# 1$^{st}$ Year Curriculum for B.Tech courses in Engineering & Technology

*(Applicable from the academic session 2018-2019)*

**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
**1st Year Curriculum Structure for B.Tech courses in Engineering & Technology**
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**A. Definition of Credit:**

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

**B. Range of credits :**

A range of credits from 150 to 160 for a student to be eligible to get B.Tech Degree in Engineering. A student will be eligible to get B.Tech Degree *with Honours*, if he/she completes an additional 20 credits. These could be acquired through Massive Open Online Courses (MOOCs).

**C. MOOCs for B. Tech Honours**

The additional 20 credits (for obtaining B. Tech with Honours) are to be gained through MOOCs. The complete description of the MOOCs relevant for the first year course are given in *Annexure-I.* The courses for subsequent years of study will be posted subsequently.

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

All concerned are requested to follow the guidelines given in *Annexure-II* (Notice dt.06/12/2017) concerning Mandatory Induction Program. The colleges/ Institute may also refer to the AICTE Model Curriculum for Undergraduate Degree Courses in Engineering & Technology (January 2018) -Volume I (Page No.31-38), if necessary.

**E. Mandatory Additional Requirement for earning B. Tech Degree**

All concerned are requested to follow the guidelines in *Annexure-III* concerning Mandatory Additional Requirements.
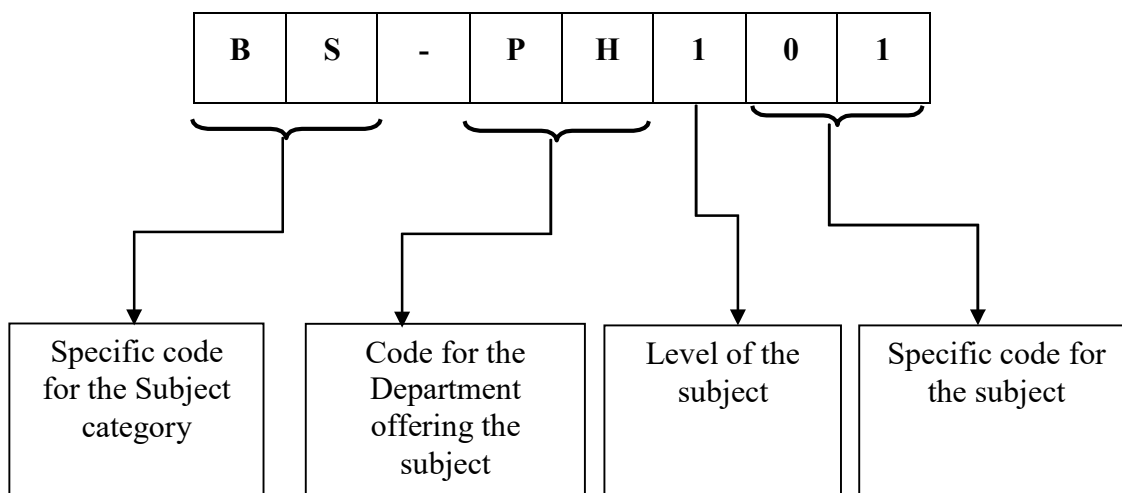
**F. Group division:**

*Group-A:*

Chemistry based subjects: [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Engineering and any other Engineering that chooses to be Chemistry based] + Physics based subjects: [Mechanical Engineering, Production Engineering, Civil Engineering, Automobile Engineering, Marine Engineering, Apparel Production Engineering, Computer Science & Engineering, Information Technology.]

*Group-B:*

All Physics based subjects which are also Electrical & Electronics based [Electrical Engineering, Electronics & Communication Engineering, Applied Electronics & Instrumentation Engineering, Power Engineering, Electrical & Electronics Engineering, Bio-Medical Engineering, Instrumentation & Control Engineering]

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## G. Subject Numbering Scheme:

| B | S | - | P | H | 1 | 0 | 1 |
|---|---|---|---|---|---|---|---|

| Specific code for the Subject category | Code for the Department offering the subject | Level of the subject | Specific code for the subject |
|---|---|---|---|

### List of Codes for Subject Category

| Code | Category Name |
|---|---|
| BS | Basic Science Courses |
| ES | Engineering Science Courses |
| HM | Humanities and Social Sciences including Management courses |
| PC | Professional core courses |
| PE | Professional Elective courses |
| OE | Open Elective courses |
| MC | Mandatory courses |
| PW | Project |

### List of Codes for Departments

| Code | Name of the Department | Code | Name of the Department |
|---|---|---|---|
| APM | Apparel Production Engineering | ECE | Electronics & Communication Engineering |
| AEIE | Applied Electronics & Instrumentation Engineering | FT | Food Technology |
| AUE | Automobile Engineering | IT | Information Technology |
| BME | Bio-Medical Engineering | ICE | Instrumentation & Control Engineering |
| BT | Bio-Technology | LT | Leather Technology |
| CT | Ceramic Technology | MRE | Marine Engineering |
| CHE | Chemical Engineering | ME | Mechanical Engineering |
| CE | Civil Engineering | PWE | Power Engineering |
| CSE | Computer Science & Engineering | PE | Production Engineering |
| EEE | Electrical & Electronics Engineering | TT | Textile Technology |
| EE | Electrical Engineering | | |

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| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | | | Credits |
|---|---|---|---|---|---|---|---|
| **First Year First Semester** | | | | | | | |
| **Mandatory Induction Program- 3 weeks duration** | | | | | | | |
| | | | | L | T | P | |
| **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 Courses | ES-EE101 | Basic Electrical Engineering | 3 | 1 | 0 | 4 |
| | | *Total Theory* | | **9** | **3** | **0** | **12** |
| **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 Courses | ES-EE191 | Basic Electrical Engineering Laboratory | 0 | 0 | 2 | 1 |
| 3 | Engineering Science Courses | ES-ME191/ ES-ME192 | Engineering Graphics & Design(Gr-B)/ Workshop/Manufacturing Practices(Gr-A) | 1 | 0 | 4 | 3 |
| | | *Total Practical* | | **1** | | **9** | **5.5** |
| | | **Total of First Semester** | | **10** | **3** | **9** | **17.5** |

\* Mathematics –IA (BS-M101) - CSE & IT
   Mathematics –IB (BS-M102) - All stream except CSE & IT

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| Sl No. | Category | Subject Code | Subject Name | Total Number of contact hours | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| **Theory** | | | | | | | |
| 1 | Basic Science courses | BS-PH201/ BS-CH201 | Physics-I (Gr-B)/ Chemistry-I (Gr-A) | 3 | 1 | 0 | 4 |
| 2 | Basic Science courses | BS-M201/ BS-M202 | Mathematics –IIA#/ Mathematics –IIB# | 3 | 1 | 0 | 4 |
| 3 | Engineering Science Courses | 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 |
| | *Total Theory* | | | **11** | **2** | **0** | **13** |
| **Practical** | | | | | | | |
| 1 | Basic Science courses | BS-PH291/ BS-CH291 | Physics-I Laboratory (Gr-B)/ Chemistry-I Laboratory (Gr-A) | 0 | 0 | 3 | 1.5 |
| 2 | Engineering Science Courses | ES-CS291 | Programming for Problem Solving | 0 | 0 | 4 | 2 |
| 3 | Engineering Science Courses | 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 Practical* | | | **1** | **0** | **13** | **7.5** |
| | **Total of Second Semester** | | | **12** | **2** | **13** | **20.5** |

# Mathematics –II (BS-M201) - CSE & IT
Mathematics –II (BS-M202) - All stream except CSE & IT

| | Group-A | Group-B |
|---|---|---|
| 1st Year 1st Semester | Physics-I (BS-PH101); Workshop/Manufacturing Practices (ES-ME192) | Chemistry-I (BS-CH101); Engineering Graphics & Design (ES-ME191) |
| 1st Year 2nd Semester | Chemistry-I (BS-CH201); Engineering Graphics & Design (ES-ME291) | Physics-I (BS-PH201); Workshop/Manufacturing Practices (ES-ME292) |

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| Course Code : BS-PH101/ BS-PH201 | Category : Basic Science Courses |
|---|---|
| Course Title : Physics-I | Semester : First/ Second |
| L-T-P     : 3-1-0 | Credit:4 |
| Pre-Requisites: | |

**Course objectives :**

Basic concepts of mechanics, optics and its applications, electricity, magnetism and qualitative understanding of concepts of quantum physics and statistical mechanics.

**1. Mechanics** ( 7L)

Problems including constraints & friction. Basic ideas of vector calculus and partial differential equations. Potential energy function  F = -grad V,  equipotential surfaces and meaning of gradient. Conservative and non-conservative forces. Conservation laws of energy & momentum. Non-inertial frames of reference. Harmonic oscillator; Damped harmonic motion forced oscillations and resonance. Motion of a rigid body in a plane and in 3D. Angular velocity vector. Moment of inertia.

**2.  Optics**    (5L)

- Distinction between interference and diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits ( only the expressions for max;min, & intensity and qualitative discussion of fringes); diffraction grating(resolution formulac only), characteristics of diffration grating and its applications.

- Polarisation : Introduction, polarisation by reflection, polarisation by double reflection, scattering of light, circular and elliptical polarisation, optical activity.

- Lasers : Principles and working of laser : population inversion, pumping, various modes, threshold population inversion with examples .

**3. Electromagnetism and Dielectric Magnetic Properties of Materials**  (8L)

- Maxwell's equations. Polarisation, permeability and dielectric constant, polar and non-polar dielecrrics, internal fields in a solid, Clausius- Mossotti equation(expression only), applications of dielectrics.

- Magnetisation , permeability and susceptibility, classificationof magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

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**4. Quantum Mechanics**    (16L)

- Introduction to quantum physics, black body radiation, explanation using the photon concept, Compton effect, de Broglie hypothesis, wave-particle duality, verification of matter waves, uncertainty principle, Schrodinger wave equation, particle in box, quantum harmonic oscillator, hydrogen atom.

**5. Statistical Mechanics**    (8L)

- Macrostate, Microstate, Density of states, Qualitative treatment of Maxwell Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

 **Course outcomes:**

Students will be familiar with

- Basic concepts of mechanics
- Bragg's Law and introduction to the principles of lasers, types of lasers and applications.
- Various terms related to properties of materials such as, permeability, polarization,etc.
- Some of the basic laws related to quantum mechanics as well as magnetic and dielectric properties of materials.
- Simple quantum mechanics calculations.
- 

**Learning Resources:**

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

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| | |
|---|---|
| **Course Code** : BS-CH101/ BS-CH201 | **Category :** Basic Science Courses |
| **Course Title** : Chemistry-I | **Semester** : First/ Second |
| **L-T-P** : 3-1-0 | **Credit:4** |
| **Pre-Requisites:** | |

*Detailed contents*

**i) Atomic and molecular structure (10 lectures)**

Schrodinger equation. Particle in a box solutions and their applications for simple sample. Molecular orbitals of diatomic molecules (e.g.$H_2$). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

**ii) Spectroscopic techniques and applications (8 lectures)**

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

**iii)Intermolecular *forces and potential energy surfaces (4 lectures)***

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena.

**iv) Use of free energy in chemical equilibria (8 lectures)**

First and second laws of thermodynamics and thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

**v) Periodic properties (4 Lectures)**

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

***vi)* Stereochemistry *(4 lectures)***

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

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*vii)* **Organic *reactions and synthesis of a drug molecule (4 lectures)***

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

*Course Outcomes*

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

☐ Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.

☐ Rationalise bulk properties and processes using thermodynamic considerations.

☐ Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques

☐ Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.

☐ List major chemical reactions that are used in the synthesis of molecules.

**Learning Resources:**

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

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| Course Code : BS-M101 | Category : Basic Science Course |
|---|---|
| Course Title : Mathematics – I A | Semester : First (CSE & IT) |
| L-T-P    : 3-1-0 | Credit: 4 |
| Pre-Requisites: High School Mathematics | |

| Module No. | Description of Topic | Lectures Hours |
|---|---|---|
| 1 | ***Calculus (Integration):*** <br> 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):*** <br> 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:*** <br> 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:*** <br> Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map. | 9 |
| 5 | ***Vector Spaces (Continued):*** <br> Eigenvalues, Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. <br> Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization. | 10 |

**Course Outcomes:**

The students will be able to:
- Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.
- Understand the domain of applications of mean value theorems to engineering problems.
- Learn different types of matrices, concept of rank, methods of matrix inversion and their applications.
- Understand linear spaces, its basis and dimension with corresponding applications in the field of computer science.
- Learn and apply the concept of eigen values, eigen vectors, diagonalisation of matrices and orthogonalization in inner product spaces for understanding physical and engineering problems

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**Learning Resources:**

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 Code : BS-M102 | Category : Basic Science Course |
|---|---|
| Course Title : Mathematics –I B | Semester : First (All stream except CSE & IT) |
| L-T-P   : 3-1-0 | Credit: 4 |
| Pre-Requisites: High School Mathematics | |

| Module No. | Description of Topic | Lectures Hours |
|---|---|---|
| 1 | *Calculus (Integration):* <br><br> 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):* <br><br> 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 | *Sequence and Series:* <br><br> Convergence of sequence and series, tests for convergence; Power series, Taylor's series, series for exponential, trigonometric and logarithm functions; Fourier series: Half range sine and cosine series, Parseval's theorem. | 11 |
| 4 | *Multivariate Calculus:* <br><br> Limit, continuity and partial derivatives, Directional derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, Curl and Divergence. | 9 |
| 5 | *Matrices:* <br><br> Inverse and rank of a matrix, Rank-nullity theorem; System of linear equations; Symmetric, Skew-symmetric and Orthogonal matrices; Determinants; Eigenvalues and Eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, and Orthogonal transformation. | 8 |

**Course Outcomes:**

After completing the course the student will be able to

☐ Apply the concept and techniques of differential and integral calculus to determine curvature and evaluation of different types of improper integrals.

☐ Understand the domain of applications of mean value theorems to engineering problems.

☐ Learn the tools of power series and Fourier series to analyze engineering problems and apply the concept of convergence of infinite series in many approximation techniques in engineering disciplines.

☐ Apply the knowledge for addressing the real life problems which comprises of several variables or attributes and identify extremum points of different surfaces of higher dimensions.

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☐ Understand different types of matrices, their eigen values, eigen vectors, rank and also their

orthogonal transformations which are essential for understanding physical and engineering problems.

**Learning Resources:**

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.

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| | |
|---|---|
| **Course Code** : ES-EE101 | **Category :** Engineering Science Courses |
| **Course Title** : Basic Electrical Engineering | **Semester** : First |
| **L-T-P**    : 3-1-0 | **Credit: 4** |
| **Pre-Requisites:** | |

*Detailed contents:*

**Module 1: DC Circuits (8 hours)**

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Time-domain analysis of first-order RL and RC circuits.

**Module 2: AC Circuits (8 hours)**

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

**Module 3: Transformers (6 hours)**

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections.

**Module 4: Electrical Machines (8 hours)**

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction
and working of synchronous generators.

**Module 5: Power Converters (6 hours)**

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

**Module 6: Electrical Installations (6 hours)**

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

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**Course Outcomes**

☐ To understand and analyze basic electric and magnetic circuits

☐ To study the working principles of electrical machines and power converters.

☐ To introduce the components of low voltage electrical installations

**Learning Recourses:**

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.

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| | |
|---|---|
| **Course Code** : BS-PH191/ BS-PH291 | **Category :** Basic Science course |
| **Course Title** : Physics-I Laboratory | **Semester** : First/ Second |
| **L-T-P** : 0-0-3 | **Credit:1.5** |
| **Pre-Requisites:** | |

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

**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

**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

**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.

**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

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| | |
|---|---|
| **Course Code** : BS-CH191/ BS-CH291 | **Category :** Basic Science Courses |
| **Course Title** : Chemistry-I Laboratory | **Semester** : First/ Second |
| **L-T-P**   : 0-0-3 | **Credit:1.5** |
| **Pre-Requisites:** | |

**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.

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| | |
|---|---|
| **Course Code** : ES-EE291 | **Category :** Engineering Science Courses |
| **Course Title** : Basic Electrical Engineering Laboratory | **Semester** : First |
| **L-T-P**   : 0-0-2 | **Credit: 1** |
| **Pre-Requisites:** | |

**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.

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| Course Code : ES-ME191/ ES-ME 291 | Category : Engineering Science Courses |
|---|---|
| Course Title : Engineering Graphics & Design | Semester : First/ Second |
| L-T-P    : 1-0-4 | Credit: 3 |
| Pre-Requisites: | |

| Sl. No. | Content | Lecture (L) | Practical (P) |
|---|---|---|---|
| 1 | **INTRODUCTION TO ENGINEERING DRAWING** <br><br> Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Different types of lines and their use; Drawing standards and codes. | 1 | 4 |
| 2 | **LETTERING, DIMENSIONING, SCALES** <br><br> Plain scale, Diagonal scale and Vernier Scales. | 1 | 4 |
| 3 | **GEOMETRICAL CONSTRUCTION AND CURVES** <br><br> Construction of polygons, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid, Involute, Archemedian Spiral. | 1 | 4 |
| 4 | **PROJECTION OF POINTS, LINES, SURFACES** <br><br> 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. | 1 | 4 |
| 5 | **PROJECTION OF REGULAR SOLIDS** <br><br> Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone). | 1 | 4 |
| 6 | **COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** <br><br> 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. | 1 | 4 |
| 7 | **ISOMETRIC PROJECTIONS** <br><br> 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; | 1 | 4 |

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| | | | |
|---|---|---|---|
| 8 | **SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS**<br><br>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) | 1 | 4 |
| 9 | **OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION& CAD DRAWING**<br><br>listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids]; Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles; | 1 | 4 |
| 10 | **ANNOTATIONS, LAYERING & OTHER FUNCTIONS**<br><br>applying dimensions to objects, applying annotations to drawings;<br><br>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; | 2 | 8 |

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| | | | | |
|---|---|---|---|---|
| 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). | | 2 | 8 |

**Course Outcomes**

The student will learn:

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling

## 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 assignment.

2.  The problems for class work are to be prepared on 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 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)

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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.


**Learning Resources:**

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

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| | |
|---|---|
| **Course Code** : ES-ME192/ ES-ME 292 | **Category :** Engineering Science Courses |
| **Course Title** : Workshop/ Manufacturing Practices | **Semester** : First/ Second |
| **L-T-P    : 1-0-4** | **Credit:3** |
| **Pre-Requisites:** | |

**(i) Lectures & videos:**

Detailed contents:

1.  Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods
2.  CNC machining, Additive manufacturing
3.  Fitting operations & power tools
4.  Electrical &Electronics
5.  Carpentry
6.  Plastic moulding, glass cutting
7.  Metal casting
8.  Welding (arc welding & gas welding), brazing

**(ii) Workshop Practice:**
 **Machine shop (8 hours)**
*Typical jobs that may be made in this practice module:*
  To make a pin from a mild steel rod in a lathe.
  To make rectangular and vee slot in a block of cast iron or mild steel in a shaping and / or milling machine.
 **Fitting shop (8 hours)**
*Typical jobs that may be made in this practice module:*
  To make a Gauge from MS plate.
 **Carpentry (8 hours)**
*Typical jobs that may be made in this practice module:*
  To make wooden joints and/or a pattern or like.
 **Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs))**
*Typical jobs that may be made in this practice module:*
  ARC WELDING (4 hours): To join two thick (approx 6mm) MS plates by manual metal arc welding.
  GAS WELDING (4 hours): To join two thin mild steel plates or sheets by gas welding.
 **Casting (8 hours)**
*Typical jobs that may be made in this practice module:*
  One/ two green sand moulds to prepare, and a casting be demonstrated.

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- **Smithy (4 hours) ~ 4 hours**

*Typical jobs that may be made in this practice module:*

- A simple job of making a square rod from a round bar or like.

- **Plastic moulding & Glass cutting (4 hours)**

*Typical jobs that may be made in this practice module:*

- For plastic moulding, making at least one simple plastic component should be made.

- For glass cutting, three rectangular glass pieces may be cut to make a kaleidoscope using a black colour diamond cutter, or similar other components may be made.

- **Electrical & Electronics (8 hours)**

- Familiarization with LT switchgear elements, making its sketches and noting down its specification. Kitkat fuse, Glass cartridge fuse, Plastic fuse holders (optional), Iron clad isolators, MCB style isolators, Single phase MCB, Single-phase wire, wiring cable.

- Demonstration of domestic wiring involving two MCB, two piano key switches, one incandescent lamp, one LED lamp and plug point.

- Simple wiring exercise to be executed to understand the basic electrical circuit.

- Simple soldering exercises to be executed to understand the basic process 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.

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

**Laboratory Outcomes**

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.

- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

- By assembling different components, they will be able to produce small devices of their interest.

**Learning Resources:**

1. Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., "Elements of Workshop Technology", Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.

2. Kalpakjian S. and Steven S. Schmid, "Manufacturing Engineering and Technology", 4th edition, Pearson Education India Edition, 2002.

3. Gowri P. Hariharan and A. Suresh Babu,"Manufacturing Technology – I" Pearson Education, 2008.

4. Roy A. Lindberg, "Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.

5. Rao P.N., "Manufacturing Technology", Vol. I and Vol. II, Tata McGraw Hill House, 2017.

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### (Applicable from the academic session 2018-2019)

| Course Code : BS-M201 | Category : Basic Science Course |
|---|---|
| Course Title : Mathematics – II A | Semester : Second (CSE &IT) |
| L-T-P       : 3-1-0 | Credit: 4 |
| Pre-Requisites: High School Mathematics and BS-M101 | |

| Module No. | Description of Topic | Lectures Hours |
|---|---|---|
| 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 |

**Course Outcomes:**

The students will be able to:

☐ Learn the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment.

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☐ Understand the basic ideas of statistics with different characterisation of a univariate and bivariate data set.

☐ Apply statistical tools for analysing data samples and drawing inference on a given data set.

**Learning Resources:**

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.

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| Course Code : BS-M202 | Category : Basic Science Course |
|---|---|
| Course Title : Mathematics – II B | Semester : Second (All stream except CSE & IT) |
| L-T-P    : 3-1-0 | Credit: 4 |
| Pre-Requisites: High School Mathematics and BS-M102 | |

| Module No. | Description of Topic | Lectures Hours |
|---|---|---|
| 1 | ***Multivariate Calculus (Integration):*** <br> Multiple Integration: Double integrals (Cartesian), change of order of integration in double integrals, change of variables (Cartesian to Polar), Applications: Areas and volumes, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian), Orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds; Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes. | 11 |
| 2 | ***First order ordinary differential equations:*** <br> Exact, linear and Bernoulli's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. | 5 |
| 3 | ***Ordinary differential equations of higher orders:*** <br> Second order linear differential equations with constant coefficients, Use of D-operators, Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties. | 9 |
| 4 | ***Complex Variable – Differentiation*** <br> Differentiation of complex functions, Cauchy-Riemann equations, Analytic functions, Harmonic functions, determination of harmonic conjugate, elementary analytic functions (exponential, trigonometric, logarithmic) and their properties; Conformal mappings, Mobius transformations and their properties. | 6 |
| 5 | ***Complex Variable – Integration*** <br> Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, Zeros of analytic functions, Singularities, Laurent's series; Residues, Cauchy residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour. | 9 |

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**Course Outcomes:**

The students will be able to:

☐ Learn the methods for evaluating multiple integrals and their applications to different physical problems.

☐ Understand different techniques to solve first and second order ordinary differential equations with its formulation to address the modelling of systems and problems of engineering sciences.

☐ Learn different tools of differentiation and integration of functions of a complex variable that are used with various other techniques for solving engineering problems.

☐ Apply different types of transformations between two 2- dimensional planes for analysis of physical or engineering problems.

**Learning Resources:**

1. Reena Garg, Chandrika Prasad, Advanced Engineering Mathematics, 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. E. L. Ince, Ordinary Differential Equations, Dover Publications.
8. J. W. Brown and R. V. Churchill, Complex Variables and Applications, Mc-Graw Hill.

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| | |
|---|---|
| **Course Code** : ES-CS201 | **Category :** Engineering Science Courses |
| **Course Title** : Programming for Problem Solving | **Semester** : Second |
| **L-T-P**    : 3-0-0 | **Credit:**3 |
| **Pre-Requisites:** | |

*Detailed contents*

**Unit 1:** Introduction to Programming **(4 lectures)**

☐ Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) - **(1 lecture).**

☐ Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

☐ From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

**Unit 2:** Arithmetic expressions and precedence **(2 lectures)**

**Unit 3:** Conditional Branching and Loops **(6 lectures)**

☐ Writing and evaluation of conditionals and consequent branching **(3 lectures)**

☐ Iteration and loops **(3 lectures)**

**Unit 4:** Arrays **(6 lectures)**

☐ Arrays (1-D, 2-D), Character arrays and Strings

**Unit 5:** Basic Algorithms **(6 lectures)**

☐ Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

**Unit 6:** Function **(5 lectures)**

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

**Unit 7:** Recursion **(4 -5 lectures)**

☐ Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

**Unit 8:** Structure **(4 lectures)**

☐ Structures, Defining structures and Array of Structures

**Unit 9:** Pointers **(2 lectures)**

☐ Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

**Unit 10:** File handling (only if time is available, otherwise should be done as part of the lab)

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**Course Outcomes**

The student will learn

- To formulate simple algorithms for arithmetic and logical problems.

- To translate the algorithms to programs (in C language).

- To test and execute the programs and correct syntax and logical errors.

- To implement conditional branching, iteration and recursion.

- To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

- To use arrays, pointers and structures to formulate algorithms and programs.

- To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

- To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.


**Learning Resources:**

1. R. S. Salaria, Computer Concepts and Programming in C, Khanna Publishers
2. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

3. 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

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| | |
|---|---|
| **Course Code** : ES-CS291 | **Category :** Engineering Science Courses |
| **Course Title** : Programming for Problem Solving | **Semester** : Second |
| **L-T-P     : 0-0-4** | **Credit:2** |
| **Pre-Requisites:** | |

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

**Tutorial 1:** Problem solving using computers:

   **Lab1:** Familiarization with programming environment

**Tutorial 2:** Variable types and type conversions:

   **Lab 2:** Simple computational problems using arithmetic expressions

**Tutorial 3:** Branching and logical expressions:

   **Lab 3**: Problems involving if-then-else structures

**Tutorial 4:** Loops, while and for loops:

   **Lab 4:** Iterative problems e.g., sum of series

**Tutorial 5:** 1D Arrays: searching, sorting:

   **Lab 5:** 1D Array manipulation

**Tutorial 6:** 2D arrays and Strings

   **Lab 6:** Matrix problems, String operations

**Tutorial 7:** Functions, call by value:

   **Lab 7:** Simple functions

**Tutorial 8 &9:** Numerical methods (Root finding, numerical differentiation, numerical integration):

   **Lab 8 and 9:** Programming for solving Numerical methods problems

**Tutorial 10:** Recursion, structure of recursive calls

   **Lab 10:** Recursive functions

**Tutorial 11:** Pointers, structures and dynamic memory allocation

   **Lab 11:** Pointers and structures

**Tutorial 12:** File handling:

   **Lab 12:** File operations

**Laboratory Outcomes**
   ☐ To formulate the algorithms for simple problems
   ☐ To translate given algorithms to a working and correct program
   ☐ To be able to correct syntax errors as reported by the compilers
   ☐ To be able to identify and correct logical errors encountered at run time
   ☐ To be able to write iterative as well as recursive programs
   ☐ To be able to represent data in arrays, strings and structures and manipulate them through a program
   ☐ To be able to declare pointers of different types and use them in defining self-referential structures.
   ☐ To be able to create, read and write to and from simple text files.

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| | |
|---|---|
| **Course Code** : HM-HU201 | **Category :** Humanities and Social Sciences including Management courses |
| **Course Title** : English | **Semester** : Second |
| **L-T-P** : 2-0-0 | **Credit:2** |
| **Pre-Requisites:** | |

## Detailed contents

**1. Vocabulary Building**
1.1 The concept of Word Formation: Compounding, Backformation, Clipping, Blending.
1.2 Root words from foreign languages and their use in English
1.3 Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
1.4 Synonyms, antonyms, and standard abbreviations: Acronyms

**2. Basic Writing Skills**
2.1 Sentence Structures & Types: Simple, Compound, Complex
2.2 Use of phrases and clauses in sentences: Transformation of sentences, active, passive, narration
2.3 Importance of proper punctuation
2.4 Creating coherence: Arranging paragraphs & Sentences in logical order
2.5 Creating Cohesion: Organizing principles of paragraphs in documents
2.6 Techniques for writing precisely

**3. Identifying Common Errors in Writing**
3.1 Subject-verb agreement
3.2 Noun-pronoun agreement
3.3 Misplaced modifiers
3.4 Articles
3.5 Prepositions
3.6 Redundancies
3.7 Clichés

**4. Nature and Style of sensible Writing**
4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence
4.5 Writing introduction and conclusion

**5. Writing Practices**
5.1 Comprehension
5.2 Précis Writing
5.3 Essay Writing
5.4 Business Letter, Cover Letter & CV; E-mail

**Addendum**

## Some examples of English words with foreign roots

| Greek Root/Affix | Examples |
|---|---|
| Anti | Antisocial, antiseptic |

**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
**1ˢᵗ Year Curriculum Structure for B.Tech courses in Engineering & Technology**
(Applicable from the academic session 2018-2019)

| | |
|---|---|
| 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 |

**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
**1st Year Curriculum Structure for B.Tech courses in Engineering & Technology**
(Applicable from the academic session 2018-2019)

| | |
|---|---|
| Mono | Monarch |
| Pan | Panorama |
| Pathos | Pathetic |
| Phobia | Hydrophobia |
| Pod (Gk), ped (Latin) | Pseudopodia |
| Poly | polyglot |
| Tele | Telephone |
| Theo | Theology, theist |
| **Latin Root** | **Examples** |
| Aud | Audible |
| Bene | Beneficial |
| Brev | abbreviate, brief |
| circum | Circulate |
| Contra | Contradict |
| Cred | Credible |
| Dict | Diction |
| Femina | Feminine |
| Inter | Internet, interval |
| Magna | Magnificient |
| Mal | Malnutrition |
| Multi | multinational |
| Nova | Novel |
| Multi | Multiple, multiplex |
| Non | Nonstop |

**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
**1st Year Curriculum Structure for B.Tech courses in Engineering & Technology**
(Applicable from the academic session 2018-2019)

| | |
|---|---|
| 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 |

**Learning Resources:**
(i)    Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.
(ii)    Practical English Usage. Michael Swan. OUP. 1995.
(iii)    Remedial English Grammar. F.T. Wood. Macmillan.2007
(iv)    On Writing Well. William Zinsser. Harper Resource Book. 2001
(v)    Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(vi)    Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vii)    Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(viii)    Universal English Prof. Prasad Kataria Publications, 2019.
(ix)    "Communication Skills for Professionals"-Nira Konar, Prentice Hall of India 2nd edition, New Delhi, 2011
(x)    Gajendra Singh Chauhan, Smita Kashiramka and L. Thimmesha. Functional English. Cengage , 2019.

**Course Outcomes**

The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
**1st Year Curriculum Structure for B.Tech courses in Engineering & Technology**
(Applicable from the academic session 2018-2019)

| | |
|---|---|
| **Course Code** : HM-HU291 | **Category :** Humanities and Social Sciences including Management courses |
| **Course Title** : Language Laboratory | **Semester** : Second |
| **L-T-P** : 0-0-2 | **Credit:1** |
| **Pre-Requisites:** | |

1) Honing 'Listening Skill' and its sub skills through Language Lab Audio device;         3P

2) Honing 'Speaking Skill' and its sub skills         2P

3) Helping them master Linguistic/Paralinguistic features (Pronunciation/Phonetics/ Voice modulation/ Stress/ Intonation/ Pitch &Accent) of connected speech         2P

4) Honing 'Conversation Skill' using Language Lab Audio –Visual input; Conversational Practice Sessions (Face to Face / via Telephone, Mobile phone & Role Play Mode)         2P

5) Introducing 'Group Discussion' through audio –Visual input and acquainting them with key strategies for success         2P

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         4P

7) Honing 'Reading Skills' and its sub skills using Visual / Graphics/ Diagrams /Chart Display/Technical/Non Technical Passages Learning Global / Contextual / Inferential Comprehension;         2P

8) Honing 'Writing Skill' and its sub skills by using Language Lab Audio –Visual input; Practice Sessions         2P

**Course Outcomes**

- The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

# MOOCs for B. Tech Honours



**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

# Maulana Abul Kalam Azad University of Technology, West Bengal

## Notice

### MOOCs for B.Tech Honours
(Applicable from the session 2018-2019)

### Preamble

All India Council for Technical Education (AICTE) has introduced Model Curriculum for Bachelor of Technology programme with 160 credits in the entire programme of 4 years, and additional 20 credits will be required to be done for the degree of Bachelor of Technology with Honours. These additional 20 credits will have to be acquired with online courses (MOOCs) as per AICTE. So students will have to complete additional 20 credits through MOOCs within 4 years of time. This creates an excellent opportunity for students to acquire the necessary skill set for employability through massive online courses where the rare expertise of world famous experts from academics and industry are available. Maulana Abul Kalam Azad University of Technology, West Bengal (MAKAUT,WB) has thus decided to introduce AICTE model curriculum for its B.Tech Programmes and suggest baskets for MOOCs available year wise for the four-year long B.Tech programme from the sessions 2018-2019. The basket for MOOCs will be a dynamic one, as courses keep on updating with time. Few essential skill sets required for employability are also identified year wise by MAKAUT,WB. For MOOCs platforms where examination or assessment is absent (like SWAYAM) or where certification is costly (like Coursera or edX), faculty members of the Institutes are to audit the courses and prepare the examination question papers, for the courses undertaken by the students of respective Institutes, so that MAKAUT,WB can conduct examination for the course. The total of 20 credits that is required to be attained for B.Tech Honours degree are distributed over four years in the following way:

| | | |
|---|---|---|
| For first year | : | 8 credits |
| For second year | : | 4 credits |
| For third year | : | 4 credits |
| For fourth year | : | 4 credits |

A student of first year has to cover courses from at least three skills :
    1. Computer Programing with Python / R
    2. Soft skill
    3. Ethics
Courses are * marked in the above areas

If a student is unable to cover the credits assigned for the first year, he/she can do these courses in either of the subsequent years, but he/she has to choose the courses from the basket of MOOCs announced by MAKAUT,WB from time to time. The same rule will be applicable for the other years of the programme.

The basket for MOOCs for the 1ˢᵗ year B. Tech for the session 2018-2019 are made available herewith.

By order.

# MOOCs for First Year, Engineering and Technology

| Sl. No | Course | Provider | Duration | Credits | Name of University / Institution |
|---|---|---|---|---|---|
| 1. | Presentation Skills: Designing Presentation Slides | Coursera* | 4 weeks | 1 | Tomsk State University |
| 2. | Effective Problem-Solving and Decision-Making | Coursera | 4 weeks | 1 | University of California |
| 3. | Communication in the 21st Century Workplace | Coursera* | 4 weeks | 1 | University of California |
| 4. | Psychology at Work | Coursera* | 6 weeks | 2 | University of Western Australia |
| 5. | Critical Thinking & Problem Solving | EdX* | 3 weeks | 3 | Rochester Institute of Technology |
| 6. | Successful Career Development | Coursera | 7 weeks | 2 | University System of Georgia |
| 7. | Working in Teams: A Practical Guide | edX | 4 weeks | 1 | University of Queensland |
| 8. | Communication theory: bridging academia and practice | Coursera | 9 weeks | 3 | Higher School of Economics |
| 9. | Speaking Effectively | NPTEL* | 8 weeks | 3 | Indian Institute of Technology, Kharagpur |
| 10. | Introduction to Philosophy | Coursera | 5 weeks | 1 | University of Edinburgh |
| 11. | Moralities of Everyday Life | Coursera | 6 weeks | 2 | Yale University |
| 12. | Introduction to Logic | Coursera* | 10 weeks | 3 | Stanford University |
| 13 | Write Professional Emails in English | Coursera* | 5 weeks | 2 | Georgia Institute of Technology |
| 14 | Technical Writing | Coursera | 5 weeks | 1 | Moscow Institute of Physics and Technology |
| 15 | Learn to Program: The Fundamentals | Coursera | 7 weeks | 2 | University of Toronto |
| 16 | The Science of Everyday Thinking | edX | 12 weeks | 4 | University of Queensland |
| 17 | Introduction to Problem Solving and Programming | NPTEL | 12 weeks | 4 | NPTEL |
| 18 | The Science of Well Being | Coursera | 6 weeks | 2 | Yale University |
| 19 | Developing Soft Skills and Personality | NPTEL | 8 weeks | 3 | |
| 20 | Programming Basics | edX | 9 weeks | 3 | IIT Bombay |
| 21 | Introduction to Python: Absolute Beginner | EdX* | 5 weeks | 2 | Microsoft |
| 22 | Inferential Statistics | Coursera* | 7 weeks | 2 | University of Amsterdam |
| 23 | Linear Regression and Modelling | Coursera | 4 weeks | 1 | Duke University |
| 24 | Foundation of Data Structures | edX | 6 weeks | 2 | IIT Bombay |
| 25 | Introduction to Logic | NPTEL | 12 weeks | 4 | NPTEL |
| 26 | Introduction to Probability and Data | Coursera* | 5 weeks | 1 | Duke University |
| 27 | Ethics | NPTEL* | 12 weeks | 4 | |
| 28 | Science, Technology and Society | NPTEL | 12 weeks | 4 | |
| 29 | Creating Innovation | Coursera | 6 weeks | 2 | Macquarie University |
| 30 | Ethical Leadership Through Giving Voice to Values | Coursera* | 4 weeks | 2 | University of Virginia |
| 31 | Creativity, Innovation, and Change | Coursera* | 6 weeks | 2 | Pennsylvania State University |
| 32 | Interpersonal Communication for Engineering Leaders | Coursera | 4 weeks | 1 | Rice University |

| 33 | Learn to Program: The Fundamentals | Coursera* | 7 weeks | 3 | University of Toronto |
|----|-----------------------------------|-----------|---------|---|----------------------|
| 34 | Introduction to Mathematical Thinking | Coursera* | 9 weeks | 3 | Stanford University |
| 35 | The Science of Everyday Thinking | edX | 12 weeks | 4 | University of Queensland |
| 36 | A Life of Happiness and Fulfillment | Coursera | 6 weeeks | 2 | Indian School of Business |
| 37 | Model Thinking | Coursera | 12 weeks | 4 | University of Michigan |
| 38 | Introduction to Philosophy: God, Knowledge, and Consciousness | edX | 12 weeks | 4 | MIT |
| 39 | Soft skills | NPTEL* | 12 Weeks | 4 | IIT Roorkee |
| 40 | Developing Soft Skills and Personality | NPTEL* | 8 weeks | 3 | IIT Kanpur |
| 41 | Indian Fiction in English | NPTEL | 12 Weeks | 4 | IIT Madras |
| 42 | Development of Sociology in India | NPTEL | 4 Weeks | 1 | IIT Kanpur |
| 43 | Intellectual Property | NPTEL | 12 Weeks | 4 | IIT Madras |
| 44 | Essential Statistics for Data Analysis using Excel | EdX* | Self Paced | 3 | Microsoft |
| 45 | Ethics and Law in Data and Analytics | edX | Self Paced | 4 | Microsoft |
| 46 | Climate Change Mitigation in Developing Countries | Coursera* | 6 weeks | 3 | University of Cape town |
| 47 | Web Design for Everybody (Basics of Web Development and Coding) Specialization | Coursera | 15weeks | 4 | University of Michigan |
| 48 | Ecology: Ecosystem Dynamics and Conservation | Coursera | 5 weeks | 1 | American Museum of Natural History, Howard Hughes Medical Institute |
| 49 | Environmental Studies: A Global Perspective | EdX* | Self Paced | 4 | Curtin University |
| 50 | Introduction to Computer Science and Programming Using Python | edX* | Self Paced | 4 | MIT, USA |
| 51 | Statistics and R | edX* | Self Paced | 4 | Harvard University |
| 52 | Introduction to Programming in C | Coursera* | 4 weeks | 4 | Duke University |
| 53 | Java Programming: Solving Problems with Software | Coursera | 4 weeks | 4 | Duke University |
| 54 | Grammar and Punctuation | Coursera | 4 weeks | 1 | University of California |
| 55 | How to Write an Essay | Coursera* | 5 weeks | 1 | University of California, Berkeley |
| 56 | Conversational English Skills | EdX* | 10 weeks | 3 | Tsinghua University |
| 57 | Advanced Writing | Coursera* | 4 weeks | 1 | University of California, Irvine |
| 58 | Speak English Professionally: In Person, Online & On the Phone | Coursera* | 5 weeks | 1 | Georgia Institute of Technology |
| 59 | English for Science, Technology, Engineering, and Mathematics | Coursera | 5 weeks | 1 | University of Pennsylvania |
| 60 | English Composition | edX | 8 weeks | 3 | Arizona State University |
| 61 | Take Your English Communication Skills to the Next Level | Coursera* | 4 weeks | 1 | Georgia Institute of Technology |

# Guidelines regarding

# Mandatory Induction Program for

# the new students

MAULANA ABUL KALAM AZAD
UNIVERSITY OF TECHNOLOGY,
WEST BENGAL

Utech

*In Pursuit Of Knowledge And Excellence*

**Maulana Abul Kalam Azad University of Technology, West Bengal**
*(Formerly West Bengal University of Technology)*
BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

Date: 06.12.2017

# Maulana Abul Kalam Azad University of Technology, West Bengal

## Guidelines regarding Induction Programme for the new students

(As per Model Curriculum for 1ˢᵗ Year UG degrees courses in Engineering & Technology, November 2017)

### To be followed from the 2018-19 academic session

**Preamble:** Engineering education has evolved globally in a continuous manner to address the twin needs of industry and society. It is now an accepted fact that the institutions imparting technical education should aspire to create manpower who will possess strong technical knowledge and skill, have leadership qualities and be a team player, capable of coming up with innovative solutions and be alive to societal and community concerns.

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

The following schedule is laid down by the University to implement the three week long Induction Programme:

| Week 1 | 1ˢᵗ Half | Day 1 | Overall introduction of the new students to the Institution, its different Departments & Faculty Members |
|---|---|---|---|
| | 2ⁿᵈ Half | Day 1 | (a) Assignment of faculty mentors to the new students <br> (b) Assessment and allotment for mentoring by senior students preferably from the second year |
| | 2 hrs | Day 2, 3, 4, 5 | Lectures by eminent personalities on different areas such as (a) Introduction to Engineering (b) Various topics of science and technology <br> ( c) Innovation and entrepreneurship <br> ( d) Creative and performing arts (e) Social issues |
| | 2 hrs. | Day 2, 3, 4, 5 | Participation in Games, Yoga, Meditation etc. |
| | 2 hrs | Day 2, 3, 4, 5 | Visit to the different Departments of the Institute |
| Week 2 (All Days) | 2hrs | | Scheduled class lectures as per time table. |
| | 2hrs | | Students to be conducted through proficiency modules to be prepared by respective Colleges for ascertaining English skills & Computer knowledge of the students |

| | | | and to prepare a report on the same |
|---|---|---|---|
| | 2hrs | | Participation in Games, Sports, Yoga, Creative arts etc. |
| Week 3 | 2hrs | | Scheduled class lectures as per time table |
| | | Day 1 | Visits to neighbourhood locations |
| | | Day 2 | Visits to natural spots in adjoining areas to understand the effect of nature on society |
| | | Day 3 | Visits to Science Museum / laboratories |
| | | Day 4<br><br>Day 5 | Visits to NGOs |

Any other activity, as deemed fit by the Director/Principal of the affiliated Colleges, may be proposed and discussed with the Academic Coordinator of the University, by sending email to the following address: academics.makaut@gmail.com.

Note: 1) If necessary, networking may be established with NGOs to facilitate the different components and aspects of the Induction Programme.

# Mandatory Additional Requirement

# for earning B. Tech Degree

MAULANA ABUL KALAM AZAD
UNIVERSITY OF TECHNOLOGY,
WEST BENGAL

**Utech**

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BF- 142, Sector-I, Salt Lake, Kolkata- 700064, India

# Maulana Abul Kalam Azad University of Technology, West Bengal
## BF-142, Sector-I, Saltlake

### Notice

### Mandatory Additional Requirement for earning B.Tech Degree

**Addressing the needs of the industry and the society**: Globally, engineering education systems have continuously evolved, in order to address the needs of the industry and the society. It is becoming imperative that every University should create opportunities for the students to inculcate attributes, which are not restricted only to engineering knowledge and acumen. Industry needs professionals who can work successfully in teams, who have leadership qualities, who are alive to social and community needs and who can bring innovation and creativity to their work and who are also digitally proficient. Hence, in order to prepare its students to match these multiple requirements, MAKAUT,WB has created a unique mechanism of awarding 100 Activity Points over and above the academic grades. It is planned that the students at MAKAUT,WB will be able to reap benefits from these activities at their own pace and comfort. It is expected that by the time MAKAUT,WB's students reach their Final Year, they would have developed themselves so well both through their studies in the respective technological field and through their active participation in the co-curricular and extra-curricular activities as also through SAWYAM based learning activities that they would be well-prepared for contributing to building the India and the world of their dreams.

**The additional requirement applies to**: Every student, who is admitted to the 4 years B.Tech program from the academic year 2018-19 onwards, is required to earn minimum 100 Activity Points in addition to the required academic grades, for getting MAKAUT,WB's B.Tech degree. Similarly, it is mandatory to earn 75 Activity Points, in addition to the academic grades, for getting B.Tech degree by a student (Lateral Entry) who is admitted to the B.Tech program from the academic year 2018-19 onwards. *(Please see Table 1 for details.)* [Lateral Entry students will have a multiplying factor of 1.33 to bring uniformity in score].

| Level of Entry in B.Tech Course | Total duration for earning Points | Minimum Points |
|---|---|---|
| 1st Year from the academic year 2018-19 onwards | 1st to 4th Year | 100 |
| 2nd Year from the academic year 2018-19 onwards (Lateral Entry) | 2nd to 4th Year | 75 |

**Table – I**

**For existing Students (except students in the 4th year)**: Every student, who is admitted to the 4 years B.Tech program prior to the academic year 2018-19, is required to earn minimum number of Activity Points as per Table II in addition to the required academic grades, for getting MAKAUT,WB's B.Tech degree.

| Current Semester | Total Points to be earned During the full course |
|---|---|
| 2nd | 100 |
| 4th | 75 |
| 6th | 50 |

**Table –II**

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

**Notes:**

- **Current 4th year students who are going to sit for Final Semester examination in May-June, 2018 are outside the preview of this Mandatory Additional Requirement**
- Every student shall participate in the co-curricular and extra-curricular activities and produce documentary proof to the designated Faculty Members appointed by the Head of Department / Principal / Director in the respective college. Thereby the student should earn the required Points before *her* she appears for his/ her Final Examinations.
- A student's result of his/her Final Examinations will be withheld until he/she completes the minimum Activity Points by the end of his/her B.Tech Program.
- In every semester, every student is required to prepare a file containing documentary proofs of activities, done by him / her. This file will be duly verified and Activity Points will be assigned by the teachers as appointed above, at the end of every semester.
- The college will form a 3 members committee and finalize the Activity Points for each student before entering them into the Online Point Entry System (at the URL, as specified by the COE of the University).
- Every student has to earn at least 100 activity points. The points students has earned will be reflected in the student's marksheet.
- Activity points earned by Lateral Entry students will be multiplied by 1.33.

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

| Sl. No. | Name of the Activity | Points | Maximum Points Allowed |
|---|---|---|---|
| 1. | MOOCS (SWAYAM/NPTEL/Spoken Tutorial) (per course) | 20 | 40 |
| 2. | Tech Fest/Teachers Day/Freshers Welcome | | |
| | Organizer | 5 | 10 |
| | Participants | 3 | 6 |
| 5. | Rural Reporting | 5 | 10 |
| 6. | Tree Plantation (per tree) | 1 | 10 |
| 7. | Participation in Relief Camps | 20 | 40 |
| 8. | Participation in Debate/Group Discussion/ Tech quiz | 10 | 20 |
| 9. | Publication of Wall magazine in institutional level (magazine/article/internet) | 10 | 20 |
| 10. | Publication in News Paper, Magazine & Blogs | 10 | 20 |
| 11. | Research Publication (per publication) | 15 | 30 |
| 12. | Innovative Projects (other than course curriculum) | 30 | 60 |
| 13. | Blood donation | 8 | 16 |
| | Blood donation camp Organization | 10 | 20 |
| 15. | Participation in Sports/Games | | |
| | College level | 5 | 10 |
| | University Level | 10 | 20 |
| | District Level | 12 | 24 |
| | State Level | 15 | 30 |
| | National/International Level | 20 | 20 |
| 21. | Cultural Programme (Dance, Drama, Elocution, Music etc.) | 10 | 20 |
| 22. | Member of Professional Society | 10 | 20 |
| 23. | Student Chapter | 10 | 20 |
| 24. | Relevant Industry Visit & Report | 10 | 20 |
| 25. | Photography activities in different Club( Photography club, Cine Club, Gitisansad) | 5 | 10 |
| 26. | Participation in Yoga Camp (Certificate to be submitted) | 5 | 10 |
| 27. | Self-Entrepreneurship Programme | 20 | 20 |
| 28. | Adventure Sports with Certification | 10 | 20 |
| 29. | Training to under privileged/Physically challenged | 15 | 30 |
| 30. | Community Service & Allied Activities | 10 | 20 |

Suggestions from the College Principals will be considered to append in the above Table-III.

Sd/-

Registrar(Acting)
MAKAUT,WB

# Maulana Abul Kalam Azad University of Technology, West Bengal
## Record of Activities for Mandatory Additional Requirement

| College Name (College Code): | | | | | | Department: | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Student Name: | | | University Roll No: | | | Registration No: | | | | | |

| Sl No | Activity | Points | Max. Points Allowed | Points Earned | | | | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sem1 | Sem2 | Sem3 | Sem4 | Sem5 | Sem6 | Sem7 | Sem8 | |
| 1 | *MOOCS (SWAYAM/NPTEL/Spoken Tutorial) per course* | | | | | | | | | | | |
| | For 12 weeks duration | 20 | 40 | | | | | | | | | |
| | For 8 weeks duration | 16 | | | | | | | | | | |
| 2 | *Tech Fest/Teachers Day/Freshers Welcome* | | | | | | | | | | | |
| | Organizer | 5 | 10 | | | | | | | | | |
| | Participants | 3 | 6 | | | | | | | | | |
| 3 | Rural Reporting | 5 | 10 | | | | | | | | | |
| 4 | Tree Plantation and up keeping (per tree) | 1 | 10 | | | | | | | | | |
| 5 | Participation in Relief Camps | 20 | 40 | | | | | | | | | |
| 6 | Participation in Debate/Group Discussion/ Tech quiz | 10 | 20 | | | | | | | | | |
| 7 | *Publication of Wall magazine in institutional level (magazine/article/internet)* | | | | | | | | | | | |
| | Editor | 10 | 20 | | | | | | | | | |
| | Writer | 6 | 12 | | | | | | | | | |
| 8 | Publication in News Paper, Magazine & Blogs | 10 | 20 | | | | | | | | | |
| 9 | Research Publication (per publication) | 15 | 30 | | | | | | | | | |
| 10 | Innovative Projects (other than course curriculum) | 30 | 60 | | | | | | | | | |
| 11 | Blood donation | 8 | 16 | | | | | | | | | |
| | Blood donation camp Organization | 10 | 20 | | | | | | | | | |

# Maulana Abul Kalam Azad University of Technology, West Bengal
# Record of Activities for Mandatory Additional Requirement

*Annexure-I*
Rev:00

| Sl No | Activity | Points | Max. Points Allowed | Points Earned | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Sem1 | Sem2 | Sem3 | Sem4 | Sem5 | Sem6 | Sem7 | Sem8 | Total |
| 12 | *Participation in Sports/Games* | | | | | | | | | | | |
| | College level | 5 | 10 | | | | | | | | | |
| | University Level | 10 | 20 | | | | | | | | | |
| | District Level | 12 | 24 | | | | | | | | | |
| | State Level | 15 | 30 | | | | | | | | | |
| | National/International Level | 20 | 20 | | | | | | | | | |
| 13 | Cultural Programme (Dance, Drama, Elocution, Music etc.) | 10 | 20 | | | | | | | | | |
| 14 | Member of Professional Society | 10 | 20 | | | | | | | | | |
| 15 | Student Chapter | 10 | 20 | | | | | | | | | |
| 16 | Relevant Industry Visit & Report | 10 | 20 | | | | | | | | | |
| 17 | Photography activities in different Club(Photography club, Cine Club, Gitisansad) | 5 | 10 | | | | | | | | | |
| 18 | Participation in Yoga Camp (Certificate to be submitted) | 5 | 10 | | | | | | | | | |
| 19 | Self-Entrepreneurship Programme | 20 | 20 | | | | | | | | | |
| 20 | Adventure Sports with Certification | 10 | 20 | | | | | | | | | |
| 21 | Training to under privileged / Differently abled | 15 | 30 | | | | | | | | | |
| 22 | Community Service & Allied Activities | 10 | 20 | | | | | | | | | |
| | **Total Points** | | | | | | | | | | | |
| | **Signature of Mentor** | | | | | | | | | | | |
| | **Signature of HOD** | | | | | | | | | | | |

*Please abide strictly to the **Notes at the end of the Notice by Registrar,** MAKAUT,WB regarding **Mandatory Additional Requirement for earning B.Tech Degree**

* *Annexure-I* is to be retained in the Institute records with all documentary proofs of activities (*to be verified by the University as and when required*).

# Maulana Abul Kalam Azad University of Technology, West Bengal
*(Formerly West Bengal University of Technology)*
**Syllabus for B. Tech in Information Technology**
(Applicable from the academic session 2018-2019)
## Curriculum Structure

| Semester III (Second year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Type of course | Code | Course Title | Hours per week | | | Credits |
| | | | | L | T | P | |
| **Theory** | | | | | | | |
| 1 | Engineering Science Course | ESC 301 | Analog and Digital Electronics | 3 | 0 | 0 | 3 |
| 2 | Professional Core Courses | PCC-CS301 | Data Structure & Algorithms | 3 | 0 | 0 | 3 |
| 3 | Professional Core Courses | PCC-CS302 | Computer Organisation | 3 | 0 | 0 | 3 |
| 4 | Basic Science course | BSC 301 | Mathematics-III (Differential Calculus) | 2 | 0 | 0 | 2 |
| 5 | Humanities & Social Sciences including Management courses | HSMC 301 | Economics for Engineers (Humanities-II) | 3 | 0 | 0 | 3 |
| **Practical** | | | | | | | |
| 6 | Professional Core Courses | PCC-CS393 | IT Workshop (Sci Lab/MATLAB/Python/R) | 0 | 0 | 4 | 2 |
| 7 | Engineering Science Course | ESC 391 | Analog and Digital Electronics | 0 | 0 | 4 | 2 |
| 8 | Professional Core Courses | PCC-CS391 | Data Structure & Algorithms | 0 | 0 | 4 | 2 |
| 9 | Professional Core Courses | PCC-CS392 | Computer Organisation | 0 | 0 | 4 | 2 |
| | | | | | | **Total credits** | **22** |

| Semester IV (Second year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Type of course | Code | Course Title | Hours per week | | | Credits |
| | | | | L | T | P | |
| **Theory** | | | | | | | |
| 1 | Professional Core Courses | PCC-CS401 | Discrete Mathematics | 3 | 1 | 0 | 4 |
| 2 | Professional Core Courses | PCC-CS 402 | Computer Architecture | 3 | 0 | 0 | 3 |
| 3 | Professional Core Courses | PCC-CS403 | Formal Language & Automata Theory | 3 | 0 | 0 | 3 |

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| 4 | Professional Core Courses | PCC-CS404 | Design & Analysis of Algorithms | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|---|
| 5 | Basic Science courses | BSC 401 | Biology | 2 | 1 | 0 | 3 |
| 6 | Mandatory Courses | MC401 | Environmental Sciences | 1 | - | - | 1 |
| **Practical** | | | | | | | |
| 7 | Engineering Science Course | PCC-CS 492 | Computer Architecture | 0 | 0 | 4 | 2 |
| 8 | Professional Core Courses | PCC-CS494 | Design & Analysis of Algorithms | 0 | 0 | 4 | 2 |
| | | | | | | **Total credits** | **21** |

| **Semester V (Third year)** | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Sl. No.** | **Type of course** | **Code** | **Course Title** | **Hours per week** | | | **Credits** |
| | | | | **L** | **T** | **P** | |
| 1 | Engineering Science Course | ESC501 | Signals & Systems | 3 | 0 | 0 | 3 |
| 2 | Professional Core Courses | PCC-CS501 | Compiler Design | 3 | 0 | 0 | 3 |
| 3 | Professional Core Courses | PCC-CS502 | Operating Systems | 3 | 0 | 0 | 3 |
| 4 | Professional Core Courses | PCC-CS503 | Object Oriented Programming | 3 | 0 | 0 | 3 |
| 5 | Humanities &Social Sciences including Management courses | HSMC-501 | Introduction to Industrial Management (Humanities III) | 3 | 0 | 0 | 3 |
| 6 | Professional Elective | PEC-IT 501A/B/C/D | (Elective-I) Theory of | 3 | 0 | 0 | 3 |

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | courses | | Computation/Artificial Intelligence/ Advanced Computer Architecture/ Computer Graphics | | | | |
| 7 | Mandatory Courses | MC- CS501 | Constitution of India/ Essence of Indian Knowledge Tradition | - | - | - | 0 |
| **Practical** | | | | | | | |
| 8 | Professional Core Courses | PCC-CS591 | Compiler Design | | 0 | 4 | 2 |
| 9 | Professional Core Courses | PCC-CS592 | Operating Systems | | 0 | 4 | 2 |
| 10 | Professional Core Courses | PCC-CS593 | Object Oriented Programming | | 0 | 4 | 2 |
| | | | | | | **Total credits** | **24** |

| Semester VI (Third year) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Sl. No. | Type of course | Code | Course Title | Hours per week | | | Credits |
| | | | | L | T | P | |
| 1 | Professional Core Courses | PCC-CS601 | Database Management Systems | 3 | 0 | 0 | 3 |
| 2 | Professional Core Courses | PCC-CS602 | Computer Networks | 3 | 0 | 0 | 3 |
| 3 | Professional Elective courses | PEC-IT601A/B/C/D | (Elective-II) Advanced Algorithms/ Distributed Systems/Software Engineering/ Image Processing | 3 | 0 | 0 | 3 |
| 4 | Professional Elective courses | PEC-IT602A/B/C/D | (Elective-III) Parallel and Distributed Algorithms/ Data Mining/Human Computer Interaction/Pattern | 3 | 0 | 0 | 3 |

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| 5 | Open Elective courses | OEC-IT601A/B | (Open Elective-) Numerical Methods/ Human Resource Development and Organizational Behavior | 3 | 0 | 0 | 3 |
|---|---|---|---|---|---|---|---|

**Practical**

| 6 | Professional Core Courses | PCC-CS691 | Database Management Systems | 0 | 0 | 4 | 2 |
|---|---|---|---|---|---|---|---|
| 7 | Professional Core Courses | PCC-CS692 | Computer Networks | 0 | 0 | 4 | 2 |
| 8 | Project | PROJ-CS681 | Project-1 | 0 | 0 | 6 | 3 |
| | | | | | | **Total credits** | **22** |

## Semester VII (Fourth year)

| Sl. No. | Type of course | Code | Course Title | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
| | | | | L | T | P | |
| 1 | Professional Elective courses | PEC-IT701A/B/C/D | (Elective-IV) Internet Technology/Quantum Computing/ Cloud Computing/Machine learning | 3 | 0 | 0 | 3 |
| 2 | Professional Elective courses | PEC-IT702A/B/C/D/E/F | (Elective-V) Multimedia Technology/Neural Networks and Deep Learning/Soft Computing/ Ad-Hoc and Sensor Networks/Information Theory and Coding/Cyber Security | 3 | 0 | 0 | 3 |
| 3 | Open Elective courses | OEC-IT701A/B/C | (Open Elective-II) Operations Research/Introduction to Philosophical Thoughts/ Soft Skill & Interpersonal Communication | 3 | 0 | 0 | 3 |
| 4 | Humanities &Social Sciences including | HSMC 701 | Project Management and Entrepreneurship | 2 | 1 | 0 | 3 |

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|   | Management courses |   |   | L | T | P |   |
|---|---|---|---|---|---|---|---|
| 5 | Project | PROJ-IT781 | Project-II | 0 | 0 | 12 | 6 |
|   |   |   |   |   | **Total credits** |   | **18** |

## Semester VIII (Fourth year)
### [Summer Industry Internship]

| Sl. No. | Type of course | Code | Course Title | Hours per week | | | Credits |
|---|---|---|---|---|---|---|---|
|   |   |   |   | L | T | P |   |
| 1 | Professional Elective courses | PEC-IT801A/B/C/D/E | (Elective-VI) Signals and Networks/Cryptography & Network Security/ Speech and Natural Language Processing/ /Internet of Things/ Remote Sensing and GIS | 3 | 0 | 0 | 3 |
| 2 | Open Elective courses | OEC-IT801A/B/C/D/E | Open Elective-III Big Data Analysis/Cyber Law and Ethics/ Mobile Computing/Bioinformatics/ Robotics | 3 | 0 | 0 | 3 |
| 3 | Open Elective courses | OEC-IT802A/B/C | (Open Elective-IV) E-Commerce and ERP/Micro-electronics and VLSI Design/Economic Policies in India | 3 | 0 | 0 | 3 |
| 4 | Project | PROJ-CS881 | Project-III | 0 | 0 | 12 | 6 |
|   |   |   |   |   | **Total credits** |   | **15** |

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## SEMESTER – III

**Analog & Digital Electronics**
**Code: ESC-301**
**Contact: 3L**

| Name of the Course: | **Analog & 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: hrs./week | End Semester Exam : 70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | To acquire the basic knowledge of different analog components and their applications | |
| 2 | To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits. | |
| 3 | To prepare students to perform the analysis and design of various digital electronic circuits | |
| **Pre-Requisite:** | | |
| 1 | Basic Electronics Parts I & II learned in the First year, semesters 1 & 2. Basic BJTs,. | |
| 2 | Basic concept of the working of P-N diodes, Schottky diodes, | |
| 3 | Basic FETs and OPAMP as a basic circuit component. Concept of Feedback | |

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

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

**Text book and Reference books:**

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

**Course Outcomes**:

On completion of the course students will be able to
ESC-301.1 Realize the basic operations of different analog components.
ESC-301.2 Realize basic gate operations and laws Boolean algebra.

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ESC-301.3 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.

**Data Structure & Algorithm**
**Code: PCC-CS301**
**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:  hrs./week | End Semester Exam :70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | To learn the basics of abstract data types. | |
| 2 | To learn the principles of linear and nonlinear data structures. | |
| 3 | To build an application using sorting and searching | |
| **Pre-Requisite:** | | |
| 1 | CS 201 (Basic Computation and Principles of C | |
| 2 | M101 & M201 (Mathematics), basics of set theory | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Technique sand their complexity analysis. | 10 | |
| 2 | Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis. | 9 | |
| 3 | Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from | 10 | |

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| | | | |
|---|---|---|---|
| | 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.<br><br>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 | | |
| 4. | Sorting and Hashing: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing. Graph: BasicTerminologies and Representations, Graph search and traversal algorithms and complexity analysis. | 9 | |

**Text book and Reference books:**

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

**Course Outcomes:**

On completion of the course students will be able to
    PCC-CS301.1 Differentiate how the choices of data structure & algorithm methods impact the performance of program.
    PCC-CS301.2 Solve problems based upon different data structure & also write programs.
    PCC-CS301.3 Identify appropriate data structure & algorithmic methods in solving problem.
    PCC-CS301.4 Discuss the computational efficiency of the principal algorithms for sorting, searching, and hashing
    PCC-CS301.5 Compare and contrast the benefits of dynamic and static data structures implementations.

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**Computer Organization**
**Code: PCC-CS302**
**Contacts: 3L**

| Name of the Course: | **Computer Organization** | |
|---|---|---|
| Course Code: PCC-CS302 | Semester: III | |
| Duration:6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory: 3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz : 10 marks | |
| | Attendance: 5 marks | |
| Practical:  hrs./week | End Semester Exam: 70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | To prepare students to perform the analysis and design of various digital electronic circuits. | |
| 2 | To know how Computer Systems work & its basic principles | |
| 3 | To know how I/O devices are being accessed and its principles etc | |
| **Pre-Requisite:** | | |
| 1 | Concept of basic components of a digital computer, Basic concept of Fundamentals & Programme structures. Boolean Algebra | |
| 2 | Basic number systems, Binary numbers, representation of signed and unsigned numbers, Binary Arithmetic as covered in Basic Computation & Principles of Computer Programming | |
| 3 | Boolean Algebra | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Basic organization of the stored program computer and operation sequence for execution of a program. Role of operating systems and compiler/assembler. Fetch, decode and execute cycle, Concept of operator, operand, registers and storage, Instruction format. Instruction sets and addressing modes. [7L]<br>Commonly used number systems. Fixed and floating point representation of numbers.[1L] | 8 | |
| 2 | Overflow and underflow. Design of adders - ripple carry and carry look ahead principles. [3L]<br>Design of ALU. [1L]<br>Fixed point multiplication -Booth's algorithm. [1L] | 8 | |

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| | | | |
|---|---|---|---|
| | Fixed point division - Restoring and non-restoring algorithms. [2L]<br>Floating point - IEEE 754 standard. [1L] | | |
| 3 | Memory unit design with special emphasis on implementation of CPU-memory interfacing. [2L]<br>Memory organization, static and dynamic memory, memory hierarchy, associative memory. [3L]<br>Cache memory, Virtual memory. Data path design for read/write access. [5L] | 10 | |
| 4. | Design of control unit - hardwired and microprogrammed control. [3L]<br>Introduction to instruction pipelining. [2L]<br>Introduction to RISC architectures. RISC vs CISC architectures. [2L]<br>I/O operations - Concept of handshaking, Polled I/O, interrupt and DMA. [3L] | 10 | |

## Text book and Reference books:

1. Mano, M.M., "Computer System Architecture", PHI.
2. Behrooz Parhami "Computer Architecture", Oxford University Press
3. Hayes J. P., "Computer Architecture & Organisation", McGraw Hill,
4. Hamacher, "Computer Organisation", McGraw Hill,
5. N. senthil Kumar, M. Saravanan, S. Jeevananthan, "Microprocessors and Microcontrollers" OUP
6. Chaudhuri P. Pal, "Computer Organisation & Design", PHI,
7. P N Basu- "Computer Organization & Architecture" ,Vikas Pub
8. B. Ram, "Computer Organization & Architecture", Newage Publications
9. I. Singh – "Computer Organization & Architecture", Khanna Publishing House

## Course Outcomes:

On completion of the course students will be able to
   PCC-CS302.1 Understand basic structure of digital computer, stored program concept and different arithmetic and control unit operations.
   PCC-CS302.2 Understand basic structure of different combinational circuits-multiplexer, decoder, encoder etc.
   PCC-CS302.3 Perform different operations with sequential circuits.
   PCC-CS302.4 Understand memory and I/O operations.

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**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 | | |
| 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. | 8 | |
| 2 | Limit, continuity and partial derivatives, Chain rule, Implicit function, Jacobian, Directional derivatives, Total derivative; Maxima, minima and saddle points; Gradient, curl and divergence and related problems. | 7 | |
| 3 | Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar). Theorems of Green, Gauss and Stokes (Statement only) and related problems. | 8 | |
| 4. | First Order Differential Equation, Exact, Linear and Bernoulli's equations, Equations of first order but not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's form, general & singular solution. [5L] | 9 | |

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| | | | |
|---|---|---|---|
| | Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. [4L] | | |
| 5 | Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree. | 8 | |

**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,
7. Advanced Engineering Mathematics, Chandrika Prasad, Khanna Publishing House
8. Differential Calculas, Shanti Narayan, S.Chand Publications

**Course Outcomes:**

On completion of the course students will be able to
   BSC-301.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives.
   BSC-301.2 Apply the rules of inference and methods of proof including direct and indirect proof forms, proof by contradiction, and mathematical induction.
   BSC-301.3 Use tree and graph algorithms to solve problems
   BSC-301.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra.

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**Economics for Engineers (Humanities-II)**
**Code: HSMC-301**
**Contacts: 3L**

| Name of the Course: | **Economics for Engineers (Humanities-II)** | |
|---|---|---|
| Course Code: HSMC-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: 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 | 9 | |

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| | | | |
|---|---|---|---|
| | Money, Debt repayment, Nominal& Effective Interest.<br>4. Cash Flow & Rate of Return Analysis – Calculations, Treatment of Salvage Value, Annual Cash Flow Analysis, Analysis Periods;<br>Internal Rate of Return, Calculating Rate of Return, Incremental Analysis; Best Alternative Choosing an Analysis Method, Future<br>Worth Analysis, Benefit-Cost Ratio Analysis, Sensitivity and Breakeven Analysis. Economic Analysis In The Public Sector -Quantifying And Valuing Benefits & drawbacks. | | |
| 3 | 5. Inflation and Price Change – Definition, Effects, Causes, Price Change with Indexes, Types of Index, Composite vs Commodity<br>Indexes, Use of Price Indexes In Engineering Economic Analysis, Cash Flows that inflate at different Rates.<br>6. Present Worth Analysis: End-Of-Year Convention, Viewpoint Of Economic Analysis Studies, Borrowed Money Viewpoint, Effect<br>Of Inflation & Deflation, Taxes, Economic Criteria, Applying Present Worth Techniques, Multiple Alternatives.<br>7. Uncertainty In Future Events - Estimates and Their Use in Economic Analysis, Range Of Estimates, Probability, Joint Probability<br>Distributions, Expected Value, Economic Decision Trees, Risk, Risk vs Return, Simulation, Real Options. | 9 | |
| 4. | 8. Depreciation - Basic Aspects, Deterioration & Obsolescence, Depreciation And Expenses, Types Of Property, Depreciation Calculation Fundamentals, Depreciation And Capital Allowance Methods, Straight-Line Depreciation Declining Balance Depreciation, Common Elements Of Tax Regulations For Depreciation And Capital Allowances.<br>9. Replacement Analysis - Replacement Analysis Decision Map, Minimum Cost Life of a New Asset, Marginal Cost, Minimum Cost Life Problems.<br>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:**

**Maulana Abul Kalam Azad University of Technology, West Bengal**
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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, David B. Pratt : Principle of Engineering Economic Analysis, John Wiley
4. Premvir Kapoor, Sociology & Economics for Engineers, Khanna Publishing House
5. Sullivan and Wicks: Engineering Economy, Pearson
6. R.Paneer Seelvan: Engineering Economics, PHI
7. Michael R Lindeburg : Engineering Economics Analysis, Professional Pub

**Course Outcome:**

On completion of the course students will be able to

HSMC-301.1 Make different economic decisions and estimate engineering costs by applying different cost estimation models.

HSMC-301.2 Create cash flow diagrams for different situations and use different interest formulae to solve associated problems.

HSMC-301.3 Take decisions regarding different engineering projects by using various criteria like rate of return analysis, present worth analysis, cost-benefit analysis etc.

HSMC-301.4 Incorporate the effect of uncertainty in economic analysis by using various concepts like expected value, estimates and simulation.

HSMC-301.5 Understand the concepts of depreciation and replacement analysis and solve associated problems.

HSMC-301.6 Understand the process of inflation and use different price indices to adjust for its effect.

HSMC-301.7 Apply the various concepts of Accounting like balance sheet and ratio analysis.

HSMC-301.8 Understand the scope of Finance and the role of financial planning and management.

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**PRACTICAL SYLLABUS**
**Semester III**

**Analog & Digital Electronics Lab**
**Code: ESC-391**
**Contacts: 4P**

| Name of the Course: | **Analog & Digital Electronics Lab** |
|---|---|
| Course Code: ESC-391 | Semester: III |
| Duration: 6 months | Maximum Marks: 100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement: 60 |
| Practical: 4 hrs./week | Distribution of marks: 40 |
| Credit Points: | 2 |
| **Course Outcomes:** | |
| 1 | ESC-301.1 |
| 2 | ESC-301.2 |
| 3 | ESC-301.3 |
| **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** | |
| 4 | Design a Full Adder using basic gates and verify its output / Design a Full Subtractor circuit using basic gates and verify its output. |
| 5 | Construction of simple Decoder & Multiplexer circuits using logic gates. |
| 6 | Realization of RS / JK / D flip flops using logic gates |
| 7 | Design of Shift Register using J-K / D Flip Flop |
| 8 | Realization of Synchronous Up/Down counter |
| 9 | Design of MOD- N Counter |
| 10 | Study of DAC |

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

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**Data Structure & Algorithm Lab**
**Code: PCC-CS391**
**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: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement: 60 |
| Practical: 4 hrs./week | Distribution of marks: 40 |
| Credit Points: | 2 |
| **Course Outcomes:** | |
| 1  PCC-CS301.1 | |
| 2  PCC-CS301.2 | |
| 3  PCC-CS301.3 | |
| 4  PCC-CS301.4 | |
| 5  PCC-CS301.5 | |
| **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 & queues using linked lists |
| 5 | Polynomial addition, Polynomial multiplication |
| **Non Linear Data Structure** | |
| 6 | Recursive and Non-recursive traversal of Trees |
| 7 | Threaded binary tree traversal. AVL tree implementation |
| 8 | Application of Trees. Application of sorting and searching algorithms |
| 9 | Hash tables implementation: searching, inserting and deleting, searching & sorting techniques. |

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

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**Computer Organization Lab**
**Code: PCC-CS392**
**Contacts: 4P**

| Name of the Course: | **Computer Organization Lab** |
|---|---|
| Course Code: PCC-CS392 | Semester: III |
| Duration:6 months | Maximum Marks: 100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement: 60 |
| Practical: 4 hrs./week | Distribution of marks: 40 |
| Credit Points: | 2 |
| **Course Outcomes:** | |
| 1  PCC-CS302.1 | |
| 2  PCC-CS302.2 | |
| 3  PCC-CS302.3 | |
| 4  PCC-CS302.4 | |
| **Pre-Requisite:** | |
| Pre-requisites as in PCC-CS302 | |

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

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

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**IT Workshop (Sci Lab/MATLAB/Python/R)**
**Code: PCC-CS393**
**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 Outcomes:** | |
| 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. |

**Practical Syllabus**

**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.

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## Programming in Matlab

### Introduction
Why MATLAB?, History, Its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB

### Basics
Familiar with MATLAB windows, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables

### Programming-I
Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept

### Programming-II
Script file, Input commands, Output commands, Structure of function file, Inline functions, Feval command, Comparison between script file and function file

### 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

### 2D Plotting
In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface

### 3D Plotting
Use of meshgrid function, Mesh plot, Surface plot, Plots with special graphics

## Programming with Python

### Introduction
History, Features, Setting up path, Working with Python, Basic Syntax, Variable and Data Types, Operator

### Conditional Statements
If, If- else, Nested if-else, Looping, For, While, Nested loops

### Control Statements
Break, Continue, Pass

### String Manipulation
Accessing Strings, Basic Operations, String slices, Function and Methods

### Lists
Introduction, Accessing list, Operations, Working with lists, Function and Methods

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**Tuple**
Introduction, Accessing tuples, Operations, Working, Functions and Methods

**Dictionaries**
Introduction, Accessing values in dictionaries, Working with dictionaries, Properties

**Functions**
Defining a function, Calling a function, Types of functions, Function Arguments, Anonymous functions, Global and local variables

**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

**Exception Handling**
Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions.

| Laboratory Experiments: | |
|---|---|
| 1 | Practical Assignments related with implementation of PCC-CS393 |

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**SEMESTER – IV**

**Discrete Mathematics**
**Code: PCC-CS401**
**Contacts: 3L+1T**

| Name of the Course: | **Discrete Mathematics** | |
|---|---|---|
| Course Code: PCC-CS401 | 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: | 4 | |
| **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. | 8 | |
| 2 | Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination | 5 | |
| 3 | Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, | 8 | |

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

**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

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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
19. S.B. Singh, Discrete Structures, KPH
20. S.B. Singh, Combinatorics & Graph Theory, Khanna Book Publishing Co. (P) Ltd. Delhi

## Course Outcome(s)

On completion of the course students will be able to

PCC-CS401.1 Express a logic sentence in terms of predicates, quantifiers, and logical connectives

PCC-CS401.2 Derive the solution for a given problem using deductive logic and prove the solution based on logical inference

PCC-CS401.3 Classify its algebraic structure for a given a mathematical problem,

PCC-CS401.4 Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra

PCC-CS401.5 Develop the given problem as graph networks and solve with techniques of graph theory.

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**Computer Architecture**
**Code: PCC-CS402**
**Contacts: 3L**

| Name of the Course: | **Computer Architecture** | |
|---|---|---|
| Course Code: PCC-CS402 | Semester: IV | |
| Duration: 6 months | Maximum Marks:100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory: 3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz: 10 marks | |
| | Attendance: 5 marks | |
| Practical: hrs./week | End Semester Exam: 70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | To learn the basics of stored program concepts. | |
| 2 | To learn the principles of pipelining | |
| 3 | To learn mechanism of data storage | |
| 4 | To distinguish between the concepts of serial, parallel, pipeline architecture. | |
| **Pre-Requisite:** | | |
| 1 | Basic Structure of Computers, Functional units, software, performance issues software, machine instructions | |
| 2 | RAM, ROM, Memory management | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Introduction: Review of basic computer architecture (Revisited), Quantitative techniques in computer design, measuring and reporting performance. (3L) Pipelining: Basic concepts, instruction and arithmetic pipeline, data hazards, control hazards and structural hazards, techniques for handling hazards. Exception handling. Pipeline optimization techniques; Compiler techniques for improving performance. (9L) | 12 | |
| 2 | Hierarchical memory technology: Inclusion, Coherence and locality properties; Cache memory organizations, Techniques for reducing cache misses; Virtual memory organization, mapping and management techniques, memory replacement policies. (8L) | 8 | |
| 3 | Instruction-level parallelism: basic concepts, techniques for increasing ILP, superscalar, super-pipelined and VLIW processor architectures. Array | 6 | |

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| | | | |
|---|---|---|---|
| | and vector processors. (6L) | | |
| 4. | Multiprocessor architecture: taxonomy of parallel architectures; Centralized shared- memory architecture: synchronization, memory consistency, interconnection networks. Distributed shared-memory architecture. Cluster computers. (8L) Non von Neumann architectures: data flow computers, reduction computer architectures, systolic architectures. (4L) | 7 | |

**Text/Reference Books:**

1. V. Carl, G. Zvonko and S. G. Zaky, "Computer organization", McGraw Hill, 1978.
2. B. Brey and C. R. Sarma, "The Intel microprocessors", Pearson Education, 2000.
3. J. L. Hennessy and D. A. Patterson, "Computer Architecture A Quantitative Approach", Morgan Kauffman, 2011.
4. W. Stallings, "Computer organization", PHI, 1987.
5. P. Barry and P. Crowley, "Modern Embedded Computing", Morgan Kaufmann, 2012.
6. N. Mathivanan, "Microprocessors, PC Hardware and Interfacing", Prentice Hall, 2004.
7. Y. C. Lieu and G. A. Gibson, "Microcomputer Systems: The 8086/8088 Family", Prentice Hall India, 1986.
8. J. Uffenbeck, "The 8086/8088 Design, Programming, Interfacing", Prentice Hall, 1987.
9. B. Govindarajalu, "IBM PC and Clones", Tata McGraw Hill, 1991.
10. P. Able, "8086 Assembly Language Programming", Prentice Hall India6. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.

**Course Outcomes:**

On completion of the course students will be able to
   PCC-CS402.1 Learn pipelining concepts with a prior knowledge of stored program methods
   PCC-CS402.2 Learn about memory hierarchy and mapping techniques.
   PCC-CS402.3 Study of parallel architecture and interconnection network

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**Formal Language & Automata Theory**
**Code: PCC-CS403**
**Contacts: 3L**

| Name of the Course: | **Formal Language & Automata Theory** | |
|---|---|---|
| Course Code: PCC-CS403 | Semester: IV | |
| Duration: 6 months | Maximum Marks:100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory: 3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz: 10 marks | |
| | Attendance: 5 marks | |
| Practical: NIL | End Semester Exam: 70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | Be able to construct finite state machines and the equivalent regular expressions. | |
| 2 | Be able to prove the equivalence of languages described by finite state machines and regular expressions | |
| 3 | Be able to construct pushdown automata and the equivalent context free grammars. And Be able to prove the equivalence of languages described by pushdown automata and context free grammars. | |
| 4 | Be able to construct Turing machines and Post machines. Be able to prove the equivalence of languages described by Turing machines and Post machines | |
| **Pre-Requisite:** | | |
| 1 | Grammar and its classification (Context Free Grammar) | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | 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 | |
| | Context-free languages and pushdown automata: | | |

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

**Text books/ reference books:**

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

**Course Outcomes:**

On completion of the course students will be able to
   PCC-CS403.1 Write a formal notation for strings, languages and machines.
   PCC-CS403.2 Design finite automata to accept a set of strings of a language.
   PCC-CS403.3 For a given language determine whether the given language is regular or not.
   PCC-CS403.4 Design context free grammars to generate strings of context free language.
   PCC-CS403.5 Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars

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PCC-CS403.6 Write the hierarchy of formal languages, grammars and machines.

PCC-CS403.7 Distinguish between computability and non-computability and Decidability and undecidability

**Design and Analysis of Algorithms**
**Code: PCC-CS404**
**Contacts: 3L**

| Name of the Course: | **Design and Analysis of Algorithms** | |
|---|---|---|
| Course Code: PCC-CS404 | Semester: IV | |
| Duration: 6 months | Maximum Marks:100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory: 3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz: 10 marks | |
| | Attendance: 5 marks | |
| Practical: hrs./week | End Semester Exam: 70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | The aim of this module is to learn how to develop efficient algorithms for simple computational tasks and reasoning about the correctness of them | |
| 2 | Through the complexity measures, different range of behaviors of algorithms and the notion of tractable and intractable problems will be understood. | |
| **Pre-Requisite:** | | |
| 1 | To know data-structure and basic programming ability | |

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

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

**Text books/ reference books:**

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

**Course Outcomes**

On completion of the course students will be able to
   PCC-CS404.1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.
   PCC-CS404.2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.
   PCC-CS404.3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.
   PCC-CS404.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and
   PCC-CS404.5 develop the dynamic programming algorithms, and analyze it to determine its computational complexity.
   PCC-CS404,6 For a given model engineering problem model it using graph and write the corresponding algorithm to solve the problems.
   PCC-CS404.7 Explain the ways to analyze randomized algorithms (expected running time, probability of error).
   PCC-CS404.8 Explain what an approximation algorithm is. Compute the approximation factor of an approximation algorithm (PTAS and FPTAS).

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**Biology**
**Code: BSC 401**
**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 hour | 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 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 | |
| 2 | The underlying criterion, such as morphological, biochemical or ecological be highlighted. Hierarchy of life forms at phenomenological level. A common thread weaves this hierarchy Classification. Discuss classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) | 3 | |

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|  |  |  |  |
|---|---|---|---|
|  | 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 | To convey that "Genetics is to biology what Newton's laws are to Physical Sciences" Mendel's laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Emphasis to be give not to the mechanics of cell division nor the phases but how genetic material passes from parent to offspring. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Discuss about the single gene disorders in humans. Discuss the concept of complementation using human genetics. | 4 |  |
| 4. | Biomolecules: To convey that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine Molecules of life. In this context discuss monomeric units and polymeric structures. Discuss about sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA.Two carbon units and lipids. | 4 |  |
| 5 | Enzymes: To convey that without catalysis life would not have existed on earth Enzymology: How to monitor enzyme catalysed reactions. How does an enzyme catalyse reactions? Enzyme classification. Mechanism of enzyme action. Discuss at least two examples. Enzyme kinetics and kinetic parameters. Why should we know these parameters to understand biology? RNA catalysis. | 4 |  |
| 6 | Information Transfer:The molecular basis of coding and decoding genetic information is universal Molecular basis of information transfer. DNA as a genetic material. Hierarchy of DNA | 4 |  |

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| | | | |
|---|---|---|---|
| | 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. | | |
| 7 | Macromolecular analysis: How to analyse biological processes at the reductionist level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements. | 5 | |
| 8 | Metabolism: The fundamental principles of energy transactions are the same in physical and biological world. Thermodynamics as applied to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of $K_{eq}$ 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 | 4 | |
| 9 | Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics. | 3 | |

**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. Freeman and Company
4. Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, 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
6. Biology for Engineers, McGraw Hill (ISBN: 978-11-21439-931)

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## Course Outcomes:

On completion of the course students will be able to

BSC-401.1 Describe how biological observations of 18th Century that lead to major discoveries.

BSC-401.2 Convey that classification *per se* is not what biology is all about but highlight the underlying

criteria, such as morphological, biochemical and ecological

BSC-401.3 Highlight the concepts of recessiveness and dominance during the passage of genetic material

from parent to offspring

BSC-401.4 Convey that all forms of life have the same building blocks and yet the manifestations are as

diverse as one can imagine

BSC-401.5 Classify enzymes and distinguish between different mechanisms of enzyme action.

BSC-401.6 Identify DNA as a genetic material in the molecular basis of information transfer.

BSC-401.7 Analyse biological processes at the reductionistic level

BSC-401.8 Apply thermodynamic principles to biological systems.

BSC-401.9 Identify and classify microorganisms.

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

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Basic ideas of environment, basic concepts, man, society & environment, their interrelationship (1L)<br><br>Mathematics of population growth and associated problems, Importance of population study in environmental engineering, definition of resource, types of resource, renewable, non-renewable, potentially renewable, effect of excessive use vis-à-vis population growth, Sustainable Development.   (2L)<br><br>Materials balance: Steady state conservation system, steady state system with non-conservative pollutants, step function. (1L)<br><br>Environmental degradation: Natural environmental Hazards like Flood, earthquake, Landslide-causes, effects and control/management; Anthropogenic | 6 | |

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| | | | |
|---|---|---|---|
| | degradation like Acid rain-cause, effects and control. Nature and scope of Environmental Science and Engineering. (2L) | | |
| 2 | Elements of ecology: System, open system, closed system, definition of ecology, species, population, community, definition of ecosystem- components types and function. (1L)

Structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems, Mangrove ecosystem (special reference to Sundar ban); Food chain [definition and one example of each food chain], Food web.( 2L)

Biogeochemical Cycle- definition, significance, flow chart of different cycles with only elementary reaction [Oxygen, carbon, Nitrogen, Phosphate, Sulphur]. (1L)

Biodiversity- types, importance, Endemic species, Biodiversity Hot-spot, Threats to biodiversity, Conservation of biodiversity.( 2L) | 6 | |
| 3 | Atmospheric Composition: Troposphere, Stratosphere, Mesosphere, Thermosphere, Tropopause and Mesopause. (1L)

Energy balance: Conductive and Convective heat transfer, radiation heat transfer, simple global temperature model [Earth as a black body, earth as albedo], Problems.( 1L)

Green house effects: Definition, impact of greenhouse gases on the global climate and consequently on sea water level, agriculture and marine food. Global warming and its consequence, Control of Global warming. Earth's heat budget.(1L)

Lapse rate: Ambient lapse rate Adiabatic lapse rate, atmospheric stability, temperature inversion (radiation inversion).(2L)

Atmospheric dispersion: Maximum mixing depth, ventilation coefficient, effective stack height, smokestack plumes and Gaussian plume model.(2L)

Definition of pollutants and contaminants, Primary and secondary pollutants: emission standard, criteria | 11 | |

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| | | | |
|---|---|---|---|
| | pollutant. Sources and effect of different air pollutants-Suspended particulate matter, oxides of carbon, oxides of nitrogen, oxides of sulphur, particulate, PAN. (2L) Smog, Photochemical smog and London smog. Depletion Ozone layer: CFC, destruction of ozone layer by CFC, impact of other green-house gases, effect of ozone modification. (1L) | | |
| | Standards and control measures: Industrial, commercial and residential air quality standard, control measure (ESP. cyclone separator, bag house, catalytic converter, scrubber (ventury), Statement with brief reference). (1L) | | |
| 4. | Hydrosphere, Hydrological cycle and Natural water. Pollutants of water, their origin and effects: Oxygen demanding wastes, pathogens, nutrients, Salts, thermal application, heavy metals, pesticides, volatile organic compounds. (2L) | 9 | |
| | River/Lake/ground water pollution: River: DO, 5-day BOD test, Seeded BOD test, BOD reaction rate constants, Effect of oxygen demanding wastes on river [deoxygenation, reaeration], COD, Oil, Greases, pH. (2L) | | |
| | Lake: Eutrophication [Definition, source and effect]. (1L) | | |
| | Ground water: Aquifers, hydraulic gradient, ground water flow (Definition only)(1L) | | |
| | Standard and control: Waste water standard [BOD, COD, Oil, Grease], | | |
| | Water Treatment system [coagulation and flocculation, sedimentation and filtration, disinfection, hardness and alkalinity, softening] Waste water treatment system, primary and secondary treatments [Trickling filters, rotating biological contractor, Activated sludge, sludge treatment, oxidation ponds] tertiary treatment definition. (2L) | | |
| | Water pollution due to the toxic elements and their biochemical effects: Lead, Mercury, Cadmium, and Arsenic (1L) | | |
| 5 | Lithosphere; Internal structure of earth, rock and soil (1L) | 3 | |

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| | | | |
|---|---|---|---|
| | Solid Waste: Municipal, industrial, commercial, agricultural, domestic, pathological and hazardous solid wastes;<br>Recovery and disposal method- Open dumping, Land filling, incineration, composting, recycling.<br>Solid waste management and control (hazardous and biomedical waste).(2L) | | |
| 6 | Definition of noise, effect of noise pollution, noise classification [Transport noise, occupational noise, neighbourhood noise] (1L)<br>Definition of noise frequency, noise pressure, noise intensity, noise threshold limit value, equivalent noise level,<br>$L10$ (18hr Index) ,*n Ld*.Noise pollution control. (1L) | 3 | |
| 7 | Environmental impact assessment, Environmental Audit, Environmental laws and protection act of India, Different international environmental treaty/ agreement/ protocol. (2L) | 2 | |

## Text books/ reference books:

1. Masters, G. M., "Introduction to Environmental Engineering and Science", Prentice-Hall of India Pvt. Ltd.,1991.
2. Erach Bharucha, Environmental Studies, University Press
3. M.P. Poonia, Environmental Studies, Khanna Publishing House
4. De, A. K., "Environmental Chemistry", New Age International
5. Rajagopalan, Environmental Studies, Oxford University Press

## Course Outcomes:

On completion of the course students will be able to

MC-401.1 To understand the natural environment and its relationships with human activities.

MC-401.2 To apply the fundamental knowledge of science and engineering to assess environmental and health risk.

MC-401.3 To develop guidelines and procedures for health and safety issues obeying the environmental laws and regulations.

MC-401.4 Acquire skills for scientific problem-solving related to air, water, noise& land pollution.

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**PRACTICAL SYLLABUS**
**Semester IV**

**Computer Architecture Lab**
**Code: PCC-CS492**
**Contacts: 4P**

| Name of the Course: | **Computer Architecture Lab** |
|---|---|
| Course Code: PCC-CS492 | Semester: IV |
| Duration: 6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement: 60 |
| Practical: 4 hrs./week | Distribution of marks: 40 |
| Credit Points: | 2 |
| **Course Outcomes:** | |
| 1 | PCC-CS402.1 |
| 2 | PCC-CS402.2 |
| 3 | PCC-CS402.3 |
| **Pre-Requisite:** | |
| 1 | The hardware based design has been done in 1.the Analog & Digital Electronics laboratory |
| 2 | Computer Organisation laboratory |

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

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

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**Design & Analysis Algorithm Lab**
**Code: PCC-CS494**
**Contact: 4P**

| Name of the Course: | **Design & Analysis Algorithm Lab** |
|---|---|
| Course Code: PCC-CS494 | Semester: IV |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement: 60 |
| Practical: 4 hrs./week | Distribution of marks: 40 |
| Credit Points: | 2 |
| **Course Outcomes:** | |
| 1 | PCC-CS402.1 |
| 2 | PCC-CS402.2 |
| 3 | PCC-CS402.3 |
| **Pre-Requisite:** | |
| Pre-Requisite as in : PCC-CS404 | |

| **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) |

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| | Implement Depth First Search (DFS) |
|---|---|

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

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## SEMESTER – V

**Signals & Systems**
**Code: ESC501**
**Contacts: 3L**

| Name of the Course: | **Signals & Systems** | |
|---|---|---|
| Course Code: ESC-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 | |

| 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, continuous and discrete amplitude signals. System properties: linearity: additivity and homogeneity, shift-invariance, causality, stability, realizability.Examples. | 3 | |
| 2 | **Behavior of continuous and discrete-time LTI systems (8 hours)** 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 | |

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| | | | |
|---|---|---|---|
| | | | |
| 3 | **Fourier, Laplace and z- Transforms**<br>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.

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10. B. P. Lathi, " Linear Systems and Signals", Oxford University Press,2009.
11. R. Anand, "Signals & Systems", Khanna Publishing House, 2018

**Course Outcomes:**

- On completion of the course students will be able to
- Understand the concepts of continuous time and discrete time systems.
- Analyse systems in complex frequency domain.
- Understand sampling theorem and its implications.
- Understand the concepts of continuous time and discrete time systems.

**Compiler Design**
**Code: PCC-CS501**
**Contact: 3L**

| Name of the Course: | **Compiler Design** | |
|---|---|---|
| Course Code: PCC-CS501 | Semester:V | |
| Duration:6 months | Maximum Marks:100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory:3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance: 5 marks |
| Practical:  hrs./week | | End Semester Exam:70 Marks |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | To understand and list the different stages in the process of compilation. | |
| 2 | Identify different methods of lexical analysis | |
| 3 | Design top-down and bottom-up parsers | |
| 4 | Identify synthesized and inherited attributes | |
| 5 | Develop syntax directed translation schemes | |
| 6 | Develop algorithms to generate code for a target machine | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction to Compiling** [3L] Compilers, Analysis of the source program, The | 3 | |

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| | | | | |
|---|---|---|---|---|
| | | phases of the compiler, Cousins of the compiler. | | |
| 2 | | **Lexical Analysis** [6L]<br>The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of a<br>tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex). | 6 | |
| 3 | | **Syntax Analysis** [9L]<br>The role of a parser, Context free grammars, Writing a grammar, Top down Parsing, Non-recursive Predictive parsing<br>(LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques. | 9 | |
| 4 | | **Syntax directed translation** [5L]<br>Syntax director definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes. | 5 | |
| 5 | | **Type checking** [4L]<br>Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions | 4 | |
| 6 | | **Run time environments** [5L]<br>Source language issues (Activation trees, Control stack, scope of declaration, Binding of names), Storage organization<br>(Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques. | 5 | |
| 7 | | **Intermediate code generation** [4L]<br>Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements<br>(Quadruples, Triples, Indirect triples). | 4 | |
| 8 | | **Code optimization** [5L]<br>Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The<br>principle sources of optimization, Loops in flow graph, Peephole optimization. | 5 | |
| 9 | | **Code generations** [4L] | 4 | |

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| Issues in the design of code generator, a simple code generator, Register allocation & assignment. | | |
|---|---|---|

**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
1. Understand given grammar specification develop the lexical analyser
2. Design a given parser specification design top-down and bottom-up parsers
3. Develop syntax directed translation schemes
4. Develop algorithms to generate code for a target machine

**Operating Systems**
**Code: PCC-CS502**
**Contacts: 3L**

| Name of the Course: | **Operating Systems** | |
|---|---|---|
| Course Code: PCC-CS502 | Semester: V | |
| Duration: 6 months | Maximum Marks:100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory:3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz: 10 marks | |
| | Attendance : 5 marks | |
| Practical:  hrs./week | End Semester Exam :70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | To 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/U | Marks/ |
|---|---|---|---|

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| | | nit | 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 <br> **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, <br> **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 Problemetc. | 5 | |
| 4. | **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery. | 5 | |
| 5. | **Memory Management:** Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation– Fixed and variable partition– Internal and External fragmentation and Compaction; Paging: Principle of operation –Page allocation Hardware support for paging, Protection and sharing, Disadvantages of paging. <br> **Virtual Memory**: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty | 8 | |

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| | | | |
|---|---|---|---|
| | bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least 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<br>**File Management**: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency andperformance.<br><br>**Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks | 6 | |

**Text book and Reference books:**

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

**Course Outcomes:**

On completion of the course students will be able to
1. Create processes and threads.
2. Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response

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Time.

3. For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time. Design and implement file management system.

4. For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.

**Object Oriented Programming**
**Code: PCC-CS503**
**Contacts: 3L**

| Name of the Course: | **Computer Organization** | |
|---|---|---|
| Course Code: PCC-CS503 | Semester: V | |
| Duration:6 months | Maximum Marks:100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory:3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz : 10 marks | |
| | Attendance: 5 marks | |
| Practical:  hrs./week | End Semester Exam:70 Marks | |
| Credit Points: | 3 | |

| 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. | 8 | |
| 2 | Features  of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance. | 8 | |
| 3 | Inheritance in OO design. Design patterns. Introduction and classification. The iterator pattern. | 6 | |

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| 4 | Model-view-controller pattern. Commands as methods and as objects. Implementing OO language features. Memory management. | 6 | |
|---|---|---|---|
| 5 | Generic types and collections GUIs. Graphical programming with Scale and Swing . The software development process | 6 | |

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

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

| Name of the Course: | **Introduction to Industrial Management (Humanities III)** | |
|---|---|---|
| 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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction**<br>System- concept, definition, types, parameters, variables and behavior.<br>1.2 Management – definition and functions.<br>1.3 Organization structure:<br> i. Definition.<br>ii. Goals.<br>iii. Factors considered in formulating structure.<br> iv. Types.<br> v. Advantages and disadvantages.<br> vi. Applications.<br>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.<br>1.5 Organizational culture and climate – meaning, differences and factors affecting them.<br>1.6 Moral-factors affecting moral.<br>1.7 Relationship between moral and productivity.<br>1.8 Job satisfaction- factors influencing job satisfaction.<br>1.9 Important provisions of factory act and labor laws. | 6 | |

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| 2 | **Critical Path Method (CPM) and Programme Evaluation Review Technique (PERT):**<br><br>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).<br>2.4 Determination of critical path on network.<br>2.5 Floats, its types and determination of floats.<br>2.6 Crashing of network, updating and its applications. | 8 | |
|---|---|---|---|
| 3 | **Materials Management:**<br><br>3.1 Material management-definition, functions, importance, relationship with other departments.<br>3.2 Purchase - objectives, purchasing systems, purchase procedure, terms and forms used in purchase department.<br>3.3 Storekeeping- functions, classification of stores as centralized and decentralized with their advantages, disadvantages and application in actual practice.<br>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.<br>3.5 Inventory control:<br>i. Definition.<br>ii. Objectives.<br>iii. Derivation for expression for Economic Order Quantity (EOQ) and numeric examples. iv. ABC analysis and other modern methods of analysis.<br>v. Various types of inventory models such as Wilson's inventory model, replenishment model and two bin model. (Only sketch and understanding, no derivation.).<br>3.6 Material Requirement Planning (MRP)- concept, applications and brief details about software packages available in market. | 6 | |

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| 4 | **Production planning and Control (PPC):**<br><br>4.1 Types and examples of production.<br>4.2 PPC : i. Need and importance. ii. Functions. iii. Forms used and their importance. iv. General approach for each type of production.<br>4.3 Scheduling- meaning and need for productivity and utilisation.<br>4.4 Gantt chart- Format and method to prepare.<br>4.5 Critical ratio scheduling-method and numeric examples.<br>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.<br>4.7 Bottlenecking- meaning, effect and ways to reduce. | 8 | |
| 5 | **Value Analysis (VA) and Cost Control:**<br>5.1 VA-definition, terms used, process and importance. 5.2 VA flow diagram.<br>5.3 DARSIRI method of VA.<br>5.4 Case study of VA-at least two.<br>5.5 Waste-types, sources and ways to reduce them.<br>5.6 Cost control-methods and important guide lines. | 4 | |
| 6 | **Recent Trends in IM:**<br>6.1 ERP (Enterprise resource planning) - concept, features and applications.<br>6.2 Important features of MS Project.<br>6.3 Logistics- concept, need and benefits.<br>6.4 Just in Time (JIT)-concept and benefits.<br>6.5 Supply chain management-concept and benefits. | 4 | |

**Text book and Reference books:**

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

**Course Outcomes:**

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On completion of the course students will be able to
1. Interpret given organization structure, culture, climate and major provisions of factory acts and laws.
2. Explain material requirement planning and store keeping procedure.
3. Plot and analyze inventory control models and techniques.
4. Prepare and analyze CPM and PERT for given activities.
5. List and explain PPC functions.

**Theory of Computation**
**Code:** PEC-IT501A
**Contacts: 3L**

| Name of the Course: | **Theory of Computation** | |
|---|---|---|
| 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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Fundamentals: Basic definition of sequential circuit, block diagram, mathematical representation, concept of transition table and transition diagram (Relating of Automata concept to sequential circuit concept) Design of sequence detector, Introduction to finite state model [ 2L] Finite state machine: Definitions, capability & state equivalent, kth-equivalent concept [ 1L] Merger graph, Merger table, Compatibility graph [ 1L] Finite memory definiteness, testing table & testing graph. [1L] Deterministic finite automaton and non deterministic finite automaton. [1L] Transition diagrams and Language recognizers. [1L] Finite Automata: NFA with Î transitions - Significance, acceptance of languages. [1L] Conversions and Equivalence: Equivalence between NFA with and without Î transitions. NFA to DFA conversion. [2L] Minimization of FSM, Equivalence between two FSM's , Limitations of FSM [1L] Application of finite automata, Finite Automata with output- Moore & | 13 | |

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| | | | |
|---|---|---|---|
| | Melay machine. [2L] | | |
| 2 | Regular Languages : Regular sets. [1L] Regular expressions, identity rules. Arden's theorem state and prove [1L] Constructing finite Automata for a given regular expressions, Regular string accepted by NFA/DFA [1L] Pumping lemma of regular sets. Closure properties of regular sets (proofs not required). [1L] Grammar Formalism: Regular grammars-right linear and left linear 9grammars. [1L] Equivalence between regular linear grammar and FA. [1L] Inter conversion, Context free grammar. [1L] Derivation trees, sentential forms. Right most and leftmost derivation of strings. (Concept only) [1L] | 8 | |
| 3. | Context Free Grammars, Ambiguity in context free grammars. [1L] Minimization of Context Free Grammars. [1L] Chomsky normal form and Greibach normal form. [1L] Pumping Lemma for Context Free Languages. [1L] Enumeration of properties of CFL (proofs omitted). Closure property of CFL, Ogden's lemma & its applications [1L] Push Down Automata: Push down automata, definition. [1L] Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence. [1L] Equivalence of CFL and PDA, interconversion. (Proofs not required). [1L] Introduction to DCFL and DPDA. [1L] | 9 | |
| 5. | Turing Machine : Turing Machine, definition, model [1L] Design of TM, Computable functions [1L] Church's hypothesis, counter machine [1L] Types of Turing machines (proofs not required) [1 L] Universal Turing Machine, Halting problem [2L] | 5 | |

**Text book and Reference books:**

1. "Introduction to Automata Theory Language and Computation", Hopcroft H.E. and Ullman J. D., Pearson education.
2. "Theory of Computation", R.B. Patel & Prem Nath, Khanna Book Publishing.
3. "Theory of Computer Science ", Automata Languages and computation", Mishra and Chandra shekaran, 2nd edition, PHI.
4. "Formal Languages and Automata Theory", C.K.Nagpal, Oxford
5. "Switching & Finite Automata", ZVI Kohavi, 2nd Edn., Tata McGraw Hill
6. "Introduction to Computer Theory", Daniel I.A. Cohen, John Wiley
7. "Introduction to languages and the Theory of Computation", John C Martin, TMH
8. "Elements of Theory of Computation", Lewis H.P. & Papadimitrou C.H. Pearson, PHI.

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**Course Outcomes:**

On completion of the course students will be able to
1. Define a system and recognize the behavior of a system. They will be able to minimize a system
   and compare different systems
2. Convert Finite Automata to regular expression. Students will be able to check equivalence between regularlinear grammar and FA.
3. Minimize context free grammar. Student will be able to check equivalence of CFL and PDA. They
4. Will be able to design Turing Machine.
5. Design Turing machine.

**Artificial Intelligence**
**Code: PEC-IT501B**
**Contacts: 3L**

| Name of the Course: | **Artificial Intelligence** | |
|---|---|---|
| Course Code**: PEC-IT501B** | Semester: V | |
| Duration: 6 months | Maximum Marks:100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory:3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance : 5 marks |
| Practical:  NIL | | End Semester Exam :70 Marks |
| Credit Points: | 3 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction [2]**<br>Overview of Artificial intelligence- Problems of AI, AI technique, Tic - Tac - Toe problem.<br>**Intelligent Agents [2]**<br>Agents & environment, nature of environment, structure of agents, goal based agents, utility based agents, learning agents.<br>**Problem Solving [2]**<br>Problems, Problem Space & search: Defining the problem as state space search, production system, problem characteristics, issues in the design of search programs. | 6 | |
| 2. | **Search techniques [5]** | 13 | |

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| | | | |
|---|---|---|---|
| | Solving problems by searching :problem solving agents, searching for solutions; uniform search strategies: breadth first search, depth first search, depth limited search, bidirectional search, comparing uniform search strategies.<br>**Heuristic search strategies [5]**<br>Greedy best-first search, A* search, memory bounded heuristic search: local search algorithms & optimization problems:<br>Hill climbing search, simulated annealing search, local beam search, genetic algorithms; constraint satisfaction problems,<br>local search for constraint satisfaction problems.<br>**Adversarial search [3**]<br>Games, optimal decisions & strategies in games, the minimax search procedure, alpha-beta pruning, additional refinements,<br>iterative deepening. | | |
| 3 | **Knowledge & reasoning [3]**<br>Knowledge representation issues, representation & mapping, approaches to knowledge representation, issues in knowledge representation. | 3 | |
| 4 | **Using predicate logic [2]**<br>Representing simple fact in logic, representing instant & ISA relationship, computable functions & predicates, resolution, natural deduction.<br>**Probabilistic reasoning [4]**<br>Representing knowledge in an uncertain domain, the semantics of Bayesian networks, Dempster-Shafer theory, Fuzzy sets & fuzzy logics. | 6 | |
| 5 | **Natural Language processing [2]**<br>Introduction, Syntactic processing, semantic analysis, discourse & pragmatic processing.<br>**Learning [2]**<br>Forms of learning, inductive learning, learning decision trees, explanation based learning, learning using relevance information, neural net learning & genetic learning.<br>**Expert Systems [2]**<br>Representing and using domain knowledge, expert system shells, knowledge acquisition. | 6 | |

**Text book and Reference books:**

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

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**Advanced Computer Architecture**
**Code:** PEC-IT501C
**Contacts: 3L**

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

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Computer Architecture and Organization-Review, Fundamentals of Computer Design, Technology Trends Cost Performance Analysis (3L)<br>Parallel Processing Architectures- Taxonomy- SISD, MISD, SIMD,MIMD, PRAM models (3L) | 6 | |
| 2. | Data and Resource Dependencies, Program Partitioning and Scheduling, Control Flow vs. Data Flow (3L)<br>Network topologies-Static, Dynamic, Types of Networks (3L)<br>RISC vs. CISC, Memory Hierarchy, Virtual Memory (4L) | 10 | |
| 3 | Concepts of Pipelining, Instruction Pipelining, dynamic pipelining, arithmetic pipelines. (4L)<br>Multiprocessors- Multistage Networks, Cache Coherence, Synchronization, Message- passing (4L)<br>Vector Processing Principles- Instruction types, Compound, Vector Loops, Chaining (4L) | 12 | |
| 4 | Array Processors- Structure, Algorithms (3L)<br>Data Flow Architecture- Graphs. Petri Nets, Static and Dynamic DFA, VLSI Computations (4L)<br>Parallel Programming Models, Languages, Compilers (4L) | 11 | |

**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

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**Computer Graphics**
**Code: PEC-IT501D**
**Contacts: 3L**

| Name of the Course: | **Computer Graphics** | |
|---|---|---|
| Course Code: PEC-IT501D | Semester: V | |
| Duration: 6 months | Maximum Marks:100 | |
| **Teaching Scheme** | | **Examination Scheme** |
| Theory:3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: NIL | | Assignment and Quiz: 10 marks |
| | | Attendance : 5 marks |
| Practical:  NIL | | End Semester Exam :70 Marks |
| Credit Points: | 3 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction to computer graphics & graphics systems [6L]:** Overview of computer graphics, representing pictures, preparing, presenting & interacting with pictures for presentations; Visualization & image processing; RGB color model, direct coding, lookup table; storage tube graphics display, Raster scan display, 3D viewing devices, Plotters, printers, digitizers, Light pens etc.; Active & Passive graphics devices; Computer graphics software. **Scan conversion [8L]:** Points & lines, Line drawing algorithms; DDA algorithm, Bresenham's line algorithm, Circle generation algorithm; Ellipse generating algorithm; scan line polygon, fill algorithm, boundary fill algorithm, flood fill algorithm. | 14 | |
| 2 | **2D transformation & viewing [15L]:** Basic transformations: translation, rotation, scaling; Matrix representations & homogeneous coordinates, transformations between coordinate systems; reflection shear; Transformation of points, lines, parallel lines, intersecting lines. Viewing pipeline, Window to view port co-ordinate transformation, clipping operations, point clipping, line clipping, clipping circles, polygons & ellipse. Cohen and Sutherland line clipping, Sutherland-Hodgeman Polygon clipping, Cyrus-beck clipping method 3D transformation & viewing [5L]: 3D transformations: translation, rotation, scaling & other transformations. Rotation about an arbitrary axis in space, reflection through an arbitrary plane; general parallel projection transformation; clipping, view port clipping, 3D viewing. | 20 | |

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| 3. | **Curves [3L]:** Curve representation, surfaces, designs, Bezier curves, B-spline curves, end<br>conditions for periodic B-spline curves, rational B-spline curves.<br>**Hidden surfaces [3L]:** Depth comparison, Z-buffer algorithm, Back face detection, BSP tree<br>method, the Painter's algorithm, scan-line algorithm; Hidden line elimination, wire frame<br>methods , fractal - geometry.<br>**Color & shading models [2L]:** Light & color model; interpolative shading model; Texture.<br>**Introduction to Ray-tracing: [3L]**<br>Human vision and color, Lighting, Reflection and transmission models. | 6 | |

**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

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

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

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction:**<br> Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy | 3 | |
| 2 | **Union Government and its Administration :**<br>Structure of the Indian Union: Federalism, Centre- State relationship, | 6 | |

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| | | | |
|---|---|---|---|
| | President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha | | |
| 3. | **State Government and its Administration Governor:** Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions | 6 | |
| 4. | **Local Administration District's Administration head:** Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation, Pachayati raj: Introduction, PRI: Zila Pachayat, Elected officials and their roles, CEO Zila Pachayat: Position and role, Block level: Organizational Hierarchy (Different 4.departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy | 8 | |
| 5. | **Election Commission Election Commission:** Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women | | |

**Text book and Reference books:**

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

**PRACTICAL SYLLABUS**

**Compiler Design Lab**
**Code:** PCC-CS591
**Contacts: 4P**

| Name of the Course: | **Compiler Design Lab** |
|---|---|
| Course Code: PCC-CS591 | Semester:V |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement:60 |
| Practical: 4 hrs./week | Distribution of marks:40 |
| Credit Points: | 2 |
| **Course Outcomes:** | |
| 1 | Be exposed to compiler writing tools. |

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| 2 | Learn to implement the different Phases of compiler |
|---|---|
| 3 | Be familiar with control flow and data flow analysis |
| 4 | Learn simple optimization techniques |

**Pre-Requisite:**

Pre-requisites as in ESC-301

**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 by the college
(Detailed instructions for Laboratory Manual to be followed for further guidance)

Object Oriented Programming Lab
**Code:** PCC-CS593
**Contacts: 4P**

| Name of the Course: | Object Oriented Programming Lab |
|---|---|
| Course Code: PCC-CS593 | Semester:V |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement:60 |
| Practical: 4 hrs./week | Distribution of marks:40 |

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| Credit Points: | 2 |
|---|---|

| **Laboratory   Experiments:** |
|---|
| 1. Assignments on class, constructor, overloading, inheritance, overriding<br>2. Assignments on wrapper class, arrays<br>3. Assignments on developing interfaces- multiple inheritance, extending interfaces<br>4. Assignments on creating and accessing packages<br>5. Assignments on multithreaded programming<br>6. Assignments on applet programming<br>**Note: Use Java for programming** |

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

Operating System Lab
**Code:** PCC-CS592
**Contacts: 4P**

| Name of the Course: | Operating System Lab |
|---|---|
| Course Code: PCC-CS592 | Semester:V |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement:60 |
| Practical: 4 hrs./week | Distribution of marks:40 |
| Credit Points: | 2 |

| **Laboratory   Experiments:** |
|---|
| 1 1. **Managing Unix/Linux Operating System [8P]:**<br>Creating a bash shell script, making a script executable, shell syntax (variables, conditions, control structures, functions,<br>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<br>methods Kernel loading, init and the inittab file, Run-levels, Run level scripts. Password file management, Password<br>security, Shadow file, Groups and the group file, Shells, restricted shells, user-management commands, homes and<br>permissions, default files, profiles, locking accounts, setting passwords, Switching user, Switching group, Removing users &user groups. |

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

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

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## SEMESTER – VI

**Database Management Systems**
**Code: PCCCS601**
**Contact: 3L**

| Name of the Course: | **Database Management Systems** | |
|---|---|---|
| Course Code: PCC-CS601 | 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:  hrs./week | End Semester Exam:70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | To understand the different issues involved in the design and implementation of a database system. | |
| 2 | To study the physical and logical database designs, database modeling, relational, hierarchical, and network models | |
| 3 | To understand and use data manipulation language to query, update, and manage a database | |
| 4 | To develop an understanding of essential DBMS concepts such as: database security, integrity, concurrency, distributed database, and intelligent database, Client/Server (Database Server), Data Warehousing. | |
| 5 | To design and build a simple database system and demonstrate competence with the fundamental tasks involved with modeling, designing, and implementing a DBMS. | |
| 6 | To understand the different issues involved in the design and implementation of a database system. | |

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

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

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

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**Course Outcomes**:

On completion of the course students will be able to
1. For a given query write relational algebra expressions for that query and optimize the developedexpressions
2. For a given specification of the requirement design the databases using E R method andnormalization.
3. For a given specification construct the SQL queries for Open source and Commercial DBMS -MYSQL, ORACLE, andDB2.
4. For a given query optimize its execution using Query optimizationalgorithms
5. For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, anddurability.
6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

**Computer Networks**
**Code: PCC-CS602**
**Contact: 3L**

| Name of the Course: | **Computer Networks** | | |
|---|---|---|---|
| Course Code: PCC-CS602 | 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:  hrs./week | | End Semester Exam:70 Marks | |
| Credit Points: | 3 | | |
| **Objective:** | | | |
| 1 | To develop an understanding of modern network architectures from a design and performance perspective. | | |
| 2 | To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs). | | |
| 3 | To provide an opportunity to do network programming | | |
| 4 | To provide a WLAN measurement ideas. | | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Data communication Components: Representation of data and its flow | 9 | |

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| | | | |
|---|---|---|---|
| | 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. | | |
| 2 | Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA,CSMA/CD,CDMA/CA | 8 | |
| 3 | Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. | 14 | |
| 4. | **Transport Layer:** Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. | 8 | |
| 5 | **Application Layer:** Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography. | 8 | |

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**Text book and Reference books:**
1. Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. "Design and Analysis of Algorithms" by Gajendra Sharma.

**Course Outcomes**:

On completion of the course students will be able to
1. Understand research problem formulation.
2. Analyze research related information
3. Follow research ethics
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

**Advanced Algorithms**
**Code: PEC-IT601 A**
**Contact: 3L**

| Name of the Course: | **Advanced Algorithms** | |
|---|---|---|
| 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:  NIL | End Semester Exam:70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | Introduce students to the advanced methods of designing and analyzing algorithms. | |
| 2 | The student should be able to choose appropriate algorithms and use it for a specific | |

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| | | |
|---|---|---|
| | | problem. |
| 3 | | To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems. |
| 4 | | Students should be able to understand different classes of problems concerning their computation difficulties. |
| 5 | | To introduce the students to recent developments in the area of algorithmic design. |
| **Pre-Requisite:** | | |
| 1 | | Algorithm Design and Analysis |

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

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

**Text book and Reference books:**
1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.
4. "Design and Analysis of Algorithms" by Gajendra Sharma.

**Course Outcomes**:

On completion of the course students will be able to
1. Analyze the complexity/performance of different algorithms.
2. Determine the appropriate data structure for solving a particular set of problems.
3. Categorize the different problems in various classes according to their complexity.
4. Students should have an insight of recent activities in the field of the advanced data structure.

**Distributed Systems**
**Code: PEC-IT601B**
**Contact: 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 |

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|  |  | Attendance: 5 marks |
|---|---|---|
| Practical: NIL |  | 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 | 8 |  |
| 2 | **DISTRIBUTED DATABASE DESIGN** Alternative design strategies; Distributed design issues; Fragmentation; Data allocation **SEMANTICS DATA CONTROL** View management; Data security; Semantic Integrity Control QUERY **PROCESSING ISSUES** Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data | 11 |  |
| 3 | **DISTRIBUTED QUERY OPTIMIZATION** Factors governing query optimization; Centralized query optimization; 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 | 11 |  |

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| | | | |
|---|---|---|---|
| 4. | Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols Algorithm | 8 | |
| 5 | **PARALLEL DATABASE** SYSTEMS Parallel architectures; parallel query processing | 6 | |
| 6 | **ADVANCED TOPICS Mobile** Databases, Distributed Object Management, Multi-databases | 4 | |

**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
1. Design trends in distributed systems.
2. Apply network virtualization.
3. Apply remote method invocation and objects.

**Software Engineering**
**Code:PEC-IT601C**
**Contact: 3L**

| Name of the Course: | **Software Engineering** | | |
|---|---|---|---|
| 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:  NIL | | End Semester Exam:70 Marks | |
| Credit Points: | 3 | | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|

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

**Text book and Reference books:**

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
7. N.S. Gill, Software Engineering – Khanna Publishing House

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**Image Processing**
**Code:PEC-IT601 D**
**Contact: 3L**

| Name of the Course: | Image Processing | |
|---|---|---|
| Course Code: PEC-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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction [3L]** Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display. | 9 | |
| 2 | **Digital Image Formation [4L]** A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation), Perspective Projection, Sampling & Quantization - Uniform & Non uniform. | 4 | |
| 3 | **Mathematical Preliminaries[9L]** Neighbour of pixels, Connectivity, Relations, Equivalence & Transitive Closure; Distance Measures, Arithmetic/Logic Operations, Fourier Transformation, Properties of The Two Dimensional Fourier Transform, Discrete Fourier Transform, Discrete Cosine & SineTransform. | 9 | |

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| 4. | **Image Enhancement [8L]**<br>Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High- boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering. | 8 | |
|---|---|---|---|
| 5 | **Image Restoration [7L]**<br>Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation. | 7 | |
| 6 | **Image Segmentation [7L]**<br>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. 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

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**Parallel and Distributed Algorithms**
**Code:** PEC-IT602A
**Contacts: 3L**

| Name of the Course: | **Parallel and Distributed Algorithms** | |
|---|---|---|
| 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 | |

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

**Text book and Reference books:**

1. Parallel Programming, Barry Wilkinson, Michael Allen, Pearson Education, 2nd Edition.
2. Introduction to Parallel algorithms by Jaja from Pearson, 1992.

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**Data Warehousing and Data Mining**
**Code:** PEC-IT602B
**Contacts: 3L**

| Name of the Course: | **Data Warehousing and Data Mining** | |
|---|---|---|
| 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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Unit 1:** Introduction to Data Warehousing; Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods; | 8 | |
| 2 | **Unit 2:** Classification and prediction; Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns, | 8 | |
| 3 | **Unit 3:** Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, Similarity search in Time-series analysis; | 8 | |
| 4. | **Unit 4:** Mining Data Streams, Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;modulation for communication, filtering, feedback control systems. | 11 | |
| | **Unit 5:** Web Mining, Mining the web page layout structure, | 9 | |

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| | | |
|---|---|---|
| mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining. | | |
| **Unit 6:** Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis | 5 | |

**Text book and Reference books:**

1. Data Warehousing Fundamentals for IT Professionals, Second Edition by Paulraj Ponniah, Wiley India.
1. Data Warehousing, Data Mining, & OLAP – Second Edition by Alex Berson and Stephen J. Smith, Tata McGraw Hill Education
2. Data warehouse Toolkit by Ralph Kimball, Wiley India

3. Jiawei Han and M Kamber, Data Mining Concepts and Techniques,, Second Edition, Elsevier Publication, 2011.
4. Vipin Kumar, Introduction to Data Mining - Pang-Ning Tan, Michael Steinbach, Addison Wesley,2006.
4. G Dong and J Pei, Sequence Data Mining, Springer, 2007.

**Course Outcomes:**
After completion of course, students would be:

1. Study of different sequential pattern algorithms
2. Study the technique to extract patterns from time series data and it application in real world.
3. Can extend the Graph mining algorithms to Web mining
4. Help in identifying the computing framework for Big Data

**Human Computer Interaction**
**Code:** PEC-IT602C
**Contacts: 3L**

| Name of the Course: | **Human Computer Interaction** | |
|---|---|---|
| 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:** | | |

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| 1 | Learn the foundations of Human Computer Interaction |
| 2 | Be familiar with the design technologies for individuals and persons with disabilities |
| 3 | Be aware of mobile Human Computer interaction |
| 4 | Learn the guidelines for user interface. |
| **Pre-Requisite:** | |
| 1 | Computer Organization &Architecture |

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

**Text book and Reference books:**

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

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

**Course Outcomes:**

On completion of the course students will be able to
1. Differentiate between various software vulnerabilities.
2. Software process vulnerabilities for an organization.
3. Monitor resources consumption in a software.
4. Interrelate security and software development process.

**Pattern Recognition**

**Code:**PEC-IT602D

**Contact: 3L**

| Name of the Course: | **Pattern Recognition** | |
|---|---|---|
| Course Code: **PEC-IT602D** | Semester: VI | |
| Duration:6 months | Maximum Marks:100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory:3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz: 10 marks | |
| | Attendance: 5 marks | |
| Practical: NIL | End Semester Exam:70 Marks | |
| Credit Points: | 3 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Basics of pattern recognition | 2 | |
| 2 | **Bayesian decision theory 8L** Classifiers, Discriminant functions, Decision surfaces Normal density and discriminant functions Discrete features | 8 | |
| 3 | **Parameter estimation methods 6L** Maximum-Likelihood estimation Gaussian mixture models Expectation-maximization method Bayesian estimation | 6 | |
| | **Hidden Markov models for sequential pattern** | 8 | |

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| | | | |
|---|---|---|---|
| 4. | **classification 8L**<br>4.1. Discrete hidden Markov models<br>4.2. Continuous density hidden Markov models | | |
| 5 | **Dimension reduction methods 3L**<br>5.1. Fisher discriminant analysis<br>5.2Principal component analysis<br>. Parzen-window method<br>K-Nearest Neighbour method | 3 | |
| 6 | Non-parametric techniques for density estimation | 2 | |
| 7 | **Linear discriminant function based classifier 5L**<br>7.1. Perceptron<br>7.2. Support vector machines | 5 | |
| 8 | **Non-metric methods for pattern classification 4L**<br>8.1. Non-numeric data or nominal data<br>8.2. Decision trees | 4 | |
| 9 | **Unsupervised learning and clustering 2L**<br>9.1. Criterion functions for clustering<br>9.2. Algorithms for clustering: K-means, Hierarchical and other methods | 2 | |

**Text book and Reference books:**

1. R. O. Duda, P. E. Hart and D. G. Stork: Pattern Classification, John Wiley, 2001.
2. S. Theodoridis and K. Koutroumbas, Pattern Recognition, 4th Ed., Academic Press, 2009.
3. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.

**Numerical Methods**
**Code: OEC-IT601A**

**Contact: 3L**

| Name of the Course: | **Numerical Methods** |
|---|---|
| Course Code: OEC-IT601A | Semester: VI |

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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 | | |

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

**Text book and Reference books:**

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

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**Human Resource Development and Organizational Behavior**
**Code: OEC-IT601 B**

**Contact: 3L**

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

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB. **[2]** Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction. | 4 | |
| 2 | Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making. **[2]** 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. | 8 | |
| 3 | Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making. **[2]** Communication: Communication Process, Direction | 4 | |

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| | | | |
|---|---|---|---|
| | of Communication, Barriers to Effective Communication. **[2]** Leadership: Definition, Importance, Theories of Leadership Styles. | | |
| 4. | Organizational Politics: Definition, Factors contributing to Political Behaviour. **[2]** Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process. **[2]** Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture. | 8 | |

**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.

### PRACTICAL SYLLABUS

**Database Management System Lab**
**Code:** PCC-CS691
**Contacts: 4P**


| Name of the Course: | **Database Management System Lab** |
|---|---|
| Course Code: PCC-CS691 | Semester:VI |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |
| Tutorial: NIL | External Assesement:60 |
| Practical: 4 hrs./week | Distribution of marks:40 |
| Credit Points: | 2 |

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| Laboratory Experiments: |
| --- |
| **Structured Query Language** |
| 1. **Creating Database** |
| • ☐Creating a Database |
| • ☐Creating a Table |
| • ☐Specifying Relational Data Types |
| • ☐Specifying Constraints |
| • ☐Creating Indexes |
| 2. **Table and Record Handling** |
| • ☐INSERT statement |
| • ☐Using SELECT and INSERT together |
| • ☐DELETE, UPDATE, TRUNCATE statements |
| • ☐DROP, ALTER statements |
| 3. **Retrieving Data from a Database** |
| 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 |
| **Cursors in Oracle PL / SQL** |
| **Writing Oracle PL / SQL Stored Procedures** |

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

**Computer Networks Lab**
**Code:** PCC-CS692
**Contacts: 4P**

| Name of the Course: | Computer Networks Lab |
| --- | --- |
| Course Code: PCC-CS692 | Semester:VI |
| Duration:6 months | Maximum Marks:100 |
| **Teaching Scheme:** | |
| Theory: hrs./week | Continuous Internal Assessment |

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

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

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

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## SEMESTER – VII

**Internet Technology**
**Code: PEC-IT701A**
**Contacts: 3L**

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

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction to Internet Technology(6L)  :**<br>Overview, Network of Networks, Intranet, Extranet and Internet.,World Wide Web:Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP.<br>Review of TCP/IP:Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6.<br>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<br>POP3, SMTP. | 6 | |
| 2 | **HTML, Image Maps ,XML,CGI Scripts(9L):**<br>Introduction, Editors, Elements, Attributes,<br>Heading, Paragraph. Formatting, Link,<br>Head, Table, List, Block, Layout, CSS.<br>Form,  Iframe, Colors, Color name, Color<br>value, map, area, attributes of image area.<br>Extensible Markup Language, Introduction,<br>Tree, Syntax, Elements, Attributes,<br>Validation, Viewing. XHTML in brief.<br>Introduction, Environment Variable, GET<br>and POST Methods | 9 | |
| 3 | **Perl, JavaScript,Java applets(10L)**<br>Introduction, Variable, Condition, Loop, Array, | 10 | |

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| | | | |
|---|---|---|---|
| | 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. | | |
| 4. | **Client-Server programming In Java Threats, Network Security techniques(4L)** 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(5L):** 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)

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**Quantum Computing**
**Code: PEC-IT701B**
**Contacts: 3L**

| Name of the Course: | **Quantum Computing** | |
|---|---|---|
| Course Code: PEC-IT701B | Semester: VII | |
| Duration: 6 months | Maximum Marks:100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory:3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz: 10 marks | |
| | Attendance : 5 marks | |
| Practical:  NIL | End Semester Exam :70 Marks | |
| Credit Points: | 3 | |
| **Objective:** | | |
| 1 | The course will provide an insight of basic of quantum physics from a computer scientist's perspective, and how it describes reality and understand the philosophical implications of quantum computing | |
| **Pre-Requisite:** | | |
| 1 | Linear Algebra, Theory of Computation | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchyschwarez and triangle Inequalities. | 3 | |
| 2 | Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators, | 10 | |
| 3. | Commutator Algebra, Heisenberg uncertainty principle, polar decomposition &singular values, Postulates of Quantum Mechanics. | 5 | |
| 4. | Tensor Products: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key | 5 | |

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| | | | |
|---|---|---|---|
| | Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector. | | |
| 5. | Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized Measurements, Positive Operator- Valued Measures. | 8 | |
| 6. | Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming. | 6 | |

**Text book and Reference books:**

Quantum Computing without Magic by Zdzislaw Meglicki
2. Quantum Computing Explained By DAVID Mc MAHON
3. Quantum Computer Science By Marco Lanzagorta, Jeffrey Uhlmann
4. An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca.

**Course Outcomes:**

On completion of the course students will be able to
knowledge of Vector spaces, Matrices, Quantum state, Density operator and Quantum

**Cloud Computing**
**Code:** PEC-IT701C
**Contact: 3L**

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

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Definition of Cloud Computing and its Basics (Lectures )**. Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds), | 9 | |

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| | | | |
|---|---|---|---|
| | 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 <br> SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) <br> Compliance as a Service (CaaS) | | |
| 2 | **Use of Platforms in Cloud Computing** <br> 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, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) <br> 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 <br> Use of PaaS Application frameworks, Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and | 12 | |

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| | | | |
|---|---|---|---|
| | 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**:<br>Cloud Management:<br>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<br>some products, Lifecycle management of cloud services (six stages of lifecycle).<br>Concepts of Cloud Security:<br>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<br>Identity management (awareness of Identity protocol standards) | 7 | |
| 4. | **Concepts of Services and Applications :**<br><br>Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs,<br>Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service | 8 | |

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| | | |
|---|---|---|
| attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs<br><br>Cloud-based Storage: Cloud storage definition – Manned and Unmanned<br><br>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

**Machine Learning**
**Code: PEC-IT701D**
**Contacts: 3L**

| Name of the Course: | Machine Learning | |
|---|---|---|
| Course Code: PEC IT-701D | 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 | |

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| COURSE OBJECTIVE | | |
|---|---|---|
| ☐ To learn the concept of how to learn patterns and concepts from data without being explicitly programmed | | |
| ☐ To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances. | | |
| ☐ Explore supervised and unsupervised learning paradigms of machine learning. | | |
| ☐ To explore Deep learning technique and various feature extraction strategies. | | |
| | **Hrs/unit** | **Marks/unit** |
| **Unit 1:** <br> **Supervised Learning (Regression/Classification)** <br> ☐ Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes <br> ☐ Linear models: Linear Regression, Logistic Regression, Generalized Linear Models <br> ☐ Support Vector Machines, Nonlinearity and Kernel Methods <br> ☐ Beyond Binary Classification: Multi-class/Structured Outputs, Ranking | 10 | |
| **Unit 2:** <br> **Unsupervised Learning** <br> ☐ Clustering: K-means/Kernel K-means <br> ☐ Dimensionality Reduction: PCA and kernel PCA <br> ☐ Matrix Factorization and Matrix Completion <br> ☐ Generative Models (mixture models and latent factor models) | 7 | |
| **Unit 3** <br> Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests) | 6 | |
| **Unit 4** <br> Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning | 9 | |
| **Unit 5** <br> Scalable Machine Learning (Online and Distributed Learning) <br> A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference | 9 | |
| **Unit 6:** <br> Recent trends in various learning techniques of machine learning and classification methods | 5 | |

**References:**

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

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

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

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

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**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 | |

| 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(14L)** Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI<br><br>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 | 8 | |
| 4. | **Image and Video Database, Document Architecture and    Content    Management    (17L):**    Image representation, segmentation, similarity based retrieval, | 17 | |

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| | | | |
|---|---|---|---|
| | 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 | | |
| 5. | **Multimedia Applications(4L):** 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. V.K. Jain, Multimedia and Animation, Khanna Publishing House, 2019.
3. Nalin K. Sharda , Multimedia Information System , PHI.
4. Fred Halsall , Multimedia Communications , Pearson Ed.
5. Koegel Buford , Multimedia Systems , Pearson Ed.
6. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
7. Ralf Steinmetz and Klara Nahrstedt , Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing , PHI.
8. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.

**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: | End Semester Exam: 70 Marks | |
| Credit Points: | 3 | |

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| 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, backpropagation, regularization, model selection, and optimization. | 6 | |
| 4. | **Conditional Random Fields:** Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy. | 9 | |
| 5 | **Deep Learning:** Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network. | 6 | |
| 6 | **Deep Learning research:** Object recognition, sparse coding, computer vision, natural language | 6 | |

**Text book and Reference books:**

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
6. Rajiv Chopra, Deep Learning, Khanna Publishing House, 2018.

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**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: | End Semester Exam: 70 Marks | |
| Credit Points: | 3 | |

| 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 | |

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| | | | |
|---|---|---|---|
| | | | |
| 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 modelling:Applications of Neural Networks: Pattern Recognition and classification | 10 | |
| 4. | Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition | 10 | |
| 5 | **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.

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**Adhoc –Sensor Network**
**Code: PEC-IT702D**
**Contact: 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 | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz: 10 marks | |
| | Attendance: 5 marks | |
| Practical: 4 hrs | 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. . | |
| 5 | To study about sensor node hardware and software platforms and understand the simulation and programming techniques.. | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction and Overview [4L]** :Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs. | 4 | |
| 2 | **Architectures** Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes , operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources | 9 | |

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| | | | |
|---|---|---|---|
| | and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design princip | | |
| 3 | **Communication Protocols [9L]**: Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC , the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing 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 | | |
| 5 | **Sensor Network Platforms and Tools [9L]:**Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM. | | |

**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

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Information Processing Approach", Elsevier, 2007.
REFERENCES
1.      Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor
Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2.      Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3.      Thomas Haenselmann, "Sensor Networks", available online for free, 2008.

**Information Theory and Coding**
**Code: PEC-IT702E**
**Contact: 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 | | |
| 2 | | |
| 3 | | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Source Coding [7L]** Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes | 7 | |

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| | | | |
|---|---|---|---|
| 2 | **Channel Capacity And Coding [7L]** <br> Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit | 7 | |
| 3 | **Linear And Block Codes For Error Correction [8L]** <br> 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 [7L]** <br> Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes.. | 7 | |
| 5 | **BCH Codes [8L]** <br> Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes. | 8 | |
| 6 | **Convolutional Codes [8L]** <br> 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 | 8 | |

**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.

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**Cyber Security**
**Code: PEC-IT702F**
**Contact: 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 develop an understanding of modern network architectures from a design and performance perspective. | |
| 2 | To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs). | |
| 3 | To provide an opportunity to do network programming | |
| 4 | To provide a WLAN measurement ideas. | |

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

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| | | | |
|---|---|---|---|
| 4. | Cyber Forensics and Auditing: Introduction to Cyber Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013 | 10 | |
| 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 & Cyber Laws, Gupta & Gupta, Khanna Publishing House  (AICTE Recommended - 2018)
3. Information Security and Cyber Laws, Pankaj Agarwal
4. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cyberdefense Program Against Advanced Threats, A-press
5. Nina Godbole, SumitBelapure, Cyber Security, Willey
6. Hacking the Hacker, Roger Grimes, Wiley
7. Cyber Law By Bare Act, Govt Of india, It Act 2000.

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**Operation Research**
**Code:** OEC-IT701A
**Contact: 3L**

| Name of the Course: | **Operation Research** | |
|---|---|---|
| Course Code: OEC-IT701A | Semester: VII | |
| Duration: 6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | | **Examination Scheme** |

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

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Basic LPP and Applications; Various Components of LP Problem Formulation.<br><br>Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method;<br>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:<br>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:<br>Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): ($\infty$ / FIFO) and (M/M/1: N / FIFO) and problems. | 5 | |

**Text book and Reference books:**

**Maulana Abul Kalam Azad University of Technology, West Bengal**
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(Applicable from the academic session 2018-2019)

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

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Introduction to Philosophical Thoughts
**Code:** OEC-IT701B
**Contact: 3L**

| Name of the Course: | Introduction to Philosophical Thoughts | |
|---|---|---|
| Course Code: OEC-IT701B | Semester: VII | |
| Duration: 6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory: 3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: NIL | Assignment and Quiz: 10 marks | |
| | Attendance: 5 marks | |
| Practical: NIL | End Semester Exam: 70 Marks | |
| Credit Points: | 3 | |

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

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**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

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Soft Skills & Interpersonal Communication
**Code:** OEC-IT701C
**Contact: 3L**

| Name of the Course: | Soft Skills & 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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **1. Soft Skills:** An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurment of Soft Skill Development.<br>**2. Self-Discovery:** Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue.<br>**3. Positivity and Motivation:** Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels. | 12 | |
| 2 | **Interpersonal Communication:** Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective | 12 | |

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| | | | |
|---|---|---|---|
| | 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. | | |
| 3 | **1. Interview Skills:** Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. **2. Presentation Skills:** Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. 3. Etiquette and Manners – Social and Business. **4. Time Management** – Concept, Essentials, Tips. **5. Personality Development** – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills. | 12 | |

**Text book and Reference books:**
1. Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.
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Project Management and Entrepreneurship
**Code:** HSMC 701
**Contact: 2L+1T**

| Name of the Course: | Project Management and Entrepreneurship |
|---|---|
| Course Code: HSMC 701 | Semester: VII |
| Duration: 6 months | Maximum Marks: 100 |

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| Teaching Scheme | | Examination Scheme |
| --- | --- | --- |
| Theory: 3 hrs./week | | Mid Semester exam: 15 |
| Tutorial: 1hr | | Assignment and Quiz: 10 marks |
| | | Attendance: 5 marks |
| Practical:  NIL | | End Semester Exam: 70 Marks |
| Credit Points: | 3 | |

### ENTREPRENEURSHIP

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

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

9. Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L]

10. Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L]
11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L]

12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]
13. Case Studies with Hands-on Training on MS-Project [4L]

**Text Books and References**

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**Maulana Abul Kalam Azad University of Technology, West Bengal**
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1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

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**Project**
**Code: PROJ-IT781**
**Contact: 12P**

| Project work I |

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

**Project Work II & Dissertation**

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

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## SEMESTER – VIII

**Signal and Networks**
**Code: PEC-IT801A**
**Contact: 3L**

| Name of the Course: | **Signal and Networks** | |
|---|---|---|
| Course Code: PEC-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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Objective and overview, signal and system types and classifications, step response, impulse response and convolution integral; | 3 | |
| 2 | **Periodic signal analysis:** Fourier series and properties; Aperiodic signal analysis : Fourier Transform - its properties and sinusoidal steady state analysis of systems; | 7 | |
| 3 | **Elements of electrical network :** dependent and independent sources, active and passive components; classical differential equations for description of transient conditions of Network; Solutions of linear time invariant networks with initial conditions; Unilateral and Bilateral Laplace Transforms and properties; Transient solutions of networks using Laplace Transform; Network functions: poles, zeros, transfer function, Bode plot; | 12 | |
| 4. | **One and two port network parameters and functions :** Z, Y and ABCD parameters, driving point and transfer impedances and admittances; Network Theorems and Formulation of Network equations: generalized formulation of KCL, KVL, State Variable descriptions; Thevenin, Norton, Maximum Power Transfer, Tellegen and | 10 | |

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| | | | |
|---|---|---|---|
| | Reciprocity Theorems; | | |
| 5 | **Graph theory:** Tree, Co-tree, fundamental cut-set, fundamental loop analysis of network; Analog filter design: Butterworth, Sallen Key, frequency transformation and scaling; | 6 | |

**Text book and Reference books:**

1. Signals and Systems by P. Ramesh Babu & R. Ananda Natarajan, Scitech Publications (India) .
2. Signals & Systems by A. V. Oppenheim, A. S. Willsky and S. H. Nawab, Prentice-Hall India .
3. Networks & Systems by D Roy Choudhury.
4. Networks & Systems by Ashfaq Husian.

**Cryptography and Network Security**
**Code: PEC-IT801B**
**Contact: 3L**

| Name of the Course: | **Cryptography and Network Security** | |
|---|---|---|
| Course Code: PEC-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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | Attacks on Computers & Computer Security - Introduction, Need for Security, Security approaches, Principles of Security, Types of attack | 5 | |
| 2 | Cryptography: Concepts & Techniques- Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size | 7 | |

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| | | | |
|---|---|---|---|
| 3 | Symmetric Key Algorithm - Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm. | 8 | |
| 4. | Asymmetric Key Algorithm, Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required). | 5 | |
| 5 | Internet Security Protocols, User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication. | 6 | |
| 6 | Electronic Mail Security - Basics of mail security, Pretty Good Privacy, S/MIME. | 4 | |
| 7 | Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network | 3 | |

**Text book and Reference books:**

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

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**Natural Language Processing**
**Code: PEC-IT801C**
**Contacts: 3L**

| Name of the Course: | **Natural Language Processing** | |
|---|---|---|
| Course Code: PEC-IT801C | 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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Regular Expressions and AutomataRecap)** - Introduction to NLP, Regular Expression, Finite State Automata [2L] <br> **Tokenization -** Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance [5L] <br> **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 [4L] | 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. [4L] <br> **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. [4L] | 8 | |
| 3 | **Text Classification** Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. [4L] <br> **Context Free Grammar** Context Free Grammar and Constituency, Some common CFG phenomena for | 9 | |

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| | | | |
|---|---|---|---|
| | English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing [4L] | | |
| 4. | **Computational Lexical Semantics** Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity [4L] **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 [5L] | 9 | |

**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.

**Internet of Things**
**Code: PEC-IT801D**
**Contacts: 3L**

| Course Code | PEC-IT801D |
|---|---|
| **Course Name** | **Internet of Things** |
| **Credits** | 3 |
| **Pre-Requisites** | Wireless Networks |

Total Number of Lectures: 48

| COURSE OBJECTIVE |
|---|
| ☐ Able to understand the application areas of IOT |
| ☐ Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks |
| ☐ Able to understand building blocks of Internet of Things and characteristics |

| LECTURE WITH BREAKUP | NO. OF LECTURES |
|---|---|

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| | |
|---|---|
| **Unit 1**: Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT | 7 |
| **Unit 2:** Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications<br>Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc | 8 |
| **Unit 3:** Important Characteristics of Sensors: Determination of the Characteristics<br>Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality<br>Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors<br>Importance and Adoption of Smart Sensors | 11 |
| **Unit 4:** Architecture of Smart Sensors: Important components, their features<br>Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel | 10 |
| **Unit 5:** Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor | 7 |
| **Unit 6:** Recent trends in smart sensor for day to day life, evolving sensors and their architecture. | 5 |

| **COURSE OUTCOMES** |
|---|
| On completion of the course the student should be able to |
| ☐ Understand the vision of IoT from a global context. |
| ☐ Determine the Market perspective of IoT. |
| ☐ Use of Devices, Gateways and Data Management in IoT. |
| ☐ Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints. |
| ☐ Building state of the art architecture in IoT. |

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

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**Remote Sensig and GIS**
**Code: OEC-IT801E**
**Contacts: 3L**

| Name of the Course: | **Remote Sensig and GIS** | |
|---|---|---|
| Course Code: PEC-IT801E | 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 | |

| 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; | 4 | |

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| | | | |
|---|---|---|---|
| | 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 lowcost packages. | | |
| 1. | 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. | 8 | |
| 2. | Remote Sensing Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape | 8L | |
| | | | |
| | | | |

**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.

**Big Data Analytics**
**Code:** OEC-IT801A
**Contacts: 3L**

| Name of the Course: | **Big Data Analytics** | |
|---|---|---|
| Course Code: OEC-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 | |

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Total Number of Lectures: 48

| COURSE OBJECTIVE | |
|---|---|
| ☐ Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools | |
| **LECTURE WITH BREAKUP** | **NO. OF LECTUR** |
| **Unit 1:** <br> What is big data, why big data, convergence of key trends, unstructured data, <br> industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics. | 8 |
| **Unit 2:** <br> Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations. | 8 |
| **Unit 3:** <br> Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures | 9 |
| **Unit 4:** <br> MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats | 10 |
| **Unit 5:** | 7 |
| Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration. | |
| **Unit 6:** <br> Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. <br> Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries. | 6 |

| COURSE OUTCOMES |
|---|
| **After completion of course, students would be:** |

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- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

**References:**

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11. Alan Gates, "Programming Pig", O'Reilley, 2011.

**Cyber Law and Ethics**
**Code: OEC-IT801B**
**Contacts: 3L**

| Name of the Course: | **Cyber Law and Ethics** | |
|---|---|---|
| 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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction of Cybercrime:** What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion[4L].<br>**Category of Cybercrime:** how criminals plan attacks, passive attack, Active attacks, cyberstalking. [4L] | 8 | |

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| | | | |
|---|---|---|---|
| 2 | **Cybercrime Mobile & Wireless devices:** Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop [8L] | 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. [8L] | 8 | |
| 4. | **Phishing & Identity Theft:** Phising methods, ID Theft; Online identity method. [4L] <br> **Cybercrime & Cybersecurity:** Legal aspects, indian laws, IT act, Public key certificate. [4L] | 8 | |

**Text book and Reference books:**

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber laws, Gupta & Gupta, Khanna Publishing House

**Mobile Computing**
**Code: OEC-IT801C**
**Contacts: 3L**

| Name of the Course: | **Mobile Computing** | |
|---|---|---|
| Course Code: **OEC-IT801C** | Semester: VIII | |
| Duration: 6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | **Examination Scheme** | |
| Theory:3 hrs./week | Mid Semester exam: 15 | |
| Tutorial: 3L | 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 Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling. | 5 | |
| 2 | General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE | 5 | |

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| | | | |
|---|---|---|---|
| | 802.11 standard, Mobile IP. | | |
| 3 | Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies. | 7 | |
| 4. | Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G | 7 | |
| 5 | Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols. | 7 | |
| 6 | Server-side programming in Java, Pervasive web application architecture, Device independent example application | 8 | |

**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.
9. Brijesh Gupta "Mobile Computing", Khanna Publishing House, New Delhi

**Bio Informatics**
**Code: OEC-IT801D**
**Contacts: 3L**

| Name of the Course: | **Bio Informatics** | |
|---|---|---|
| Course Code: OEC-IT801D | Semester: VIII | |
| Duration: 6 months | Maximum Marks: 100 | |
| **Teaching Scheme** | **Examination Scheme** | |

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

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **INTRODUCTION TO MOLECULAR BIOLOGY** Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways. | 5 | |
| 2 | **Sequence Databases** Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed; | 2 | |
| 3 | **DNA SEQUENCE ANALYSIS** DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman. | 14 | |
| 4. | **Introduction Probabilistic models used in Computational Biology** Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics. | 8 | |
| 5. | **Biological Data Classification and Clustering** Assigning protein function and predicting splice sites: Decision Tree | 6 | |

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**Robotics**
**Code: OEC-IT801E**
**Contacts: 3L**

| Name of the Course: | **Robotics** | |
|---|---|---|
| Course Code: OEC-IT801E | 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 | |

| Unit | Content | Hrs/Unit | Marks/Unit |
|---|---|---|---|
| 1 | **Introduction :**Introduction -- brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals. | 1 | |
| 2 | **Elements of robots – links, joints, actuators, and sensors** Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision. | 5 | |
| 3 | **Kinematics of serial robots** Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator**.** | 4 | |
| 4. | **Kinematics of parallel robots** Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations, | 5 | |

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| | | | |
|---|---|---|---|
| | Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform. | | |
| 5. | **Velocity and static analysis of robot manipulators** Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics. | 5 | |
| 6 | **Dynamics of serial and parallel manipulators** Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation (direct and inverse) of dynamic equations of motion, Examples of a planar 2R and four-bar mechanism, Recursive dynamics, Commercially available multi-body simulation software (ADAMS) and Computer algebra software Maple. | 4 | |
| 7 | **Motion planning and control** Joint and Cartesian space trajectory planning and generation, 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, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators. 8 Module 8: Modeling and | 6 | |
| 8 | **Modeling and control of flexible robots** Models of flexible links and joints, Kinematic modeling of multi-link flexible robots, Dynamics and control of flexible link manipulators, Numerical simulations results, Experiments with a planar two-link flexible manipulator. | 4 | |
| 9 | **Modeling and analysis of wheeled mobile robots** 3Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain, | 3 | |

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| | | | |
|---|---|---|---|
| | Kinematics, dynamics and static stability of a three-wheeled WMR's on uneven terrain, Simulations using Matlab and ADAMS. | | |
| 10 | **Selected advanced topics in robotics** Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE's). | 3 | |

**Text book and Reference books:**
1. Robotics Process Automation, Khanna Publishing House
2. Saha, S.K., "Introduction to Robotics, 2$^{nd}$ Edition, McGraw-Hill Higher Education, New Delhi, 2014
3. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

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**E-Commerce & ERP:**
**Code: OEC-IT802A**
**Contacts: 3L**

1. Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. [ 3 L ]
2. Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . [ 5 L ]
3. Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance. [2 L ]
4. E – strategy : Overview, Strategic Methods for developing E – commerce. [2 L ]
5. Four C's : ( Convergence, Collaborative Computing, Content Management & Call Center ). Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). [ 6 L ]

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7. Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power. [ 3 L ]

8. E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. [ 1 L ]

9. E – Marketing :. Home –shopping, E-Marketing, Tele-marketing [ 1 L ]

10. Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L ]

11. Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. [4 L ]

12. Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, QualityManagement, Sales&Distribution ERPPackage, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP [10]

**Reference :**

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

**Micro-electronics and VLSI Design**
**Code:** OEC-IT802B
Contact: 3L
Credits: 3
Allotted Hrs: 39L

Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers. [6L]

Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule [10L] .

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Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reprogramable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioural Synthesis, RTL synthesis [8L]

Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays. [5L]

Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability. [5L]

Overview of VHDL [5L]

**Text Book:**

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

**References:**

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


**Economic Policies in India**
**Code: OEC-IT802C**
**Contacts: 3L**

**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.
**Planning in India**
Objectives and strategy of planning; Failures and achievements of Plans; Developing grass-root organizations for
development – Panchayats, NGOs and pressure groups.
**Demographic Features, Poverty and Inequality**

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Broad demographic features of Indian population; rural-urban migration; Urbanization and civic amenities; Poverty and
Inequality.

## Resource Base and Infrastructure
Energy; social infrastructure – education and health; Environment; Regional imbalance; Issues and policies in financing
infrastructure development.

## 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.

## Section – II
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 labour market reforms; approaches for employment generation.

## 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.

## Money, Banking and Prices
Analysis of price behaviour in India; Financial sector reforms; Interest rate policy; Review of monetary policy of RBI; Money
and capital markets; Working of SEBI in India.

## 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.

## 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.

## BASIC READING LIST
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.

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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 &amp; 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 Delhi.