	Study the working principles of electrical machines and power converters.	Study	K1
ES-EE101.CO3	Introduce the components of low voltage electrical installations.	Introduce	K1
ES-EE101.CO4	Understand the general structure of electrical power system.	Understand	K2
ES-EE101.CO5	Understand the construction and operation of single-phase transformer.	Understand	K2
ES-EE101.CO6	Explain the working principle of power converters.	Explain	K2

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	3	2	-	-	2	-	-	-	-	-	-	-	-	-
CO2	2	3	3	2	2	-	-	-	-	-	-	-	-	-
CO3	2	-	3	1	-	-	-	-	-	-	-	1	-	-
CO4	2	-	2	2	3	-	-	-	-	-	-	2	-	-
CO5	2	2	-	2	3	-	-	-	-	-	-	1	-	-
CO6	2	1	3	3	3	-	-	-	-	-	-	1	-	-
AVG.	2.17	2	2.75	2	2.6	0	0	0	0	0	0	1.25	0	0

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

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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
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	Observe	K1
BS-PH191.CO2	Arrange sequential connection in electrical experiment to verify principles of Kirchhoff's law to verify passive elements of electrical circuit	Arrange	K3
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	Operate	K3
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.	Determine	K5
BS-PH191.CO5	Apply concepts of quantum mechanics to verify Bohr's atomic orbital theory	Apply	K3
BS-PH191.CO6	Determine Planck's constant and Stefan's constant applying modern Physics	Determine	K5

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	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	3	1	1	-	-	-	-	-	-	-	-	-	-
CO3	2	2	3	1	-	-	-	-	-	-	-	-	-	-
CO4	2	3	1	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	3	1	-	-	-	-	-	-	-	-	-	-
CO6	2	1	3	2	-	-	-	-	-	-	-	-	-	-
AVG.	2	2.33	2	1.33	0	0	0	0	0	0	0	0	0	0

University Syllabus :

Choose 10 experiments including at least one from Optics, Electricity and Magnetism and Quantum Mechanics and at least a total of six from these three groups.

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

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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ES-EE191.CO1	Calibrate Ammeter and Wattmeter	Calibrate	**K3**
ES-EE191.CO2	Demonstrate the measuring instrument and electrical machines	Demonstrate	K3
ES-EE191.CO3	Conduct open circuit and short circuit test of single-phase transformer	Conduct	K2
ES-EE191.CO4	Measure 3 phase power using two wattmeters	Measure	**K5**
ES-EE191.CO5	Identify the components of LT switchgear	Identify	K1
ES-EE191.CO6	Understand the characteristic of RLC series and parallel circuit	Understand	K2

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	-	-	-	3	-	-	-	2	-	-	-	-	-
CO2	2	3	3	1	2	-	-	-	3	-	-	-	-	-
CO3	2	2	3	-	-	-	-	-	2	-	-	-	-	-
CO4	2	-	2	-	3	-	-	-	3	-	-	-	-	-
CO5	1	-	-	-	1	-	-	-	-	-	-	-	-	-
CO6	2	1	2	1	3	-	-	-	2	-	-	-	-	-
AVG.	1.83	2	2.5	1	2.4	0	0	0	2.4	0	0	0	0	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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ES-ME192.CO1	Understanding the applications of hand tools and machine tools.	Understand	K2
ES-ME192.CO2	Comprehend the safety measures required to be taken while using the tools.	Comprehend	K2
ES-ME192.CO3	Select the appropriate tools required to manufacture an object of predetermined shape and size considering least wastage and cost.	Select	K2
ES-ME192.CO4	Fabricate components with their own hands	Fabricate	K6
ES-ME192.CO5	Practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes	Analyze	K6
ES-ME192.CO6	Produce small devices of their interest, by assembling different components,	Produce	K6

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	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	1	-	1	-	-	-	-	-	-
CO3	1	-	-	-	-	1	-	1	1	-	-	-	-	-
CO4	1	-	-	-	-	-	2	-	2	1	1	-	-	1
CO5	1	-	-	-	-	-	2	-	2	1	1	1	-	-
CO6	1	-	-	-	-	-	2	-	2	1	2	1	-	1
AVG.	1	0	0	0	0	1	2	1	1.75	1	1.33	1	0	1

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.

Maulana Abul Kalam Azad University of Technology
(Formerly West Bengal University of Technology)
Syllabus and Curricular Mapping for B. Tech. in Computer Science and Engineering
Effective from Academic Session 2023-24

SEMESTER – II
THEORY

Course Title: Chemistry-I	Code: BS-CH 201
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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
BS-CH 201.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.	Apply	K3
BS-CH 201.CO2	Using the concept of conductance of ions analyze the design and working principle of different electrochemical cells.	Use	K3
BS-CH 201.CO3	Derive rate of a reaction at a specified temperature under different medium	Derive	K4
BS-CH 201.CO4	Explain the mechanism considering the structure of the molecules and type of electronic effect present in them.	Explain	K5
BS-CH 201.CO5	Analyze different types of fuels for industrial application.	Analyze	K4
BS-CH 201.CO6	Distinguish different types of polymer for diverse application.	Distinguish	K4

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	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	1	-	-	-	-	-	-	-	-	-	-
CO5	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO6	3	1	1	1	-	-	-	-	-	-	-	-	-	-
AVG.	3	1.66	1	1	0	0	0	0	0	0	0	0	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.H_2). 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

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(Formerly West Bengal University of Technology)
Syllabus and Curricular Mapping for B. Tech. in Computer Science and Engineering
Effective from Academic Session 2023-24

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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
BS-M201.CO1	Learn the basic mathematical tools to deal with problems of engineering sciences.	Learn	K1
BS-M201.CO2	Understand properties and application of Linear Algebra, Ordinary Differential Equations (ODE) and numerical analysis.	Understand	K2
BS-M201.CO3	Analyze of physical or engineering problems.	Analyze	K4
BS-M201.CO4	Acquire problem solving skills related to engineering science.	Acquire	K2
BS-M201.CO5	Apply Linear Algebra, Ordinary Differential Equations (ODE) and Numerical analysis in real life problems.	Apply	K3
BS-M201.CO6	Classify ensembles and differentiate among Linear Algebra, Ordinary Differential Equations (ODE) and numerical analysis.	Classify	K4

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	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

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	8

	single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	
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

Course Title:Programming for ProblemSolving	**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 HoD (convenor of DAB)**	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ES-CS201.CO1	Analyze the problem and formulate algorithms for them.	Analyze	K4
ES-CS201.CO2	Translate the algorithms to programs (in C language).	Understand	K2
ES-CS201.CO3	Understand the correct syntax of logical expression, branch instruction, iteration,	Understand	K2
ES-CS201.CO4	Apply array and pointer to solve problem.	Apply	K3
ES-CS201.CO5	Understand the use of , function, recursion.	Understand	K2
ES-CS201.CO6	Build analytical skill.	Create	K6

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	3	3	3	3	2	1	1	1	1	1	2	2	3	3
CO2	3	3	3	3	-	1	1	1	1	1	2	2	3	3
CO3	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO4	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO5	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO6	3	3	3	3	-	-	-	-	1	1	-	2	2	2
AVG.	3	3	3	3	2	1	1	1	1	1	2	2	2.33	2.33

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)	

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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
HM-HU201.CO1	Understand and apply English Speech Sounds for enhancing English Communication	Understand	K2
HM-HU201.CO2	Apply English Language Presentation Skill in Academic and in Professional Communication	Apply	K3
HM-HU201.CO3	Apply Receptive Skills of English in Academics and in Engineering Profession	Apply	K3
HM-HU201.CO4	Apply Writing Skill of English in Academics and in Profession	Apply	K3
HM-HU201.CO5	Apply Grammar Skill of English in Academic and in Professional Communication	Apply	K3
HM-HU201.CO6	Apply Critical Thinking Skill of English in Academic and in professionional Communication	Apply	K3

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	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

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

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Syllabus and Curricular Mapping for B. Tech. in Computer Science and Engineering
Effective from Academic Session 2023-24

SEMESTER – II
PRACTICAL

Course Title:Chemistry-I Laboratory	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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
BS-CH291.CO1	Determine some physical parameter like viscosity of a solution and rate constant of a reaction	Determine	K5
BS-CH291.CO2	Determine the strength of an acid using conductometric method.	Determine	K5
BS-CH291.CO3	Determine the strength of an acid using pH metric method.	Determine	K5
BS-CH291.CO4	Determine partition coefficient of a compound	Determine	K5
BS-CH291.CO5	Estimate the amount of an ion present in a given solution using permanganometric and argentometric methods.	Estimate	K5
BS-CH291.CO6	Evaluate alkalinity (in terms of $CaCO_3$ equvalent), hardness (in ppm) and amount of dissolved oxyzen (in mg/l) present in a given water sample using volumetric method.	Evaluate	K5

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	1	1	2	3	-	-	-	-	-	-	-	-	-	-
CO2	1	1	2	3	-	-	-	-	-	-	-	-	-	-
CO3	1	1	2	3	-	-	-	-	-	-	-	-	-	-
CO4	1	2	2	3	-	-	-	-	-	-	-	-	-	-
CO5	1	2	2	3	-	-	-	-	-	-	-	-	-	-
CO6	1	2	2	3	-	-	-	-	-	-	-	-	-	-
AVG.	1	1.5	2	3	0	0	0	0	0	0	0	0	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.

Course Title:Programming for ProblemSolving	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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ES-CS291.CO1	Analyze the problem and formulate algorithms for them.	Analyze	K4
ES-CS291.CO2	Translate the algorithms to programs (in C language).	Understand	K2
ES-CS291.CO3	Understand the correct syntax of logical expression, branch instruction, iteration,	Understand	K2
ES-CS291.CO4	Apply array and pointer to solve problem.	Apply	K3
ES-CS291.CO5	Understand the use of , function, recursion.	Understand	K2
ES-CS291.CO6	Build analytical skill.	Create	K6

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	2	2	2	-	-	-	-	-	-	-	2	2	1
CO2	2	2	2	2	-	-	-	-	-	-	-	2	2	1
CO3	2	2	2	2	-	-	-	-	-	-	-	2	2	1
CO4	2	2	2	2	-	-	-	-	-	-	-	2	2	1
CO5	2	2	2	2	-	-	-	-	-	-	-	2	2	1
CO6	2	2	2	2	-	-	-	-	-	-	-	2	2	1
AVG.	2	2	2	2	0	0	0	0	0	0	0	2	2	1

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

Course Title:Engineering Graphics & Design	Code: ES-ME291
Type of Course: Practical	Course Designation: Compulsory
Semester: 2nd	Contact Hours: 1L+4P/week
Continuous Assessment: 40 Marks	Final Exam: 60 Marks
Writer: Course Coordinator	Approved by HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ES-ME291.CO1	Understand the applications of hand tools and machine tools.	Understand	K2
ES-ME291.CO2	Comprehend the safety measures required to be taken while using the tools.	Create	K6
ES-ME291.CO3	Select the appropriate tools required to manufacture an object of predetermined shape and size considering least wastage and cost.	Evaluate	K5
ES-ME291.CO4	Fabricate components with their own hands.	Create	K6
ES-ME291.CO5	Confident on practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.	Understand	K2
ES-ME291.CO6	Produce small devices of their interest by assembling different components.	Create	K6

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	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	-	-	-	1	-	1	-	-	-	-	-	-
CO3	1	-	-	-	-	1	-	1	1	-	-	-	-	-
CO4	1	-	-	-	-	-	2	-	2	1	1	-	-	1
CO5	1	-	-	-	-	-	2	-	2	1	1	1	-	-
CO6	1	-	-	-	-	-	2	-	2	1	2	1	-	1
AVG.	1	0	0	0	0	1	2	1	1.75	1	1.333	1	0	1.00

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 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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
HM-HU291.CO1	Understand and apply English Speech Sounds for enhancing English Communication	Understand	K2
HM-HU291.CO2	Apply English Language Presentation Skill in Academic and in Professional Communication	Apply	K3
HM-HU291.CO3	Apply Receptive Skills of English in Academics and in Engineering Profession	Apply	K3
HM-HU291.CO4	Apply Writing Skill of English in Academics and in Profession	Apply	K3
HM-HU291.CO5	Apply Grammar Skill of English in Academic and in Professional Communication	Apply	K3
HM-HU291.CO6	Apply Critical Thinking Skill of English in Academic and in professionional Communication	Apply	K3

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	2	2	2	2	2	-	2	1	3	-	2	1	1
CO2	2	2	2	2	2	2	-	2	1	3	-	2	1	1
CO3	2	2	2	2	2	2	-	2	1	3	-	2	1	1
CO4	2	2	2	2	2	2	-	2	1	3	-	2	1	1
CO5	2	2	2	2	2	2	-	2	1	3	-	2	1	1
CO6	2	2	2	2	2	2	-	2	1	3	-	2	1	1
AVG.	2	2	2	2	2	2	0	2	1	3	0	2	1	1

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

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SEMESTER – III
THEORY

Course Title: Analog and 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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ESC 301.CO1	Explain Different Classes of Amplifiers - (Class-A, B, AB and C, power, efficiency; Summarize the basic concepts of Feedback and Oscillation. Demonstrate Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer.	Explain	K2
ESC 301.CO2	Define the basic concepts of Boolean algebra, binary number system. 1's and 2's complement methods, Binary arithmetic. Define the representation in SOP and POS forms;	Define	K1
ESC 301.CO3	Demonstrate the concept of Minimization of logic using algebraic and k-map. Build various combinational circuits like Adder and Subtractor circuits, Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator.	Demonstrate	K2
ESC 301.CO4	Explain Sequential Circuits - Basic Flip-flop & Latch, Flip-flops -SR, JK, D, T and JK Master-slave Flip Flops.	Explain	K2
ESC 301.CO5	Build Registers (SISO, SIPO, PIPO, PISO) Ring counter, Johnson counter, Synchronous and Asynchronous counters, Mod N Counter.	Build	K6
ESC 301.CO6	Explain A/D and D/A conversion techniques – Basic concepts (D/A :R-2-R only A/D: successiveapproximation). Explain Logic families- TTL, ECL, MOS and CMOS - basic concepts.	Explain	K2

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	3	-	-	-	-	-	-	-	-	-	-	3	3	3
CO2	3	3	2	2	-	-	-	-	-	1	-	3	3	3
CO3	3	2	2	2	1	-	-	-	-	1	-	3	3	3
CO4	3	3	3	2	3	-	-	-	-	1	1	3	3	3
CO5	3	3	2	2	2	-	-	-	-	-	2	3	3	3
CO6	3	2	1	1	-	-	-	-	-	-	2	3	3	3
AVG.	3	2.6	2	1.8	2	0	0	0	0	1	1	3	3	3

University Syllabus :

Unit	Content	Hrs/Unit
1	Different Classes of Amplifiers - (Class-A, B, AB and C - basic concepts, power, efficiency; Recapitulation of basic concepts of Feedback and Oscillation, Phase Shift, Wein Bridge oscillators Astable & Monostable Multivibrators; Schimtt Trigger circuits, 555 Timer	9
2	Binary Number System & Boolean Algebra (recapitulation); BCD, ASCII, EBDIC, Gray codes and their conversions; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic, Venn diagram, Boolean algebra (recapitulation); Representation in SOP and POS forms; Minimization of logic 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 [2L] A/D: successive approximation [2L]) Logic families- TTL, ECL, MOS and CMOS - basic concepts. (2L)	6

Course Title:Data Structure & Algorithms	**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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS301.CO1	Construct algorithms from problems.	Construct	K3
PCC-CS301.CO2	Understand the basics of abstract data types.	Understand	K2
PCC-CS301.CO3	Categorize the property of linear and nonlinear data structures.	Categorize	K4
PCC-CS301.CO4	Learn the use of Tree and graph.	Learn	K3
PCC-CS301.CO5	Compare different shorting and searching methods.	Compare	K5
PCC-CS301.CO6	Learn the use of hashing.	Learn	K3

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	3	3	3	3	2	1	1	1	1	1	2	2	3	3
CO2	3	3	3	3	-	1	1	1	1	1	2	2	3	3
CO3	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO4	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO5	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO6	3	3	3	3	-	-	-	-	1	1	-	2	2	2
AVG.	3	3	3	3	2	1	1	1	1	1	2	2.00	2.33	2.33

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

Course Title:Computer Organisation	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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS302.CO1	Illustrate the history of modern computers and the Von Neumann architecture.	Illustrate	K2
PCC-CS302.CO2	Demonstrate basic number systems, Binary numbers, representation of signed and unsigned numbers, Floating point representation.	Demonstrate	K2
PCC-CS302.CO3	Define addressing modes, instruction formats.	Define	K1
PCC-CS302.CO4	Distinguish the organization of various parts of a system memory hierarchy i.e. cache memory , virtual memory etc.	Distinguish	K4
PCC-CS302.CO5	Classify basics of systems topics like, single-cycle (MIPS), multi-cycle (MIPS), parallel, pipelined, superscalar, and RISC/CISC architectures.	Classify	K4
PCC-CS302.CO6	Define different control unit operations and I/O organization.	Define	K1

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	3	3	3	3	2	-	-	-	-	-	-	-	3	2
CO2	3	3	3	3	3	-	-	-	-	-	1	-	3	2
CO3	3	3	3	1	3	-	-	-	-	-	2	-	1	3
CO4	3	2	3	3	2	-	-	-	-	-	1	-	2	3
CO5	3	2	3	3	-	-	-	-	-	-	2	2	3	3
CO6	3	3	3	2	3	-	-	-	-	-	3	3	3	3
AVG.	3	2.67	3	2.5	2.6	0	0	0	0	0	1.8	2.5	2.5	2.33

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.	10

	[2L] Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L] Cache memory, Virtual memory. Data path design for read/write access. [5L]	
4	Design of control unit - hardwired and microprogrammed 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

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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
BSC 301.CO1	Apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.	Apply	K3
BSC 301.CO2	Learn 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.	Learn	K2
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.	Apply	K3
BSC 301.CO4	Apply 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.	Apply	K3
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.	Solve	K3
BSC 301.CO6	Identify and solve different type of graphs and Analyze/Model application of Graph Theory in Information Science.	Identify	K3

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	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO2	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO3	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO4	3	3	2	1	-	-	-	-	-	-	-	-	2	1
CO5	3	2	2	-	-	-	-	-	-	-	-	-	2	1
CO6	3	3	2	1	-	-	-	-	-	-	-	-	2	1
AVG.	3	3	2	1	0	0	0	0	0	0	0	0	2	1

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

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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
HSMC 301.CO1	Understand major principles of economic analysis for decision making among alternative courses of action in engineering.	Understand	K2
HSMC 301.CO2	Apply economic principles to prices and quantities in competitive supply and demand for goods and for money.	Apply	K3
HSMC 301.CO3	Solve economic problems involving comparison and selection of alternatives by using analytical techniques including benefit-cost ratio and breakeven analysis.	Solve	K3
HSMC 301.CO4	Evaluate the effect of inflation,deflation and price change with indexes in Engineering Economic Analysis	Evaluate	K5
HSMC 301.CO5	Analyze the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation	Analyze	K4
HSMC 301.CO6	Understand the concepts of depreciation and replacement analysis andsolve associated problems	Understand	K2

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	2	2	2	-	2	-	1	-	-	3	1	1	1
CO2	2	2	2	2	-	2	-	1	-	-	3	1	1	1
CO3	2	2	2	2	-	2	-	1	-	-	3	1	1	1
CO4	2	2	2	2	-	2	-	1	-	-	3	1	1	1
CO5	2	2	2	2	-	2	-	1	-	-	3	1	1	1
CO6	2	2	2	2	-	2	-	1	-	-	3	1	1	1
AVG.	2	2	2	2	0	2	0	1	0	0	3	1	1	1

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

Maulana Abul Kalam Azad University of Technology
(Formerly West Bengal University of Technology)
Syllabus and Curricular Mapping for B. Tech. in Computer Science and Engineering
Effective from Academic Session 2023-24

SEMESTER – III
PRACTICAL

Course Title:Analog and Digital Electronics	**Code: ESC 391**
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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ESC 391.CO1	Understand of the fundamental concepts and techniques used in digital electronics.	Understand	K2
ESC 391.CO2	Understand and examine the structure of various number systems and its application in digital design.	Understand	K2
ESC 391.CO3	Apply the basic requirements for a design application and propose a cost effective solution of various combinational circuits.	Apply	K3
ESC 391.CO4	Analyze basic requirements for a design application and propose a cost effective solution of various sequential circuits.	Analyze	K4
ESC 391.CO5	Identify and prevent various hazards and timing problems in a digital design for developing skill to build, and troubleshoot in digital circuits.	Identify	K3
ESC 391.CO6	Design and examine the structure of analog circuits and verify its operations.	Design	K6

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	3	3	3	1	1	0	0	-	-	-	1	3	3	3
CO2	3	3	3	1	1	0	0	-	-	1	1	3	3	3
CO3	3	3	3	-	-	0	0	1	-	1	1	3	3	3
CO4	3	3	2	2	1	0	0	1	2	1	1	3	3	3
CO5	3	2	1	-	2	0	0	2	2	1	1	3	3	3
CO6	3	2	2	-	2	0	0	2	2	-	1	3	3	3
AVG.	3	2.67	2.33	1.33	1.4	0	0	1.5	2	1	1	3.00	3.00	3

University Syllabus :

Unit	Content
1	**Analog Electronics** 1 Design a Class A amplifier 2 Design a Phase-Shift Oscillator 3 Design of a Schmitt Trigger using 555 timer
2	**Digital Electronics** 4 Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output.

5 Construction of simple Decoder & Multiplexer circuits using logic gates. 6 Realization of RS / JK / D flip flops using logic gates 7 Design of Shift Register using J-K / D Flip Flop 8 Realization of Synchronous Up/Down counter 9 Design of MOD- N Counter 10 Study of DAC	

Course Title:Data Structure & Algorithm Lab	**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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS391.CO1	Construct algorithms from problems.	Construct	K3
PCC-CS391.CO2	Understand the basics of Stack, Queue.	Understand	K2
PCC-CS391.CO3	Categorize the necessarily of linked list and array implementation.	Categorize	K4
PCC-CS391.CO4	Learn the real life use of Tree and graph.	Learn	K3
PCC-CS391.CO5	Compare different shorting and searching methods.	Compare	K5
PCC-CS391.CO6	Understand the implementation mechanism of shorting and searching.	Understand	K2

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	3	3	3	3	2	1	1	1	1	1	2	2	3	3
CO2	3	2	3	3	-	1	1	1	1	1	2	2	3	3
CO3	3	3	3	2	-	-	-	-	1	1	-	2	2	2
CO4	3	2	3	3	-	-	-	-	1	1	-	2	2	2
CO5	3	3	2	3	-	-	-	-	1	1	-	2	2	2
CO6	3	3	3	3	-	-	-	-	1	1	-	2	2	2
AVG.	3	2.67	2.83	2.83	2	1	1	1	1	1	2	2	2.33	2.33

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.

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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS392.CO1	Understand the behaviour of logic gates.	Understand	K2
PCC-CS392.CO2	Design combinational circuits for basic components of computer system and Applications.	Design	K6
PCC-CS392.CO3	Analyze the operational behaviour and applications of various flip-flop.	Analyze	K4
PCC-CS392.CO4	Implement Arithmetic logic units and different types of memory blocks.	Implement	K3
PCC-CS392.CO5	Design to cascade multiple RAM chips for vertical and horizontal expansion.	Design	K6
PCC-CS392.CO6	Implement Carry-Look-Ahead Adder and BCD adder circuit .	Implement	K3

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	3	3	3	2	3	3	1	2	3	3	2	2	3	1
CO2	3	3	1	2	1		1	2	3	3	2	2	-	1
CO3	3	3	2	2	2	1	1	2	2	2	1	3	2	1
CO4	3	3	2	2	2	1	1	2	2	2	2	3	1	3
CO5	3	3	3	2	3	1	1	2	2	2	1	3	-	1
CO6	3	3	3	2	3		1	2	3	3	2	3	3	2
AVG.	3	3	2.33	2	2.3	1.5	1	2	2.5	2.5	1.67	2.67	2.25	1.5

University Syllabus :

Unit	Content
1	Familiarity with IC-chips: a) Multiplexer, b) Decoder, c) Encoder b) Comparator Truth Table verification and clarification from Data-book.
2	Design an Adder/Subtractor composite unit.
3	Design a BCD adder.
4	Design of a 'Carry-Look-Ahead' Adder circuit.
5	Use a multiplexer unit to design a composite ALU
6	Use ALU chip for multibit arithmetic operation
7	Implement read write operation using RAM IC
8	(a) & (b) Cascade two RAM ICs for vertical and horizontal expansion.

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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS393.CO1	Interpret the basic syntax of python variables,datatypes and operator in python and	Interpret	K2
PCC-CS393.CO2	Make use of conditional and control flow statement in python fluently.	Make use of	K3
PCC-CS393.CO3	Define the use of string and list datatype in proficiency level.	Define	K1
PCC-CS393.CO4	Discoverthe method to create and manipulation of python data structure like tuple and dictionary.	Discover	K4
PCC-CS393.CO5	Explain the use of python function and uses of different modules in python.	Explain	K5
PCC-CS393.CO6	Discuss the concepts of object oriented programming like exception handling.	Discuss	K6

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	3	3	2	-	1	1	1	-	-	1	-	3	3	2
CO2	3	2	1	-	1	1	1	1	-	1	-	2	3	1
CO3	3	3	3	1	3	-	2	-	2	1	1	2	3	2
CO4	3	3	3	1	2	-	-	1	1	-	1	3	2	1
CO5	3	3	3	2	3	-	-	1	2	-	1	3	3	2
CO6	3	3	3	2	3	-	2	2	2	3	1	3	3	2
AVG.	3	2.83	2.5	1.5	2.17	1	1.5	1.25	1.75	1.5	1	2.67	2.83	1.67

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.

Maulana Abul Kalam Azad University of Technology
(Formerly West Bengal University of Technology)
Syllabus and Curricular Mapping for B. Tech. in Computer Science and Engineering
Effective from Academic Session 2023-24

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
Course Coordinator :	Approved by HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS401.CO1	Define fundamental mathematical concepts such as sets, relations, functions, and integers.	Define	K1
PCC-CS401.CO2	Demonstrate induction hypotheses and simple induction proofs.	Demonstrate	K2
PCC-CS401.CO3	Solve numbers of possible outcomes of elementary combinatorial processes such as permutations and combinations.	Solve	K3
PCC-CS401.CO4	Explain a logic sentence in terms of predicates, quantifiers, and logical connectives.	Explain	K2
PCC-CS401.CO5	Classify algebraic structure for a given mathematical problem.	Classify	K4
PCC-CS401.CO6	Apply graph theory models of data structures and state machines to solve problems of connectivity and constraint satisfaction.	Apply	K3

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	3	3	-	-	2	2	-	-	-	-	-	3	-	1
CO2	3	3	-	-	3	3	-	-	-	-	-	3	-	1
CO3	3	3	3	2	3	-	-	-	-	-	-	3	1	1
CO4	3	3	1	2	2	2	-	-	-	-	-	3	2	2
CO5	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO6	3	3	3	3	3	2	-	-	-	-	-	3	3	3
AVG.	3	3	2.5	2.75	2.6	2.25	0	0	0	0	0	3.00	2.25	1.84

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

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**
Course Coordinator :	**Approved by HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS402.CO1	Understand The basic of Computer architecture	Understand	K2
PCC-CS402.CO2	Discuss the Pipelining technique of Computer architecture	Discuss	K6
PCC-CS402.CO3	Illustrate Different memory management technology	Illustrate	K2
PCC-CS402.CO4	Develop The Instruction level parallelism	Develop	K3
PCC-CS402.CO5	Analyze array and vector processors.	Analyze	K4
PCC-CS402.CO6	Explain the multiprocessor architecture and different taxonomy	Explain	K5

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	-	-	-	-	-	-	-	-	-	-	-	2	3
CO2	2	2	2	1	-	-	-	-	-	-	-	-	3	3
CO3	1	-	2	2	1	-	1	-	-	-	-	-	3	2
CO4	-	3	2	-	1	-	-	-	-	-	-	-	3	2
CO5	-	1	3	-	2	1	-	-	-	-	-	1	2	3
CO6	-	2	2	1	2	1	1	1	-	1	-	-	2	2
AVG.	1.67	2	2.2	1.33	1.5	1	1	1	0	1	0	1.00	2.50	2.5

University Syllabus :

Unit	Content	Hrs/Unit
1	Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L) Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L)	12
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	6
4	Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared- memory architecture. Cluster computers.(8L) Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L)	7

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
Course Coordinator :	Approved by HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS403.CO1	Write a formal notation for strings, languages and machines.	Write	K6
PCC-CS403.CO2	Design finite automata to accept a set of strings of a language.	Design	K6
PCC-CS403.CO3	For a given language determine whether the given language is regular or not	Determine	K5
PCC-CS403.CO4	Design context free grammars to generate strings of context free language.	Design	K6
PCC-CS403.CO5	Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars	Determine	K5
PCC-CS403.CO6	Write the hierarchy of formal languages, grammars and machines and Distinguish between computability and non-computability and Decidability and undecidability	Write	K6

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	3	3	3	2	2	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	3	3	2
CO3	3	1	2	2	2	-	-	-	-	-	-	3	2	2
CO4	3	2	2	2	3	-	-	-	-	-	1	3	2	3
CO5	3	3	2	2	3	-	-	-	-	-	2	3	2	2
CO6	3	3	2	2	3	-	-	-	-	-	2	3	2	2
AVG.	3	2.5	2.17	2	2.5	0	0	0	0	0	1.67	3	2.33	2.17

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	6

	equivalence with Turing machines, TMsas enumerators	
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

Course Title: Design and Analysis of Algorithms		**Code: PCC-CS404**	
Type of Course: Theory		**Course Designation: Compulsory**	
Semester: 4th		**Contact Hours: 3L/week**	
Continuous Assessment: 25 Marks		**Final Exam: 70 Marks**	
Course Coordinator :		**Approved by HoD (convenor of DAB)**	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS404.CO1	Analyse the complexities of different algorithms.	Analyze	K4
PCC-CS404.CO2	Develop the algorithm techniques (example Divide & Conquer, Dynamic Programming etc) to solve different mathematical models.	Develop	K3
PCC-CS404.CO3	Illustrate the techniques of Greedy paradigm, Branch and Bound, Backtracking etc and compare and contrast them.	Illustrate	K2
PCC-CS404.CO4	Discuss the types of Minimal spanning tree and traversal algorithm with their applications.	Discuss	K6
PCC-CS404.CO5	Understand the variations among tractable and intractable problems to introduce polynomial and non-polynomial reduction.	Understand	K2
PCC-CS404.CO6	Explain the randomized algorithms and approximation algorithms to illustrate their applications.	Explain	K5

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	3	2	3	1	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	3	-
CO3	3	3	3	3	2	-	-	-	-	-	-	-	3	1
CO4	3	3	3	2	2	-	-	-	-	-	-	-	3	2
CO5	3	3	3	1	1	-	2	-	-	-	-	-	2	3
CO6	3	3	3	2	2	2	1	-	-	-	-	-	2	3
AVG.	3	2.83	3	2	1.75	2	1.5	0	0	0	0	0	2.67	2.25

University Syllabus :

Unit	Content	Hrs/Unit
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.	8
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and- Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8

3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6
4	Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P,NP, NP- complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.	10
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	6

Course Title: Biology	Code: BSC 401
Type of Course: Theory	Course Designation: Compulsory
Semester: 4th	Contact Hours: 2L+1T/week
Continuous Assessment: 25 Marks	Final Exam: 70 Marks
Course Coordinator :	Approved by HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
BSC 401.CO1	Describe with examples the biological observations lead to major discoveries	Describe	K1
BSC 401.CO2	Explain the classification of kingdom and building blocks of life, classification at cellular, energy and excretory level, habitat, study of model organisms, explain techniques of biophysics to study biological phenomena, cancer diagnosis and treatment.	Explain	K2
BSC 401CO3	Identify DNA as genetic material in the molecular basis of information transfer	Identify	K3
BSC 401.CO4	Analyze biological processes at the reductionistic level.	Analyze	K4
BSC 401.CO5	Apply thermodynamic principles to biological systems.	Apply	K3
BSC 401.CO6	Identify microorganism	Identify	K3

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	-	1	1	-	-	1	-	-	-	-	-	-	-	-
CO2	-	2	2	-	-	2	-	-	-	-	-	-	-	-
CO3	-	-	-	-	-	1	-	-	-	-	-	-	-	-
CO4	-	-	1	-	-	1	-	-	-	-	-	-	-	-
CO5	-	-	1	-	-	1	-	-	-	-	-	-	-	-
CO6	-	1	2	-	-	1	-	-	-	-	-	-	-	-
AVG.	0	1.33	1.4	0	0	1.16	0	0	0	0	0	0	0	0

University Syllabus :

Unit	Content	Hrs/Unit
1	To convey that Biology is as important a scientific discipline as Mathematics, Physics and Chemistry Bring out the fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Mention the most exciting aspect of biology as an independent scientific discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from	2

	Brownian motion and the origin of thermodynamics by referring to the original observation of Robert Brown and Julius Mayor. These examples will highlight the fundamental importance of observations in any scientific inquiry.	
2	The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilisation -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricoteliec, ureotelic (e) Habitata- acquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. A given organism can come under different category based on classification. Model organisms for the study of biology come from different groups. E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus	3
3	To convey that "Genetics is to biology what Newton's lawsaretoPhysicalSciences"Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics.	4
4	Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids	4
5	Enzymes: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis.	4
6	Information Transfer:The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Define gene in terms of complementation and recombination	4
7	Macromolecular analysis: How to analyse biological processes at the reductionist level Proteins-structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements	5
8	Metabolism: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keqand its relation to standard free energy. Spontaneity. ATP as an energy currency. This should include the breakdown of glucose to CO_2 + H_2O (Glycolysis and Krebs cycle) and synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge	4
9	Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.	3

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**
Course Coordinator :	**Approved by HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
BSC 401.CO1	Resolve different open-ended problems related to air pollution acquiring the detailed knowledge about source, effect and mechanism of the pollution.	Resolve	K3
BSC 401.CO2	Solve various societal problems related to land pollution after detailed understanding about source, effect and mechanism of the pollution	Solve	K3
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	Conceive	K2
BSC 401.CO4	Acquire skills for scientific problem-solving related to air, water, noise& land pollution.	Acquire	K1
BSC 401.CO5	Determine the issues related to noise pollution after studying the existing situation in detail.	Determine	K5
BSC 401.CO6	Develop awareness about the geographical feature of the country considering biodiversity and the variety of ecological systems present in the nature.	Develop	K6

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,	6

	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)	
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 disposal method- Open dumping, Land filling, incineration, composting, recycling. Solid waste management and control (hazardous and biomedical waste).(2L)	3
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, L_{10} (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

Maulana Abul Kalam Azad University of Technology
(Formerly West Bengal University of Technology)
Syllabus and Curricular Mapping for B. Tech. in Computer Science and Engineering
Effective from Academic Session 2023-24

SEMESTER – IV
PRACTICAL

Course Title: Computer Architecture Lab	**Code: PCC-CS492**
Type of Course: Practical	**Course Designation: Compulsory**
Semester: 4th	**Contact Hours: 4P/week**
Continuous Assessment: 40 Marks	**Final Exam: 60 Marks**
Course Coordinator :	**Approved by HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS492.CO1	Discuss the various logic gates using the VHDL programming language.	Discuss	K6
PCC-CS492.CO2	Understanding the arithmetic operations of n- bit numbers using VHDL.	Understand	K2
PCC-CS492.CO3	Analyzing the synthesis of different combinational circuits using VHDL.	Analyze	K4
PCC-CS492.CO4	Illustrate the synthesis of the different sequential circuits using VHDL.	Illustrate	K2
PCC-CS492.CO5	Explain the construction of different memory elements using VHDL.	Explain	K5
PCC-CS492.CO6	Develop different processing elements using VHDL.	Develop	K3

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	3	-	2	2	1	-	-	0	-	-	-	-	2	3
CO2	2	2	2	1	1	-	-	0	-	-	-	-	2	2
CO3	2	1	2	2	-	-	-	0	1	-	-	-	2	2
CO4	3	3	3	2	-	-	-	0	1	-	-	-	3	2
CO5	3	2	2	1	1	2	2	0	1	-	-	1	2	2
CO6	3	2	3	2	1	2	1	0	1	1	2	2	3	3
AVG.	2.67	2	2.33	1.67	1	2	1.5	0	1	1	2	1.50	2.33	2.33

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

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

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS494.CO1	Analyse different types of applications of Divide & Conquer techniques	Analyze	K4
PCC-CS494.CO2	Understanding to implement Dynamic Programming techniques	Understand	K2
PCC-CS494.CO3	Examine to implement knapsack, Job sequencing with deadlines, Prim's and Kruskal's algorithms by using greedy method	Examine	K4
PCC-CS494.CO4	Discuss the implementation of the N-Queen and Graph Coloring Problem by using Backtracking	Discuss	K6
PCC-CS494.CO5	Develop 15 Puzzle problem by using Branch & Bound	Develop	K3
PCC-CS494.CO6	Explain the way of implementation of BFS and DFS by using Graph Traversal Algorithms	Explain	K2

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	3	3	3	1	-	-	-	-	-	-	-	-	3	-
CO2	3	3	3	2	-	-	-	-	-	-	-	-	3	2
CO3	3	3	3	2	-	-	-	-	-	-	-	-	3	1
CO4	3	3	3	1	-	-	-	-	-	-	-	-	3	1
CO5	3	3	3	1	1	-	-	-	-	-	-	-	3	2
CO6	3	3	3	3	2	-	-	1	-	-	-	-	3	3
AVG.	3	3	3	1.67	1.5	0	0	1	0	0	0	0	3	1.8

University Syllabus :

Unit	Content
1	**Divide and Conquer:** 1 Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach 2 Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach 3 Find the minimum number of scalar multiplication needed for chain of matrix 4 Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem 5 Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm
2	**Brunch and Bound:** 6 Implement 15 Puzzle Problem
3	**Backtracking:** 7 Implement 8 Queen problem 8 Graph Coloring Problem Hamiltonian Problem
4	**Greedy method** 9 Knapsack Problem Job sequencing with deadlines 10 Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm

5	Graph Traversal Algorithm: 11 Implement Breadth First Search (BFS) Implement Depth First Search (DFS)

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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ESC501.CO1	Identify and define the various phases of lifecycle for a given project and the appropriate process model depending on the user requirements in order to develop a cost effective software product.	Identify	K1
ESC501.CO2	Distinguish between a structure chart and a flow chart and Identify the activities carried out during transform.	Distinguish	K4
ESC501.CO3	Choose between the coding style(structured or OO)and Perform Code review, Code analysis, build process	Choose	K3
ESC501.CO4	Judge appropriate software testing techniques to the quality of a software product at modules, integration, and system granularity levels.	Judge	K5
ESC501.CO5	Apply the principles, processes and main knowledge areas for Software Project Management	Apply	K3
ESC501.CO6	Design different types of UML diagram with knowledge when and why use a particular type of dig based on the software product requirements	Design	K6

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	3	3	3	2	2	1	-	-	-	-	2	3	3	2
CO2	3	3	2	2	2	-	1	-	-	1	-	3	3	2
CO3	3	1	3	2	2	1	-	-	-	-	-	3	2	2
CO4	3	2	2	2	3	2	-	-	-	-	1	3	3	3
CO5	3	3	2	2	3	-	1	1	-	-	2	3	3	3
CO6	3	3	2	2	3	-	-	-	-	-	2	3	2	2
AVG.	3	2.5	2.33	2	2.5	1.33	1	1	0	1	1.75	3.00	2.66	2.33

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

Course Title: Compiler Design	Code: PCC-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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS501.CO1	Understand and list the different stages in the process of compilation.	Understand	K2
PCC-CS501.CO2	Identify different methods of lexical analysis	Identify	K3
PCC-CS501.CO3	Design top-down and bottom-up parsers	Design	K6
PCC-CS501.CO4	Identify synthesized and inherited attributes	Identify	K3
PCC-CS501.CO5	Develop syntax directed translation schemes	Develop	K3
PCC-CS501.CO6	Develop algorithms to generate code for a target machine	Develop	K6

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	3	3	3	3	2	-	-	2	2	3	2	2	3	1
CO2	3	3	3	3	3	1	-	-	2	2	1	2	3	2
CO3	3	3	3	1	3	-	2	1	3	-	-	2	3	2
CO4	3	3	3	3	-	2	2	2	3	3	2	2	3	2
CO5	3	3	3	3	2	-	-	3	-	2	2	2	2	2
CO6	3	3	3	2	3	-	-	3	2	2	2	3	3	3
AVG.	3	3	3	2.5	2.6	1.5	2	2.2	2.4	2.4	1.8	2.6	2.83	2

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, 6 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, Nonrecursive 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	5

	of inherited attributes.	
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

Course Title: Operating Systems	**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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS502.CO1	Demonstrate the concepts of Operating System Services, System calls, structure and types.	Demonstrate	K2
PCC-CS502.CO2	Discuss processes and threads for multiprogramming and multi-threading.	Discuss	K6
PCC-CS502.CO3	Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response	Develop	K3
PCC-CS502.CO4	Explain algorithmic solutions to process synchronization problems for Inter-Process communication	Explain	K5
PCC-CS502.CO5	Analyse the necessary conditions for Deadlock avoidance and prevention to solve them.	Analyze	K6
PCC-CS502.CO6	Explain Memory management, Virtual Memory, I/O Hardware, File and Disk Management system.	Explain	K2

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	3	1	1	1	-	2	2	3	2	3	-	2	3	3
CO2	3	2	1	1	2	-	-	3	3	1	1	3	3	2
CO3	3	2	3	1	1	-	-	2	3	2	2	2	3	2
CO4	3	3	3	2	-	-	-	3	3	2	2	2	3	2
CO5	3	2	1	1	3	-	-	2	3	1	2	2	3	2
CO6	3	2	2	1	-	-	-	2	2	-	2	1	3	2
AVG.	3	2	1.83	1.167	2	2	2	2.5	2.667	1.8	1.8	2	3.00	2.17

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

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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS503.CO1	Describe classes, objects, members of a class and relationships among them needed for a specific problem.	Describe	K1
PCC-CS503.CO2	Explain the features of object-oriented principles such as encapsulation, polymorphism and composition of systems based on object identity.	Explain	K2
PCC-CS503.CO3	Analyze the concepts of inheritance and its application in OO design with different design patterns.	Analyze	K4
PCC-CS503.CO4	Discuss simple abstract data types and design implementations using abstraction functions to document them.	Discuss	K2
PCC-CS503.CO5	Apply some common object-oriented design patterns and give examples of their use.	Apply	K3
PCC-CS503.CO6	Design applications with an event-driven graphical user interface.	Design	K6

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	3	3	1	2	-	-	-	2	-	-	2	2	2	1
CO2	3	3	1	3	-	-	-	1	-	-	2	2	2	3
CO3	3	3	2	3	-	-	-	3	-	-	2	2	3	2
CO4	3	3	2	3	-	-	-	3	-	-	2	2	3	2
CO5	3	3	-	1	-	-	-	2	2	2	2	2	2	1
CO6	3	3	-	3	-	-	-	3	2	2	2	2	3	2
AVG.	3	3	1.5	2.5	0	0	0	2.33	2	2	2	2	2.5	1.83

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

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 HoD (convenor of DAB)	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
HSMC-501.CO1	Recall the concepts of Accounting and Recognize different systems used in industrial applications.	Recall	K1
HSMC-501.CO2	Discuss on the design of appropriate accounting tool required for real life problems.	Discuss	K1
HSMC-501.CO3	Apply and demonstrate the use of Economical concepts.	Apply	K3
HSMC-501.CO4	Analyze and Simulate a sequential accounting tool for a system or process appropriate for required accuracy.	Analyze	K4
HSMC-501.CO5	Design a sequential economic policy that can work according to the required specifications.	Design	K6
HSMC-501.CO6	Justify a specific accounting technique for an specific purpose.	Justify	K5

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	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	3	-	-	-	-	1	-	-	-	-	-	-	-
CO3	-	-	-	-	3	-	-	-	-	-	-	-	-	-
CO4	-	-	3	-	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-	-	1	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
AVG.	3	3	3	0	3	0	1	0	1	0	0	0	0	0

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,	6

	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.	
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. Waste-types, sources and ways to reduce them. Cost control-methods and important guide lines.	4
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

Course Title: Artificial Intelligence	**Code: PEC-IT501B**
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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PEC-IT501B.CO1	Understand the various search techniques, constraint satisfaction problems along with problem solving techniques in strategic games.	Understand	K2
PEC-IT501B.CO2	Apply such techniques in real world problems which involve perception, reasoning and learning.	Apply	K3
PEC-IT501B.CO3	Understand the role of agents and identify ways to evaluate their performance in achieving goals.	Understand	K2
PEC-IT501B.CO4	Understand and Apply Predicate Logic to process natural language texts.	Apply	K3
PEC-IT501B.CO5	Analyze and apply machine learning techniques to solve real world problems.	Analyze	K4
PEC-IT501B.CO6	Design and employ expert systems for the societal needs.	Design	K6

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	3	3	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	2	-	-	-	-	-	-	2	-	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	-	-	-	-	2
CO5	-	-	2	3	3	-	-	-	-	-	-	-	-	-
CO6	3	-	-	-	3	-	-	-	3	-	-	3	-	2
AVG.	3	2.5	2	3	3	0	0	0	2.5	0	0	3	2	2

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.	6

	Probabilistic reasoning [4] Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	
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

Course Title: Constitution of India	**Code: MC- 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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
MC- CS501.CO1	Understand Basic Structure of the Constitution of India	Understand	K2
MC- CS501.CO2	Apply the understanding in Engineering Profession	Apply	K3
MC- CS501.CO3	Apply Constitutional Values in Engineering Education	Apply	K3
MC- CS501.CO4	Apply Constitutional Provisions in Policy matters of CSE	Apply	K3
MC- CS501.CO5	Apply Team Spirit and Constitutional Legislative Provisions for Industrial Design	Apply	K3
MC- CS501.CO6	Analyze Constitutional Valuesof Legislation, Executive & Judiciary in the light of the Professional requirements of Computer Science Engineering	Analyze	K4

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	-	2	3	1	-	2	1	1
CO2	-	-	-	-	-	2	-	2	3	1	-	2	1	1
CO3	-	-	-	-	-	2	-	2	3	1	-	2	1	1
CO4	-	-	-	-	-	2	-	2	3	1	-	2	1	1
CO5	-	-	-	-	-	2	-	2	3	1	-	2	1	1
CO6	-	-	-	-	-	2	-	2	3	1	-	2	1	1
AVG.	0	0	0	0	0	2	0	2	3	1	0	2	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 Council of ministers, State Secretariat: Organisation, Structure and Functions	6
4	Local Administration District's Administration head: Role and Importance,	8

	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	
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

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 HoD (convenor of DAB)**	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
ESC591.CO1	Understand the software engineering methodologies involved in the phases for project development.	Understand	K2
ESC591.CO2	Extract functional and non-functional requirement for given problem statement.	Extract	K2
ESC591.CO3	Choose between different design strategies for real life problem	Choose	K3
ESC591.CO4	Develop use case diagrams and activity diagrams, build and test class diagrams, sequence diagrams and add interface to class diagrams.	Develop	K6
ESC591.CO5	Design Test Script/Test Plan using Black box and White Box approach.	Design	K6
ESC591.CO6	Evaluate Process and Product Metrics using different models.	Evaluate	K5

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	3	1	1	-	-	-	-	-	-	-	-	-	-
CO2	1	2	2	1	1	-	1	-	-	-	-	-	1	-
CO3	1	1	3	1	2	-	1	-	-	-	-	-	3	-
CO4	1	1	3	1	2	-	1	-	-	-	-	-	3	-
CO5	3	2	2	2	3	-	-	-	-	-	-	-	2	-
CO6	2	2	2	2	2	-	-	-	-	-	2	-	1	-
AVG.	1.66	1.83	2.16	1.33	2	0	1	0	0	0	2	0	2	0

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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS592.CO1	Understanding of different Unix/Linux commands and shell programming	Understand	K2
PCC-CS592.CO2	Demonstrate the creation of processes and POSIX threads.	Demonstrate	K3
PCC-CS592.CO3	Develop the problems of process scheduling and process synchronization (Signal and Semaphore)	Develop	K6
PCC-CS592.CO4	Determine the deadlock avoidance and detection algorithms.	Determine	K5
PCC-CS592.CO5	Analyse different Memory allocation and File accessing techniques	Analyse	K4
PCC-CS592.CO6	Illustrate Inter-Process Communication through system calls.	Illustrate	K2

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	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

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).

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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS593.CO1	Define an object oriented programming language, and associated class libraries and learn how to develop object oriented programs.	Define	K1
PCC-CS593.CO2	Understand the concepts of class, constructor, data encapsulation, inheritance, overriding and polymorphism to describe large scale software.	Understand	K2
PCC-CS593.CO3	Develop and debug programs using object oriented principles with wrapper class, arrays.	Develop	K3
PCC-CS593.CO4	Apply the concept of interfaces- multiple inheritance, extending interfaces.	Apply	K3
PCC-CS593.CO5	Analyze and use an integrated environment development by creating and accessing packages and multithreaded programming	Analyze	K4
PCC-CS593.CO6	Develop programs with Graphical User Interfaces capabilities and solve related problems.	Develop	K6

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	3	3	3	1	2	-	-	-	2	-	-	2	2	1
CO2	3	3	3	1	3	-	-	-	1	-	-	2	2	3
CO3	3	3	3	2	3	-	-	-	3	-	-	2	3	2
CO4	3	3	3	2	3	-	-	-	3	-	-	2	3	2
CO5	3	3	3	-	1	-	-	-	2	2	2	2	2	1
CO6	3	3	3	-	3	-	-	-	3	2	2	2	3	2
AVG.	3	3	3	1.5	2.5	0	0	0	2.3	2	2	2	2.5	1.8

University Syllabus :

Note: Use Java for programming

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

SEMESTER – VI

THEORY

Course Title: Database Management Systems	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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC- CS601.CO1	Describe the basic concept of database and different database models along with database languages like DDL, DML etc, Data Abstraction, and Data Independence.	Describe	K1
PCC- CS601.CO2	Identify different approaches for solving queries such as Relational algebra, Tuple and domain relational calculus, considering the query optimization strategies, and different normal forms for relational database normalization.	Identify	K3
PCC- CS601.CO3	Evaluate the applications of different storage strategies such as Indices, B-trees, hashing	Evaluate	K5
PCC- CS601.CO4	Understand the transaction processing and concurrency control strategies including ACID property, serializability of scheduling, locking and timestamp based schedulers, Database recovery.	Understand	K2
PCC- CS601.CO5	Analyze the database security approaches including authentication, authorization and access control, DAC, MAC and RBAC models, intrusion detection, SQL injection etc.	Analyze	K4
PCC- CS601.CO6	Explain the advanced concepts related to DBMS such as object oriented and object relational databases, logical databases, web databases, distributed databases, data warehousing and data mining.	Explain	K2

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	2	2	1	1	-	-	-	-	-	-	1	2	-
CO2	2	-	2	2	-	-	1	-	-	-	-	-	2	-
CO3	-	2	2	2	2	-	-	2	-	-	1	-	3	1
CO4	1	3	3	1	2	-	-	-	-	-	-	-	3	2
CO5	1	2	-	2	1	-	-	-	-	-	2	-	2	-
CO6	2	2	2	2	2	3	-	-	-	-	-	-	2	1
AVG.	1.6	2.2	2.2	1.6	1.6	3	1	2	0	0	1.5	1.00	2.33	1.33

University Syllabus :

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

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

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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC- CS602.CO1	Describe the fundamental concepts of computer networking, Data Communications System and learn its components.	Describe	K1
PCC- CS602.CO2	Explain the concept of function(s) of each layer of the OSI model and learn about TCP/IP.	Explain	K2
PCC- CS602.CO3	Identify the different types of network topologies, protocols, networking devices and make concepts about their functions within a network.	Identify	K3
PCC- CS602.CO4	Simplify building the skills of subnetting and routing mechanisms.	Simplify	K4
PCC- CS602.CO5	Justify the different system component parts of the network	Justify	K5
PCC- CS602.CO6	Develop an expertise in some specific areas of networking such as the design and learn about maintenance of individual networks	Develop	K6

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	3	1	-	2	2	-	-	-	-	-	-	3	3	2
CO2	3	2	1	2	2	-	-	-	-	-	-	3	3	2
CO3	3	2	-	2	2	-	-	-	-	-	-	3	2	2
CO4	3	3	2	2	3	-	-	-	-	-	1	3	2	3
CO5	2	3	2	2	3	-	-	-	-	-	2	3	2	2
CO6	2	3	2	2	3	-	-	-	-	-	2	3	2	2
AVG.	2.66	2.33	1.75	2	2.5	0	0	0	0	0	1.67	3.00	2.33	2.17

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	8

	improving techniques: Leaky Bucket and Token Bucket algorithm.	
5	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	8

Course Title: Distributed Systems	Code: PEC-IT601B
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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PEC-IT601B.CO1	Define the basic concepts of Distributed database system and distributed database management system with the architecture details.	Define	K1
PEC-IT601B.CO2	Design different distributed database strategies and processing issues in distributed database.	Design	K6
PEC-IT601B.CO3	Evaluate the different query optimization technique and transaction concurrency control management.	Evaluate	K5
PEC-IT601B.CO4	Identify the different reliability issues and types of failure occur in distributed database system.	Identify	K3
PEC-IT601B.CO5	Illustrate the architecture and query processing of parallel database system.	Illustrate	K2
PEC-IT601B.CO6	Examine the advanced concepts of distributed database like mobile database management system and multi-database management system.	Examine	K4

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	3	1	2	1	-	-	-	-	-	-	1	-	3	1
CO2	3	2	3	1	-	1	1	-	-	-	1	1	3	-
CO3	3	2	-	1	2	1	-	-	1	-	-	1	3	2
CO4	3	3	3	1	2	1	-	-	1	1	-	2	2	3
CO5	2	3	2	3	1	-	-	1	3	1	-	1	3	2
CO6	2	3	2	3	2	1	1	2	3	-	1	2	2	1
AVG.	2.67	2.3	2.4	1.67	1.75	1	1	1.5	2	1	1	1.4	2.67	1.8

University Syllabus :

Unit	Content	Hrs/Unit
1	**INTRODUCTION Distributed data processing**; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues	8
2	**DISTRIBUTED DATABASE DESIGN** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation SEMANTICS DATA CONTROL View management; Data security; Semantic Integrity Control QUERY PROCESSING ISSUES Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data	11
3	**DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralized query optimization;	11

	Ordering of fragment queries; Distributed query optimization algorithms TRANSACTION MANAGEMENT The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models CONCURRENCY CONTROL Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management	
4	**Reliability issues in DDBSs;** Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm	8
5	**PARALLEL DATABASE SYSTEMS** Parallel architectures; parallel query processing	6
6	**ADVANCED TOPICS** Mobile Databases, Distributed Object Management, Multi-databases	4

Course Title: Image Processing	**Code:**	**PEC-IT601D**
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 HoD (convenor of DAB)**	

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PEC-IT601D.CO1	Understand the fundamental concepts of a digital image processing (DIP) system.	Understand	K2
PEC-IT601D.CO2	Remember different techniques employed for the enhancement of images.	Remember	K1
PEC-IT601D.CO3	Apply the Frequency domain Techniques to real life image Processing.	Apply	K3
PEC-IT601D.CO4	Analyse image segmentation and representation techniques.	Analyse	K4
PEC-IT601D.CO5	Analyse image restoration procedures	Analyse	K4
PEC-IT601D.CO6	Understand the rapid advances of (DIP) in Machine vision	Understand	K2

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	3	3	3	2	2	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	3	3	2
CO3	3	1	2	2	2	-	-	-	-	-	-	3	2	2
CO4	3	2	2	2	3	-	-	-	-	-	1	3	2	3
CO5	3	3	2	2	3	-	-	-	-	-	2	3	2	2
CO6	3	3	2	2	3	-	-	-	-	-	2	3	2	2
AVG.	3	2.5	2.16	2	2.5	0	0	0	0	0	1.67	3	2.33	2.16

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	9
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 -	8

	Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. Highpass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	
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] 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.	7

Course Title: Pattern Recognition	**Code:** PEC-IT602D
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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
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	Describe	K1
PEC-IT602D.CO2	Explainthe 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.	Explain	K2
PEC-IT602D.CO3	Analyze the linear discriminant function based classifier design such as perceptron and support vector machines	Analyze	K4
PEC-IT602D.CO4	Illustrate hidden markov models for sequential pattern recognition	Illustrate	K2
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	Exemplify	K6
PEC-IT602D.CO6	Explain unsupervised learning and clustering algorithms, and analyses their strengths and weakness	Explain	K2

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	3	3	2	2	2	1	1	-	-	-	2	1	3	2
CO2	3	3	2	2	2	1	1	-	-	-	2	1	3	2
CO3	3	3	2	2	2	1	1	-	-	-	2	1	3	2
CO4	3	3	2	2	2	1	1	-	-	-	1	1	3	2
CO5	3	3	2	2	2	1	1	-	-	-	2	1	3	2

| CO6 | 3 | 3 | 2 | 2 | 2 | 1 | 1 | - | - | - | 2 | 1 | 3 | 2 |
| AVG. | 3 | 3 | 2 | 2 | 2 | 1 | 1 | 0 | 0 | 0 | 1.833 | 1 | 3 | 2 |

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

Course Title: Numerical Methods	Code: OEC-IT601A
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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
OEC-IT601A.CO1	Understand the basic elements of numerical methods and error analysis.	Understand	K2
OEC-IT601A.CO2	Understand the theoretical aspects of the use of numerical methods.	Understand	K2
OEC-IT601A.CO3	Apply the concepts of numerical methods to design algorithms for automated processing.	Apply	K3
OEC-IT601A.CO4	Evaluate the limitations, advantages, and disadvantages of different numerical methods.	Evaluate	K5
OEC-IT601A.CO5	Evaluate and Apply appropriate numerical method approach for a given problem.	Evaluate	K5
OEC-IT601A.CO6	Implement numerical methods for solving various engineering problems.	Implement	K3

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	-	-	-	-	-	2	-	-	-	3	-	-
CO2	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO3	-	2	-	2	-	-	2	-	-	2	-	-	-	-
CO4	-	-	-	-	2	-	-	3	-	-	-	2	-	2
CO5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO6	-	-	-	-	-	-	-	-	-	-	-	-	-	-

AVG.	0	2	0	2	2	0	2	2.5	0	2	0	2.5	2	2

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

Course Title: Research Methodology	Code: PROJ- 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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PROJ- CS601.CO1	Define and understand the motivation and objectives of research work	Define	K1
PROJ- CS601.CO2	Explain how to define and formulate a research problem	Explain	K2
PROJ- CS601.CO3	Identify the importance of literature review in a research work	Identify	K3
PROJ- CS601.CO4	Examine the appropriate statistical methods required for a particular research design and develop the appropriate research hypothesis for a research project	Examine	K4
PROJ- CS601.CO5	Explain the ethical issues involved while undertaking research	Explain	K2
PROJ- CS601.CO6	Develop the skill set to correctly present a research work by following the protocols of writing a standard research report.	Develop	K6

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	3	3	3	2	2	-	-	-	1	-	2	3	3	2
CO2	3	3	2	2	2	-	-	-	1	-	2	3	3	2
CO3	3	1	2	2	2	-	-	-	1	-	2	3	3	2
CO4	3	2	2	2	3	-	-	-	1	-	2	3	3	2
CO5	-	-	-	-	-	-	-	3	1	-	-	3	2	3
CO6	3	3	2	2	3	-	-	-	1	-	2	3	2	3

AVG.	3	2.4	2.2	2	2.4	0	0	3	1	0	2	3.00	2.66	2.33

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

Course Title: Database 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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS691.CO1	Analyze and transform an Entity Relationship Model into a relational database schema and to use a data definition language to implement the schema using a DBMS	Analyze	K4
PCC-CS691.CO2	Declare and enforce integrity constraints on a database using a DBMS	Declare	K1
PCC-CS691.CO3	Populate and query a database using SQL DML/DDL commands.	Populate	K3
PCC-CS691.CO4	Retrieve of data from a database.	Retrieve	K3
PCC-CS691.CO5	Describe and implement relational algebra expression using aggregate functions, joins and sub-queries.	Describe	K1
PCC-CS691.CO6	Compile programs in PL/SQL including stored procedures, stored functions, cursors, packages.	Compile	K6

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	3	2	3	1	3	1	-	1	2	-	1	2	2	1
CO2	3	2	3	2	3	1	-	-	2	-	1	2	2	1
CO3	3	2	3	2	3	1	-	2	2	-	1	2	2	1

CO4	3	2	3	2	3	1	-	2	2	-	1	2	2	1
CO5	3	2	3	3	3	1	-	2	2	-	1	2	2	1
CO6	3	2	3	2	3	1	-	2	2	-	1	2	2	1
AVG.	3	2	3	3	3	1	0	1.8	2	0	1	2	2	1

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

Course Title: Computer Networks 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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PCC-CS692.CO1	Describe the Networking cables (CAT5, UTP), Connectors (RJ45, T-connector) and installation of Network Interface Card .	Describe	K1
PCC-CS692.CO2	Explain the working and difference of various networking devices like Hub, Bridge, Network Switch, Router and Modem.	Explain	K2
PCC-CS692.CO3	Developed a client server socket programming using TCP and UDP approach in C and Java.	Develop	K3
PCC-CS692.CO4	Generate techniques Data link Layer Flow control mechanisms like Stop &Wait and Sliding Window using C.	Generate	K4
PCC-CS692.CO5	Explain how to implement Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) and error control mechanism like Selective Repeat and GoBack-N algorithm using C.	Explain	K5
PCC-CS692.CO6	Create the server setup configuration using different process like FTP, DNS, TelNet,NFS and concept of Firewall.	Create	K6

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	3	2	3	-	3	-	-	-	2	-	3	-	3	3
CO2	3	2	3	-	3	-	-	-	0	-	3	-	3	1
CO3	3	2	3	-	3	-	-	-	2	-	3	3	3	1
CO4	3	2	3	-	3	-	-	-	2	-	3	3	3	2
CO5	3	2	3	-	3	-	-	-	0	-	3	0	3	3
CO6	3	2	3	-	3	-	-	-	3	-	3	3	3	3
AVG.	3	2	3	0	3	0	0	0	2.25	0	3	3	3	2.17

University Syllabus :

Unit	Content
1	NIC Installation & Configuration (Windows/Linux)
2	Understanding IP address, subnet etc Familiarization with • Networking cables (CAT5, UTP) • Connectors (RJ45, T-connector) • Hubs, Switches
3	TCP/UDP Socket Programming • Simple, TCP based, UDP based • Multicast & Broadcast Sockets • Implementation of a Prototype Multithreaded Server
4	Implementation of • Data Link Layer Flow Control Mechanism (Stop & Wait, Sliding Window) • Data Link Layer Error Detection Mechanism (Cyclic Redundancy Check) • Data Link Layer Error Control Mechanism (Selective Repeat, Go Back N)
5	Server Setup/Configuration FTP, TelNet, NFS, DNS, Firewall

Maulana Abul Kalam Azad University of Technology
(Formerly West Bengal University of Technology)
Syllabus and Curricular Mapping for B. Tech. in Computer Science and Engineering
Effective from Academic Session 2023-24

SEMESTER – VII
THEORY

Course Title: Machine Learning	Code: PEC-CS701E
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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PEC-CS701E.CO1	Explain the basic concepts of Regression/ Classification. Extend the concepts of statistical learning theory of various Regression/ Classification methods.	Explain	K2
PEC-CS701E.CO2	Analyze the linear discriminant, logistic regression, non-linear SVM, Kernel methods.	Analyze	K4
PEC-CS701E.CO3	Analyze the varoius concepts of unsupervised learning, Generative Models (mixture models and latent factor models) , Dimension reduction, Kernel PCA, Matrix factorization.	Analyze	K4
PEC-CS701E.CO4	Explain Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	Explain	K2
PEC-CS701E.CO5	Evaluate Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	Evaluate	K5
PEC-CS701E.CO6	Explain the concepts of Scalable Machine Learning (Online and Distributed Learning), Inference in Graphical Models, Introduction to Bayesian Learning and Inference, the recent trends in various learning techniques of machine learning and classification methods.	Explain	K2

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	3	3	3	3	3	-	-	-	2	-	-	3	3	3
CO2	3	3	2	3	3	-	-	-	2	1	-	3	3	3
CO3	3	2	2	3	3	-	-	-	2	1	-	3	3	3
CO4	3	3	3	3	3	-	-	-	2	1	-	3	3	3
CO5	2	2	2	2	3	-	-	-	1	-	-	3	3	3
CO6	3	1	1	1	-	-	-	-	1	-	-	3	3	3
AVG.	2.83	2.33	2.167	2.5	3	0	0	0	1.67	1	0	3	3	3

University Syllabus :

Unit	Content	Hrs/unit
1	**Supervised Learning (Regression/Classification)** Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models Support Vector Machines, Nonlinearity and Kernel Methods	10

	Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	
2	**Unsupervised Learning** Clustering: K-means/Kernel K-means Dimensionality Reduction: PCA and kernel PCA Matrix Factorization and Matrix Completion Generative Models (mixture models and latent factor models)	7
3	Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6
4	Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	9
5	Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	9
6	Recent trends in various learning techniques of machine learning and classification methods	5

Course Title: Soft Computing	**Code: PEC-CS702B**
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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PEC-CS702B.CO1	Describe the basic concepts of soft computing; fuzzy sets and fuzzy logic systems, artificial neural network and Genetic Algorithm.	Describe	K1
PEC-CS702B.CO2	Explain Fuzzy sets and Fuzzy logic systems including relationship between the Classical Sets and Fuzzy Sets, Membership functions, fuzzification and defuzzification methods, Fuzzy Inference System and Applications of Fuzzy Logic.	Explain	K2
PEC-CS702B.CO3	Analyze the different Learning Methods and Neural Network models and Competitive learning networks	Analyze	K4
PEC-CS702B.CO4	Understand the components of GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA).	Understand	K2
PEC-CS702B.CO5	Apply the soft computing techniques such as fuzzy logic, neural network and genetic algorithm in different problem domains.	Apply	K3
PEC-CS702B.CO6	Evaluate other popular soft computing techniques such as Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	Evaluate	K5

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	3	3	2	3	2	-	-	-	-	-	-	2	2	2
CO2	3	3	2	3	2	-	-	-	-	-	-	1	2	2
CO3	3	3	2	3	2	-	-	-	-	-	-	2	2	2
CO4	3	3	2	3	2	-	-	-	-	-	-	2	2	2
CO5	3	3	2	3	2	-	-	-	-	-	-	1	2	2
CO6	3	3	2	3	2	-	-	-	-	-	-	1	2	2
AVG.	3	3	2	3	2	0	0	0	0	0	0	1.5	2	2

University Syllabus :

Unit	Content	Hrs/unit
1	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm	8
2	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations : Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system –	10

	Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting	
3	Neural Network Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron. Learning Methods : Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Backpropagation and multi layer networks. Competitive learning networks: Kohonen self organizing networks, Hebbian learning; Hopfield Networks. Neuo-Fuzzy modelling:Applications of Neural Networks: Pattern Recognition and classification	10
4	Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition	10
5	Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	4

Course Title: Adhoc –Sensor Network	Code: PEC-CS702C
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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PEC-CS702C.CO1	Discuss the wireless network and MANET.	Discuss	K6
PEC-CS702C.CO2	Understand the sensor node architecture	Understand	K2
PEC-CS702C.CO3	Illustrate the different Communication protocol for WSN	Illustrate	K2
PEC-CS702C.CO4	Analyze the routing protocol for WSN	Analyze	K4
PEC-CS702C.CO5	Develop the topology control for WSN	Develop	K3
PEC-CS702C.CO6	Explain the mote architecture OS used in WSN	Explain	K5

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	3	3	3	2	2	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	3	3	2
CO3	3	1	2	2	2	-	-	-	-	-	-	3	2	2
CO4	3	2	2	2	3	-	-	-	-	-	1	3	2	3
CO5	3	3	2	2	3	-	-	-	-	-	2	3	2	2
CO6	3	3	2	2	3	-	-	-	-	-	2	3	2	2
AVG.	3	2.5	2.17	2	2.5	0	0	0	0	0	1.67	3	2.33	2.17

University Syllabus :

Unit	Content	Hrs/Unit
1	Introduction and Overview [4L] :Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.	4
2	Architectures Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes , operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design principle	9
3	Communication Protocols [9L]: Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC , the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocolsclassification, gossiping, flooding, energyefficient routing, unicast protocols, multipath routing, data-centric routing, data aggregation, SPIN, LEACH, DirectedDiffusion, geographic routing.	9
4	Infrastructure Establishment: Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services, sensor tasking and control	8

| 5 | Sensor Network Platforms and Tools [9L]:Sensor node hardware, Berkeley motes, programming challenges, nodelevel software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM. | 9 |

Course Title: Operation Research	Code: OEC-CS701A
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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
OEC-CS701A.CO1	Describe the basic concept of linear programming problem and various component of LPP formulation for solving Business Problems.	Describe	K1
OEC-CS701A.CO2	Identify different approaches for solving LPP problems such as Graphical Method, Simplex Method, Charnes' Big-M Method, Duality Theory, Transportation Problems and Assignment Problems etc.	Identify	K3
OEC-CS701A.CO3	Evaluate the applications of game theory such as 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems, Games without Saddle Point; Graphical Method; Principle of Dominance etc.	Evaluate	K5
OEC-CS701A.CO4	Understand the terms Feasible Solution, Basic and non- basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and the use of game theory.	Understand	K2
OEC-CS701A.CO5	Analyze different types of algorithms such as Floyd Algorithm, PERT-CPM etc. for Cost Analysis, Crashing, and Resource Allocation.	Analyze	K4
OEC-CS701A.CO6	Explain the concepts of Queuing Theoryalong with the some models such as Axiomatic Derivation of the Arrival & Departure (Poisson Queue), Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) etc.	Explain	K2

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	2	-	1	1	-	-	-	2	-	2	2	2	1
CO2	2	2	-	2	-	-	-	-	2	-	2	-	3	2
CO3	2	2	1	2	1	-	-	-	2	-	2	-	2	1
CO4	1	2	1	2	-	-	-	-	1	-	1	2	2	1
CO5	1	2	-	2	-	-	-	-	1	-	2	-	3	2
CO6	1	1	-	1	-	-	-	-	-	-	1	-	2	-
AVG.	1.5	1.83	1	1.67	1	0	0	0	1.6	0	1.67	2	2.33	1.4

University Syllabus :

Unit	Content	Hrs/Unit
1	Basic LPP and Applications; Various Components of LP Problem Formulation. Solution of Linear	17

	Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and nonbasic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.	
2	Network Analysis:Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERTCPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control:Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.	9
3	Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance	5
4	Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	5

Course Title: Multimedia Technology		**Code: OEC-CS701B**
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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
OEC-CS701B.CO1	Learn technical aspect of Multimedia Systems	Learn	K1
OEC-CS701B.CO2	Understand the standards available for different audio,video Image and text applications	Understand	K2
OEC-CS701B.CO3	Design various available storage model for multimedia and can give a comparison study between them	Design	K6
OEC-CS701B.CO4	Compare between different available multimedia document architecture	Compare	K4
OEC-CS701B.CO5	Explain technical aspects of popular multimedia web applications, including VoD and VoIP	Explain	K2
OEC-CS701B.CO6	Develop multimedia application and analyze the performance of the same	Develop	K3

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	-	-	-	-	-	-	-	-	-	-	-	-	-	1
CO2	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO3	-	-	-	2	1	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	1	-	-	-	-	-	-	-	1	-
CO5	-	-	-	2	1	-	-	-	-	-	-	-	1	-
CO6	-	-	3	2	1	-	-	-	-	-	-	-	1	2
AVG.	0	0	3	2	1	0	0	0	0	0	0	0	1	1.5

University Syllabus :

Unit	Content	Hrs/Unit
1	Introduction: Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications	2
2	Text and Audio, Image and Video(14L) Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size,	14

	Quantization), Audio Formats, Audio tools, MIDI Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.	
3	Synchronization, Storage models and Access Techniques:Temporal relationships, synchronization accuracy specification factors, quality of service, Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, CCD	8
4	Image and Video Database, Document Architecture and Content Management (17L): Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- kd trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing, Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications	17
5	Multimedia Applications(4L): Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors	4

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 Marks	Final Exam: 70 Marks
Writer: Course Coordinator	Approved by HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
HSMC 701.CO1	Examine role of entrepreneur in economic development	Examine	K3
HSMC 701.CO2	Describe the steps to establish an enterprise	Describe	K1
HSMC 701.CO3	Compare and classify types of entrepreneurs	Compare	K4
HSMC 701.CO4	Evaluate the entrepreneurial support in India	Evaluate	K5
HSMC 701.CO5	Describe Special institutions for entrepreneurial development and assistance in India	Describe	K1
HSMC 701.CO6	Explain project Identification	Explain	K6

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	3	3	3	3	2	-	-	-	-	-	-	3	3	1
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	2
CO3	3	3	3	1	3	1	1	-	-	-	-	3	3	2
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	2
CO5	3	3	3	3	2	-	-	-	-	-	-	3	2	2
CO6	3	3	3	2	3	2	2	-	-	-	1	3	3	3
AVG.	3	3	3	2.5	2.6	1.5	1.5	0	0	0	1	2.83	2.83	2

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

SEMESTER – VII

Sessional

Course Title: Project-II	Code: PROJ-CS781
Type of Course: Sessional	Course Designation: Compulsory
Semester: 7th	Contact Hours: 12P/week
Continuous Assessment: 25 Marks	Final Exam: 70 Marks
Writer: Course Coordinator	Approved by HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PROJ-CS781.CO1	Identify the Problem & Problem Domain in the broad field of Computer Science & Engineering.	Identify	K3
PROJ-CS781.CO2	Understand the Research Methodologies and Field Study	Understand	K2
PROJ-CS781.CO3	Understand the Tools and Techniques used	Understand	K2
PROJ-CS781.CO4	Identify of the Relevant Resources and Data Set	Identify	K3
PROJ-CS781.CO5	Prepare of s/w and h/w requirement analysis	Prepare	K6
PROJ-CS781.CO6	Develop goal in line with flow of work	Develop	K6

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	3	3	3	3	3	3	-	-	-	2	2	2	3
CO2	2	3	3	3	1	2	3	-	-	-	-	-	1	3
CO3	2	2	-	2	3	-	-	-	-	-	-	-	3	1
CO4	2	2	-	2	3	-	-	-	-	-	-	-	2	2
CO5	1	1	1	2	2	-	-	-	-	-	-	-	2	1
CO6	1	1	1	2	-	2	2	2	2	-	2	-	1	2
AVG.	1.66	2	2	2.33	2.4	2.33	2.66	2	2	0	2	2	1.83	2

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 and Network Security	**Code: PEC-CS801B**
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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PEC-CS801B.CO1	Describe conceptual understanding of network security issues, challenges and mechanisms common network vulnerabilities and attacks and basic concept of cryptography.	Describe	K1
PEC-CS801B.CO2	Evaluate various techniques of cryptography.	Evaluate	K5
PEC-CS801B.CO3	Illustrate the algorithms of different symmetric key cryptography.	Illustrate	K2
PEC-CS801B.CO4	Apply the public key algorithms, digital signature and message digest.	Apply	K3
PEC-CS801B.CO5	Analyze the approaches of security protocol and authentication.	Analyze	K4
PEC-CS801B.CO6	Explain the concept of electronic mail security and types of firewall and its configurations.	Explain	K2

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	3	3	2	-	-	-	-	-	-	-	-	1	3	3
CO2	3	3	3	-	2	-	-	-	-	-	-	-	3	2
CO3	2	2	1	2	3	1	-	1	1	3	-	-	3	2
CO4	3	3	2	2	3	1	2	1	0	2	-	-	3	2
CO5	3	2	3	2	1	-	-	-	-	1	-	-	2	2
CO6	3	2	3	2	2	2	-	-	-	-	-	-	2	2
AVG.	2.83	2.5	2.33	2	2.2	1.33	2	1	0.5	2	0	1	2.67	2.167

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

Course Title: Internet of Things	**Code: PEC-CS801E**
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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PEC-CS801E.CO1	Understand the vision of IoT from a global context.	Understand	K2
PEC-CS801E.CO2	Determine the Market perspective of IoT.	Determine	K5
PEC-CS801E.CO3	Use of Devices, Gateways and Data Management in IoT.	Use of	K3
PEC-CS801E.CO4	Analysed the use of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.	Analysed	K4
PEC-CS801E.CO5	Understand the architecture of smart sensor.	Understand	K2
PEC-CS801E.CO6	Build the interfacing among IoT components.	Build	K5

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	3	3	3	3	2	1	1	1	1	1	2	2	3	3
CO2	3	3	3	3	-	1	1	1	1	1	2	2	3	3
CO3	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO4	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO5	3	3	3	3	-	-	-	-	1	1	-	2	2	2
CO6	3	3	3	3	-	-	-	-	1	1	-	2	2	2
AVG.	3	3	3	3	2	1	1	1	1	1	2	2	2.33	2.33

University Syllabus :

Unit	Content	Hrs/Unit
1	Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
2	Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
3	Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	11
4	Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing,	10

	Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	
5	Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
6	Recent trends in smart sensor for day to day life, evolving sensors and their architecture	5

Course Title: Big Data Analytics	**Code: OEC-CS801A**
Type of Course: Theory	**Course Designation: Elective**
Semester: 8th	**Contact Hours: 3L/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Course Coordinator :	**Approved by HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
OEC-CS801A.CO1	Understand Big Data and its Business Implications.	Understand	K2
OEC-CS801A.CO2	Analyze the nonrelational database framework like, NOSQL to efficiently store and process Big Data to generate analytics. Analyze HDFS distributed file system, HADOOP streaming and I/O.	Analyze	K4
OEC-CS801A.CO3	Design of Algorithms to solve Data Intensive Problems using Map Reduce Paradigm, YARN job scheduling and shuffle sort task execution.	Design	K6
OEC-CS801A.CO4	Explain the concepts of Hbase data model, client and implementations. Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	Explain	K2
OEC-CS801A.CO5	Design with Implementation of Big Data Analytics using Apache pig and spark to solve data intensive problems and to generate analytics	Design	K6
OEC-CS801A.CO6	Implement Big Data Activities using Hive.	Implement	K6

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	3	3	3	2	2	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	3	3	2
CO3	3	1	2	2	2	-	-	-	-	-	-	3	2	2
CO4	3	2	2	2	3	-	-	-	-	-	1	3	2	3
CO5	3	3	2	2	3	-	-	-	-	-	2	3	2	2
CO6	3	3	2	2	3	-	-	-	-	-	2	3	2	2
AVG.	3	2.5	2.16667	2	2.5	0	0	0	0	0	1.6667	3	2.33	2.166

University Syllabus :

Unit	Content	Hrs/Unit
1	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and	8

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

Course Title: Mobile Computing	**Code: OEC-CS801C**
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 HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
OEC-CS801C.CO1	Analyze the Personal Communication service and GSM architecture	Analyze	K4
OEC-CS801C.CO2	Develop the concept of GPRS architecture and WLAN standard	Develop	K3
OEC-CS801C.CO3	Illustrate the WLL structure and the concept of WAP protocol.	Illustrate	K2
OEC-CS801C.CO4	Discuss the 3G mobile services	Discuss	K1
OEC-CS801C.CO5	Understand the concept of Global Mobile Satellite Systems and its case studies	Understand	K2
OEC-CS801C.CO6	Explain the Server-side programming in Java and Pervasive web application architecture	Explain	K2

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	3	3	3	2	2	-	-	-	-	-	-	3	3	2
CO2	3	3	2	2	2	-	-	-	-	-	-	3	3	2
CO3	3	1	2	2	2	-	-	-	-	-	-	3	2	2
CO4	3	2	2	2	3	-	-	-	-	-	1	3	2	3
CO5	3	3	2	2	3	-	-	-	-	-	2	3	2	2
CO6	3	3	2	2	3	-	-	-	-	-	2	3	2	2
AVG.	3	2.5	2.17	2	2.5	0	0	0	0	0	1.67	3	2.33	2.17

University Syllabus :

Unit	Content	Hrs/Unit
1	Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling.	5
2	General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE 802.11 standard, Mobile IP.	5
3	Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.	7
4	Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G	7
5	Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.	7
6	Server-side programming in Java, Pervasive web application architecture, Device independent example application	8

Course Title: E-Commerce & ERP	Code: OEC-CS802A
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 HoD (convenor of DAB)

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
OEC-CS802A.CO1	Describe the fundamental concept and scope of E-Commerce, relation between E-Commerce and Networking and their concerned hardware.	Describe	K1
OEC-CS802A.CO2	Explain various business models and E-strategies for developing E-Commerce	Explain	K2
OEC-CS802A.CO3	Understand the role of Conve1rgence, Collaborative Computing, Content Management & Call Center in E-Commerce and Supply Chain Management	Understand	K2
OEC-CS802A.CO4	Analyze the mechanism & security issues related to E-Payment and E-Marketing.	Analyze	K4
OEC-CS802A.CO5	Apply the knowledge of EDI Models and Security Standards in E-Commerce applications.	Apply	K3
OEC-CS802A.CO6	Elaborate the concept of Enterprise Resource Planning using different ERP Packages	Elaborate	K6

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	1	2	-	-	1	2	-	-	-	-	1	1	1	1
CO2	1	2	2	1	1	1	-	-	-	-	1	-	2	-
CO3	1	1	1	1	1	-	-	-	-	-	1	-	1	-
CO4	1	1	1	1	1	1	-	-	-	-	1	-	2	1
CO5	1	1	1	1	1	1	-	-	-	-	1	-	2	-
CO6	2	2	2	2	3	2	-	-	1	-	2	1	2	2

AVG.	1.16	1.5	1.4	1.2	1.33	1.4	0	0	1	0	1.16	1	1.66	1.33

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, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L]	2
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&Distribution ERPPackage, 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

SEMESTER – VIII

SESSIONAL

Course Title: Project-III	**Code: PROJ-CS881**
Type of Course: Sessional	**Course Designation: Compulsory**
Semester: 8th	**Contact Hours: 12P/week**
Continuous Assessment: 25 Marks	**Final Exam: 70 Marks**
Writer: Course Coordinator	**Approved by HoD (convenor of DAB)**

COURSE OUTCOMES (COs)

On completion of the course students will be able to

Course Outcomes	Details	Action Verb	Knowledge Level
PROJ-CS881.CO1	Understand the underlying technical concepts and theory.	Understand	K2
PROJ-CS881.CO2	Practice hands on experience to build the basic models	Apply	K3
PROJ-CS881.CO3	Develop mathematical generalize of the solution	Create	K6
PROJ-CS881.CO4	Integrate all the parts and deployment of the project	Apply	K3
PROJ-CS881.CO5	Prepare a Dissertation and Presentation in the standard format for being evaluated by the Department.	Create	K6
PROJ-CS881.CO6	Prepare a paper for Conference presentation/Publication in Journals, if possible.	Create	K6

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	2	1	2	2	1	1	-	-	-	-	-	3	1
CO2	2	2	3	3	3	1	-	-	-	-	-	-	3	1
CO3	3	3	3	2	1	-	1	-	-	-	-	-	2	3
CO4	2	2	2	2	2	-	-	-	2	2	2	2	2	3
CO5	2	-	2	-	2	-	-	2	3	3	3	3	2	3
CO6	2	-	2	-	2	-	-	2	3	3	3	3	2	3
AVG.	2	2.25	2.16	2.25	2	1	1	2	2.66	2.66	2.66	2.66	2.33	2.33