Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

COURSE CURRICULUM

❖ VISION OF THE DEPARTMENT

To be recognized for technological advancement of the Department in teaching, learning, research and innovation and serve to address evolving global needs.

❖ MISSION OF THE DEPARTMENT

M1: To give quality education to future leaders for contribution to the professional workforce in engineering and technology.

M2: Promote interdisciplinary research and innovation in emerging areas of technology convergence for building entrepreneurs.

M3: To prepare learners with leadership qualities, team-spirit and ethical responsibilities with a positive contribution to the society.

❖ PROGRAM OUTCOMES

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: Identity, formulates, review research literature, and analyze 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 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, and 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 teamwork: 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 and write effective reports and design documentation, make effective presentations, and give and 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.

❖ **PROGRAM SPECIFIC OUTCOMES (PSO)**

PSO 1: Ability to plan and design information systems to standard specifications using efficient algorithms in the relevant programming language(s).

PSO 2: Ability to use knowledge in diverse domains to recognize research gaps and thus to offer solutions to innovative ideas.

CURRICULUM STRUCTURE

Semester I (First Year)							
Mandatory Induction Program: Duration-3 weeks							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
Theory							
1	Basic Science course	BS-PH101/ BS-CH101	Physics-I (Gr-A)/ Chemistry-I(Gr-B)	3	1	0	4
2	Basic Science course	BS-M101/ BS-M102	Mathematics –IA*/ Mathematics –IB *	3	1	0	4
3	Engineering Science Course	ES-EE101	Basic Electrical Engineering	3	1	0	4
Practical							
1	Basic Science course	BS-PH191/ BS-CH191	Physics-I Laboratory (Gr-A)/ Chemistry-I Laboratory (Gr-B)	0	0	3	1.5
2	Engineering Science Course	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Course	ES-ME191/ ES-ME192	Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A)	1	0	4	3
							Total Credits: 17.5

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* Mathematics –IA (BS-M101) - CSE & IT * Mathematics –IB (BS-M102) - All stream except CSE & IT	
Group A	**Group B**
Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192)	Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191)

Semester II (First Year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
Theory							
1	Basic Science course	BS-PH201/ BS-CH201	Physics-I (Gr-B)/ Chemistry-I (Gr-A)	3	1	0	4
2	Basic Science course	BS-M201/ BS-M202	Mathematics –IIA# / Mathematics –IIB#	3	1	0	4
3	Engineering Science Course	ES-CS201	Programming for Problem Solving	3	0	0	3
4	Humanities and Social Sciences including Management courses	HM-HU201	English	2	0	0	2
Practical							
1	Basic Science course	BS-PH291/ BS-CH291	Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A)	0	0	3	1.5
2	Engineering Science Course	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Course	ES-ME291/ ES-ME292	Engineering Graphics & Design(Gr-A)/ Workshop/Manufacturing Practices(Gr-B)	1	0	4	3
4	Humanities and Social Sciences including Management courses	HM-HU291	Language Laboratory	0	0	2	1
							Total Credits: 20.5

# Mathematics –II (BS-M201) - CSE & IT # Mathematics –II (BS-M202) - All stream except CSE & IT	
Group A	**Group B**
Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291)	Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292)

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Semester III (Second Year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
Theory							
1	Engineering Science Course	ESC-301	Digital Electronics	3	0	0	3
2	Professional Core Courses	PCC-IT301	Data Structure & Algorithms	3	0	0	3
3	Engineering Science Course	ESC 302	Signals & System	3	0	0	3
4	Basic Science course	BSC-301	Mathematics-III	2	0	0	2
5	Basic Science course	BSC-302	Biology	3	0	0	3
Practical							
1	Engineering Science Course	ESC-391	Digital Electronics Lab	0	0	4	2
2	Professional Core Courses	PCC-IT391	Data Structure & Algorithms Lab	0	0	4	2
3	Professional Core Courses	PCC-IT392	IT Workshop (Sci-Lab/ R)	0	0	4	2
							Total Credits: 20

Semester IV (Second Year)							
Sl. No	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
Theory							
1	Professional Core Courses	PCC-IT401	Discrete Mathematics	3	1	0	4
2	Professional Core Course	PCC-IT402	Computer Organization & Architecture	3	0	0	3
3	Professional Core Courses	PCC-IT403	Formal Language & Automata Theory	3	0	0	3
4	Professional Core Courses	PCC-IT404	Communication Engineering	3	0	0	3
5	Humanities & Social Sciences including Management courses	HSMC-401	Economics For Engineers	3	0	0	3
6	Mandatory Courses	MC-401	Environmental Sciences	1	-	-	0
Practical							
1	Professional Core Course	PCC-IT492	Computer Organization & Architecture Lab	0	0	4	2
2	Professional Core Courses	PCC-IT494	Communication Engineering Lab	0	0	4	2
							Total Credits: 20

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Semester V (Third Year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
Theory							
1	Professional Core Courses	PCC-IT501	Design Analysis & Algorithm	3	0	0	3
2	Professional Core Courses	PCC-IT502	DBMS	3	0	0	3
3	Professional Core Courses	PCC-IT503	Operating Systems	3	0	0	3
4	Professional Core Courses	PCC-IT504	Object Oriented Programming with Python	2	0	0	2
5	Humanities & Social Sciences including Management Courses	HSMC-501	Introduction to Industrial Management (Humanities III)	3	0	0	3
6	Professional Elective Courses	PEC-IT501	(Elective-I) Human Computer Interaction/ AdvancedComputer Architecture/ Computer Graphics	3	0	0	3
7	Mandatory Courses	MC-IT501	Constitution of India/ Essence of Indian Knowledge Tradition	2	0	0	0
Practical							
1	Professional Core Courses	PCC-IT591	Design Analysis & Algorithm Lab	0	0	4	2
2	Professional Core Courses	PCC-IT592	DBMS Lab	0	0	4	2
3	Professional Core Courses	PCC-IT593	Operating Systems Lab	0	0	4	2
4	Professional Core Courses	PCC-IT594	Object Oriented Programming with Python Lab	0	0	4	2
							Total Credits: 25

Semester VI (Third Year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
Theory							
1	Professional Core Courses	PCC-IT601	Software Engineering	3	0	0	3
2	Professional Core Courses	PCC-IT602	Computer Networks	3	0	0	3
3	Professional Elective Courses	PEC-IT601	(Elective-II) Compiler Design/ DistributedSystems/ Image Processing	3	0	0	3

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4	Professional Elective Courses	PEC-IT602	(Elective-III) Artificial Intelligence/ Internet of Things/ Machine Learning	3	0	0	3
5	Open Elective Courses	OEC-IT601	(Open Elective-I) Big Data Analytics/ Cyber Law & Ethics/ Mobile Computing/ Bioinformatics/ Robotics	3	0	0	3
Practical							
1	Professional Core Courses	PCC-IT691	Software Engineering Lab	0	0	4	2
2	Professional Core Courses	PCC-IT692	Computer Networks Lab	0	0	4	2
3	Professional Elective Courses	PEC-IT691	(Elective-II) Compiler Design/ DistributedSystems/ Image Processing	0	0	4	2
4	Project	PROJ-IT691	Project-I	0	0	6	3
							Total Credits: 24

Semester VII (Fourth Year)							
Sl. No.	Type of Course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
Theory							
1	Professional Core Courses	PCC-IT701	Internet & Web Technology	3	0	0	3
2	Professional Elective Courses	PEC-IT701	(Elective-IV) Multimedia Technology/ Neural Networks and Deep Learning/ Soft Computing/ Adhoc –Sensor Network/ InformationTheory and Coding/ Cyber Security/ Cloud Computing	3	0	0	3
3	Open Elective Courses	OEC-IT701	(Open Elective-II) Operations Research/ Introduction to Philosophical Thoughts/ Soft Skill & Interpersonal Communication/ Numerical Methods/ Project Management	3	0	0	3
4	Humanities & Social Sciences including Management courses	HSMC-701	Management 1 (OrganizationalBehavior)	3	0	0	3

Practical							
1	Professional Core Courses	PCC-IT791	Internet & Web Technology Lab	0	0	4	2
2	Project	PROJ-IT791	Project-II	0	0	12	6
3	Project	PROJ-IT792	Industrial Training	Duration: 12-Weeks			3
							Total Credits: 22

Semester VIII (Fourth Year)							
Sl. No.	Type of course	Code	Course Title	Hours per week			Credits
				Lecture	Tutorial	Practical	
Theory							
1	Professional Core Courses	PCC-IT801	Information Security	3	0	0	3
2	Open Elective Courses	OEC-IT801	(Open Elective-III) Digital Signal Processing/ Natural Language Processing	3	0	0	3
3	Open Elective Courses	OEC-IT802	(Open Elective-IV) E-Commerce and ERP/ Economic Policies in India/ Remote Sensing & GIS	3	0	0	3
Practical							
1	Project	PROJ-IT891	Project-III	0	0	12	6
2	Project	PROJ-IT892	Grand Viva	-	-	-	2
							Total Credits: 17

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SEMESTER-I (First Year)

Physics-I
Code: BS-PH101
Contact: 3L+1T

Name of the Course:	**Physics-I**
Course Code: **BS-PH101**	Semester: I/II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: 1 hrs./week	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	4

Objective:	
1	Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.
Pre-Requisite:	
1	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Mechanics** 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** 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** Maxwell's equations. Polarization, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics. Magnetisation , permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications	8	
4.	**Quantum Mechanics** 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** Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.	8	

Text book and Reference books:

1. Introduction to Electrodynamics, David J. Griffiths, Pearson Education India Learning Private Limited
2. Principles of Physics, 10ed, David Halliday, Robert Resnick Jearl Walker , Wiley
3. Electricity, Magnetism, and Light, Wayne M. Saslow, Academic Press
4. Engineering Mechanics (In SI Units) (SIE), S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati , McGraw Hill Education
5. Classical mechanics, Narayan Rana, Pramod Joag, McGraw Hill Education
6. Introduction to Classical Mechanics, R Takwale, P Puranik, McGraw Hill Education
7. Engineering Mechanics, M.K. Harbola , Cengage India
8. An Introduction to Mechanics (SIE), David Kleppner, Robert Kolenkow, McGraw Hill Education
9. Principles of mechanics, John L. Synge and Byron A. Griffith, New York, McGraw-Hill
10. Mechanics (Dover Books on Physics) , J. P. Den Hartog , Dover Publications Inc.
11. Engineering Mechanics: Dynamics, L.G. Kraige J.L. Meriam, Wiley
12. Quantum Physics of Atoms, Molecules, Solids, Nuclei and Particles, Robert Eisberg, Robert Resnick, Wiley
13. Introduction to Quantum Mechanics, J. Griffiths David , Pearson Education
14. Modern Quantum Mechanics, J. J. Sakurai, Cambridge University Press
15. Optics , Hecht, Pearson Education
16. Optics, Ghatak, McGraw Hill Education India Private Limited

17. Fundamentals of Statistical and Thermal Physics, Reif, Sarat Book Distributors
18. Statistical Mechanics , Pathria , Elsevier
19. Statistical Physics, L.D.Landau , E.M. Lifshitz, Butterworth-Heinemann

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Basic concepts of mechanics
2	Bragg's Law and introduction to the principles of lasers, types of lasers and applications
3	Various terms related to properties of materials such as, permeability, polarization, etc.
4	Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties
5	Simple quantum and Statistical mechanics Calculation.

Chemistry-I
Code: BS-CH201
Contact: 3L+1T

Name of the Course:	**Chemistry-I**
Course Code: **BS-CH201**	Semester: I/II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: 1 hrs./week	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	4
Objective:	
1	
Pre-Requisite:	
1	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Atomic and molecular structure** Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the	10	

	role of doping on band structures		
2	**Spectroscopic techniques and applications** 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** 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** 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** 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** 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 compounds	4	
7	**Organic reactions and synthesis of a drug molecule** Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule	4	

Text book and Reference books:

1. Engineering Chemistry, Satyaprakash, Khanna Book Publishing, Delhi

2. University chemistry, by B. H. Mahan
3. Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
4. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
5. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
6. Physical Chemistry, by P. W. Atkins
7. Spectroscopy of Organic Compounds, by P.S.Kalsi, New Age International Pvt Ltd Publishers
8. Physical Chemistry, P. C. Rakshit, Sarat Book House
9. Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Analyze microscopic chemistry in terms of molecular orbital's and intermolecular forces
2	Rationalize bulk properties and processes using thermodynamic considerations
3	Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
4	Rationalize periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
5	List of the chemical reactions that are used in the synthesis of molecules.

Mathematics-IA
Code: BS-M101
Contact: 3L+1T

Name of the Course:	**Mathematics-IA**
Course Code: **BS-M101**	Semester: I
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: 1 hrs./week	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	4
Objective:	
1	
Pre-Requisite:	
1	High School Mathematics

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

Text book and Reference books:

1. Reena Garg, Engineering Mathematics-I, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
3. Michael Greenberg, Advanced Engineering Mathematics, Pearson.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
5. Kanti B. Dutta, Mathematical Methods of Science and Engineering, Cenage Learning.
6. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi.
7. S.K. Mapa, Higher Algebra: Abstract and Linear, Sarat Book House Pvt.Ltd.
8. Hoffman and Kunze: Linear algebra, PHI.

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Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals
2	Understand the domain of applications of mean value theorems to engineering problems.
3	Learn different types of matrices, concept of rank, methods of matrix inversion and their applications
4	Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science
5	Learn and apply the concept of eigenvalues, eigen vectors, diagonalization of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems.

Basic Electrical Engineering
Code: ES-EE101
Contact: 3L+1T

Name of the Course:	**Basic Electrical Engineering**
Course Code: **ES-EE101**	Semester: I
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: 1 hrs./week	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	4
Objective:	
1	
Pre-Requisite:	
1	

Unit	Content	Hrs/Unit	Marks/Unit
1	**DC Circuits** 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** 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** 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** 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** DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.	6	
6	**Electrical Installations** 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	

Text book and Reference books:

1. Ritu Sahdev, Basic Electrical Engineering, Khanna Book Publishing Co. (P) Ltd., Delhi.
2. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
3. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
4. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
5. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.

6. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Solve problems of different types of DC Circuits using different laws and theorems of DC circuits, Single and three phase AC circuits.
2	Calculate performance parameters like current, voltage, efficiency etc of Transformers using equivalent circuits and other concepts.
3	Explain the construction and working principles of Transformers, DC and AC Motors and Generators and solve numerical and conceptual problems regarding performance DC and AC Motors and Generators.
4	Explain working principles of different types of Power Electronic Converters.
5	Classify different types of wires and cable, and Batteries.
6	Explain working principles of different types of LT Switch Gears and Circuit Breakers, principles of Earthing, Battery Characteristics, Elementary calculations for energy consumptions and Power factor Improvement principles of Earthing, Battery Characteristics, Elementary calculations for energy consumptions and Power factor Improvement.

Physics-I Laboratory
Code: BS-PH191/ BS-PH291
Contact: 3P

Name of the Course:	**Physics-I Laboratory**
Course Code: **BS-PH191/ BS-PH291**	Semester: I/II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: NIL	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: 3 hrs./week	End Semester Exam :70 Marks
Credit Points:	1.5
Objective:	
1	
Pre-Requisite:	
1	

Unit	Experiments
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

Text book and Reference books:

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Apply the various techniques and procedures for the Engineering Physics experiments
2	Use the different meters and measuring devices to record the data with precision
3	Apply the equations/mathematical concepts to obtain quantitative results
4	Develop basic communication skills through working in groups in performing the laboratory experiments.
5	Acquire skill for interpreting the results obtained from Laboratory experiments.

Chemistry-I Laboratory
Code: BS-CH191/ BS-CH291
Contact: 3P

Name of the Course:	**Chemistry-I Laboratory**
Course Code: **BS-CH191/ BS-CH291**	Semester: I/II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: NIL	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: 3 hrs./week	End Semester Exam :70 Marks
Credit Points:	1.5
Objective:	
1	
Pre-Requisite:	
1	

Unit	Experiments
1	**Choose 10 experiments from the following**
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.

Text book and Reference books:

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Analyze the requirement of equipment to be used for a particular experiment.
2	Perform the titration experiments of acid & base using indicator using pH meter & conductivity meter.
3	Determination of hardness, dissolved oxygen & chloride ion in water.
4	Able to analyze a chemical salt, oil and check impurity.
5	Able to handle instruments.

Basic Electrical Engineering Laboratory
Code: ES-EE191
Contact: 2P

Name of the Course:	**Basic Electrical Engineering Laboratory**
Course Code: **ES-EE191**	Semester: I/II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: NIL	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: 2 hrs./week	End Semester Exam :70 Marks
Credit Points:	1
Objective:	
1	

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Pre-Requisite:	
1	

Unit	Experiments
1	**Choose 10 experiments from the following**

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.

Text book and Reference books:

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Use Electrical Elements and Measuring Instruments.
2	Measure Time Response of RLC Circuits and Resonance.
3	Analyze performance of Single Phase and three phase Transformer.
4	Evaluation of operation of (a) DC-DC converter (b) DC-AC converter (c) DC-AC converter for speed control of an Induction motor
5	Determination of Torque –Speed characteristics of separately excited DC motor and induction motor

Engineering Graphics & Design
Code: ES-ME191/ ES-ME 291
Contact: 1L+4P

Name of the Course:	**Engineering Graphics & Design**
Course Code: **ES-ME191/ ES-ME 291**	Semester: I/II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 1 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: 4 hrs./week	End Semester Exam :70 Marks
Credit Points:	3
Objective:	
1	
Pre-Requisite:	
1	

Unit	Content	Hrs/Unit	Marks/Unit
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.	1T+4P	
2	**LETTERING, DIMENSIONING, SCALES** Plain scale, Diagonal scale and Vernier Scales.	1T+4P	
3	**GEOMETRICAL CONSTRUCTION AND CURVES** Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid,	1T+4P	

	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.	1T+4P	
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).	1T+4P	
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.	1T+4P	
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;	1T+4P	
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)	1T+4P	
9	**OVERVIEW OF COMPUTER GRAPHICS**, C**USTOMISATION& 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	1T+4P	

	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; 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;	2T+8P	
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).	2T+8P	

General Instructions

1. In every topic some problems are to be done in the class and some are to be given to students as home assignments.
2. The problems for class work are to be prepared on a drawing sheet of A1 size in the class/ using AutoCAD software.
3. The problems for home assignments are to be prepared on drawing copy/ using AutoCAD software.
4. Print out of every assignment is to be taken for CAD Drawings on Drawing sheets (A4 Sheets).
5. A title block must be prepared in each sheet/ assignment.

Following is the list of drawing instruments that are required for making engineering drawings on paper with perfection.

1. Drawing Board
2. Mini drafter/ Set-squares (45°–45° & 60°–90°), T-square
3. Protractor (180°, 360°)
4. Scales (Plain, Diagonal)
5. Compass (Small and Large)
6. Divider (Small and Large)
7. French Curves
8. Drawing paper (A1 Size)
9. Drawing pencil (H, HB, B)
10. Sharpener
11. Eraser
12. Drawing pins & clips
13. Duster or handkerchief etc.

Text book and Reference books:

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

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Familiarize with the fundamentals and standards of Engineering graphics
2	Perform freehand sketching of basic geometrical constructions and multiple views of objects.
3	Project orthographic projections of lines and plane surfaces.
4	Draw projections and solids and development of surfaces.
5	Visualize and to project isometric and perspective sections of simple solids.
6	Ability to draw 2D & 3D Object in Auto CAD.

Workshop/ Manufacturing Practices
Code: ES-ME192/ ES-ME 292
Contact: 1L+4P

Name of the Course:	**Workshop/ Manufacturing Practices**
Course Code: **ES-ME192/ ES-ME 292**	Semester: I/II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 1 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: 4 hrs./week	End Semester Exam :70 Marks
Credit Points:	3
Objective:	
1	
Pre-Requisite:	
1	

Unit	Content	Hrs/Unit	Marks/Unit
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 molding, glass cutting 7. Metal casting 8. Welding (arc welding & gas welding), brazing		
Workshop Practice:			
3	**Machine shop** 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.	8	
4	**Fitting shop** Typical jobs that may be made in this practice module: To make a Gauge from MS plate.	8	
5	**Carpentry** Typical jobs that may be made in this practice module: To make wooden joints and/or a pattern or like.	8	
6	**Welding shop** 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.	8	
7	**Casting** Typical jobs that may be made in this practice module: One/ two green sand molds to prepare, and a casting be demonstrated.	8	
8	**Smithy** Typical jobs that may be made in this practice module: A simple job of making a square rod from a round bar or like.	4	
9	**Plastic moulding & Glass cutting** 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.	4	
10	**Electrical & Electronics** 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.	8	

	Simple wiring exercise to be executed to understand the basic electrical circuit. Simple soldering exercises to be executed to understand the basic process of soldering. 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.		

General Instructions

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Text book and Reference books:

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

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Build thorough knowledge of various to ols, machines, devices used in engineering practice
2	Acquire thorough knowledge of carrying out various operations in mechanical engineering workshop
3	Utilize measuring skills gained in workshop practice
4	Acquire "Hands on" training and practice to students for use of various tools, devices and machines
5	Acquire skills in basic engineering practice for creating objects from raw materials

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SEMESTER-II (First Year)

Mathematics – II A
Code: BS-M201
Contact: 3L+1T

Name of the Course:	**Mathematics – II A**
Course Code: **BS-M201**	Semester: II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: 1 hrs./week	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	4
Objective:	
1	
Pre-Requisite:	
1	High School Mathematics and BS-M101

Unit	Content	Hrs/Unit	Marks/Unit
1	**Basic Probability:** Probability spaces, conditional probability, independence; Discrete random variables, Independent random variables, the Multinomial distribution, Poisson approximation to the Binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality.	11	
2	**Continuous Probability Distributions:** Continuous random variables and their properties, Distribution functions and densities, Normal, Exponential and Gamma densities.	4	
3	**Bivariate Distributions:** Bivariate distributions and their properties, distribution of sums and quotients, Conditional densities, Bayes' rule.	5	
4.	**Basic Statistics:** Measures of Central tendency, Moments, Skewness and Kurtosis, Probability distributions: Binomial, Poisson and Normal and evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.	8	

5	**Applied Statistics:** Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves. Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.	8	
6	**Small samples:** Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.	4	

Text book and Reference books:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Familiar with the concept and techniques of probability and statistical theory.
2	Understand the domain of applications of probability and statistical theory to engineering problems.
3	Learn different types of data analytic and data analysis methods through statistical theory.
4	Apply statistical tools for analyzing data samples and drawing inference on a given data set.
5	Learn and apply several decision making method from large sample of data or such problem

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Programming for Problem Solving
Code: ES-CS201
Contact: 3L

Name of the Course:	**Programming for Problem Solving**
Course Code: **ES-CS201**	Semester: II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam :70 Marks
Credit Points:	3

Objective:	
1	To write efficient algorithms to solve various problems
2	To understand and use various constructs of the programming language
3	To apply such as conditionals, iteration, and recursion in programming
Pre-Requisite:	
1	Basic Knowledge of Computer System

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Computers** Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development, Flow charts. Number Systems: Binary, Octal, Decimal, Hexadecimal Introduction to C Language - Background, C Programs, Identifiers, Data Types, Variables, Constants, Input / Output Statements Arithmetic Operators and Expressions: Evaluating Expressions, Precedence and Associativity of Operators, Type Conversions.	6	10
2	**Conditional Control Statements** Bitwise Operators, Relational and Logical Operators, If, If- Else, Switch-Statement and Examples. Loop Control Statements: For, While, DoWhile and Examples. Continue, Break and Goto statements Functions: Function Basics, User-defined Functions, Inter Function Communication, Standard Functions, Methods of Parameter Passing. Recursion- Recursive Functions.. Storage Classes: Auto, Register, Static, Extern, Scope Rules, and Type Qualifiers.	8	10
3	**Pre-processors and Arrays** Pre-processor Commands Arrays - Concepts, Using Arrays in C, Inter-Function Communication, Array Applications, Two- Dimensional Arrays,	8	16

	Multidimensional Arrays, Linear and Binary Search, Selection and Bubble Sort.		
4.	**Pointers** Pointers for Inter-Function Communication, Pointers to Pointers, Compatibility, Lvalue and Rvalue, Arrays and Pointers, Pointer Arithmetic and Arrays, Passing an Array to a Function, Memory Allocation Functions, Array of Pointers, Programming Applications, Pointers to void, Pointers to Functions, Command Line Arguments. Strings - Concepts, C Strings, String Input/ Output Functions, Arrays of Strings, String Manipulation Functions.	8	16
5	**Structures and File** Definition and Initialization of Structures, Accessing Structures, Nested Structures, Arrays of Structures, Structures and Functions, Pointers to Structures, Self-Referential Structures, Unions, Type Definition (typedef), Enumerated Types. Input and Output: Introduction to Files, Modes of Files, Streams, Standard Library Input/ Output Functions, Character Input/ Output Functions.	6	18

Text book and Reference books:

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

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Identify the need and use of programming in real world environment
2	Illustrate the C data types, syntax and constructs.
3	Compare decision making, branching and looping statements.
4	Explain the concept of Array, Pointer and Strings to solve different problems.
5	Develop the concepts of Function modules, their usage and memory allocation.
6	Classify the concepts of structures and unions: declaration, initialization and implementation.

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Programming for Problem Solving Lab
Code: ES-CS291
Contact: 4P

Name of the Course:	**Programming for Problem Solving Lab**
Course Code: **ES-CS291**	Semester: II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: -	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: 3 hrs./week	End Semester Exam :70 Marks
Credit Points:	2

Objective:	
1	The ability to learn concepts and apply them to other problems.
2	Basic mathematical skills.
3	A passion for problem solving.
4	Confidence around a computer programming Language.

Pre-Requisite:	
1	The laboratory should be preceded or followed by a tutorial

Unit	Eperiments
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

Text book and Reference books:

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, Khanna Publishers.
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
3. S. Ross, A First Course in Probability, Pearson Education India
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, Wiley.
5. John E. Freund, Ronald E. Walpole, Mathematical Statistics, Prentice Hall.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
7. N.G. Das, Statistical Methods (Combined Volume), Tata-McGraw Hill.

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Implement procedural language concepts.
2	Implement C data types, syntax and constructs
3	Implement decision making, branching and looping statements
4	Implement Function modules, their usage and memory allocation
5	Implement the concept of Array, Pointer and Strings to solve different problems.
6	Apply concepts of structures and unions: declaration, initialization and implementation.

English
Code: HU-MU201
Contact: 2L

Name of the Course:	**English**
Course Code: **HU-MU201**	Semester: II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks

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Practical: -	End Semester Exam :70 Marks
Credit Points:	2
Objective:	
1	
Pre-Requisite:	
1	

Unit	Eperiments
1	**Vocabulary Building** The concept of Word Formation: Compounding, Backformation, Clipping, Blending. Root words from foreign languages and their use in English Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives. Synonyms, antonyms, and standard abbreviations: Acronyms
2	**Basic Writing Skills** Sentence Structures & Types: Simple, Compound, Complex Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration Importance of proper punctuation Creating coherence: Arranging paragraphs & Sentences in logical order Creating Cohesion: Organizing principles of paragraphs in documents Techniques for writing precisely
3	**Identifying Common Errors in Writing** Subject-verb agreement Noun-pronoun agreement Misplaced modifiers Articles Prepositions Redundancies Clichés
4.	**Nature and Style of sensible Writing** Describing Defining Classifying Providing examples or evidence Writing introduction and conclusion
5	**Writing Practices** Comprehension Précis Writing Essay Writing Business Letter, Cover Letter & CV; E-mail
6	**Addendum** Some examples of English words with foreign roots

Greek Root/Affix	Examples
Anti	Antisocial, antiseptic

Auto	Automatic, autograph
Anthropos	Anthropology, philanthropy
Bio	Biography
Chronos	Time
Di	Dilemma
Bio	Biology
Biblio	Bibliography
Chron	Chronology
Cracy	Contradiction
Geo	Geology
Hyper	Hyperactive
Mania	Kleptomania
Mega	Megaserial
Eu	Eulogy, euphoria
Geo	Geology
Graph	autograph, photograph
Hetero	Heterogeneous
Hyper	Hyperactive
Hypo	hypodermic, hypoglycemia
Macro	Macrocosm
Mega	megalomania
Micro	microcosm
Mono	Monarch
Pan	Panorama
Latin Root	**Examples**
Aud	Audible
Bene	Beneficial
Brev	abbreviate, brief
circum	Circulate
Contra	Contradict
Cred	Credible
Inter	Internet, interval
Magna	Magnificient
Nova	Novel
Multi	Multiple, multiplex
Non	Nonstop
Pre	Previous, predicate
Re	Redo, rewind
Scrib	Scripture
Spect	Spectator
Trans	Transport
Uni	Unity
Omni	Omnipotent
Semi	Semicircle
Sub	Subway
somnus	Insomnia,
Super	Superman

Sym	Sympathy
scribe	Describe, scribble(write illegibly), inscribe
Trans	Transform
Un	Unnecessary
Uni	Universal

Text book and Reference books:

1. Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
7. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
8. Universal English Prof. Prasad Kataria Publications, 2019.
9. "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
10. Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	At the end of the course, students should be able to recall the basic tenets of English grammar, using them in formation of sentences for speaking and writing skills.
2	The students should be able to compare the skill sets to be used for given situations.
3	The students should be able to utilize the concepts which they have garnered in the assessments as well as in practical situations.
4	The students should be able to test the skills which they have learnt such as the concepts of note-taking via lesson on Minutes of Meeting to real-life situations.
5	The students should be able to prioritize certain facets of their knowledge in accordance to individual application.
6	The students can modify their narratives/discourse in accordance to their requirement and individuality.

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Syllabus for 4-Years B.Tech. in Information Technology

Language Laboratory
Code: HU-MU291
Contact: 2P

Name of the Course:	**Language Laboratory**
Course Code: **HU-MU291**	Semester: II
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: -	Mid Semester exam: 15
Tutorial: -	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: 2 hrs/week	End Semester Exam :70 Marks
Credit Points:	1
Objective:	
1	
Pre-Requisite:	
1	

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

Text book and Reference books:

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Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Recall the basic tenets of English conversation.
2	Relate the skill sets to be used for given situations.
3	Make use of the skill of listening in acquiring new knowledge.
4	Examine the skills which they have learnt in real-life situations.
5	Defend their statements properly using concise logic.

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SEMESTER-III (Second Year)

Digital Electronics
Code: ESC-301
Contact: 3L

Name of the Course:	**Digital Electronics**
Course Code: ESC-301	Semester: III
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam :70 Marks
Credit Points:	3

Objective:	
1	To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
2	To prepare students to perform the analysis and design of various digital electronic circuits
Pre-Requisite:	
1	Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs.
2	Basic concept of the working of P-N diodes, Schottky diodes,
3	Basic FETs and OPAMP as a basic circuit component. Concept of Feedback

Unit	Content	Hrs/Unit	Marks/Unit
1	Number Systems & Codes Decimal Number, Binary Number, Octal Number, Hexadecimal Number, Conversion — Decimal to Binary, Binary to Decimal, Octal to Binary, Binary to Octal, Hexadecimal to Binary, Binary to Hexadecimal, Octal to Binary to Hexadecimal, Hexadecimal to Binary to Octal; Floating Point Number Representation, Conversion of Floating Point Numbers, Binary Arithmetic, 1's and 2's Complement, 9's and 10's Complement, Complement Arithmetic, BCD, BCD addition, BCD subtraction, Weighted Binary codes, Non-weighted codes, Parity checker and generator, Alphanumeric codes.	5	
2	Logic Gates OR, AND, NOT, NAND, NOR, Exclusive — OR, Exclusive — NOR, Mixed logic.	2	
3	Boolean Algebra Boolean Logic Operations, Basic Law of Boolean Algebra, Demorgan's Theorem, Principle of Duality.	4	

4.	Minimization Techniques Sum of Products, Product of Sums, Karnaugh Map [up to 4 variables].	3	
5	Multilevel Gate Network Implementation of Multilevel Gate Network, Conversion to NAND-NAND and NOR-NOR Gate Networks.	2	
6	**Arithmetic Circuits** Half Adder, Full Adder, Half Subtractor, Full Subtractor, Carry Look Ahead Adder, 4-Bit Parallel Adder	5	
7	**Combinational Circuits** Basic 2-input and 4-input multiplexer, Demultiplexer, Basic binary decoder, BCD to binary converters, Binary to Gray code converters, Gray code to binary converters, Encoder.	5	
8	Sequential Circuits Introduction to sequential circuit, Latch, SR Flip Flop, D Flip Flop, T Flip Flop, JK Flip Flop, Master Slave Flip Flop	5	
9	Basics of Counters Asynchronous [Ripple or serial] counter, Synchronous [parallel] counter	2	
10	Basics of Registers SISO, SIPO, PISO, PIPO, Universal Registers	3	

Text book and Reference books:

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

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Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Compare between analog and digital systems.
2	Solve different types of codes and number systems which are used in digital communication and computer systems.
3	Analyze Boolean laws and K-map to simplify the digital circuits.
4	Apply the various digital Combinational circuits and their operation.
5	Apply the various digital Sequential Circuits and their operation.

Digital Electronics Lab
Code: ESC-391
Contacts: 4P

Name of the Course:	**Digital Electronics Lab**
Course Code: ESC-391	Semester: III
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Pre-Requisite:	
Pre-requisites as in ESC-301	
Laboratory Experiments:	
Analog Electronics	
1	Design a Class A amplifier
2	Design a Phase-Shift Oscillator
3	Design of a Schmitt Trigger using 555 timer
Digital Electronics	
1	Realization of basic gates using Universal logic gates.
2	Analysis of Functions of BCD-TO-7-segment Decoder / Driver and Operation of 7-segment LED Display
3	Characterization of Digital Logic Families
4	Analysis and Synthesis of Boolean Expressions using Basic Logic Gates
5	Analysis and Synthesis of Logic Functions using Multiplexers
6	Analysis and Synthesis of Logic Functions using Decoders
7	Analysis and Synthesis of Boolean Relations using Digital Comparators
8	Analysis and Synthesis of Arithmetic Expressions using Adders / Subtractors
9	Analysis and Synthesis of Sequential Circuits using Basic Flip-Flops

10	Design of Shift Register using Flip Flops
11	Analysis and Synthesis of Multi-bit Sequential Circuits using Shift Registers

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Implement the designing of BCD to seven segment displays.
2	Analyze the working functionality of Half adders and full Adders.
3	Analyze the working functionality of subtractor.
4	Examine the procedures for the analysis and design of Multiplexers and de-multiplexers.
5	Analyze the working functionality of decoder.
6	Designing of various types of sequential circuits like flip flops, registers.

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

Name of the Course:	**Data Structure & Algorithm**
Course Code: PCC-CS301	Semester: III
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance : 5 marks
Practical: -	End Semester Exam :70 Marks
Credit Points:	3

Objective:	
1	To learn the basics of abstract data types.
2	To learn the principles of linear and nonlinear data structures.
3	To build an application using sorting and searching
Pre-Requisite:	
1	CS 201 (Basic Computation and Principles of C
2	M101 & M201 (Mathematics), basics of set theory

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Basic Terminologies: Elementary Data	8	

	Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.		
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 type 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: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.	9	

Text book and Reference books:

1. “Data Structures and Program Design In C”, 2/E by Robert L. Kruse, Bruce P. Leung.
2. “Fundamentals of Data Structures of C” by Ellis Horowitz, SartajSahni, Susan Anderson-freed.
3. “Data Structures in C” by Aaron M. Tenenbaum.
4. “Data Structures” by S. Lipschutz.
5. “Data Structures Using C” by ReemaThareja.
6. “Data Structure Using C”, 2/e by A.K. Rath, A. K. Jagadev.
7. “Introduction to Algorithms” by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein

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Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Summarize the concept of data structure, data type and array data structure.
2	Implement linked list data structure to solve various problems.
3	Apply various data structures such as stacks, queues, trees and graphs to solve various computing problems using C-programming language.
4	Compare the standard algorithms for searching and sorting.
5	Evaluate the performance of an algorithm in terms of complexity using asymptotic notation.
6	Choose effectively the data structure that efficiently model the information in a problem.

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

Name of the Course:	**Data Structure & Algorithm Lab**
Course Code: PCC-CS391	Semester: III
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Pre-Requisite:	
Pre-requisites as in PCC-CS301	
Laboratory Experiments:	
Linear Data Structure	
1	Implementation of array operations
2	Stacks and Queues: adding, deleting elements Circular Queue: Adding & deleting elements
3	Merging Problem: Evaluation of expressions operations on Multiple stacks & queues:
4	Implementation of linked lists: inserting, deleting, inverting a linked list. Implementation of stacks & queuesusing linked lists
5	Polynomial addition, Polynomial multiplication
Non Linear Data Structure	
6	Recursive and Non-recursive traversal of Trees
7	Threaded binary tree traversal. AVL tree implementation

8	Application of Trees. Application of sorting and searching algorithms
9	Hash tables implementation: searching, inserting and deleting, searching & sorting techniques.

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcome(s)
On completion of the course students will be able to

CO	STATEMENT
1	Represent data for efficient processing using the fundamental concept of Data Structure.
2	Develop applications using the search algorithms and sorting algorithms based on their time complexities.
3	Develop applications using the concepts of linear data structure like stack, queue and Linked List for different requirements.
4	Implement non-linear data structure like trees and graphs.
5	Design the application using the data structure that efficiently model the information in a problem

Signals & Systems
Code: ESC302
Contacts: 3L

Name of the Course:	**Signals & Systems**
Course Code: ESC-302	Semester: III
Duration: 6 months	Maximum Marks: 100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Signals and Systems :** Signals and systems as seen in everyday life, and in various branches of engineering and science. Signal properties: periodicity, absolute integrability, determinism and stochastic character. Some special signals of importance: the unit step, the unit impulse, the sinusoid, the complex exponential, some special time-limited signals; continuous and discrete time signals,	3	

	continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.		
2	**Behavior of continuous and discrete-time LTI systems** Impulse response and step response, convolution, input-output behavior with periodic convergent inputs, cascade interconnections. Characterization of causality and stability of LTI systems. System representation through differential equations and difference equations. State-space Representation of systems. State-Space Analysis, Multi-input, multi-output representation. State Transition Matrix and its Role. Periodic inputs to an LTI system, the notion of a frequency response and its relation to the impulse response.	8	
3	**Fourier, Laplace and z- Transforms** Fourier series representation of periodic signals, Waveform Symmetries, Calculation of Fourier Coefficients. Fourier Transform, convolution/multiplication and their effect in the frequency domain, magnitude and phase response, Fourier domain duality. The Discrete- Time Fourier Transform (DTFT) and the Discrete Fourier Transform (DFT). Parseval's Theorem. Review of the Laplace Transform for continuous time signals and systems, system functions, poles and zeros of system functions and signals, Laplace domain analysis, solution to differential equations and system behavior. The z-Transform for discrete time signals and systems, system functions, poles and zeros of systems and sequences, z-domain analysis.	10	
4.	The Sampling Theorem and its implications. Spectra of sampled signals. Reconstruction: ideal interpolator, zero-order hold, first-order hold. Aliasing and its effects. Relation between continuous and discrete time systems. Introduction to the applications of signal and system theory: modulation for communication, filtering, feedback control systems.	9	

Text book and Reference books:

1. A. V. Oppenheim, A. S. Willsky and S. H. Nawab, " Signalsand systems", Prentice Hall India,1997.
2. J. G. Proakis and D. G. Manolakis, " Digital Signal Processing: Principles, Algorithms, and Applications" , Pearson,2006.
3. H. P. Hsu, " Signals and systems", Schaum'sseries, McGraw Hill Education,2010.
4. S. Haykinand B. V. Veen, " Signals and Systems", John Wiley and Sons,2007.

5. A. V. Oppenheim and R. W. Schafer, " Discrete-Time Signal Processing", Prentice Hall,2009.
6. M. J. Robert " Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
7. B. P. Lathi, " LinearSystems and Signals", Oxford University Press,2009.
8. A. V. Oppenheim and R. W. Schafer, " Discrete-Time Signal Processing", Prentice Hall,2009.
9. M. J. Robert " Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
10. B. P. Lathi, " LinearSystems and Signals", Oxford University Press,2009.

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Classify the signals as Continuous time and Discrete time.
2	Analyze the spectral characteristics of signals using Fourier analysis.
3	Classify systems based on their properties and determine the response of LTI system using convolution.
4	Identify system properties based on impulse response and Fourier analysis.
5	Apply transform techniques to analyze continuous-time and discrete-time signals and systems.

IT Workshop (Sci Lab/MATLAB/Python/R)
Code: PCC-IT392
Contacts: 4P

Name of the Course:	**IT Workshop**
Course Code: PCC-CS392	Semester:III
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: NIL	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Course Objectives:	
1	To master an understanding of scripting & the contributions of scripting languages
2	Design real life problems and think creatively about solutions
3	Apply a solution in a program using R/Matlab/Python.
4	To be exposed to advanced applications of mathematics, engineering and natural sciences to program real life problems.
Pre-Requisite:	
1.	Knowledge of Programming Logic

2.	Experience with a high level language (C/C++,) is suggested.
3.	Prior knowledge of a scripting language and Object-Oriented concepts is helpful but not mandatory.
Programming in R	
1	Introduction to mechanism for statistics, data analysis, and machine learning; Introduction of R Programming, How to install and run R, Use of R help files, R Sessions, R Objects – Vectors, Attributes, Matrices, Array, Class, List, Data Frames etc. Operators in R.
2	R Programming Structures, Control Statements, Loops, Repeat and Break, R-Function, R-Vector Function, Recursive Function in R.
3	R Packages (Install and Use), Input/Output Features in R, Reading or Writing in File. Data Manipulation in R.Rearranging data, Random Number and Simulation, Statistical methods like min, max, median, mean, length, Linear Regression, Normal Distribution, Decision tree
4	Graphics, Creating Graphs, The Workhorse of R Base Graphics, Graphical Functions –Customizing Graphs, Saving Graphs to Files, Pie chart, Bar Chart, Histogram.
Programming in Matlab	
1	**Introduction:** Why MATLAB?, History, Its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB
2	**Basics:** Familiar with MATLAB windows, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables
3	**Programming-I:** Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept
4	**Programming-II:** Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file
5	**Conditional statements and Loop:** Relational and Logical Operators, If-else statements, Switch-case statements, For loop, While loop, Special commands (Break and continue), Import data from large database, Export data to own file or database
6	**2D Plotting:** In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface
7	**3D Plotting:** Use of mesh grid function, Mesh plot, Surface plot, Plots with special graphics
Programming with Python	
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
Laboratory Experiments:	
1	Practical Assignments related with implementation of PCC-CS393

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcome(s)
On completion of the course students will be able to

CO	STATEMENT
1	Understanding the contributions of scripting languages.
2	Design real life problems and think creatively about solutions.
3	Apply a solution in a program using R/Matlab/Python.
4	Solve real life problems using advanced applications of mathematics, engineering, natural sciences.

Mathematics-III (Differential Calculus)
Code: BSC-301
Contacts: 2L

Name of the Course:	**Mathematics-III (Differential Calculus)**
Course Code: BSC-301	Semester: III
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks

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Credit Points:	2
Objective:	
1	To know Convergence of sequence and series
2	To know Limit, continuity and partial derivatives, Chain rule, Implicit function
3	To know First Order Differential Equation, Exact, Linear and Bernoulli's equations, Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph
Pre-Requisite:	
1	Concept Linear Algebra Determinant and its properties (up to third order)
2	Minor and cofactors, Matrices, addition, multiplication and transpose of a matrix, Symmetric and skew-symmetric

Unit	Content	Hrs/Unit	Marks/Unit
1	Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions.	5	
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.	5	
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.	4	
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. Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation.	5	
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.	5	

Text book and Reference books:

1. Higher Algebra, S. K. Mapa, Levant Books.
2. Advanced Higher Algebra, Chakravorty and Ghosh, U N Dhar Pvt. Ltd.
3. Co-ordinate Geometry, S. L. Loney
4. Integral Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.
5. Differential Calculus, Das and Mukherjee, U N Dhar Pvt. Ltd.

6. Advanced Engineering Mathematics, E Kreyszig,

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Distinguish between absolute and conditional convergence of series and be aware of the consequences of reordering terms in conditionally converging series.
2	Apply partial derivatives for estimating maxima and minima of real-life multivariable functions
3	Make use of double and triple integrals to find the volume of rectangular regions in the xyz-plane
4	Understand the terms 'exponential growth/decay', 'proportionate growth rate' and 'doubling/halving time' in differential equation when applied to population models, and the terms 'exponential decay', 'decay constant' and 'half-life' in D.E when applied to radioactivity.
5	Analyze new networks using the main concepts of graph theory.

Biology
Code: BSC 302
Contacts: 2L+1T

Name of the Course:	**Biology**
Course Code: BSC-401	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:2hrs./week	Mid Semester exam: 15
Tutorial: 1 hrs./week	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3
Objective:	
1	Bring out the fundamental differences between science and engineering
2	Discuss how biological observations of 18th Century that lead to major discoveries
Pre-Requisite:	
1	Basic knowledge of Physics ,Chemistry and mathematics

Unit	Content	Hrs/Unit	Marks/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	2	

	discipline. Why we need to study biology? Discuss how biological observations of 18th Century that lead to major discoveries. Examples from 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	Theunderlying 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 laws are to PhysicalSciences”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. Conceptof 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 catalyzed reactions. How does an enzyme catalyze 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.	6	
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 K_{eq} and 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	5	
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.	4	

Text books/ reference books:

1. Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2. Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.John Wiley and Sons

3. Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freemanand Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman andcompany, Distributed by Satish Kumar Jain for CBS Publisher
5. Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.Brown Publishers

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Describe biological observations of the 18th century that lead to major discoveries.
2	Convey that classification per se is not what biology is all about but highlight the underlying criteria, such as morphological, biochemical, and ecological.
3	Highlight the concepts of excessiveness and dominance during the passage of genetic material. Also identify DNA as a genetic material in the molecular basis of information transfer.
4	Convey all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine.
5	Classify enzymes and distinguish between the different mechanisms of enzyme action.
6	Identify and classify microorganisms.
7	Apply thermodynamic principles to biological systems.

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Syllabus for 4-Years B.Tech. in Information Technology

SEMESTER- IV (Second Year)

Discrete Mathematics
Code: PCC-IT401
Contacts: 3L+1T

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

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

Unit	Content	Hrs/Unit	Marks/Unit
1	Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem. Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.	12	
2	Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination	7	
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,	10	

	Proof by Contraposition, Proof of Necessity and Sufficiency.		
4.	Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domainand Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form	9	
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.	10	

Text book and Reference books:

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

15. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
16. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
17. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
18. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH

Course Outcome(s)
On completion of the course students will be able to

CO	STATEMENT
1	Express a logic sentence in terms of predicates, quantifiers and logical connectives.
2	Derive the solution for a given problem using deductive logic and prove the solution based on logical inference.
3	Classify its algebraic structure for a given mathematical problem.
4	Evaluate Boolean functions and simplify expressions using the properties of Boolean Algebra.
5	Develop the given problem as graph networks and solve with techniques of graph theory.

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

Name of the Course:	**Computer Organization & Architecture**
Course Code:PCC-IT402	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam:70 Marks
Credit Points:	3
Objective:	
1	Student should learn the basic and advanced concepts of processor & memory architecture and designing processor and memories. They should also know the performance matrix and how to enhance performance of the processor
2	Student should learn the concept and architecture and design flow of Programmable hardware FPGA.

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Pre-Requisite:	
1	Digital Electronics and logic design with a thorough knowledge about state machine design. Familiarities with algorithm and programming concept

Unit	Content	Hrs/Unit	Marks/Unit
1	**Processor Architecture:** a) Concept of a Computer Systems, Basic building blocks, Store and forward concept, Von-Neumann Architecture, Introduction to Processor and Processor Organization. b) Processor Architecture: Instruction Set Architecture: Instructions & Addressing, Procedures and Data, Instruction Set Variations.	6	
2	**Data path Design:** a) The Arithmetic/ Logic Unit: Number Representation, Adders and Simple ALUs, Multipliers and Dividers, Floating-Point Architecture. Carry Look Ahead adders, Carry Save adder, Pipelined array multiplier, Pipelined adder.	6	
3	**Control unit Design**: a)Design of a Processor b) Control unit Design: Hardwired Control Unit , Microprogram Controlled Unit: Horizontal and vertical Microprogramming	6	
4.	**Advanced Processor Architecture and Performance Matrix:** a) Concept of Pipelining, Pipeline performance, Pipeline performance measurement parameters- speedup, efficiency, throughput, pipeline structure of CPU b)various types of hazard in pipeline, methods to solve the hazards c) Harvard Architecture d) RISC and CISC Architectures e) Performance Matrix (MIPS, FLOPS) and performance enhancement techniques.	6	
5	**Memory Design:** a)Concept of Volatile and Non Volatile Memory ,ROM, EPROM, EEPROM ,Static RAM, Dynamic RAM, Cache Memory, Primary and secondary cache, cache cohesion.	6	
6	**Introduction to FPGA: Architecture and Design:** a) FPGA concept, architecture and design flow. b) introduction Reconfigurable architecture using FPGA	6	

Text/Reference Books:

1. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
2. Willam Stalling ,Computer organization and architecture, designing for performance ,(PHI)
3. Hamacher, "Computer Organization", McGraw Hill
4. Behrooz Parhami "Computer Architecture", Oxford University Press

5. Vincent P. Heuring and Harry F. Jordan, Computer Organization and Architecture: Designing
6. A.Sinha, MAKAUT, " Lecture notes on Computer Organization & Architecture"
7. Chaudhuri, P. Pal, "Computer Organization & Design", PHI

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	To learn the Concept of a Computer System and Design methodology of Processor Design
2	To learn Data path Design (Design of Adder, Subtractor, multiplier etc. and advanced ALU)
3	To learn the design of hardwired control unit, micro programmed and nano-programmed Control unit.
4	To learn the concept of RISC & CISC processors, Harvard Architecture.
5	To learn Memory Technology & design various types of memory units and memory Organization
6	To learn the concept of Performance Enhancement of Processor by Pipelining
7	FPG Architecture, design and concept of Reconfigurable Architecture

Computer Organization & Architecture Lab
Code: PCC-IT492
Contacts: 4P

Name of the Course:	**Computer Architecture Lab**
Course Code: PCC-IT492	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Pre-Requisite:	
1	The hardware based design has been done in 1.the Analog& Digital Electronics laboratory
2	Computer Organization laboratory
Laboratory Experiments:	
1	Familiarity with IC-chips: a) Flip-Flops b) Registers c) Tri-state buffers d) Multiplexer, b) Decoder, c) Encoder d) ALU
2	Familiarity with Hardware description Language (Verilog) & FPGA All the following circuits will be realized on PLA/PLD/CPLD/FPGA using VERILOG & with discreet Logic Gates.
3	Design a 4 bit BCD adder and a 4 bit 'Carry-Look-Ahead' Adder circuit.

4	Design an ALU with Adder/Subtractor unit
5	Using tri-state buffer design a 4 :1 Multiplexer, and D F/F
6	Design an 8 bit Register with a) tri-stated input/ output lines and b)RD and WR control signals
7	Design and implement a 4X4 bit RAM
8	Design a !2 Bit CPU with the following features and implement the design on FPGA i) 4 bit OP-CODE ii) 8 bit ADDRESS lines iii) Types of instructions: a) Data Transfer b) Arithmetic c) Logical d) Branch : Conditional and unconditional e) subroutine f) Processor control iv)All the instructions are of same length

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	To learn the Concept of a Computer System and Design methodology of Processor Design
2	To learn Datapath Design (Design of Adder, Subtractor, multiplier etc. and advanced ALU)
3	To learn the design of hardwired control unit, micro programmed and nano-programmed Control unit.
4	To learn the concept of RISC & CISC processors, Harvard Architecture.
5	To learn Memory Technology & design various types of memory units and memory Organization
6	To learn the concept of Performance Enhancement of Processor by Pipelining
7	FPG Architecture, design and concept of Reconfigurable Architecture

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

Name of the Course:	**Formal Language & Automata Theory**
Course Code:PCC-IT403	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Objective:	
1	Be able to construct finite state machines and the equivalent regular expressions.
2	Be able to prove the equivalence of languages described by finite state machines and regular expressions
3	Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars.
4	Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines
Pre-Requisite:	
1	Grammar and its classification (Context Free Grammar)

Unit	Content	Hrs/Unit	Marks/Unit
1	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 pushdown automata, closure properties of CFLs.	6	
4.	Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.	6	
5	Turing machines: The basic model for Turing machines (TM), Turing recognizable(recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMsas enumerators	6	
6	Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem,	5	

	undecidable problems about languages		

Text books/ reference books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to AutomataTheory, Languages, and Computation, Pearson Education Asia.
2.Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory ofComputation, Pearson Education Asia.
3.Dexter C. Kozen, Automata and Computability, Undergraduate Texts in ComputerScience, Springer.
4. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
5. John Martin, Introduction to Languages and The Theory of Computation, TataMcGraw Hill., PEARSON.

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Define the mathematical principles behind theoretical computer science.
2	Illustrate for the different types of automata like finite automata, push down automata, linear bounded automata and Turing machine.
3	Correlate the different types of automata to real world applications.
4	Design appropriate automata for the different requirements outlined by theoretical computer science.
5	Identify the different computational problems and their associated complexity.

Communication Engineering
Code: PCC-IT404
Contacts: 3L

Name of the Course:	**Communication Engineering**
Course Code: PCC-IT404	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam:70 Marks
Credit Points:	3

Objective:

1	To comprehend basics of communication system
2	To apply the basic concept of PCM systems and baseband transmission schemes
3	To develop a fundamental understanding on Communication Systems with

	emphasis on analog modulation techniques and noise performance
4	To analyze, evaluate and produce spectral characteristics of band pass signaling schemes
5	To understand the key modules of digital communication systems with emphasis on digital modulation techniques
6	To get introduced to the basics of Spread Spectrum Modulation
7	To asses noise issues

Unit	Content	Hrs/Unit	Marks/Unit
1	Elements of Communication system, Analog Modulation & Demodulation, Noise, SNR Analog-to-Digital Conversion. (Basic ideas in brief) : Details: Introduction to Base Band transmission & Modulation (basic concept); Elements of Communication systems (mention of transmitter, receiver and channel); origin of noise and its effect, Importance of SNR in system design; Basic principles of Linear Modulation (Amplitude Modulation); Basic principles of Linear Modulator & Demodulator circuits (Amplitude Modulation); Basic principles of Non-linear modulation (Angle Modulation - FM, PM); Basic principles of Non-linear modulator (Angle Modulation – FM, PM) & Demodulator circuits; Sampling theorem, Sampling rate, Impulse sampling, Reconstruction from samples, Aliasing; Analog Pulse Modulation - PAM (Natural & flat topped sampling), PWM, PPM; Basic concept of Pulse Code Modulation, Block diagram of PCM; Multiplexing - TDM, FDM;	14	
2	Digital Transmission: Details: Concept of Quantisation & Quantisation error, Uniform Quantiser; Non-uniform Quantiser, A-law & law companding (mention only); Encoding, Coding efficiency; Line coding & properties, NRZ & RZ, AMI, Manchester coding PCM, DPCM; Baseband Pulse Transmission, Matched filter (mention of its importance and basic concept only), Error rate due to noise; ISI, Raised cosine function, Nyquist criterion for distortion-less base-band binary transmission, Eye pattern, Signal power in binary digital signals.	10	
3	Digital Carrier Modulation & Demodulation Techniques: Details: Bit rate, Baud rate; Information capacity, Shanon's limit; M-ary encoding, Introduction to the different digital modulation techniques - ASK, FSK, PSK, BPSK, QPSK, mention of 8 BPSK, 16 BPSK; Introduction to QAM, mention of 8QAM, 16 QAM without elaboration; Delta modulation, Adaptive delta modulation (basic concept and importance only, no details; Introduction to	12	

	the concept of DPCM, Delta Modulation, Adaptive Delta modulation and their relevance; Spread Spectrum Modulation - concept only, Introduction to different digital modulator like ASK, FSK, PSK, BPSK, QPSK, 8 BPSK, 16 BPSK modulator & Demodulator; Introduction to QAM, 8QAM, 16 QAM, Delta & Adaptive delta Modulator and Demodulator.		

Text books/ reference books:

1. An Introduction to Analog and Digital Communications by Simon Haykin; Published by Wiley India.
2. Modern Digital & Analog Communication Systems, B.P. Lathi, 3rd Edn, Oxford University Press, Chennai, 1998.
3. Data Communication and Networking by Behrouz A. Forouzan, Published by Tata McGraw-Hill
4. Principle of Communication Systems by Herbert Taub and D.L.Schilling
5. J. G. Proakis, "Digital Communication", Tata McGraw – Hill, (4/e), 2001.

Course Outcomes

On completion of the course students will be able to

CO	STATEMENT
1	To understand the fundamentals of radio communication system and analog modulation and demodulation techniques applying the basic knowledge of signals and systems and will be able to understand the concept of Frequency modulation.
2	To apply the basic knowledge of electronic circuits and understands the effect of Noise in communication system and noise performance of AM & FM systems
3	To understand TDM and Pulse Modulation techniques and baseband transmission schemes
4	To apply the knowledge of statistical theory of communication and signals and system and to explain and evaluate the performance of digital communication system in the presence of noise
5	To describe and analyze the digital communication system with spread spectrum modulation.
6	To design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for analog & digital modulators and demodulators using hardware components and communication systems using CAD tool.

Communication Engineering Lab
Code: PCC-IT494
Contacts: 4P

Name of the Course:	**Communication Engineering Lab**
Course Code: PCC-IT494	Semester: IV
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment

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Syllabus for 4-Years B.Tech. in Information Technology

Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2

Objectives:	
1	To visualize the effects of sampling
2	To implement AM & FM modulation and demodulation
3	To implement PAM, PWM and PPM schemes
Pre-Requisite:	
1	Knowledge in Fourier Analysis and Basic Electronics
Laboratory Experiments:	
1	Design and Generation of Amplitude Modulation
2	Design and Generation of Amplitude Demodulation using Envelope Detection
3	Design and Generation of Narrow Band Frequency Modulation (NBFM) signal
4	Design and Generation of Wide Band Frequency Modulation (WBFM) signal
5	Design and Generation of Frequency Demodulation
6	Design and Generation of PAM, PWM and PPM signal

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Understand the generation of AM signals and its performance
2	Study the amplitude demodulation techniques
3	Understand the generation of FM signals and its performance
4	Study the frequency demodulation techniques
5	Perform signal sampling by determining the sampling rates for baseband signals & to generate digital modulation signals for PAM
6	Understand the generation of PWM & PPM schemes and estimate their output performance

Economics for Engineers (Humanities-II)
Code: HSMC-401
Contacts: 3L

Name of the Course:	**Economics for Engineers (Humanities-II)**
Course Code: HSMC-401	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 3 hrs./week	Mid Semester exam: 15

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Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	Understand the role and scope of Engineering Economics and the process of economic decision making
2	Understand the different concepts of cost and different cost estimation techniques
3	Familiarization with the concepts of cash flow, time value of money and different interest formulas
4	Appreciation of the role of uncertainty in future events and using different concepts from probability to deal with uncertainty
5	Understand the concepts of Depreciation and Replacement analysis along with their methods of calculation
6	Familiarization with the phenomenon of inflation and the use of price indices in engineering Economics
7	Introduction to basic concepts of Accounting and Financial Management
Pre-Requisite:	
1	Mathematics

Unit	Content	Hrs/Unit	Marks/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 - Per- Unit 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.	9	

	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.		
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	

Text book and Reference books:

1. James L.Riggs,David D. Bedworth, Sabah U. Randhawa : Economics for Engineers 4e , Tata McGraw-Hill
2. Donald Newnan, Ted Eschembach, Jerome Lavelle: Engineering Economics Analysis, OUP
3. John A. White, Kenneth E.Case,DavidB.Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Sullivan and Wicks: Engineering Economy, Pearson
5. R.PaneerSeelvan: Engineering Economics, PHI
6. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

Course Outcome:

On completion of the course students will be able to

CO	STATEMENT
1	Knowledge of Basic and its Global Application.
2	Grasping the perceptions of all basic economic concepts.
3	Applications of Concepts of Economics in various fields of Studies.

4	Understanding the concepts and its applications in Micro Economics.
5	Economical advances and its applications.
6	Advanced applications and future trending in Economics.

Environmental Sciences
Code: MC-401
Contacts: 1L

Name of the Course:	**Environmental Sciences**
Course Code: MC-401	Semester: IV
Duration:6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 1hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz : 10 marks
	Attendance : 5 marks
Practical: NIL	End Semester Exam :70 Marks
Credit Points:	0

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

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic ideas of environment, basic concepts, man, society & environment, their interrelationship. 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.	5	

	Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. 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.		
2	Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. 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. Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.	6	
3	Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems. 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. Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion). Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model. 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.	10	

	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. 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).		
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. 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. Lake: Eutrophication [Definition, source and effect]. Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only) 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. Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic.	7	
5	Lithosphere; Internal structure of earth, rock and soil 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).	3	
6	Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level, *L*10 (18hr Index) ,*n Ld*.Noise pollution control.	3	
7	Environmental impact assessment, Environmental	2	

	Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol.		

Text books/ reference books:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd.,1991.
2. De, A. K., "Environmental Chemistry", New Age International

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	describe the natural environment and its relationships with human activities
2	learn fundamental Knowledge of science and engineering to assess environmental and health risk
3	develop guidelines and procedures for health and safety issues obeying environmental laws and regulations
4	acquire skills for scientific problem-solving related to air, water, noise & land pollution
5	gain knowledge how to perform EIA, Environmental Audit to assess the impact and further development

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Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

SEMESTER-V (Third Year)

Design Analysis & Algorithms
Code: PCC-IT501
Contacts: 3L

Name of the Course:	**Design Analysis & Algorithms**		
Course Code: PCC-IT501	Semester: V		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: -		End Semester Exam:70 Marks	
Credit Points:		3	
Objective:			
1	To learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them		
2	Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood		
Pre-Requisite:			
1	Basic knowledge of data-structure and basic programming ability		
Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem	8	
2	Fundamental Algorithmic Strategies: Brute-Force, Greedy, Dynamic Programming, Branch and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving, Bin Packing, Knap Sack TSP. Heuristics –characteristics and their application domains.	8	
3	Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.	6	
4	Tractable and Intractable Problems: Computability of	10	

	Algorithms, Computability classes – P,NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques		
5	Advanced Topics: Approximation algorithms, Randomized algorithms, Class of problems beyond NP – P SPACE	4	

Text books/ reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Define the Significance of Algorithm, its applications and how to formulate and solve complex engineering problems related to Computer Science and Engineering
2	Explain the mathematical expressions to prove asymptotic bounds for time complexity and use asymptotic notation to formulate the time and space requirements of complex problems.
3	Choose the fundamental techniques to design the algorithms efficiently. Understanding of basic recursive problems, finding recurrence relations and solved sorting problems (quick sort and merge sort) by divide and conquer approach
4	Analyze the time complexity of different algorithms and Define dynamic programming approach and build solution for the optimization problems like chain matrix multiplication, all pair shortest path etc. Analyze the concept of greedy technique and apply it to solve the problems like single pair shortest path, minimum spanning tree using two popular method- prim's algorithm and kruskal algorithm
5	Explain the back tracking methodology and develop 8 Queens problem and graph coloring problem using it, also develop branch- and-bound algorithms

Design Analysis & Algorithm Lab
Code: PCC-IT591
Contact: 4P

Name of the Course:	**Design Analysis & Algorithm Lab**
Course Code: **PCC-IT591**	Semester: V
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60

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Practical: 4 hrs./week	Distribution of marks: 40
Credit Points:	2
Objectives:	
1	To learn the importance of designing an algorithm in an effective way by considering space and time complexity
2	To learn divide and conquer strategy based algorithms
3	To learn greedy method based algorithms
4	To learn the dynamic programming design techniques
5	To learn graph search and network flow algorithms
Pre-Requisite:	
1	Proficiency in a C & C++ programming language, basic program design concepts
2	familiarity with basic algorithms such as those for searching, and sorting,
3	Knowledge of Discrete Structures as minimum cost spanning trees.
Laboratory Experiments:	
Divide and Conquer:	
1	Implement Binary Search using Divide and Conquer approach Implement Merge Sort using Divide and Conquer approach
2	Implement Quick Sort using Divide and Conquer approach Find Maximum and Minimum element from a array of integer using Divide and Conquer approach
3	Find the minimum number of scalar multiplication needed for chain of matrix
4	Implement all pair of Shortest path for a graph (Floyed- Warshall Algorithm) Implement Traveling Salesman Problem
5	Implement Single Source shortest Path for a graph (Dijkstra , Bellman Ford Algorithm
Brunch and Bound:	
6	Implement 15 Puzzle Problem
Backtracking:	
7	Implement 8 Queen problem
8	Graph Coloring Problem Hamiltonian Problem
Greedy method	
9	Knapsack Problem Job sequencing with deadlines
10	Minimum Cost Spanning Tree by Prim's Algorithm Minimum Cost Spanning Tree by Kruskal's Algorithm
Graph Traversal Algorithm:	
11	Implement Breadth First Search (BFS) Implement Depth First Search (DFS)

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

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Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Solve some problems using recursion.
2	Develop searching algorithms and sorting algorithms.
3	Represent Tree & Graphs and solve Bin Packing & TSP
4	Implement KMP, BFS and DFS algorithms
5	Estimate the minimum cost of spanning tree, minimum cost any two nodes of a graphs, etc

Database Management System (DBMS)
Code: PCC-IT502
Contacts: 3L

Name of the Course:	**Database Management System**
Course Code: PCC-IT502	Semester: V
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To understand the different issues involved in the design and implementation of a database system
2	To study the physical and logical database designs, database modeling, relational, hierarchical, and network models
3	To understand and use data manipulation language to query, update, and manage a database
4	To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing.
5	To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS.
6	To understand the different issues involved in the design and implementation of a database system
Pre-Requisite:	
1	Computer Programming & Utilization (3) Knowledge about data structures and algorithms, corresponding to the basic course on Data Structures and Algorithms.

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Unit	Content	Hrs/Unit	Marks/Unit
1	Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations	9	
2	Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms.	13	
3	Storage strategies: Indices, B-trees, hashing.	3	
4	Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.	5	
5	Database Security: Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection.	3	
6	Advanced topics: Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.	3	

Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Illustrate the different components of database and data model
2	Design the databases using E R method and normalization for a given specification of the requirement
3	Construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, and DB2

4	Optimize query execution using Query optimization algorithms
5	Determine the transaction atomicity, consistency, isolation, and durability for a given transaction-processing system,
6	Justify the ACID property based on locking, time stamping algorithm on concurrency control and Serializability of scheduling.

Database Management System Lab
Code: PCC-IT592
Contacts: 4L

Name of the Course:	**Database Management System Lab**	
Course Code: **PCC-IT592**	Semester: V	
Duration:6 months	Maximum Marks:100	
Teaching Scheme:		
Theory: -		Continuous Internal Assessment
Tutorial: NIL		External Assessments: 60
Practical: 4 hrs./week		Distribution of marks: 40
Credit Points:		2
Objectives:		
1	Design database schema for a given application and apply normalization	
2	Acquire skills in using SQL commands for data definition and data manipulation.	
3	Develop solutions for database applications using procedures, cursors and triggers	
Laboratory Experiments:		
1	**Creating Database** ● Creating a Database ● Creating a Table ● Specifying Relational Data Types ● Specifying Constraints ● Creating Indexes	
2	**Table and Record Handling** ● INSERT statement ● Using SELECT and INSERT together ● DELETE, UPDATE, TRUNCATE statements ● DROP, ALTER statements	
3	**Retrieving Data from a Database** 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**

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Illustrate different types of SQL commands
2	Formulate queries using SQL operators
3	Apply different types of joining operation on multiple tables
4	Implement various queries using different functions and elaborate nested queries
5	Construct Views
6	Describe the concept of cursor and triggers

Operating Systems (OS)
Code: PCC-IT503
Contacts: 3L

Name of the Course:	**Operating Systems**
Course Code: PCC-IT503	Semester: V
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To learn the mechanisms of OS to handle processes and threads and their communication
2	To learn the mechanisms involved in memory management in contemporary OS
3	To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4	To know the components and management aspects of concurrency management
Pre-Requisite:	
1	Computer Organization & Architecture

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**

1	Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.	3	
2	Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF	10	
3	Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, etc. Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, etc.	5	
4	Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery. Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem, etc	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	8	

	Recently used(LRU).		
6	I/O Hardware: I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	5	

Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Explain the structure of different operating systems and different functionalities of it
2	Identify process, thread, the communication between application programs and hardware devices through system calls.
3	Analyze and CPU scheduling algorithm. Inspect process synchronization and its consequences.
4	Inspect process synchronization and deadlock.
5	Apply different memory management scheme
6	Analyze different file systems, I/O devices, disk scheduling and different security vulnerabilities

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Syllabus for 4-Years B.Tech. in Information Technology

Operating System Lab
Code: PCC-IT593
Contacts: 4P

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

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

Laboratory Experiments:	
1	**Managing Unix/Linux Operating System:** Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions, and 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 init tab file, Run-levels, Run level scripts. Password file management, Password security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups.
2	**Process**: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.
3	**Signal**: signal handling, sending signals, signal interface, signal sets.
4	**Semaphore**: programming with semaphores (use functions semctl, semget, semop, set_semvalue, del_semvalue, semaphore_p, semaphore_v)
5	**POSIX Threads**: programming with pthread functions (viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)
6	**Inter-process communication**: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO), message passing & shared memory(IPC version V).

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:
On completion of the course students will be able to

CO	STATEMENT
1	Understand fundamental concept of shell script.
2	Apply the concept of Array in shell script

3	Apply the concepts of operators in shell script
4	Apply the concepts of loop in shell script
5	Apply the concepts of string in shell script
6	Apply the concepts of function in shell script

Object Oriented Programming withPython
Code: PCC-IT504
Contacts: 2L

Name of the Course:	**Object Oriented Programming withPython**
Course Code: PCC-IT504	Semester: V
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam:70 Marks
Credit Points:	2

Objective:

1	To provide the students with good opportunities to develop a fundamental understanding of object-oriented programming, particular in Python
2	To use standard libraries for development of graphical user interfaces, numerical computations and plotting

Pre-Requisite:

1	Basic knowledge on fundamental of computer and python

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

Text book and Reference books:

1. Rambaugh, James Michael, Blaha – "Object Oriented Modelling and Design" – Prentice Hall, India

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Analyze the drawbacks of Procedure Oriented Programming comparing with the concepts of Object Oriented Programming paradigm
2	Identify the role of Classes & Objects, constructors & destructors in program design.
3	Design various forms of inheritance and class constructors are called.
4	Evaluate operator overloading, runtime polymorphism Programming through examples.
5	Explore exception handling and various Stream classes, I/O operations in handling file operations.

Object Oriented Programming with Python Lab
Code: PCC-IT594
Contacts: 4P

Name of the Course:	**Object Oriented Programming Lab**	
Course Code: **PCC-IT594**	Semester: V	
Duration:6 months	Maximum Marks:100	
Teaching Scheme:		
Theory: -		Continuous Internal Assessment
Tutorial: NIL		External Assesement:60
Practical: 4 hrs./week		Distribution of marks:40
Credit Points:		2
Objective		
1	To build software development skills using java programming for real-world applications.	
2	To understand and apply the concepts of classes, packages, interfaces, arraylist, exception handling and file processing.	
3	To develop applications using generic programming and event handling.	
Laboratory Experiments:		
1	Assignments on class, constructor, overloading, inheritance, overriding	
2	Assignments on wrapper class, arrays	
3	Assignments on developing interfaces- multiple inheritance, extending interfaces	
4	Assignments on creating and accessing packages	
5	Assignments on multithreaded programming	
6	Assignments on applet programming	
Note: Use Python for programming		

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

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Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Develop algorithmic solutions to simple computational problems.
2	Demonstrate programs using simple Python statements and expressions.
3	Design various forms of inheritance and analyze how base class constructors are called.
4	Evaluate operator overloading, runtime polymorphism Programming through examples.
5	Explain files, exception, modules and packages in Python for solving problems.

Introduction to Industrial Management (Humanities III)
Code: HSMC-501
Contacts: 3L

Name of the Course:	**Introduction to Industrial Management**
Course Code: **HSMC-501**	Semester: V
Duration: 6 months	Maximum Marks:100

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

Objective:

1	To recognize organization structure, human resource issues in industries and major provisions of factory acts.
2	To plan, use, monitor and control resources optimally and economically.

Pre-Requisite:

1	Basic knowledge on Operation Research and Statistics

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction** 1.1 System- concept, definition, types, parameters, variables and behavior. 1.2 Management – definition and functions. 1.3 Organization structure: i. Definition. ii. Goals. iii. Factors considered in formulating structure. iv. Types. v. Advantages and disadvantages. vi. Applications. 1.4 Concept, meaning and importance of division of labor, scalar & functional processes, span of control, delegation of authority, centralization and decentralization in industrial management. 1.5 Organizational culture and climate – meaning, differences and factors affecting them. 1.6 Moral-factors affecting moral. 1.7 Relationship between moral and productivity. 1.8 Job satisfaction- factors influencing job satisfaction.	6	

	1.9 Important provisions of factory act and labor laws.		
2	**Critical Path Method (CPM) and Program Evaluation Review Technique (PERT):** 2.1 CPM & PERT-meaning, features, difference, applications. 2.2 Understand different terms used in network diagram. 2.3 Draw network diagram for a real life project containing 10-15 activities, computation of LPO and EPO.(Take minimum three examples). 2.4 Determination of critical path on network. 2.5 Floats, its types and determination of floats. 2.6 Crashing of network, updating and its applications.	8	
3	**Materials Management:** 3.1 Material management-definition, functions, importance, relationship with other departments. 3.2 Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department. 3.3 Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice. 3.4 Functions of store, types of records maintained by store, various types and applications of storage equipment, need and general methods for codification of stores. 3.5 Inventory control: i. Definition. ii. Objectives. iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis. v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.). 3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market.	6	
4	**Production planning and Control (PPC):** 4.1 Types and examples of production. 4.2 PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production. 4.3 Scheduling- meaning and need for productivity and utilization. 4.4 Gantt chart- Format and method to prepare. 4.5 Critical ratio scheduling-method and numeric examples.	8	

	4.6 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.		
5	**Value Analysis (VA) and Cost Control:** 5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram. 5.3 DARSIRI method of VA. 5.4 Case study of VA-at least two. 5.5 Waste-types, sources and ways to reduce them. 5.6 Cost control-methods and important guide lines	4	
6	**Recent Trends in IM:** 6.1 ERP (Enterprise resource planning) - concept, features and applications. 6.2 Important features of MS Project. 6.3 Logistics- concept need and benefits. 6.4 Just in Time (JIT)-concept and benefits. 6.5 Supply chain management-concept and benefits.	4	

Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand the Genesis of Industrial Engineering and Management (IEM).
2	Understand the linkage between IEM and Operations Management (OM).
3	Understand applications of OM
4	Applications of Optimization Principles.
5	Applications of Principles of IEM in Industry.
6	Justification and controlling of improvements and applications in industry.

Human Computer Interaction

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Code: PEC-IT501A

Contacts: 3L

Name of the Course:	**Human Computer Interaction**
Course Code: **PEC-IT501A**	Semester: V
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To learn the basic physiological, perceptual, and cognitive components of human learning and memory.
2	To gain theoretical knowledge of and practical experience in the fundamental aspects of designing and implementing user interfaces.
3	To analyze interaction problems from a technical, cognitive, and functional perspective.
4	To develop an awareness of the range of general human-computer interaction issues that must be considered when designing information systems
5	To learn about multimodal displays for conveying and presenting information.
6	To know and have practiced a variety of simple methods for designing and evaluating the quality of user interfaces and spatial displays.
Pre-Requisite:	
1	Basic knowledge on computer fundamentals and internet

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	The Human: I/O channels – Memory – Reasoning and problem solving; The Computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms. - Case Studies	7	
2	Interactive Design: Basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process: Software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules: principles, standards, guidelines, rules. Evaluation Techniques – Universal Design	7	
3	HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.	6	
4	Mobile Ecosystem: Platforms, Application frameworks-	8	

	Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools. - Case Studies		
5	Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow - Case Studies	8	

Text book and Reference books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, —Human Computer Interaction, 3rd Edition, Pearson Education, 2004
2. Brian Fling, —Mobile Design and Development||, First Edition, O'Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, —Designing Web Interfaces||, First Edition, O'Reilly, 2009.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Demonstrate the capabilities of both humans and computers from the viewpoint of human information processing.
2	Interpret typical human–computer interaction (HCI) models, styles, and various historic HCI paradigms.
3	Apply an interactive design process and universal design principles to design HCI systems
4	Make use of HCI design principles, standards and guidelines.
5	Analyze and identify user models, user support, socio-organizational issues, and stakeholder requirements of HCI systems
6	Analyze and discuss HCI issues in groupware, ubiquitous computing, virtual reality, multimedia, and Word Wide Web-related environments.

Advanced Computer Architecture
Code: PEC-IT501B
Contacts: 3L

Name of the Course:	**Advanced Computer Architecture**
Course Code: **PEC-IT501B**	Semester: V
Duration: 6 months	Maximum Marks:100

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

Objective:

1	To understand the Concept of Parallel Processing and its applications.
2	To implement the Hardware for Arithmetic Operations.

3	To analyze the performance of different scalar Computers.
4	To develop the Pipelining Concept for a given set of Instructions.
5	To distinguish the performance of pipelining and non pipelining environment in a processor.
Pre-Requisite:	
1	Basic knowledge of programming and data structures, discrete Math's, and computer organization

Unit	Content	Hrs/Unit	Marks/Unit
1	Computer Architecture and Organization-Review, Fundamentals of Computer Design, Technology Trends Cost Performance Analysis Parallel Processing Architectures- Taxonomy- SISD, MISD, SIMD,MIMD, PRAM models	6	
2	Data and Resource Dependencies, Program Partitioning and Scheduling, Control Flow vs. Data Flow Network topologies-Static, Dynamic, Types of Networks RISC vs. CISC, Memory Hierarchy, Virtual Memory	8	
3	Concepts of Pipelining, Instruction Pipelining, dynamic pipelining, arithmetic pipelines. Multiprocessors- Multistage Networks, Cache Coherence, Synchronization, Message- passing Vector Processing Principles- Instruction types, Compound, Vector Loops, Chaining	12	
4	Array Processors- Structure, Algorithms Data Flow Architecture- Graphs. Petri Nets, Static and Dynamic DFA, VLSI Computations Parallel Programming Models, Languages, Compilers	10	

Text book and Reference books:

1. Computer Architecture and Parallel Processing- Kai Hwang and A. .Brigggs International Edition, McGraw Hill
2. Advanced Computer Architecture: D. Sima, T. fountain, P. Kacsuk, Pearson
3. Parallel Computer Architecture: D. Culler, J.P.Singh, A.Gupta, Elsevier

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Expose the advanced concepts of different computer architectures.
2	Investigate recent design structures of Pipelined and Multiprocessors systems.
3	Analyze vector and array processing principals.
4	Acquainted with modern data flow architectures as well as the programming model required to drive/manage these types of architectures.

Computer Graphics

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Code: PEC-IT501C
Contacts: 3L

Name of the Course:	**Computer Graphics**
Course Code: **PEC-IT501C**	Semester: V
Duration: 6 months	Maximum Marks:100

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

Objectives:

1	To understand the two dimensional graphics and their transformations.
2	To gain knowledge about graphics hardware devices and software used.
3	To understand the three dimensional graphics and their transformations.
4	To be familiar with understand clipping techniques.
5	To appreciate illumination and color models

Pre-Requisites:

1	Basic knowledge of computer fundamentals and programming

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	Introduction to computer graphics & graphics systems: Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software. Scan conversion: Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm	10	
2	2D transformation & viewing: Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method 3D transformation & viewing: 3D transformations:	16	

	translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing.		
3	Curves: Curve representation, surfaces, designs, Bezier curves, B-spline curves, end conditions for periodic B-spline curves, rational B-spline curves. Hidden surfaces: Depth comparison, Z-buffer algorithm, Back face detection, BSP tree method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame methods , fractal - geometry. Color & shading models: Light & color model; interpolative shading model; Texture. Introduction to Ray-tracing: Human vision and color, Lighting, Reflection and transmission models.	10	

Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Familiarize with contemporary graphics hardware, the actual methodology and techniques to draw computer graphics, animations etc.
2	Develop different kinds of graphics and animations.
3	develop graphics applications with the implementation of advanced methods such as ray tracing, texture mapping, illumination and shading
4	Build interactive user interface to manipulate objects in a 3D scene and also in the development of Web pages.
5	Demonstrate the ability to develop an animation movie

Constitution of India
Code: MC-IT501A
Contacts: 2L

Name of the Course:	**Constitution of India**
Course Code: **MC-IT501A**	Semester: V
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks

Practical: NIL	End Semester Exam:70 Marks
Credit Points:	0

Objective:	
1	To acquaint the students with legacies of constitutional development in India and help those to understand the most diversified legal document of India and philosophy behind it.
2	To make students aware of the theoretical and functional aspects of the Indian Parliamentary System.
3	To channelize students' thinking towards basic understanding of the legal concepts and its implications for engineers.
4	To acquaint students with latest intellectual property rights and innovation environment with related regulatory framework.
5	To make students learn about role of engineering in business organizations and e-governance.
Pre-Requisites:	
1	None

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy	5	
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	5	
3	State Government and its Administration Governor: Role and Position, CM and Council of ministers, State Secretariat: Organization, Structure and Functions	3	
4	Local Administration District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different 4.departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy	8	
5	Election Commission Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women	3	

Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify and explore the basic features and modalities about Indian constitution.
2	Differentiate and relate the functioning of Indian parliamentary system at the center and state level.
3	Differentiate different aspects of Indian Legal System and its related bodies.
4	Discover and apply different laws and regulations related to engineering practices.
5	Correlate role of engineers with different organizations and governance models

Essence of Indian Knowledge Tradition
Code: MC-IT501B
Contacts: 2L

Name of the Course:	**Essence of Indian Knowledge Tradition**
Course Code: **MC-IT501**	Semester: V
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory: 2 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	0

Objective:

1	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2	To make the students understand the traditional knowledge and analyze it and apply it to their day to day life

Pre-Requisites:

1	None

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to traditional knowledge:** Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge Vs western knowledge traditional knowledge	3	
2	**Protection of traditional knowledge:** The need for	6	

	protecting traditional knowledge Significance of TK Protection, value of TK in global economy, Role of Government to harness TK		
3	**Legal framework and TK:** The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.	6	
4	**Traditional knowledge and intellectual property:** Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge	7	
5	**Traditional Knowledge in Different Sectors:** Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	2	

Text book and Reference books:

1. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor1, Michel Danino
3. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
4. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
5. Fritzof Capra, Tao of Physics
6. Fritzof Capra, The wave of Life

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify the concept of Traditional knowledge and its importance.
2	Explain the need and importance of protecting traditional knowledge.
3	Illustrate the various enactments related to the protection of traditional knowledge.
4	Interpret the concepts of Intellectual property to protect the traditional knowledge.
5	Explain the importance of Traditional knowledge in Agriculture and Medicine.

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

SEMESTER-VI (Third Year)

Software Engineering
Code: PCC-IT601
Contacts: 3L

Name of the Course:	**Software Engineering**	
Course Code: **PCC-IT601**	Semester: VI	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: -		End Semester Exam:70 Marks
Credit Points:		3

Objective:	
1	This course introduces the concepts and methods required for the construction of large software intensive systems
2	It aims to develop a broad understanding of the discipline of software engineering.
3	It seeks to complement this with a detailed knowledge of techniques for the analysis and design of complex software intensive systems.
4	It aims to set these techniques in an appropriate engineering and management context.
5	It provides a brief account of associated professional and legal issues
Pre-Requisites:	
1	Basic knowledge of Data structure, database and programming

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	Overview of System Analysis & Design , Business System Concept, System Development Life Cycle, Waterfall Model , Spiral Model, Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.	6	
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.	6	
3	Coding & Documentation – Structured Programming, OO Programming, Information Hiding, Reuse, System Documentation. Testing – Levels of Testing, Integration Testing, Test case Specification, Reliability Assessment, Validation & Verification Metrics, Monitoring & Control.	10	
4	Software Project Management – Project Scheduling,	4	

	Staffing, Software Configuration Management, Quality Assurance, Project Monitoring.		
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	

Text book and Reference books:

1. Pressman, Software Engineering : A practitioner's approach– (TMH
2. Pankaj Jalote, Software Engineering- (Wiley-India)
3. Rajib Mall, Software Engineering- (PHI)
4. Agarwal and Agarwal, Software Engineering – (PHI)
5. Sommerville, Software Engineering – Pearson
6. Martin L. Shooman, Software Engineering – TMH

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify software Engineering problem specification, performance, maintenance and quality requirements
2	Select modern engineering tools necessary for software project management, time management and software reuse.
3	Analyze, elicit and specify software requirements through a productive working relationship with various stakeholders of the project.
4	Distinguish different testing strategies and it's working.
5	Design applicable solutions in one or more application domains using software engineering approaches that integrates ethical, social, legal and economic concerns.
6	Develop the code from the design and effectively apply relevant standards and perform testing, and quality management and practice.

Software Engineering Lab

Code: PCC-IT691

Contacts: 4P

Name of the Course:	**Software Engineering Lab**
Course Code: **PCC-IT691**	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objective	
1	To impart state-of-the-art knowledge on Software Engineering and UML in an interactive manner through the Web

2	To present case studies to demonstrate the practical applications of different concepts
3	To provide a scope to the students where they can solve small, real life problems
Laboratory Experiments:	
1.	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 test class 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

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	To handle software development models through rational method.
2	To prepare SRS document, design document, test cases and software configuration management and risk management related document
3	To Develop function oriented and object oriented software design using tools like rational rose.
4	To perform unit testing and integration testing.
5	To apply various white box and black box testing techniques.
6	Able to Plan a software engineering process life cycle.

Computer Networks
Code: PCC-IT602
Contacts: 3L

Name of the Course:	**Computer Networks**
Course Code: **PCC-IT602**	Semester: VI
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: -	End Semester Exam:70 Marks
Credit Points:	3
Objective:	
1	To develop an understanding of modern network architectures from a design and performance perspective.

2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs)
3	To provide an opportunity to do network programming
4	To provide a WLAN measurement ideas
Pre-Requisites:	
1	Basic knowledge of fundamentals of computers

Unit	Content	Hrs/Unit	Marks/Unit
1	Data communication Components: Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum	8	
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	6	
3	Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols	8	
4	Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.	7	
5	Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.	7	

Text book and Reference books:

1. “Computer Networks”, by Andrew S. Tanenbaum, David J.Wetherall, Pearson Education, 5th ed., ISBN 978-81-317-8757-1
2. “Data Communications and Networking”, by Behrouz A. Forouzan, McGraw Hill Education, 5th ed., ISBN 978-1-25-906475-3.
3. ”Computer Networks”, by Peterson, Davie 5th ed., Elsevier.

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Explain the basics of computer networking, different network model and architecture
2	Analyze different networking functions and features for identifying optimal solutions
3	Apply different networking concepts for implementing network solution
4	Evaluate and implement routing algorithms for implanting solution for the real life problems
5	Develop implement model of fault tolerant computer networks

Computer Networking Lab
Code: PEC-IT692
Contacts: 4P

Name of the Course:	**Computer Networking Lab**
Course Code:**PEC-IT692**	Semester: VI
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objectives:	
1	To learn about simulation tools
2	To study networking device, command and configuration
3	Study of IP addresses
4	To learn configure of the network topology using Packet tracer software
5	To learn about socket programming
Pre-Requisite:	
1	Knowledge of C programming
Laboratory Experiments:	

1) Cisco Packet Tracer installation.
2) To study basic networking devices, commands and configuration
3) Familiarization with
   a) Networking cables (CAT5, UTP)
   b) Connectors (RJ45, T-connector)
   c) Hubs, Switches
4) Simulation of basic Networking Commands
5) Understanding of IP addresses and subnet mask
6) Configuration of the network topology using packet tracer software
7) TCP/UDP Socket Programming
   a) Simple, TCP based, UDP based
   b) Implementation of a Prototype Multithreaded Server

Any experiment specially designed based on the theory syllabus will be followed

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understanding of network simulation tool
2	Ability to understanding the networking device, network command and configuration
3	Ability to simulate network topology using packet tracer software
4	The ability to do socket programming

Compiler Design
Code: PEC-IT601A
Contacts: 3L

Name of the Course:	**Compiler Design**
Course Code: **PEC-IT601A**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To understand and list the different stages in the process of compilation.
2	Identify different methods of lexical analysis
3	Design top-down and bottom-up parsers
4	Identify synthesized and inherited attributes
5	Develop syntax directed translation schemes
6	Develop algorithms to generate code for a target machine

Pre-Requisites:	
1	Basic knowledge of data structure and programming

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Compiling** Compilers, Analysis of the source program, The phases of the compiler, Cousins of the compiler	2	
2	**Lexical Analysis** The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).	5	

3	**Syntax Analysis** The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.	6	
4	**Syntax directed translation** Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.	5	
5	**Type checking** Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions	2	
6	**Run time environments** 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** Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples)	4	
8	**Code optimization** 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.	4	
9	**Code generations** Issues in the design of code generator, a simple code generator, Register allocation & assignment	3	

Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Illustrate the fundamental idea of compiler and the constituent as well as the different phases of designing a compiler with compile time error handling.
2	Understand a given grammar specification to develop the lexical analyzer

3	To compare syntactic and semantic analysis process of designing compilers.
4	Design a given parser specification design top-down and bottom-up parsers
5	Develop syntax directed translation schemes and the intermediate code generation principles
6	Apply optimization algorithms to generate code for a target machine

Compiler Design Lab
Code: PEC-IT691A
Contacts: 4P

Name of the Course:	**Compiler Design Lab**
Course Code:**PEC-IT691A**	Semester: VI
Duration: 6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objectives:	
1	To be exposed to compiler writing tools.
2	To learn to implement the different Phases of compiler
3	To familiar with control flow and data flow analysis
4	To learn simple optimization techniques
Pre-Requisite:	
1	Knowledge of C programming
Laboratory Experiments:	
1. Implementation of Symbol Table 2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.) 3. Implementation of Lexical Analyzer using Lex Tool 4. Generate YACC specification for a few syntactic categories. a) Program to recognize a valid arithmetic expression that uses operator +, – , * and /. b) Program to recognize a valid variable which starts with a letter followed by any number of letters or digits. c) Implementation of Calculator using LEX and YACC	

5. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
6. Implement type checking
7. Implement control flow analysis and Data flow Analysis
8. Implement any one storage allocation strategies (Heap,Stack,Static)
9. Construction of DAG
10. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler. The target assembly instructions can be simple move, add, sub, jump. Also simple addressing modes are used.
11. Implementation of Simple Code Optimization Techniques (Constant Folding., etc.)

Any experiment specially designed based on the theory syllabus will be followed (Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Apply the knowledge of lex tool & yacc tool to develop a scanner & parser.
2	Design & conduct experiments for NFA and DFA from a given regular expression
3	Develop program for implementing symbol table and parser problems
4	Create program for intermediate code generation
5	Learn & use the new tools and technologies used for designing a compiler
6	Apply the knowledge of patterns, tokens & regular expressions in programming for solving a problem in the field of data mining

Distributed Systems
Code: PEC-IT601B
Contacts: 3L

Name of the Course:	**Distributed Systems**
Course Code: **PEC-IT601B**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:

1	To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems

Pre-Requisite:

1	Database Management Systems

Unit	Content	Hrs/Unit	Marks/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	6	
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	8	
3	**DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralized query optimization; 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	8	
4	Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm	5	
5	**PARALLEL DATABASE SYSTEMS** Parallel architectures; parallel query processing	5	
6	**ADVANCED TOPICS** Mobile Databases, Distributed Object Management, Multi-databases	4	

Text book and Reference books:

1. Principles of Distributed Database Systems, M.T. Ozsu and PValduriez, Prentice-Hall,

1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Explain the distributed systems architecture.
2	Outline the inter process communication in distributed systems.
3	Explain the file accessing model and various services in distributed system.
4	Demonstrate concurrency control and properties of transaction in Distributed systems.
5	Discuss resource and process management in distributed system
6	

Distributed System Lab

Code: PEC-IT691B

Contacts: 4P

Name of the Course:	**Distributed System Lab**
Course Code: **PEC-IT691B**	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objective:	
1	To experience with basic techniques in the design and development of Distributed Systems
2	To understanding solutions of the fundamental problems in distributed systems like mutual exclusion, deadlock detection, termination detection, RPC, RMI, OPENMP, MPI and CORBA
Laboratory Experiments:	
1.	To Simulate the functioning of Lamport's Logical clock in 'c'.
2.	To Simulate the functioning of Lamport's Vector clock in 'c'.
	To Simulate the Distributed Mutual exclusion in 'c'.
	To Simulate the Non Token/ Token based algorithm in Distributed system.
	To Simulate the Distributed Deadlock Detection algorithm-Edge chasing
	To Implement 'RPC' mechanism for accessing methods of remote systems.
	To Implement 'Java RMI' mechanism for accessing methods of remote systems.
	To implement CORBA mechanism by using C++ program at one end and Java Program on the other
	Experiment with the application programming interface OpenMP which supports multi-platform shared-memory and multiprocessing programming in C
	Experiment with Message Passing Interface Standard (MPI).

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Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Apply knowledge of distributed systems techniques and methodologies.
2	Explain the design and development of distributed systems and distributed systems applications.
3	Use the application of fundamental Computer Science methods and algorithms in the development of distributed systems and distributed systems applications.
4	Discuss the design and testing of a large software system, and to be able to communicate that design to others.

Image Processing
Code: PEC-IT601C
Contacts: 3L

Name of the Course:	**Image Processing**
Course Code: **PEC-IT601C**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To become familiar with digital image fundamentals
2	To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
3	To learn concepts of degradation function and restoration techniques.
4	To study the image segmentation and representation techniques.
5	To become familiar with image compression and recognition methods

Pre-Requisite:	
1	Basic knowledge of mathematics and programming

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction**: Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.	6	
2	**Digital Image Formation**: A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling &	4	

	Quantization - Uniform & Non uniform.		
3	**Mathematical Preliminaries:** Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & SineTransform.	6	
4	**Image Enhancement:** Spatial Domain Method, Frequency Domain Method, Contrast Enhancement - Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.	8	
5	**Image Restoration**: 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:** 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	

Text book and Reference books:

1. Gonzalez & Woods, —Digital Image Processing||, 3rd ed., Pearson education, 2008
2. Jain Anil K., —Fundamentals Digital Image Processing||, Prentice Hall India, 2010
3. Milan Sonka, Vaclav Hlavav, Roger Boyle, —Image Processing, Analysis and Machine Vision||, 2nd ed., Thomson Learning, 2001
4. Rangaraj M. Rangayyan, —Biomedical Image Analysis||, CRC Press, 2005
5. Pratt W.K, —Digital Image Processing||, 3rd ed., John Wiley & Sons, 2007
6. Digital Image Processing, 3rd Edition, by Rafael C Gonzalez and Richard E Woods. Publisher: Pearson Education

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Define the fundamentals of digital image processing terminologies and features of images
2	Relate the mathematical foundations with image transformation, enhancement, segmentation and analysis.
3	Implement algorithms on enhancement and restoration on image data

4	Measure performance of image processing algorithms in providing solutions to real life problems
5	Build image processing systems to solve real world problems of image processing
6	Design solutions for various applications in different subject domains

Image Processing Lab
Code: PEC-IT691C
Contacts: 4P

Name of the Course:	**Image Processing Lab**
Course Code: **PEC-IT691C**	Semester: VI
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assesement:60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objective:	
1	To understand the fundamental concepts of digital signal processing and Image processing.
2	To explore DFT for 1-D and 2-D signal and FFT for 1-D signal
3	To apply processing techniques on 1-D and Image signals.
4	To apply digital image processing techniques for edge detection
Laboratory Experiments:	
1	Simulation and Display of an Image, Negative of an Image(Binary & Gray Scale)
2	Implementation of Relationships between Pixels
3	Implementation of Transformations of an Image
4	Contrast stretching of a low contrast image, Histogram, and Histogram Equalization
5	Display of bit planes of an Image
6	Display of FFT(1-D & 2-D) of an image
7	Computation of Mean, Standard Deviation, Correlation coefficient of the given Image
8	Implementation of Image Smoothening Filters(Mean and Median filtering of an Image)
9	Implementation of image sharpening filters and Edge Detection using Gradient Filters
10	Image Compression by DCT,DPCM, HUFFMAN coding
11	Implementation of image restoring techniques
12	Implementation of Image Intensity slicing technique for image enhancement
13	Canny edge detection Algorithm

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

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Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Illustrate the fundamental concepts of image processing
2	Identify image transformation to transform images into different domains
3	Apply image enhancement and restoration in images of different domains
4	Implement image segmentation and classification for automated identification of objects
5	Categorize different feature extraction techniques for image analysis and recognition
6	Design image processing systems to solve real world problems of image processing

Artificial Intelligence
Code: PEC-IT602A
Contacts: 3L

Name of the Course:	**Artificial Intelligence**
Course Code: **PEC-IT602A**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:

1	To understand the definition of artificial intelligence
2	To understand the different faculties involved with intelligent behavior
3	To examine the different ways of approaching AI
4	To look at some example systems that use AI
5	To have a fair idea of the types of problems that can be currently solved by computers and those that are as yet beyond its ability.

Pre-Requisite:

1	Basic knowledge of Probability, statistics, automata and languages, and programming

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction:** Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem. **Intelligent Agents:** Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents. **Problem Solving:** 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:** Solving problems by searching:	13	

	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:** 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:** Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements, iterative deepening.		
3	**Knowledge & reasoning:** Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation.	3	
4	**Using predicate logic:** Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction. **Probabilistic reasoning:** Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics.	6	
5	**Natural Language processing:** Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing. **Learning:** Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning. **Expert Systems:** Representing and using domain knowledge, expert system shells, knowledge acquisition.	8	

Text book and Reference books:

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

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Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand knowledge of the building blocks of AI as presented in terms of intelligent agents.
2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
3	Understand and Develop intelligent algorithms for constraint satisfaction problems and also design intelligent systems for Game Playing.
4	Understand and Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
5	Formulate and solve problems with uncertain information using Bayesian approaches.
6	Apply concept Natural Language processing to problems leading to understanding of cognitive computing.

Internet of Things
Code: PEC-IT602B
Contacts: 3L

Name of the Course:	**Internet of Things**
Course Code: **PEC-IT602B**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:

1	To understand the application areas of IOT
2	To realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
3	To understand building blocks of Internet of Things and characteristics

Pre-Requisite:

1	Basic knowledge of computer networking, data processing and electronics sensors

Unit	Content	Hrs/Unit	Marks/Unit
1	Internet: An Overview: Introduction, History of Internet, Internet Technology, Towards the IoT Universe(s), Classification of Internet, Topologies, Applications, Basics of Internet, Internet of Things Vision, The Internet of Things Today Internet of Things and Related Future Internet Technologies	6	
2	Elements of IoT: Communication, Sensing, Actuation,	6	

	I/O interfaces. Internet of Things: An overview, Introduction, Characteristics, Smart devices, IoT as a Network of Networks, IoT architecture, IoT developments, Smart Technology, Smart environment. IoT Components, Basic Principles, Embedded technology Vs IoT, Sensors, Wireless sensor networks, Aurdino, Rasberry Pi		
3	Internet Communication Technologies, Networks and Communication , Current trends in Internet: Internet of everything, Internet of everything, Internet of things, Storage, Databases Data Management , IoT Related Standardization , Protocol M2M Service Layer Standardization, OGC Sensor Web for IoT, IEEE and IETF, ITU-T, Communication protocols, Types of communication protocols, Communication Protocols-MQTT, ZigBee, Bluetooth, Communication Protocols-CoAP, UDP, TCP Addressing Schemes, M2M Service Layer Standardization	8	
4	Cloud Technology: Introduction, Overview, Why cloud ? How to implement cloud? Usage of cloud, Scalable Computing, Cloud computing, Characteristics of cloud computing, Classifications, Virtual machines,	6	
5	Virtualization technology, Models of distributed and cloud computing, Distributed computing, Clustering computing Grid computing, Service oriented Architecture. Implementations of Cloud computing.	4	
6	Protection & Security: Goals of protection and security, security attacks Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices	3	
7	**IoT Case Studies**: IoT case studies based on Industrial automation, Transportation **IoT Case Studies:** Agriculture, Healthcare, Home Automation	3	

Text book and Reference books:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer

International Publishing

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Define basic topology of IoT
2	Analyze the components and methods of data acquiring, organizing and analytics for IoT applications
3	Interpret models of distributed and cloud computing.
4	Compare different Application protocols for IoT.
5	Infer the role of Security in IoT.
6	Judge the applications of IoT.

Machine Learning
Code: PEC-IT602C
Contacts: 3L

Name of the Course:	**Machine Learning**
Course Code: **PEC-IT602C**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:

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

Pre-Requisite:

1	Must be comfortable with variables, linear equations, graphs of functions, histograms, and statistical means.
2	Should have some experience programming in Python
3	Basic knowledge of statistics and mathematics

Unit	Content	Hrs/Unit	Marks/Unit
1	**Supervised Learning (Regression/Classification)** Basic methods: Distance-based methods, Nearest-Neighboures, Decision Trees, Naive Bayes Linear models: Linear Regression, Logistic Regression, Generalized Linear Models, Support Vector Machines, Nonlinearity and Kernel Methods, Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	7	

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)	4	
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	6	
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	8	
6	Recent trends in various learning techniques of machine learning and classification methods	5	

Text book and Reference books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Develop an appreciation for what is involved in Learning models from data
2	Understand a wide variety of learning algorithms
3	Understand how to evaluate models generated from data
4	Apply the algorithms to a real problem, optimize the models learned and report on the expected accuracy that can be achieved by applying the models

Big Data Analytics
Code: OEC-IT601A
Contacts: 3L

Name of the Course:	**Big Data Analytics**
Course Code: **OEC-IT601A**	Semester: VI
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15

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Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	To understand the big data for business intelligence.
2	To Learn business case studies for big data analytics.
3	To understand Nosql big data management.
4	To perform map-reduce analytics using Hadoop and related tools

Pre-Requisite:	
1	Should have knowledge of one Programming Language, SQL (queries and sub queries), exposure to Linux Environment.

Unit	Content	Hrs/Unit	Marks/Unit
1	What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics	6	
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.	6	
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	7	
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	8	
5	Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data	5	

	model, Cassandra examples, Cassandra clients, Hadoop integration.		
6	Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	4	

Text book and Reference books:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of
4. Polyglot Persistence", Addison-Wesley Professional, 2012.
5. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
6. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
7. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
8. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
9. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010. 10. Alan Gates, "Programming Pig", O'Reilley, 2011.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify Big Data and its Business Implications.
2	List the components of Hadoop and Hadoop Eco-System
3	Access and Process Data on Distributed File System
4	Manage Job Execution in Hadoop Environment
5	Develop Big Data Solutions using Hadoop Eco System
6	Analyze Infosphere BigInsights Big Data Recommendations.

Cyber Law & Ethics

Code: OEC-IT601B

Contacts: 3L

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

1	To explore the technical, legal, and social issues related to cybercrimes, Laws Cyber Ethics.
2	It is also required to have knowledge of Cyber Ethics and its role and significance
Pre-Requisite:	
1	Basic knowledge of internet, fundamentals of computer and laws

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction of Cybercrime**: What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion. Category of Cybercrime: how criminals plan attacks, passive attack, Active attacks, cyber stalking.	8	
2	**Cybercrime Mobile & Wireless devices**: Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop	8	
3	**Tools and Methods used in Cyber crime**: Proxy servers, panword checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow.	8	
4	**Phishing & Identity Theft**: Phising methods, ID Theft; Online identity method. Cybercrime & Cybersecurity: Legal aspects, Indian laws, IT act, Public key certificate.	8	
5	**International Laws governing Cyber Space**: Introduction to International Cyber Law, UNCITRAL, and Cyber Laws: Legal Issues and Challenges in India, Net neutrality, Role of INTERPOL.	4	
6	**Cyber Ethics:** The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.	4	

Text book and Reference books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India
2. Cyber Laws: Intellectual property & E Commerce, Security- Kumar K, dominant Publisher
3. Cyber Ethics 4.0, Christoph Stuckelberger, Pavan Duggal, by Globethic
4. Information Security policy & Implementation Issues, NIIT, PHI
5. Computers, Internet and New Technology Laws, Karnika Seth, Lexis Nexis Butterworths Wadhwa Nagpur.
6. Legal Dimensions of Cyber Space, Verma S, K, Mittal Raman, Indian Law Institute, New Delhi,

7. Cyber Law, Jonthan Rosenoer, Springer, New York, (1997).
8. The Information Technology Act, 2005: A Handbook, OUP Sudhir Naib,, New York, (2011)
9. Information Technology Act, 2000, S. R. Bhansali,, University Book House Pvt. Ltd., Jaipur (2003).
10. Cyber Crimes and Law Enforcement, Vasu Deva, Commonwealth Publishers, New Delhi, (2003)

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
2	Locate and apply case laws and common laws to current legal dilemmas in the technology field
3	Apply diverse viewpoints to ethical dilemmas in the information technology field and recommend appropriate actions.
4	Regulation of cyber space at national and international level.
5	Upholding ethical standards in cyber laws and intellectual property issues118

Mobile Computing
Code: OEC-IT601C
Contacts: 3L

Name of the Course:	**Mobile Computing**
Course Code: **OEC-IT601C**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	Discuss different QoS factors over wired and wireless channels in respect to the mobile Computing
2	Illustrate the basic architecture of cellular communication
3	Explain different factors to enhance the capacity of the cellular network in different generations.
4	Explain the issues related to Satellite systems, Virtual Networks like Bluetooth
5	Discuss the security issues and protection techniques in different Mobile Networks
Pre-Requisite:	

1	Concept of Computer Networks

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signaling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signaling.	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	5	

Text book and Reference books:

1. Pervasive Computing, Burkhardt, Pearson
2. Mobile Communication, J. Schiller, Pearson
3. Wireless and Mobile Networks Architectures, Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001
4. Mobile and Personal Communication systems and services, Raj Pandya, Prentice Hall of India, 2001.
5. Guide to Designing and Implementing wireless LANs, Mark Ciampa, Thomson learning, Vikas Publishing House, 2001
6. Wireless Web Development, Ray Rischpater, Springer Publishing,
7. The Wireless Application Protocol, Sandeep Singhal, Pearson .
8. Third Generation Mobile Telecommunication systems, by P.Stavronlakis, Springer Publishers

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Discuss different QoS factors over wired and wireless channels in respect to mobile computing
2	Illustrate the basic architecture of cellular communication
3	Demonstrate the different technologies behind mobility in Cellular Communication
4	Understand the characteristics and limitations of mobile hardware devices including their user-interface modalities
5	Analyze the security issues in different Mobile Networks

Bioinformatics
Code: OEC-IT601D
Contacts: 3L

Name of the Course:	**Bioinformatics**
Course Code: **OEC-IT601D**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To provide the basic knowledge of molecular biology, interdisciplinary knowledge required in bioinformatics to the students having background in computer science and engineering
2	To make the students familiar with the use of a wide variety of biological databases/structures and to enable them to extract relevant information using appropriate algorithms
3	To equip the students with computational intelligence techniques so that they are able to do research in computational biology and R&D in biotechnological industry and medicine.

Pre-Requisite:	
1	Design & of Analysis of Algorithms, Data Structure, Machine Learning

Unit	Content	Hrs/Unit	Marks/Unit
1	**INTRODUCTION TO MOLECULAR BIOLOGY** Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways	5	

2	**Sequence Databases** Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;	2	
3	**DNA SEQUENCE ANALYSIS** DNA Mapping and Assembly: Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.	14	
4	**Introduction Probabilistic models used in Computational Biology** Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics	9	
5	**Biological Data Classification and Clustering** Assigning protein function and predicting splice sites: Decision Tree	6	

Text book and Reference books:

1. Claverie, J.M. and Notredame C. 2003 Bioinformatics for Dummies. Wiley Editor
2. Letovsky, S.I. 1999 Bioinformatics. Kluwer Academic Publishers.
3. Baldi, P. and Brunak, S. 2001 Bioinformatics: The machine learning approach, The MIT Press
4. Fogel, G.B. and Corne, D.W., 1997 Evolutionary Computation in Bioinformatics.
5. Rastogi et al 2003. Bioinformatics: Concepts, Skills and Applications. CBS
6. Rashidi and Buchler 2000. Bioinformatics Basics. CRC Press

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understanding the methodologies used for database searching, and determining the accuracies of database search.
2	Application of probabilistic model to determine important patterns.
3	Determine the protein function from sequence through analyzing data

4	Optimization of weights in a supervised and unsupervised neural network, and application of supervised learning to predict sub- cellular localization of a protein.
5	Analysis and development of models for better interpretation of biological data to extract knowledge.
6	Application of stochastic context-free grammar (SCFG) to predict RNA secondary structure.

Robotics
Code: OEC-IT601E
Contacts: 3L

Name of the Course:	**Robotics**
Course Code: **OEC-IT601E**	Semester: VI
Duration: 6 months	Maximum Marks:100

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

Objective:

1	To impart knowledge about the engineering aspects of Robots and their application

Pre-Requisite:

1	Basic knowledge on AI, mathematics and programming

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction, Brief history, types, classification and usage (basic concept), Science and Technology of robots, Interdisciplinary Areas in robotics, Applications and advantages of Robots	2	
2	Various components of Robotic System: Links and Joints, End-effecter/Gripper, Drive/Actuator, Controller, Sensor,Connectivity/degrees of freedom of a joint, Joints with one, two and three Degrees of freedom: Prismatic joint, Revolute joint, spherical Joint/Ball and Socket joint, Hooke/Universal Joint, Linear Joint and Rotary joint, Representation of joints, Degrees of freedom (DOF) of a System, Finding mobility/DOF of spatial and planar manipulators, Serial and Parallel manipulators, Grubler's criteria, numerical examples	3	
3	Classification of Robot: Point-to-point robots and Continuous Path robots, Non-servo controlled robots and servo controlled robots, Cartesian coordinate robots, cylindrical coordinate robots, polar coordinate robots and articulated coordinate robots, Robots with fixed base and mobile robots, Workspace of manipulators, Definition of Resolution, accuracy and repeatability, Types of robot end-effectors/grippers: single and	5	

	double gripper, internal and external gripper, hard and soft gripper, active and passive gripper,Robot teaching: Online and offline method, Specification of a Robot, Economic Analysis: Pay-back period, rate of return or investment, Numerical examples		
4	Representation of an object in 3d space, position, orientation, Frame Transformations: Translation and rotation of a frame, Homogeneous transformation, Roll, pitch and yaw angles, Euler angles, numerical examples, Denavit-Hartenberg Notations and rules to assign coordinate system at different joints, Link and joint parameters, Offset of link and joint angle, Rules for coordinate assignment, Forward and inverse kinematics problems, examples of Kinematics, Link representation using D-H parameters, Examples of D-H parameters and link transforms	8	
5	Trajectory Planning: cartesian scheme, Joint Space Scheme, Polynomial and Linear Trajectory functions with numerical examples, angular velocity, Singularity checking through jacobian	3	
6	Forward and Inverse Dynamics, inertia tensor, Moment of inertia,Lagrange-Euler formulation, Determination of potential and kinetic energy of the manipulator, Determination of Robotic joint torques	4	
7	Partitioned control scheme, control of motor, control architecture,Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes	4	
8	Robot vision: Steps to be followed, frame grabbing, methods of pre-processing: masking, neighborhood averaging, median filtering, edge detection, boundary descriptors, Robot motion planning: visibility graph, Voronoi Diagram, Intelligent robot	5	

Text book and Reference books:

1. King Sun Fu, Ralph Gonzalez, and CS George Lee. Robotics: Control Sensing. Vis. Tata McGraw-Hill Education, 1987.
2. Mark W.Spong, Seth Hutchinson, and MathukumalliVidyasagar. Robot modeling and control. Vol. 3. New York: Wiley, 2006.
3. H. R. Everett, Sensors for moblle robots. AK Peters/CRC Press, 1995.
4. UlrichNehmzow, Mobile robotics: a practical introduction. Springer Science & Business Media, 2012.
5. Ashitava Ghosal, Robotics: fundamental concepts and analysis. Oxford university press, 2006.
6. Subir KumarSaha,. Introduction to robotics. Tata McGraw-Hill Education, 2014.
7. R. K.Mittal, and I. J. Nagrath. Robotics and control. Tata McGraw-Hill, 2003.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Illustrate the importance of robotics, and comprehend the basic terminologies in robotics
2	Comprehend and evaluate the forward and inverse kinematics of robots
3	Comprehend and evaluate the differential motion and velocity relationships for robots
4	Develop dynamic equations of motion and discuss methods of trajectory planning.

Project-I
Code: PROJ-IT691
Contacts: 6L

Name of the Course:	**Project-I**
Course Code: **PROJ-IT691**	Semester: VI
Duration: 6 months	Maximum Marks:100

Teaching Scheme	**Examination Scheme**
Theory: NIL	Mid Semester exam:
Tutorial: NIL	Assignment and Quiz:
	Attendance:
Practical: 6Hrs./week	End Semester Exam:
Credit Points:	3

Objectives and detailed process:	
1	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	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/ Modeling/ 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.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify the problem
2	Compare existing literature.
3	Design experimental set-up and methodology
4	Apply modern tools
5	Analyze data
6	Develop valid conclusions & recommendations

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

SEMESTER-VII (Fourth Year)

Internet & Web Technology
Code: PCC-IT701
Contacts: 3L

Name of the Course:	**Internet & Web Technology**
Course Code: **PCC-IT701**	Semester: VII
Duration: 6 months	Maximum Marks:100

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

Objectives:	
1	Describe the concepts of WWW including browser and HTTP protocol.
2	List the various HTML tags and use them to develop the user friendly web pages.
3	Define the CSS with its types and use them to provide the styles to the web pages at various levels.
4	Develop the modern web pages using the HTML and CSS features with different layouts as per need of applications.
5	Use the JavaScript to develop the dynamic web pages.
6	Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.
7	Develop the modern Web applications using the client and server side technologies and the web design fundamentals.
Pre-Requisites:	
1	Basic knowledge of data structure, database and programming

Unit	**Content**	**Hrs/Unit**	**Marks/Unit**
1	**Introduction to Internet Technology:** Overview, Network of Networks, Intranet, Extranet and Internet, World Wide Web: Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. **Review of TCP/IP**: Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. **IP Subnetting and addressing**: Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables, Internet Routing Protocol .Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail POP3, SMTP.	6	

2	**HTML, Image Maps, XML, CGI Scripts:** Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value, map, area, attributes of image area. Extensible Markup Language, Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. Introduction, Environment Variable, GET and POST Methods	9	
3	**Perl, Java Script, Java applets:** Introduction, Variable, Condition, Loop, Array, Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Definition of cookies, Create and Store a cookie with example. Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.	10	
4	**Client-Server programming In Java Threats, Network Security techniques:** Java Socket, Java RMI, Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH), Introduction, Packet filtering, Stateful, Application layer, Proxy	4	
5	**Internet Telephony, Multimedia Applications, Multimedia Applications:** Introduction, VoIP. Multimedia Applications **Multimedia over IP**: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	5	

Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Define the principal of Internetworking, TCP/IP protocols, World Wide Web, client-server architecture, IP addressing, routing etc.

2	Explain the need for secured web application development with client-side, server-side scripting languages.
3	Construct web programs using the web languages--HTML, XML, JavaScript, Applet, Perl, etc.
4	Design and Develop small interactive websites using modern tools following the professional web based engineering solutions, ethics and management techniques.
5	Explain the advanced technologies like network security, multimedia applications, search engine, web crawler, etc with the websites.

Internet & Web Technology Lab
Code: PCC-IT791
Contacts: 4P

Name of the Course:	**Internet & Web Technology Lab**
Course Code: **PCC-IT791**	Semester: VII
Duration:6 months	Maximum Marks:100
Teaching Scheme:	
Theory: -	Continuous Internal Assessment
Tutorial: NIL	External Assessment: 60
Practical: 4 hrs./week	Distribution of marks:40
Credit Points:	2
Objective:	
1	To teach the basics involved in publishing content on the World Wide Web.
2	To analyze a web page and identify its elements and attributes.
3	To create web pages using XHTML and Cascading Style Sheets.
4	To build dynamic web pages using JavaScript (Client side programming).
5	To create XML documents and Schemas.
Laboratory Experiments:	
1	Create a form by using various attributes of the input tags.
2	Create a web page multiple types of style sheet used in a single page.
3	Write a CGI sample program to send output back to the user.
4	Write a Java Script program by using variables.
5	Write a java script program to multiply two numbers and display the result in separate text box.
6	Write a java script program on Form Validations.
7	Write an AJAX program checking the presence of XMLHttpRequest object.
8	Write a program to create sales report for our books by using AJAX.
9	Create an XML document template to describe the result of students in an examination. The description should include the student's roll number, name, three subject names and marks, total marks, percentage and results.
10	Write an XSLT code to only retrieve the book titles and their prices.
11	Design basic elements of a home page.

Any experiment specially designed based on the theory syllabus will be followed
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Course Outcomes:

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

On completion of the course students will be able to

CO	STATEMENT
1	Explain internet development techniques and Protocols leading Web.
2	Understand the different approaches in network security model.
3	Design different web pages using HTML, XML, CSS, JavaScript, and Java applet
4	Create client-server model using socket programming techniques
5	Develop interactive internet/web applications based on Servlets and JSP
6	

Multimedia Technology
Code: PEC-IT702A
Contacts: 3L

Name of the Course:	**Multimedia Technology**
Course Code: **PEC-IT702A**	Semester: VII
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To enable graduates to excel in multimedia technology and information technology profession by adapting to rapid advances in newer technologies.
2	To provide graduates a proper foundation in mathematical, scientific, multimedia and engineering fundamentals to solve real world problems.
3	To train graduates with good scientific, multimedia technologies and solve real time problems.

Pre-Requisite:	
1	The fundamentals of computer

Unit	Content	Hrs/ Unit	Marks/ Unit
1	**Introduction:** Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications	2	
2	**Text and Audio, Image and Video:** 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, 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.	14	

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, Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	8	
4	**Image and Video Database, Document Architecture and Content Management:** Image representation, segmentation, similarity based retrieval, image retrieval by color, shape and texture; indexing- k-d 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 of Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC **Problems**: Reader's & Writer Problem, Dinning Philosopher Problem etc.	8	
5	**Multimedia Applications:** Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors	4	

Text book and Reference books:

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications & Applications , Pearson Ed.
2. Nalin K. Sharda , Multimedia Information System , PHI.
3. Zred Halsall , Multimedia Communications , Pearson Ed.
4. Koegel Buford , Multimedia Systems , Pearson Ed.
5. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
6. Ralf Steinmetz and Klara Nahrstedt , Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing , PHI.
7. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand the policy issues related to privacy, intellectual property rights, and establishing identity those are germane to electronic commerce along with the Internet and related technologies
2	Comprehend the underlying economic mechanisms and driving forces of E-Commerce
3	Analyse the impact that electronic commerce is facing and outlines the different digital transaction

	process and basic concepts of e-commerce
4	Identify the importance of digital library and specify the development of electronic commerce capabilities in a company
5	Appraise the opportunities and potential to apply and synthesize a variety of e Commerce concepts and solutions to create business value for organizations, customers, and business partners.
6	To gain knowledge of the ethical, social, and security issues of information systems

Neural Networks and Deep Learning
Code: PEC-IT702B
Contacts: 3L

Name of the Course:	**Neural Networks and Deep Learning**
Course Code: **PEC-IT702B**	Semester: VII
Duration: 6 months	Maximum Marks:100

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

Objective:

1	To understand motivation and functioning of the most common types of neural networks
2	The students will be familiar with the significant technological trends driving the rise of deep learning; build, train, and apply fully connected deep neural networks; implement efficient (vectorized) neural networks; identify key parameters in a neural network's architecture; and apply deep learning to your own applications.

Pre-Requisite:

1	Basic knowledge of cognitive science or artificial intelligence and statistics

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

	training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.		
6	**Deep Learning research:** Object recognition, sparse coding, computer vision, natural language	6	

Text book and Reference books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Model Neuron and Neural Network, and to analyze ANN learning, and its applications.
2	Perform Pattern Recognition, Linear classification.
3	Develop different single layer/multiple layer Perception learning algorithms
4	Design of another class of layered networks using deep learning principles.

Soft Computing
Code: PEC-IT702C
Contacts: 3L

Name of the Course:	**Soft Computing**	
Course Code: **PEC-IT702C**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	Fuzzy logic and its applications.	
2	Artificial neural networks and its applications.	
3	Solving single-objective optimization problems using GAs.	
4	Solving multi-objective optimization problems using Evolutionary algorithms (MOEAs).	
5	Applications of Soft computing to solve problems in varieties of application domains.	
Pre-Requisite:		
1	A strong mathematical background.	

2	Proficiency with algorithms.
3	Programming skills in C, C++, or Java, MATLAB, etc.
4	Critical thinking and problem solving skills

Unit	Content	Hrs/ Unit	Marks/ 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 – 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	10	
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; Back-propagation and multi layer networks. **Competitive learning networks**: Kohonen self organizing networks, Hebbian learning; Hopfield Networks. **Neuo-Fuzzy modeling**: Applications of Neural Networks: Pattern Recognition and classification	8	
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	8	
5	**PSO:** Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	4	

Text book and Reference books:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
3. Principles of Soft Computing , S N Sivanandam, S. Sumathi, John Wiley & Sons
4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH
7. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
8. A beginners approach to Soft Computing, Samir Roy & Udit Chakraborty, Pearson
9. Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall
10. Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Develop intelligent systems leveraging the paradigm of soft computing techniques.
2	Implement, evaluate and compare solutions by various soft computing approaches for finding the optimal solutions.
3	Recognize the feasibility of applying a soft computing methodology for a particular problem
4	Design the methodology to solve optimization problems using fuzzy logic, genetic algorithms and neural networks.
5	Design hybrid system to revise the principles of soft computing in various applications

Adhoc –Sensor Network
Code: PEC-IT702D
Contacts: 3L

Name of the Course:	**Adhoc –Sensor Network**	
Course Code: **PEC-IT702D**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	provide an overview about sensor networks and emerging technologies	
2	To study about the node and network architecture of sensor nodes and its execution environment.	
3	To understand the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN	
4	To learn about topology control and clustering in networks with timing	

	synchronization for localization services with sensor tasking and control.
Pre-Requisite:	
1	Basic knowledge of computer networking and mobile communication

Unit	Content	Hrs/ Unit	Marks/ Unit
1	**Introduction and Overview:** 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 principles for WSNs, service interfaces for WSNs.	9	
3	**Communication Protocols**: 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 protocols- classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, 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	6	
5	**Sensor Network Platforms and Tools:** Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.	8	

Text book and Reference books:

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2. Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
3. Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, and Applications", John Wiley, 2007.
4. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
5. Thomas Haenselmann, "Sensor Networks", available online for free, 2008.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Describe the unique issues in ad-hoc/sensor networks.
2	Describe current technology trends for the implementation and deployment of wireless ad-hoc/sensor networks.
3	Discuss the challenges in designing MAC, routing and transport protocols for wireless ad-hoc/sensor networks.
4	Discuss the challenges in designing routing and transport protocols for wireless Ad-hoc/sensor networks.
5	Comprehend the various sensor network Platforms, tools and applications.
6	Illustrate the issues of routing in wsn and QoS related performance measurements

Information Theory and Coding
Code: PEC-IT702E
Contacts: 3L

Name of the Course:	**Information Theory and Coding**	
Course Code: **PEC-IT702E**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	To develop an understanding of modern network architectures from a design and performance perspective.	
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	
3	To provide an opportunity to do network programming	
4	To provide a WLAN measurement ideas.	
Pre-Requisite:		

1	Basic knowledge of statistics and mathematics

Unit	Content	Hrs/ Unit	Marks/ Unit
1	**Source Coding** Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes	5	
2	**Channel Capacity And Coding** Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit	5	
3	**Linear And Block Codes For Error Correction** Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes	8	
4	**Cyclic Codes** Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.	5	
5	**BCH Codes** Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.	6	
6	**Convolutional Codes** Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding	7	

Text book and Reference books:

1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Design the channel performance using Information theory.
2	Comprehend various error control code properties
3	Apply linear block codes for error detection and correction
4	Apply convolution codes for performance analysis & cyclic codes for error detection and correction.
5	Design BCH & RS codes for Channel performance improvement against burst errors

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Cyber Security
Code: PEC-IT702F
Contacts: 3L

Name of the Course:	**Cyber Security**
Course Code: **PEC-IT702F**	Semester: VII
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To introduce the fundamentals of science and engineering concepts essential for a computer engineer.
2	To inculcate the knowledge of mathematical foundations and algorithmic principles for effective problem solving.
3	To provide knowledge in computer systems and professional skills in prevention, investigation and alleviate the cyber-attacks.
4	To impart knowledge to analyze, design, test and implement software required for various applications.
5	To hone personality skills, trigger social commitment; inculcate societal responsibilities and implementation of best security practices.

Pre-Requisite:	
1	Basic knowledge of computer networking and security

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	**Introduction**: Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyber warfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cyber security - Organizational Implications.	6	
2	**Hackers and Cyber Crimes**: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.	7	
3	**Ethical Hacking and Social Engineering**: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modeling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defense Strategies.	8	
4	**Cyber Forensics and Auditing**: Introduction to Cyber	10	

	Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, and Collecting Network based Evidence, Writing Computer Forensics Reports, and Auditing; Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013		
5	**Cyber Ethics and Laws**: Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec.	5	

Text book and Reference books:

1. Cyber security , Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security and Cyber Laws, Pankaj Agarwal
3. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cyberdefense Program Against Advanced Threats, A-press
4. Nina Godbole, SumitBelapure, Cyber Security, Willey
5. Hacking the Hacker, Roger Grimes, Wiley
6. Cyber Law By Bare Act, Govt Of india, It Act 2000

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify vulnerabilities critical to the information assets of an organization
2	Analyze and resolve security issues in networks and computer systems to secure an IT infrastructure.
3	Apply critical thinking and problem-solving skills to detect current and future attacks on an organization's computer systems and networks.
4	Develop policies and procedures to manage enterprise security risks
5	Evaluate and communicate the human role in security systems with an emphasis on ethics, social engineering vulnerabilities and training
6	Apply business principles to analyze and interpret data for planning, decision-making, and problem solving in an information security environment

Cloud Computing
Code: PCC-IT702G
Contacts: 3L

Name of the Course:	**Cloud Computing**
Course Code: **PCC-IT702G**	Semester: VII
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks

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	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3
Objective:	
1	The course provides a unified and fundamental view of the broad field of computer networks.
2	The easy to understand and extremely relevant world of Computer Net working is introduced in a top down Approach.
3	Introduction to intranets and intranet servers and browsers, networks and network servers, LANs/WANs, internetworking technologies, the OSI reference model for networking protocols, CSMA/CD, TCP/IP implementation
Pre-Requisite:	
1	Basic knowledge of computer networking

Unit	Content	Hrs/Unit	Marks/Unit
1	**Definition of Cloud Computing and its Basics:** Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)	9	
2	**Use of Platforms in Cloud Computing** Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types,	12	

	VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance,Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks, Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services,		
3	**Cloud Infrastructure**: Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)	7	
4	**Concepts of Services and Applications :** Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service	8	

	Bus, Service catalogs, Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services		

Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Articulate the main concepts, key technologies, strengths and limitations of cloud computing.
2	Explain the key and enabling technologies that help in the development of cloud.
3	Apply NIST cloud computing architecture to solve architecture design challenges
4	Explain the core issues of cloud computing such as resource management and security.
5	Apply current cloud technologies.
6	Illustrate and choose the appropriate technologies, algorithms and approaches for implementation and use of cloud.

Operations Research
Code: OEC-IT701A
Contacts: 3L

Name of the Course:	**Operation Research**
Course Code: **OEC-IT701A**	Semester: VII
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks

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	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	This module aims to introduce students to use quantitative methods and techniques for effective decisions–making; model formulation and applications that are used in solving business decision problems.
2	Analytic techniques and computer packages will be used to solve problems facing business managers in decision environments.
Pre-Requisite:	
1	Basic knowledge of mathematics

Unit	Content	Hrs/ Unit	Marks/ Unit
1	Basic LPP and Applications; Various Components of LP Problem Formulation. Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.	17	
2	Network Analysis: Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control: Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock	9	
3	Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance	5	
4	Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	5	

Text book and Reference books:

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

Course Outcomes:

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On completion of the course students will be able to

CO	STATEMENT
1	Solve Linear Programming Problems
2	Identify and develop operational research models from the verbal description of the real system
3	Solve Transportation and Assignment Problems
4	Understand the usage of game theory and Simulation for Solving Business Problems
5	Develop operational research models from the verbal description of the real system.

Introduction to Philosophical Thoughts
Code: OEC-IT701B
Contacts: 3L

Name of the Course:	**Introduction to Philosophical Thoughts**
Course Code: **OEC-IT701AB**	Semester: VII
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	After taking this class, the students should have a good preliminary understanding of the scope and method of academic analytic philosophy, and they should also have a basic understanding of what makes for a good philosophical argument.
2	This class also fulfills a writing requirement, so the students should come out of it having improved their understanding of what makes for clear and convincing writing.
3	Students in this particular course will explore fundamental philosophical concepts and learn to deploy a variety of philosophical methods to resolve issues that arise in thinking about reality, knowledge, morality, religion, and logic.
Pre-Requisite:	
1	Basic knowledge of human thoughts and philosophy

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	**Nature of Indian Philosophy:** Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views : Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta,Rna	13	
2	**Carvaka school:** its epistemology, metaphysics and ethics. Mukti	8	
3	**Jainism:** Concepts of sat, dravya, guna, paryaya, jiva, ajiva,	5	

	anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation.		
4	**Buddhism:** theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism : Vaibhasika, Sautrantrika, Yogacara, Madhyamika	5	
5	**Nyaya:** theory of Pramanas; the individual self and its liberation; the idea of God and proofs for His existence.	5	

Text book and Reference books:

1. M. Hiriyanna: Outlines of Indian Philosophy.
2. C.D.Sharma: A Critical Survey of Indian Philosophy.
3. S.N.Das Gupta: A History of Indian Philosophy Vol – I to V.
4. S.Radhakrishnan: Indian Philosophy Vol – I & II.
5. T.R.V.Murti: Central Philosophy of Buddhism.
6. J.N.Mahanty: Reason and Tradition of Indian Thought.
7. R.D.Ranade: A Constructive Survey of Upanisadic Philosophy.
8. P.T.Raju: Structural Depths of Indian Thought.
9. K.C.Bhattacharya: Studies in Philosophy Vol – 1.
10. Datta and Chatterjee: Introduction of Indian Philosophy

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Describe and distinguish key ethical concepts.
2	Read and comprehend philosophical texts, classical or contemporary, in the area of ethics.
3	Discuss core ethical problems, such as whether religion is a source of values
4	Write clear and concise explanations and arguments about basic ethical problems.
5	Distinguish the basic ethical theories and approaches
6	Apply basic ethical concepts and approaches to solving practical problems in ethics

Soft Skill & Interpersonal Communication
Code: OEC-IT701C
Contacts: 3L

Name of the Course:	**Soft Skill & Interpersonal Communication**
Course Code: **OEC-IT701C**	Semester: VII
Duration: 6 months	Maximum Marks:100

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

Objective:

1	To acquire the knowledge of Phonetics and Phonemic sounds.

2	To learn Word stress, Accent and Intonation.
3	To study the techniques of day to day conversation and Group Discussions to strengthen the Learner's Speaking skills.
4	To enhance the confidence levels by acquiring knowledge of Role-plays, Debates and Group Discussions.
5	To present various aspects of writing by the means of Interpreting and Data Transformation.
Pre-Requisite:	
1	Basic knowledge of English language

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

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Text book and Reference books:

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

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Exhibit effective interpersonal communication in a different contextual environment with proper body language.
2	Effectively apply active listening skills for better perception and information
3	Exhibit de-escalatory behaviors in situations of conflict.
4	Give critical feedback effectively (non-threatening).
5	Receive, and reflect on, critical feedback from others.
6	Demonstrate acknowledgment and validation of the feelings, viewpoints, and contributions of others.

Numerical Methods
Code: OEC-IT701D
Contacts: 3L

Name of the Course:	**Numerical Methods**	
Course Code: **OEC-IT701D**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	To introduce the basic concepts of solving algebraic and transcendental equations.	
2	To introduce the numerical techniques of interpolation in various intervals in real life	
3	To acquaint the student with understanding of numerical techniques of differentiation and situations.	
4	To acquaint the knowledge of various techniques and methods of solving ordinary deferential integration which plays an important role in engineering and technology disciplines.	
5	To understand the knowledge of various techniques and methods of solving various types of partial deferential equations.	
Pre-Requisite:		

1	Basic knowledge of mathematics

Unit	Content	Hrs/ Unit	Marks/ Unit
1	Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors.	4	
2	Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation.	10	
3	Numerical integration: Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms.	5	
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.	5	
6	Numerical solution of ordinary differential equation: Euler's method, Runge-Kutta methods, Predictor-Corrector methods and Finite Difference method	4	

Text book and Reference books:

1. C.Xavier: C Language and Numerical Methods.
2. Dutta & Jana: Introductory Numerical Analysis.
3. J.B.Scarborough: Numerical Mathematical Analysis.
4. Jain, Iyengar , & Jain: Numerical Methods (Problems and Solution).
5. Balagurusamy: Numerical Methods, Scitech.
6. Baburam: Numerical Methods, Pearson Education.
7. N. Dutta: Computer Programming & Numerical Analysis, Universities Press

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Demonstrate competence with understanding the theoretical and practical aspects of the use of numerical methods.
2	Establish the limitations, advantages, and disadvantages of different numerical methods
3	Implement numerical methods for solving various engineering problems.
4	Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions to otherwise intractable mathematical problems.
5	Apply numerical methods to obtain approximate solutions to mathematical problems.
6	Analyze and evaluate the accuracy of common numerical methods.

Project Management
Code: OEC-IT701E
Contacts: 3L

Name of the Course:	Project Management

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Course Code: **OEC-IT701E**		Semester: VII	
Duration: 6 months		Maximum Marks:100	
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:		3	
Objective:			
1	To make them understand the concepts of Project Management for planning to execution of projects.		
2	To make them understand the feasibility analysis in Project Management and network analysis tools for cost and time estimation.		
3	To enable them to comprehend the fundamentals of Contract Administration, Costing and Budgeting.		
4	Make them capable to analyze, apply and appreciate contemporary project management tools and methodologies in Indian context.		
Pre-Requisite:			
1	Basic knowledge of mathematics		

Unit	Content	Hrs/ Unit	Marks/ Unit
1	Project Management Concepts: Concept and Characteristics of a Project, Importance of Project Management	3	
2	Project Planning: Project Evaluation, Financial Sources, Feasibility Studies	4	
3	Project Scheduling: Importance of Project Scheduling, Work Breakdown Structure and Organization Breakdown Structure, Scheduling Techniques – Gantt Chart and LOB, Network Analysis – CPM/PERT.	6	
4	Time Cost Trade-off Analysis – Optimum Project Duration.	4	
5	Resource Allocation and Leveling.	3	
6	Project Life Cycle.	2	
7	Project Cost – Capital & Operating Costs, Project Life Cycle Costing, Project Cost Reduction Methods.	3	
8	Project Quality Management: Concept of Project Quality, TQM in Projects, Project Audit.	4	
9	Software Project Characteristics and Management	2	
10	IT in Projects: Overview of types of Software's for Projects, Major Features of Project Management Software's like MS Project, Criterion for Software Selection.	5	

Text book and Reference books:

1. Gopalkrishnan P. and Rama Mmoorthy: Text Book of Project Management, Macmillan
2. Nicholas John M.: Project Management for Business and Technology – Principles

and Practice, Prentice Hall India, 2nd Edn.
3. Levy Ferdinand K., Wiest Jerome D.: A Management Guide to PERT/CPM with GERT/PDM/DCPM and other networks, Prentice Hall India, 2nd Edn.
4. Mantel Jr., Meredith J. R., Shafer S. M., Sutton M. M., Gopalan M. R.: Project Management: Core Text Book, Wiley India, 1st Indian Edn.
5. Maylor H.: Project Management, Pearson, 3rd Edn.
6. Nagarajan K.: Project Management, New Age International Publishers, 5th Edn.
7. Kelkar. S.A, Sotware Project Management: A concise Study, 2nd Ed., PHI

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand project characteristics and various stages of a project.
2	Understand the conceptual clarity about project organization and feasibility analyses – Market, Technical, Financial and Economic.
3	Analyze the learning and understand techniques for Project planning, scheduling and Execution Control.
4	Apply the risk management plan and analyze the role of stakeholders.
5	Understand the contract management, Project Procurement, Service level Agreements and productivity.
6	Understand the How Subcontract Administration and Control is practiced in the Industry.

Management 1 (Organizational Behavior)
Code: HSMC-IT701
Contacts: 3L

Name of the Course:	**Management 1 (Organizational Behavior)**	
Course Code: **HSMC-IT701**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	Increase the knowledge of OB concepts, which will help to understand and analyze how organizations and the people within them work.	
2	Provide opportunities to apply OB concepts to real-world problems faced by individuals.	
3	Develop the leadership and management potential.	
Pre-Requisite:		
1	Basic knowledge of organization and levels of organization	

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Unit	Content	Hrs/ Unit	Marks/ Unit
1	Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB.	3	
2	Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.	4	
3	Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making.	3	
4	Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.	4	
5	Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making.	4	
6	Communication: Communication Process, Direction of Communication, Barriers to Effective Communication.	2	
7	Leadership: Definition, Importance, Theories of Leadership Styles.	4	
8	Organizational Politics: Definition, Factors contributing to Political Behaviour.	4	
9	Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process.	4	
10	Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.	4	

Text book and Reference books:

1. Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
2. Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.
3. Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
4. Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.
5. Hersey, P., Blanchard, K.H., Johnson, D.E.- Management of Organizational Behavior Leading Human Resources, PHI, 10th Edn.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Describe organizational behavior and differentiate between the three levels of influence

2	Discuss the impact that diversity of race, gender, ability, religion, and age has on the workplace
3	Recognize the importance of recognizing and valuing individuals' differences
4	Explain the importance of managing stress and emotions in the workplace
5	Identify common organizational structures and the advantages and disadvantages of each

Project-II
Code: PROJ-IT791
Contacts: 12P

Name of the Course:	**Project-II**	
Course Code: **PROJ-IT791**	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: NIL		Mid Semester exam:
Tutorial: NIL		Assignment and Quiz:
		Attendance:
Practical: 12Hrs./Week		End Semester Exam:
Credit Points:		6

Objectives and detailed process:	
1	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	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.
3	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.

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Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify the problem
2	Compare existing literature.
3	Design experimental set-up and methodology
4	Apply modern tools
5	Analyze data
6	Develop valid conclusions & recommendations

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SEMESTER-VIII (Fourth Year)

Information Security
Code: PCC-IT801
Contacts: 3L

Name of the Course:	**Information Security**		
Course Code: PCC-IT801	Semester: VIII		
Duration: 6 months	Maximum Marks:100		
Teaching Scheme		**Examination Scheme**	
Theory: 3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam:70 Marks	
Credit Points:		3	
Objective:			
1	Acquire background on hash functions; authentication; firewalls; intrusion		
2	Understand vulnerability analysis of network security.		
3	Understand network security threats, security services, and countermeasures.		
4	Obtain background for original research in network security, especially wireless security protocols		
5	Understand the tradeoffs and criteria/concerns for security countermeasure network and MANET security.		
6	Apply methods for authentication, access control, intrusion detection and development. Indentify and mitigate software security vulnerabilities in existing systems prevention.		
Pre-Requisite:			
1	Basic knowledge on internet, cryptography and information act		

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Information Security:** Basics Principles of Confidentiality, Integrity Availability Concepts, Policies, procedures, Guidelines, Standards Administrative Measures and Technical Measures, People, Process, Technology	4	
2	**Current Trends in Information Security** Current Trends in information Security, Cloud Computing: benefits and Issues related to info Sec. Standards available for Info-Sec: Cobit, Cadbury, ISO 27001, OWASP, OSSTMM, etc - An Overview, Certifiable Standards	8	
3	**Risk Assessment** Vulnerability, Threat and Risk, Risk Assessment and Mitigation + Quick fixes, Introduction to BCP / DRP / Incident management, Segregation and Separation of Duties & Roles and responsibilities, IT	8	

	ACT 2000;		
4	**Types of assessments for Information Security:** 1. VAPT of Networks 2. Web Application Audits 3. IT assessments or audits 4. Assessment of Network Equipments 5. Assessment of Security Devices (Web Filtering, Firewalls, IDS / IPS, Routers 6. Data Center Assessment 7. Security of Application Software 8. SAP Security 9. Desktop Security 10. RDBMS Security 11. BCP / DRP assessments 12. Policy reviews	6	
5	**Security Management** Windows and Linux security, Types of Audits in Windows Environment: Server Security, Active Directory (Group Policy), Anti-Virus, Mails, Malware, End point protection, Shadow Passwords, SUDO users, etc	4	
6	**Web Security** Web Application Security: OWASP, Common Issues in Web Apps, What is XSS, SQL injection, CSRF, Password Vulnerabilities, SSL, CAPTCHA, Session Hijacking, Local and Remote File Inclusion, Audit Trails, Web Server Issues, etc.	6	

Text book and Reference books:

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL: Insights from a Connected World. Morgan Kaufmann, 304.
2. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.
3. Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press. http://www.cs.cornell.edu/home/kleinber/networks-book/
4. Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press. Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Examine and apply the fundamental techniques of computer security.
2	Identify and explain risk and potential security issues
3	Demonstrate responsible computer use as it deals with social, political, legal and ethical issues in today's electronic society
4	Demonstrate knowledge of the profession, its organizations, goals and leadership roles, Literature/publications, issues, and research foundations.
5	Demonstrate knowledge of security objectives and policy development
6	Plan for the future and design a solution based on user requirements. Explain business continuity, backup and disaster recovery. Understand troubleshooting and quality consumer support

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Digital Signal Processing
Code: OEC-IT801A
Contacts: 3L

Name of the Course:	**Digital Signal Processing**
Course Code: **OEC-IT801A**	Semester: VIII
Duration: 6 months	Maximum Marks:100

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

Objective:	
1	To provide background and fundamental material for the analysis and processing of digital signals.
2	To familiarize the relationships between continuous-time and discrete-time signals and systems.
3	To study fundamentals of time, frequency and z-plane analysis and to discuss the interrelationships of these analytic method.
4	To study the designs and structures of digital (IIR and FIR) filters from analysis to synthesis for a given specifications.
	To introduce a few real-world signal processing applications

Pre-Requisite:	
1	Basic knowledge of Discrete Mathematics, electronics and Matlab

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	INTRODUCTION TO DIGITAL SIGNAL PROCESSING: Discrete time signals & systems, linear shift invariant systems, stability and causality, Discrete time systems described by difference equations, Frequency domain representation of discrete time signals and systems.	4	
2	FOURIER SERIES AND FOURIER TRANSFORMS: Discrete Fourier series representation of periodic sequences, Properties of discrete Fourier series, Discrete Fourier transforms: frequency domain sampling, , linear convolution of sequences using DFT, Computation of DFT, Relationship of DFT to other transforms, Properties of DFT, Fast Fourier transforms (FFT) - Radix-2 FFT algorithm, Radix-4 FFT algorithms, Inverse FFT.	8	
3	RANSFORMS: Review of Z-transforms, Properties of Z-transform, Rational Ztransforms, Inversion of Z- transforms, stability and causality. REALIZATION OF DIGITAL FILTERS: Structures for FIR systems: Direct form structure, Cascade form structures, Structures for IIR systems: Direct form structures, Signal flow	8	

	graphs and transposed structures, cascade form structures, Parallel form structures.		
4	DESIGN OF FIR DIGITAL FILTERS: Symmetric and antisymmeric FIR filters, Design of linear phase FIR Digital Filters using Windows, Design of linear phase FIR Digital Filters by Frequency Sampling method. DESIGN OF IIR DIGITAL FILTERS: IIR filter design by Approximation of Derivatives, IIR filter design by impulse invariance, IIR filter design by bilinear transformation, Characteristics of commonly used analog filters (Butter worth and Chebyshev), Frequency transformations, comparison of IIR & FIR filters.	8	
5	MULTIRATE DIGITAL SIGNAL PROCESSING: Decimation by a factor D, interpolation by a factor I, sampling rate conversion by a rational factor I/D, Filter Design & Implementation for sampling rate conversion, Multi stage Implementation of sampling rate conversion.	8	

Text book and Reference books:

1. John G. Proakis, Dimitris G. Manolakis (2007), Digital Signal Processing, Principles, Algorithms, and Applications,Pearson Education / PHI, India.
2. A.V. Oppenheim, R. W. Schaffer (2009), Discrete Time Signal Processing, Prentice Hall of India, New Delhi.
3. Andreas Antoniou (2006), Digital Signal Processing, Tata McGraw Hill, NewDelhi.
4. M. H. Hayes (2007), Schaums Outlines of Digital Signal Processing, Tata McGraw Hill, India.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Apply DFT for the analysis of digital signals & systems
2	Design FIR & IIR filters
3	Characterize finite Word length effect on filters
4	Understanding on basics of digital signal processing which can be applied to communication systems
5	Design the Multirate Filters

Natural Language Processing
Code: OEC-IT801B
Contacts: 3L

Name of the Course:	**Natural Language Processing**
Course Code: **OEC-IT801B**	Semester: VIII
Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks

	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	Understand approaches to syntax and semantics in NLP.
2	Understand approaches to discourse, generation, dialogue and summarization within NLP.
3	Understand current methods for statistical approaches to machine translation.
4	Understand machine learning techniques used in NLP, including hidden Markov models and probabilistic context-free grammars, clustering and unsupervised methods, log-linear and discriminative models, and the EM algorithm as applied within NLP.

Pre-Requisite:	
1	Data Structure, Theory of Computation, Compiler Design and Machine Learning

Unit	Content	Hrs/ Unit	Marks/ Unit
1	**Regular Expressions and Automata Recap** - Introduction to NLP, Regular Expression, Finite State Automata **Tokenization** - Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance **Morphology** - Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer	11	
2	**Language Modeling** Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. **Hidden Markov Models and POS Tagging** Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation.	8	
3	**Text Classification** Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. **Context Free Grammar** Context Free Grammar and Constituency, Some common CFG phenomena for English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing	9	
4	**Computational Lexical Semantics** Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based	8	

	and Distributional Word Similarity **Information Retrieval** Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback		

Text book and Reference books:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education
2. Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press
3. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Describe the fundamental concepts and techniques of natural language processing.
2	Distinguish among the various techniques, taking into account the assumptions, strengths, and weaknesses of each.
3	Use appropriate descriptions, visualizations, and statistics to communicate the problems and their solutions.
4	Analyze large volume text data generated from a range of real-world applications.

E-Commerce and ERP
Code: OEC-IT802A
Contacts: 3L

Name of the Course:	**E-Commerce and ERP**	
Course Code: **OEC-IT802A**	Semester: VIII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory:3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam:70 Marks
Credit Points:		3
Objective:		
1	Define E-Marketplaces and list their components.	
2	Describe the types of Intermediaries in EC and their roles	
3	Describe electronic Catalogs, Shopping carts, and search Engines	
4	List the Major types of Electronic Markets and describe their features	
5	This course provides an introduction to information systems for business and	

	management.
6	It is designed to familiarize students with organizational and managerial foundations of systems, the technical foundation for understanding information systems
Pre-Requisite:	
1	Basic knowledge of internet, marketing and software

Unit	Content	Hrs/ Unit	Marks/ Unit
1	Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws.	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	
3	Business Models of e – commerce: Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance.	2	
4	E – Strategy: Overview, Strategic Methods for developing E – commerce.	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	
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	
7	E – Payment Mechanism: Payment through card system, E - Cheque, E – Cash, E – Payment Threats & Protections.	1	
8	E – Marketing:. Home –shopping, E-Marketing, Tele-marketing	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	
10	Risk of E – Commerce: Overview, Security for E – Commerce,	4	

	Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures.		
11	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, Quality Management, Sales & Distribution ERP Package, 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	7	

Text book and Reference books:

1. E-Commerce,M.M. Oka, EPH
2. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications.TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD 9. Krishnamurthy, E-Commerce Mgmt, Vikas

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand the basic concepts and technologies used in the field of management information systems
2	Understand the processes of developing and implementing information systems
3	Understand the role of information systems in organizations, the strategic management processes, and the implications for the management. Develop an understanding of how various information systems work together to accomplish the information objectives of an organization.
4	Know the business modules of ERP
5	Appreciate the current and future trends in ERP

Economic Policies in India
Code: OEC-IT802B
Contacts: 3L

Name of the Course:	**Economic Policies in India**
Course Code: **OEC-IT802B**	Semester: VIII

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Duration: 6 months	Maximum Marks:100
Teaching Scheme	**Examination Scheme**
Theory:3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam:70 Marks
Credit Points:	3

Objective:	
1	The objective of this course is to provide students an in-depth knowledge of theoretical concepts and tools dealing with the economic behavior of individual economic agents and market structure.
2	The subject also aims to let the student know the issues that Indian economy faces during its process of economic growth.
3	It intends to equip students with the knowledge and application of mathematical tools and techniques that are commonly used in the exposition and formulation of economic principles and theories
4	The objective of this course is to provide a detailed treatment of theoretical and practical issues in agricultural economics.
5	The objective is to provide a thorough knowledge about the economics of industry in a clear and 24 analytical manner, particularly in the Indian context.
Pre-Requisite:	
1	Basic knowledge on statistics, sources of Indian economics and Indian culture

Unit	**Content**	**Hrs/ Unit**	**Marks/ Unit**
1	Economic Development and its Determinants Approaches to economic development and its measurement – sustainable development; Role of State, market and other institutions; Indicators of development – PQLI, Human Development Index (HDI), gender development indices.	2	
2	Planning in India Objectives and strategy of planning; Failures and achievements of Plans; Developing grass-root organizations for development – Panchayats, NGOs and pressure groups	4	
3	Demographic Features, Poverty and Inequality Broad demographic features of Indian population; rural-urban migration; Urbanization and civic amenities; Poverty and Inequality	4	
4	Resource Base and Infrastructure Energy; social infrastructure – education and health; Environment; Regional imbalance; Issues and policies in financing infrastructure development.	4	
5	The Agricultural Sector Institutional Structure – land reforms in India; Technological change in agriculture – pricing of agricultural inputs and output; industry; Agricultural finance policy; Agricultural Marketing and Warehousing; Issues Terms of trade between agriculture and in food security – policies for sustainable agriculture.	4	

6	Industrial policy; Public Sector enterprises and their performance; Problem of sick units in India; Privatization and disinvestment debate; Growth and pattern of industrialization; Small-scale sector; Productivity in industrial sector; Exit policy – issues in labor market reforms; approaches for employment generation	4	
7	Public Finances Fiscal federalism – Centre-State financial relations; Finances of central government; Finances of state governments; Parallel economy; Problems relating to fiscal policy; Fiscal sector reforms in India.	3	
8	Money, Banking and Prices Analysis of price behavior in India; Financial sector reforms; Interest rate policy; Review of monetary policy of RBI; Money and capital markets; Working of SEBI in India.	3	
9	External Sector Structure and direction of foreign trade; Balance of payments; Issues in export-import policy and FEMA; Exchange rate policy; Foreign capital and MNCs in India; The progress of trade reforms in India	4	
10	Economic Reforms Rationale of internal and external reforms; Globalization of Indian economy; WTO and its impact on the different sectors of the economy; Need for and issues in good governance; Issues in competition and safety nets in Indian economy	4	

Text book and Reference books:

1. Ahluwalia, I. J. and I. M. D Little (Eds.) (1999), India's Economic Reforms and Development (Essays in honour of Manmohan Singh), Oxford University Press, New Delhi.
2. Bardhan, P. K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.
3. Bawa, R. s. and P. S. Raikhy (Ed.) (1997), Structural Changes in Indian Economy, Guru Nanak Dev University Press, Amritsar.
4. Brahmananda, P. R. and V. R. Panchmukhi (Eds.) (2001), Development Experience in the Indian Economy: Inter-State Perspectives, Book well, Delhi.
5. Chakravarty, S. (1987), Development Planning : The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M. L. (1996), Dilemmas of Growth : The Indian Experience, Sage Publications, New Delhi.
7. Datt, R. (Ed.) (2001), Second Generation Economic Reforms in India, Deep & Deep Publications, New Delhi.
8. Government of India, Economic Survey (Annual), Ministry of Finance, New Delhi.
9. Jain, a. K. (1986), Economic Planning in India, Ashish Publishing House, New Delhi.
10. Jalan, B. (1992), The Indian Economy – Problems and Prospects, Viking, New

Maulana Abul Kalam Azad University of Technology, West Bengal
Syllabus for 4-Years B.Tech. in Information Technology

Delhi

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Demonstrate an understanding, usage and application of basic economic principles
2	Understand the efficiency and equity implications of market interference, including government policy
3	Understand govt. policies and programs
4	Apply the comprehensive understanding of Indian Economy
5	Analyze the behavioral patterns of different economic agents

Remote Sensing and GIS
Code: OEC-IT802C
Contacts: 3L

Name of the Course:	**Remote Sensing and GIS**
Course Code:**OEC-IT802C**	Semester: VIII
Duration:6 months	Maximum Marks: 100

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

Objectives:

1	In this course the students will learn about the optical, thermal and microwaves based Remote Sensing and applications for solving real life problems.
2	The students will be able to disseminate basic concepts and applications of Electromagnetic Spectrum in Remote Sensing, Energy Balance and Data acquisition platforms, sensors and their characteristics.
3	In this course the students will learn about the raster and vector data analysis and applications for solving real life problems.
4	The students will be able to disseminate basic concepts and applications of spatial and non-spatial database in GIS, concept of co-ordinate system in Geo-tagging any data.

Pre-Requisite:

1	Basic knowledge on digital image processing and optical physics

Unit	Content	Hrs/ Unit	Marks /Unit

1	Introduction and Overview of Geographic Information Systems Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS.	3	
2	GIS and Maps, Map Projections and Coordinate Systems Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; precision and error.	4	
3	Data Sources, Data Input, Data Quality and Database Concepts Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata. Database concepts and components; flat files; relational database systems; data modeling; views of the database; normalization; databases and GIS.	3	
4	Spatial Analysis Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis.	3	
5	Making Maps Parts of a map; map functions in GIS; map design and map elements; choosing a map type; producing a map formats, plotters and media; online and CD-ROM distribution; interactive maps and the Web.	6	
6	Implementing a GIS Planning a GIS; requirements; pilot projects; case studies; data management; personnel and skill sets; costs and benefits; selecting a GIS package; professional GIS packages; desktop GIS; embedded GIS; public domain and low-cost packages.	4	
7	Technology & Instruments involved in GIS & Remote Sensing GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies. Future data; future hardware; future software; Object-oriented concepts and GIS; future issues – data ownership, privacy, education; GIS career options and how to pursue them.	6	
8	Remote Sensing Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape	7	

Text book and Reference books:

1. “Principles of geographical information systems”, P. A. Burrough and R. A. Mcdonnel, Oxford. 2. “Remote sensing of the environment” , J. R. Jensen, Pearson References:
2. “Exploring Geographic Information Systems”, Nicholas Chrismas, John Wiley & Sons.
3. “Getting Started with Geographic Information Systems”,Keith Clarke, PHI.

4. "An Introduction to Geographical Information Systems", Ian Heywood, Sarah Cornelius, and Steve Carver. Addison-Wesley Longman.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Understand basic concepts, principles and applications of remote sensing, particularly the geometric and radiometric principles
2	Provide examples of applications of principles to a variety of topics in remote sensing, particularly related to data collection, radiation, resolution, and sampling
3	Introduce the technology and principles of Satellite Imaging
4	Theoretical explanations on Image processing and information extraction from Satellite Data Products

Project-III
Code: PROJ-IT891
Contacts: 12P

Name of the Course:	**Project-III**	
Course Code: **PROJ-IT891**	Semester: VIII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme		**Examination Scheme**
Theory: NIL		Mid Semester exam:
Tutorial: NIL		Assignment and Quiz:
		Attendance:
Practical: 12Hrs./week		End Semester Exam:
Credit Points:		6
Objective:		
1	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	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.	
3	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.

Course Outcomes:

On completion of the course students will be able to

CO	STATEMENT
1	Identify the problem
2	Compare existing literature.
3	Design experimental set-up and methodology
4	Apply modern tools
5	Analyze data
6	Develop valid conclusions & recommendations