4-Year B. Tech in Computer Science & Engineering for in-house Course - Syllabus

1st Year Curriculum for B. Tech in Computer Science & Engineering for in- house Course

(Applicable from the academic session 2019-2020)

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.

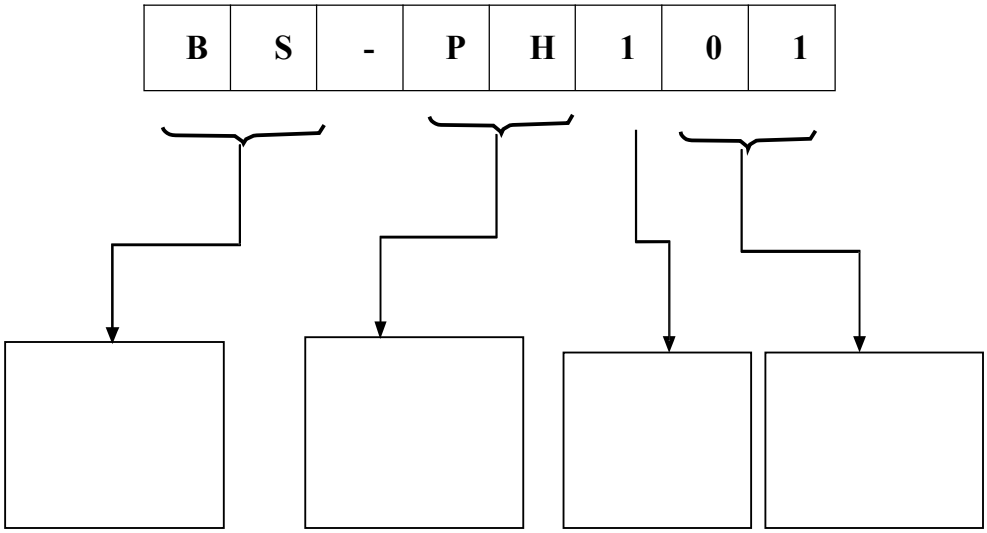
F. Codes for Departments

1. Computer Science & Engineering ---code CSE

G. Subject Numbering Scheme:

[insert image here] Image is not clear

Specific code for the subject category



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

First Year First Semester

Mandatory Induction Program- 3 weeks duration

Sl. No	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-CH101	Chemistry-I	3	1	0	4
2	Basic Science course	BS-M101	Mathematics –IA	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-CH191	Chemistry-I Laboratory	0	0	3	2
2	Engineering Science Courses	ES-EE191	Basic Electrical Engineering Laboratory	0	0	2	1
3	Engineering Science Courses	ES-ME191	Engineering Graphics & Design	1	0	4	3
Total Practical				**1**		**9**	**6**
Total of First Semester				**10**	**3**	**9**	**18**

First Year Second Semester

Sl. No	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science courses	BS-PH201	Physics-I (Gr-B)	3	1	0	4
2	Basic Science courses	BS-M201	Mathematics –IIA	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	Physics-I Laboratory	0	0	3	2
2	Engineering Science Courses	ES-CS291	Programming for Problem Solving	0	0	4	2
3	Engineering Science Courses	ES-ME292	Workshop/Manufacturing Practices	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**	**8**
Total of Second Semester				**12**	**2**	**13**	**21**

Semester-I

Course Code : BS-CH101	**Category :** Basic Science Courses
Course Title : Chemistry-I	**Semester** : First
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.H2). Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

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.

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

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

Module No.	**Description of Topic**	**Lectures Hours**
1	***Calculus (Integration):*** Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.	8
2	***Calculus (Differentiation):*** Rolle's Theorem, Mean value theorems, Taylor's and Maclaurin's theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.	6
3	***Matrices:*** Matrices, Vectors: addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer's Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.	7
4	***Vector Spaces:*** Vector Space, linear dependence of vectors, Basis, Dimension; Linear transformations (maps), Range and Kernel of a linear map, Rank and Nullity, Inverse of a linear transformation, Rank-Nullity theorem, composition of linear maps, Matrix associated with a linear map.	9
5	***Vector Spaces (Continued):*** Eigenvalues,Eigenvectors, Symmetric, Skew-symmetric, and Orthogonal Matrices, Eigenbases. Diagonalization; Inner product spaces, Gram-Schmidt orthogonalization.	10

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

Learning Resources:

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

Course Code : ESC-EE101	**Category :** Engineering Science Courses
Course Title : Basic Electrical Engineering	**Semester** : First
L-T-P : 3-1-0	**Credit: 4**
Pre-Requisites: Basic concepts of electrical equipments and electronics components	

COURSE OBJECTIVES
1. Impart a basic knowledge of electrical quantities such as current, voltage, power, energy and frequency to understand the impact of technology in a global and societal context.
2. Provide working knowledge for the analysis of basic DC and AC circuits used in electrical and electronic devices.
3. To explain the working principle, construction, applications of DC machines, AC machines & measuring instruments.
4. Highlight the importance of transformers in transmission and distribution of electric power.
5. This course provides the student with the fundamental skills to understand the basic of semiconductor and components like diode, transistor, FET, MOSFET and operational amplifier.
6. It will build mathematical and numerical background for design of electronics circuit & component value.
7. Students equipped with the knowledge and training provided in the course will be able to participate in design , development and operation in the different area of electronics system.

Module 1:

DC circuits: Mesh analysis, Superposition theorem, Thevenin's and Norton's theorems, Maximum Power Transfer theorem, delta star and star delta transformation.

Electrostatics: Introduction to Electrostatics, Gauss' theorem, Concept of capacitance. Different types of capacitors – parallel plate and cylindrical electrode arrangement. Stored energy in capacitors. Series-parallel combination of capacitors.

Electromagnetism: Review of fundamental laws of electromagnetism, Force on current carrying conductors, Magnetic circuits, permeance, reluctance, BH loop, hysteresis and eddy current losses, Inductance, Introduction to electromagnetic induction.

Module 2:

AC circuits: Sinusoidal and other periodic waveforms, average value, rms value, form factor, peak factor, representation of alternating quantities by phasors, Single phase series and parallel R, L and C circuits, reactance and impedance, resonance, active power, reactive power, apparent power and power factor, concept of power factor improvement**.**

Three phase circuits: Introduction to balanced three phase systems, Concept of phase sequence, relationship between line and phase voltages in star and delta connected systems, two wattmeter method for power measurement in balanced three phase circuits.

Module 3:

Electrical Machines: Principle of operation of transformers. Introduction to DC generators and motors. Principles of Three Phase Alternators, and Three Phase Induction Motors.

Module 4:

Semiconductor fundamentals: Band structure of solids, Fermi-dirac distribution, Semiconductor elemental & compound, Intrinsic and extrinsic semiconductor, concept of effective mass and hole, generation and recombination of carriers,

carrier diffusion.

P-n junction: Energy band diagram in equilibrium, under forward and reverse bias, I-V characteristics, breakdown mechanisms.

Semiconductor Diodes: Zener diode, LED, 7-Segment display, Photodiode, Solar cell.

Module 5:

Diode Circuits: Ideal model, Clipper, Clamper, Half-wave rectifier, Full-wave rectifier, Filter, Zener voltage regulator. Transistor: Structure and operation of BJT, JFET, MOSFET.

Transistor Circuits: CE, CB, CC configurations, Input – output characteristics, biasing, loadline, Q-point analysis, Analysis of an amplifier using simplified h-parameter model. Direct coupled, RC coupled and transformer coupled amplifiers. Feedback Circuits and Oscillators: General theory of feedback, negative feedback and its advantages, requirement for oscillation, oscillators. Transistorized voltage regulator.

Module 6:

IC and Op-amp Circuits: Monolithic ICs, Analog/Digital/Hybrid ICs – basics, Ideal op-amp, Inverting amplifier, Non-inverting amplifier, Buffer amplifier, Summing amplifier, Difference amplifier, Differentiator; Integrator, Op-amp as a comparator, Square wave generator, Triangular wave generator.

Logic Circuits: Number systems, Boolean algebra, Basic gates, Simple circuits using gates, Transistor as a switch, CMOS inverter; Block diagram level descriptions – Multiplexer, Encoder, Decoder, Flip-flop, Register, Counter. Basic Electronic Measurements: Multimeter and CRO.

LECTURE WITH BREAKUP	NO. OF LECTRES
Module 1: **DC circuits**: Mesh analysis, Superposition theorem, Thevenin's and Norton's theorems, Maximum Power Transfer theorem, delta star and star delta transformation. **Electrostatics**: Introduction to Electrostatics, Gauss' theorem, Concept of capacitance. Different types of capacitors – parallel plate and cylindrical electrode arrangement. Stored energy in capacitors. Series-parallel combination of capacitors. **Electromagnetism:** Review of fundamental laws of electromagnetism, Force on current carrying conductors, Magnetic circuits, permeance, reluctance, BH loop, Hysteresis and eddy current losses, Inductance,Introduction to electromagnetic induction.	**[6]**
Module 2: **AC circuits:** Sinusoidal and other periodic waveforms, average value, rms value, form factor, peak factor, representation of alternating quantities by phasors, Single phase series and parallel R, L and C circuits, reactance and impedance, resonance, active power, reactive power, apparent power and power factor, concept of power factor improvement**.** **Three phase circuits:** Introduction to balanced three phase systems, Concept of phase sequence, relationship between line and phase voltages in star and delta connected systems, two wattmeter method forpower measurement in balanced three phase circuits. .	**[8]**

Module 3: **Electrical Machines:** Principle of operation of transformers. Introduction to DC generators and motors. Principles of Three Phase Alternators, and Three Phase Induction Motors	**[10]**
Module 4: **Semiconductor fundamentals:** Band structure of solids, Fermi-dirac distribution, Semiconductor elemental & compound, Intrinsic and mextrinsic semiconductor, concept of effective mass and hole, generation and recombination of carriers, carrier diffusion. **P-n junction:** Energy band diagram in equilibrium, under forward and reverse bias, I-V characteristics, breakdown mechanisms. **Semiconductor Diodes:** Zener diode, LED, 7-Segment display, Photodiode, Solar cell.	**[5]**
Module 5: **Diode Circuits:** Ideal model, Clipper, Clamper, Half-wave rectifier, Full-wave rectifier, Filter, Zener voltage regulator. Transistor: Structure and operation of BJT, JFET, MOSFET. **Transistor Circuits:** CE, CB, CC configurations, Input – output characteristics, biasing, loadline, Q-point analysis, Analysis of an amplifier using simplified h-parameter model. Direct coupled, RC coupled and transformer coupled amplifiers. Feedback Circuits and Oscillators: General theory of feedback, negative feedback and its advantages, requirement for oscillation, oscillators. Transistorised voltage regulator.	**[10]**
Module 6: **IC and Op-amp Circuits:** Monolithic ICs, Analog/Digital/Hybrid ICs – basics, Ideal op-amp, Inverting amplifier, Non-inverting amplifier, Buffer amplifier, Summing amplifier, Difference amplifier, Differentiator; Integrator, Op-amp as a comparator, Square wave	**[9]**

generator, Triangular wave generator. **Logic Circuits:** Number systems, Boolean algebra, Basic gates, Simple circuits using gates, Transistor as a switch, CMOS inverter; Block diagram level descriptions – Multiplexer, Encoder, Decoder, Flip-flop,Register, Counter.Basic Electronic Measurements: Multimeter and CRO.	

COURSE OUTCOMES
After completion of course, students would be able to:
CO1: To study basics of semiconductor &devices and their applications in different areas.
CO2: To study different biasing techniques to operate transistor, FET , MOSFET and operational amplifier in different modes.
CO3: Analyze output indifferent operating modes of different Semiconductor devices.
CO4: Identify the type of electrical machine used for that particular application.
CO5: Realize the requirement of transformers in transmission and distribution of electric power and other applications
CO6: Formulate and solve complex AC, Dc circuits

Textbooks/References:

Suggested books:

1. Advanced Electrical Technology – H. Cotton
2. Electrical Technology – Hughes
3. Alternating Current Circuits – Kerchner and Corcoran
4. Fundamentals of Electrical Engineering – Ashfaq Husain
5. Solid State Electronic Devices by Ben G. Streetman and Sanjay K. Banerjee, Pearson Prentice Hall, 7th Edition, 2014.

Suggested reference books:

1. Electronic Circuits: Discrete and Integrated by D. L. Schilling and C. Belove, McGraw-Hill, 1989 Electronics
2. Fundamentals and Applications by D. Chattopadhyay and P. C. Rakshit, New Age International, 10th Edition, 2010
3. Digital Principles and Applications by A. P. Malvino and D. P. Leach, Tata McGraw-Hill, 7th edition, 2006
4. Electroni c Principles by Albert Malvino and David Bates, Tata McGraw- Hill, 7th edition, 2017

Course Code : BS-CH191	**Category :** Basic Science Courses
Course Title : Chemistry-I Laboratory	**Semester** : First
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 .

Course Code	**ESC-EE191**
Course Name	**BASIC ELECTRICAL LAB**
Credits	**0L:0T:P 2Credits**
Pre-Requisites	**Basic concept of electrical and electronics equipments**

Total Number of Lectures: 24

COURSE OBJECTIVES
1. To familiarize with the electrical component like inductors, capacitor, resistors, etc.
2. Understanding of various theorems into practical applications.
2. Better understanding of electrical components like diode, Operational amplifier and practical understanding of various characteristics of it.

LIST OF EXPERIMENTS:

1. Familiarization with Resistor, capacitor and Inductor
2. Study of VI characteristics of a Diode
3. Study of DC network theorem
4. Half Wave Rectifier and Full Wave Rectifier
5. Study of Series and parallel RLC circuit
6. Zener Diode-Voltage regulator
7. Study of DC Motor
8. Studies on BJT Common Base, Common Collector, Common

Emitter characteristics

9. Study of Three phase induction motor
10. Study of basic properties of operational amplifier, inverting and non-inverting amplifiers.
11. Study of differentiator and integrator using operational amplifier
12. Study of Transformer

Course Code : ES-ME191	**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** 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** Plain scale, Diagonal scale and Vernier Scales.	1	4
3	**GEOMETRICAL CONSTRUCTION AND CURVES** 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** Principles of Orthographic Projections-Conventions - 1st and 3rd angle projection, Projections of Points and lines inclined to both planes; Projections of planes (Rectangle,	1	4

	pentagon, Hexagon etc.) inclined Planes - Auxiliary Planes.		
5	**PROJECTION OF REGULAR SOLIDS** Regular solids inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale (Cube, Pyramid, Prism, Cylinder, Cone).	1	4
6	**COMBINATION OF REGULAR SOLIDS, FLOOR PLANS** Regular solids in mutual contact with each other like Spheres in contact with cones standing on their base. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.	1	4
7	**ISOMETRIC PROJECTIONS** Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;	1	4
8	**SECTIONS AND SECTIONAL VIEWS OF RIGHT ANGULAR SOLIDS** Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)	1	4
	OVERVIEW OF COMPUTER GRAPHICS, CUSTOMISATION& **CAD DRAWING**		

9	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, S etting 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
	ANNOTATIONS, LAYERING & OTHER FUNCTIONS applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer- aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial		

	visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale mult i views of dwelling;		
11	**DEMONSTRATION OF A SIMPLE TEAM DESIGN PROJECT** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid- modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).	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)
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. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
5. Corresponding set of CAD Software Theory and User Manuals
6. Pradeep Jain, Ankita Maheswari, A.P. Gautam, Engineering Graphics & Design, Khanna Publishing House

Semester -II

Course Code :BS-PH201	**Category :** Basic Science Courses
Course Title : Physics-I	**Semester** : 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

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

Course Code : BS-M201	**Category :** Basic Science Course
Course Title : Mathematics – II A	**Semester** : Second
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.

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

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)

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

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

Detailed contents

1. Vocabulary Building

The concept of Word Formation

Root words from foreign languages and their use in English

Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.

Synonyms, antonyms, and standard abbreviations.

2. Basic Writing Skills

Sentence Structures
Use of phrases and clauses in sentences
Importance of proper punctuation
Creating coherence
Organizing principles of paragraphs in documents
Techniques for writing precisely

3. Identifying Common Errors in Writing

Subject-verb agreement
Noun-pronoun agreement
Misplaced modifiers
Articles
Prepositions
Redundancies
Clichés

4. Nature and Style of sensible Writing

Describing
Defining
Classifying
Providing examples or evidence
Writing introduction and conclusion

5. Writing Practices

Comprehension
Précis Writing
Essay Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

□ Listening Comprehension
□ Pronunciation, Intonation, Stress and Rhythm
□ Common Everyday Situations: Conversations and Dialogues
□ Communication at Workplace
□ Interviews
□ Formal Presentations

Learning Resources:

(i) Practical English Usage. Michael Swan. OUP. 1995.

(ii) Remedial English Grammar. F.T. Wood. Macmillan.2007
(iii) On Writing Well. William Zinsser. Harper Resource Book. 2001
(iv) Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
(v) Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
(vi) Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press
(vii) Kulbushan Kumar, R S Salaria,Effective Communication Skills, Khanna Publishing House, Delhi.

CourseOutcomes

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

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

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.

Course Code : ES-ME 292	**Category :** Engineering Science Courses
Course Title : Workshop/ Manufacturing Practices	**Semester** : 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.

□ **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 McGrawHill House, 2017.

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.

Chapter -1
General, Course structure & Theme
&
Semester-wise credit distribution

A. Definition of Credit

1. Hr. Lecture (L) per week	1 credit
2. Hr. Tutorial (T) per week	1 credit
3. Hr. Practical (P) per week	0.5 credit
4. Hours Practical(Lab)/week	1 credit

B. Range of credits -A range of credits from 150 to 160 for a student to be eligible to get UnderGraduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

C. Structure of Undergraduate Engineering program :

S.L No.	Course	Credit Breakup for CSE students
1	Humanities and Social Sciences including Management courses	12
2	Basic Science courses	25
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24
4	Professional core courses	54
5	Professional Elective courses relevant to chosen specialization/branch	18
6	Open subjects – Electives from other technical and /or emerging subjects	12
7	Project work, seminar and internship in industry or elsewhere	15

8	Mandatory Courses [Environmental Sciences, Induction Program, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	160*

**Minor variation is allowed as per need of the respective disciplines.*

D. Credit distribution in the First year of Undergraduate Engineering program :

Course	**Lecture**	**Tutorial**	**Laboratory/ Practical**	**Total credits**
Chemistry-I	3	1	2	6
Physics	3	1	2	6
Maths-1	3	1	0	4
Maths -2	3	1	0	4
Programming for Problem solving	3	0	4	5
English	2	0	2	3
Engineering Graphics &Design	1	0	4	3
Workshop/Practical	1	0	4	3
Basic ElectricalEngg.	3	1	2	5
*Biology	2	1	0	3
*Maths-3	3	1	0	4

****These courses may be offered preferably in the later semesters***

E. Course code and definition:

Course code	***Definitions***
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Managementcourses
PCC-CS	Professional core courses
PEC -CS	Professional Elective courses
OEC-CS	Open Elective courses
LC	Laboratory course

MC	Mandatory courses
SI	Summer Industry Internship
PROJ-CS	Project

HUMANITIES AND SOCIAL SCIENCES INCLUDING MANAGEMENT COURSES

Sl. No	Code No.	Course Title	Hours per week			Total Credits	Semester
			Lecture	Tutorial	Practical		
1	HSMC 201	English	2	0	2	3	2
2	HSMC 301	Humanities – 1	3	0	0	3	3
3	HSMC 401	Management-I (Organizational Behaviour)/ Finance & Accounting	3	0	0	3	4
4	HSMC 501	Humanities – II	3	0	0	3	5
TotalCredits:						**12**	

BASIC SCIENCE COURSE [BSC]

Sl. No	Code No.	Course Title	Hours per week			Total Credits	Semester
			Lecture	Tutorial	Practical		
1	BSC101	Physics (Semi-conductor Physics)	3	1	3	5.5	1
2	BSC 201	Mathematics-II (Probability and Statistics)	3	1	0	4	2
3	BSC 102	Mathematics-I (Calculus and LinearAlgebra)	3	1	0	4	1
4	BSC 202	Chemistry-I	3	1	3	5.5	2
5	BSC 701	Biology	2	1	0	3	7
6	BSC 301	Mathematics-III	2	0	0	2	3

		(Differential Calculus)					
TotalCredits:						**24**	

ENGINEERING SCIENCE COURSE [ESC]

Sl. No	Code No.	Course Title	Hours per week			Total Credits	Semester
			Lecture	Tutorial	Practical		
1	ESC 101	Basic Electrical Engineering	3	1	2	5	1
2	ESC 102	Engineering Graphics &Design	1	0	4	3	1
3	ESC 201	Programming for ProblemSolving	3	0	4	5	2
4	ESC 202	Workshop/ManufacturingPractices	1	0	4	3	2
5	ESC 301	Analog Electronic Circuits	3	0	4	5	3
6	ESC 302	Digital Electronics	3	0	4	5	4
7	ESC 501	Signals and Systems	3	0	0	3	5
Total Credits:						**29**	

PROFESSIONAL CORE COURSES [PCC]

Sl. No	Code No.	Course Title	Hours per week			Total Credits	Semester
			Lecture	Tutorial	Practical		
1	PCC CS301	Data Structure & Algorithms	3	0	4	5	3
2	PCC CS303	IT Workshop – (Python/R/MATLAB/Scilab)	1	0	4	3	3
3	PCC CS401	Discrete Mathematics	3	1	0	4	4
4	PCC CS402	Computer Organizationand Architecture	3	0	4	5	3

5	PCC CS403	OperatingSystems	3	0	4	5	4
6	PCC CS404	Design and Analysis ofAlgorithms	3	0	4	5	4
7	PCC CS 501	Database Management Systems	3	0	4	5	5
8	PCC CS502	Formal Language, Automats and Complier	3	0	0	3	5
9	PCC CS503	Object Oriented Programming	2	0	4	4	5
10	PCC CS601	Compiler Design	3	0	4	5	6
11	PCC CS602	Computer Networks	3	0	4	5	6
Total Credits						**49**	

4 year Curriculum structure
Undergraduate Degree in Engineering & Technology
Branch / course :Computer Science and Engineering
Total credits (4 year course): 160

I. Induction Program (Please refer Appendix-A for guidelines)

Induction program (mandatory)	**3 weeks duration** (Please refer Appendix-A for guidelines & also details available in the curriculum of Mandatory courses)
Induction program for students to beoffered right at the start of the first year.	Physical activity Creative Arts Universal Human Values Literary Proficiency Modules Lectures by Eminent People Visits to local Areas Familiarization to Dept./Branch & Innovations

Semester-wise structure of curriculum

[L= Lecture, T = Tutorials, P = Practicals & C = Credits]

Semester I (First year) Curriculum
Branch/Course: Computer Science Engineering

First Year First Semester

Sl. No	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
Theory							
1	Basic Science course	BS-CH101	Chemistry-I	3	1	0	4
2	Basic Science course	BS-M102	Mathematics –I (Calculus & Linear Algebra)	3	1	0	4
3	Engineering Science Courses	ES-EE 101	Basic Electrical& Electronics Engineering	4	0	0	4
4	Engineering Science Courses	ES-ME 101	Engineering Graphics & Design	1	0	0	1
5	Basic Science course	BS-CH191	Chemistry-I Lab	0	0	4	2
6	Engineering Science Courses	ES-EE 191	Basic Electrical& Electronics Engineering Lab	0	0	2	1
7	Engineering Science Courses	ES-ME 191	Engineering Graphics & Design	0	0	4	2
Total Credits							**18**

Semester II (First year) Curriculum
Branch/Course: Computer Science Engineering

Sl. No	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
1	Basic Science courses	BS-PH201	Physics-II	3	1	0	4
2	Basic Science courses	BS-M201	Mathematics-II (Probability and Statistics)	3	1	0	4
3	Engineering Science Courses	ES-CS201	Programming for Problem Solving	3	0	0	3
4.	Engineering Science Courses	ES-ME201	Workshop/Manufacturing Practices	1	0	0	1
5	Humanities and Social Sciences including Management courses	HSMC 201	English	2	0	0	2
6	Basic Science courses	BS-PH 291	Physics- II Lab	0	0	4	2
7	Engineering Science Courses	ES-CS291	Programming for Problem Solving Lab	0	0	4	2
8	Engineering Science Courses	ES-ME201	Workshop/Manufacturing Practices	0	0	4	2
9	Humanities and Social Sciences including Management courses	HSMC 291	Language Lab	0	0	2	1
Total of Credits							**21**

Semester III (Second year) Curriculum
Branch/Course: Computer Science Engineering

Sl. No	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
1	Professional Course	PCC-CS301	Principles of Programming Language	3	0	0	3
2	Professional Core Courses	PCC-CS302	Data structure & Algorithms	3	0	0	3
3	Engineering Science	ES-CS301	Digital Electronics	3	0	0	3
4	Professional Core Courses	PCC-CS303	IT Workshop(Sci Lab/MATLAB)	1	0	0	1
5	Basic Science courses	BS-M301	Mathematics-III (Differential Calculus)	2	0	0	2
6	Humanities & Social Sciences including Management Courses	HSMC 301	Humanities-I	3	0	0	3
7	Professional Course	PCC-CS391	Principles of Programming Language Lab	0	0	4	2
8	Professional Core Courses	PCC-CS392	Data structure & Algorithms Lab	0	0	4	2
9	Engineering Science	ES-CS391	Digital Electronics Lab	0	0	4	2
10	Professional Core Courses	PCC-CS393	IT Workshop(Sci Lab/MATLAB) Lab	0	0	4	2
Total Credits							**23**

Semester IV (Second year) Curriculum
Branch/Course: Computer Science Engineering

Sl. No	Category	Subject Code	Subject Name	Total Number of contact hours			Credits
				L	T	P	
1	Professional Course	PCC-CS401	Discrete Mathematics	3	1	0	4
2	Professional Core Courses	PCC-CS402	Computer Organization & Architecture	3	0	0	3
3	Professional Core Courses	PCC-CS403	Operating Systems	3	0	0	3
4	Professional Core Courses	PCC-CS404	Design & Analysis of Algorithms	3	0	0	3
5	Humanities & Social Sciences including Management courses	HSMC-401	Management 1 (Organizational Behaviour/ Finance &Accounting)	3	0	0	3
6	Mandatory Courses	MC-401	Environmental Sciences	-	-	-	0
7	Professional Core Courses	PCC-CS492	Computer Organization & Architecture Lab	0	0	4	2
8	Professional Core Courses	PCC-CS493	Operating Systems Lab	0	0	4	2
9	Professional Core Courses	PCC-CS494	Design & Analysis of Algorithms Lab	0	0	4	2
Total Credits							**22**

Additional Courses for B.Tech (Hons.):

1. Graph Theory (PEC-CS-T01)
2. Software Engineering (PEC-CS-S01)
3. Embedded Systems (PEC-CS-S02)
4. Artificial Intelligence (PEC-CS-D01)
5. Cryptography and Network Security (PEC-CS-A01)
6. Internet-of-Things (PEC-CS-S03)
7. Data Analytics (PEC-CS-D02)
8. Machine Learning (PEC-CS-D03)

CHAPTER 2

DETAILED 4-YEAR CURRICULUM CONTENTS

Undergraduate Degree in Engineering & Technology

Branch/Course: COMPUTER SCIENCE AND ENGINEERING

Second year (Third semester onwards)

Semester-III

Course Code: PCC-CS301	Category: Professional Core Courses
Course Title: Principles of Programming Languages	Semester: 3rd Semester
L-T-P: 3-0-4	Credit: 5
Teaching Scheme Theory: 3hrs/week Tutorial: 1hr/week	**Examination Scheme** Class Tests & Assignments: 25 marks Attendance: 5 marks End Semester Exam: 70 marks

Detailed Syllabus

Course Objectives:

1. Provides students exposure to examples of important programming languages and paradigms such as LISP/Scheme, ML/Haskell, Prolog, C++/Python/Ruby, etc.

2. The languages are used to illustrate programming language constructs such as binding, binding times, data types and implementation, operations (assignment data-type creation, pattern matching), data control, storage management, parameter passing, and operating environment.

3. The suitability of these various languages for particular programming tasks.

4. Main goal for this course is to enable the students to understand enough about the fundamental principles of programming languages so that they are able to easily and quickly pick up any new programming language. Their understanding of any CS topic should not be tied to any particular programming language.

Pre-requisites:

A first course in programming (using any structured programming language such as C) such as PCC-CS-201 and PCC-CS-291.

Course Outcomes:

On completion of this course, students should have

1. Knowledge of, and ability to use, language features used in current programming languages
2. An ability to program in different language paradigms and evaluate their relative benefits
3. An understanding of the key concepts in the implementation of common features of programming languages

Syllabus:

Principles of Language Design, Programming language spectrum, Why study Programming Languages, Overview of Compilation, Interpretation, and Programming Environments [~2 hrs]

Specifications of Language Syntax [~2 hrs]

Fundamentals of Procedural and Object Oriented Languages [~6 hrs]

Fundamentals of Functional Programming [~9 hrs]

Fundamentals of Logic Programming [~6 hrs]

Programming Language Semantics, Values, Bindings, Types [~6 hrs]

Programming Language Constructs, Expressions, Statements, Procedures and Environments, Parameter passing [~5 hrs]

Textbook:

"Programming Language Pragmatics", 4e, by *Michael Scott*. Morgan Kaufmann Publishers
"Programming Languages: Principles and Paradigms", 2010th edition, by *Maurizio Gabbrielli, Simone Martini*. Springer

Reference:

"Concepts of Programming Languages", 11e, by *Robert W. Sebesta.* Pearson India

"Types and Programming Languages", *Benjamin C. Pierce*. MIT Press

PROFESSIONAL CORE COURSES

YEAR- 2ND		SEMESTER- III	
PCC-CS302	Data Structure & Algorithms	3L:0T: 0P	3 credits
Pre-requisites	ESC 201		

Objectives of the course:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. To understand basic concepts about stacks, queues, lists, trees and graphs.
4. To enable them to write algorithms for solving problems with the help of fundamental data structures

Detailed contents:

Module 1: [4L]

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Array : Operations , Different representations – row major, column major.
Sparse matrix - its implementation and usage. Array representation of polynomials.

Module 2: [12 L]

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.

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Module 3: **[12L]**

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.
Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Module 4: [8L]
Sorting, Searching 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, Searching: Linear Search and Binary Search Techniques and their complexity analysis. Hashing: Hashing functions, collision resolution techniques.

Text books:
1. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed, Universities Press
2. "Data Structures in C" by Aaron M. Tenenbaum, Yedidyah Langsam, Moshe J. Augenstein , Pearson
3. **"**Data Structures with C" by S. Lipschutz, McGraw Hill India

Reference books:
1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by
Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.

Course outcomes
1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it.
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.
4. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.

5. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity.

YEAR- 2ND		SEMESTER- III	
ES-CS301	Digital Electronics	3L:0T: 4P	5
Pre-requisites			

Course Objectives

The objectives are to study

1. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
2. To prepare students to perform the analysis and design of various digital electronic circuits.

Module 1 : Fundamentals of Digital Systems and logic families (7 Hours) Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples of IC gates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-state logic. 8hr

Module 2: Combinational Digital Circuits (7 Hours) Standard representation for logic functions, K-map representation, simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De-Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization. 7hr

Module 3: Sequential circuits and systems (7 Hours) A 1-bit memory, the circuit properties of Bi-stable latch, the clocked SR flip flop, J- K-T and D – types flip-flops, applications of flip-flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters. 7hr

Module 4: A/D and D/A Converters (7 Hours) Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter lCs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/ D converter, A/D converter using voltage to frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs 7hr

Module 5: Semiconductor memories and Programmable logic devices. (7 Hours) Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA). 7hr

Text/References:

1. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
2. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand working of logic families and logic gates
- Design and implement Combinational and Sequential logic circuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

Syllabus of IT Workshop - (Python/R/MATLAB/Sci Lab)

Subject Code:PCC-CS303	**Category:** Professional core course
Course Title:IT Workshop - (Python/R/MATLAB/Sci Lab)	**Semester:** III
1L : 0T: 4P	**Credits:** 3
Pre-requisites: No-prerequisite	

[L= Lecture, T = Tutorials, P = Practicals]

Programming with Python

Objectives of the course:

This course will expose students to the following

1. Learn core python scripting syntax and semantics
2. Illustrate the need to work with python data structures and their implementation.
3. Understand the concept of files, modules, and exception handling.

Detailed contents:

Module	Content	No. of Lecture
1	**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	3
2	**String Manipulation**: Accessing Strings, Basic Operations, String slices, Function and Methods **Functions**: Defining a function,Calling a function,Types of functions,Function Arguments,Anonymous functions,Global and local variables	3
3	**Lists**: Introduction, Accessing list, Operations, Working with lists, Function and Methods **Dictionaries**: Introduction, Accessing values in dictionaries, Working with dictionaries, Properties **Tuple**: Introduction, Accessing tuples, Operations,Working,Functions and Methods	3

4	**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. **Exception Handling**: Exception, Exception Handling, Try clause, Except clause.	3

Suggested text books:

1. "Introducing Python: Modern Computing in Simple Packages"- O'Reilly Media by Bill Lubanovic.

Suggested reference books:

1. "Python Cookbook: Recipes for Mastering Python 3" by David Beazley, Brian K. Jones.
2. "Think Python: How to Think Like a Computer Scientist" by Allen B. Downey.

Course outcomes:

The student will learn

1. To write Python programs, interpret correct syntax and logical errors, and implement conditional branching, iteration.
2. To implement and handle string efficiently, decompose a problem into functions and implement a program using function efficiently.
3. To implement and manipulate a python program using python data structure list, tuple and dictionaries.
4. To implement a python program to read and write data from & to files, handle exceptions, and import modules.

Programming in R

Objectives of the course:

This course will expose students to the following

1. Learn basic programming syntax and semantics.
2. Learn fundamental problem solving and programming techniques.

Detailed contents:

Module	Content	No. of Lecture
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.	3
2	R Programming Structures, Control Statements, Loops, Repeat and Break, R-Function, R-Vector Function, Recursive Function in R.	3
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.	3
4	Graphics, Creating Graphs, The Workhorse of R Base Graphics, Graphical Functions – Customizing Graphs, Saving Graphs to Files, Pie chart, Bar Chart, Histogram.	3

Suggested Text Book:

1. "Hands-On Programming with R: Write Your Own Functions and Simulations" by Garrett Grolemund.

Course outcomes:

5. Write, Test and Debug R Programs, interpret correct syntax and semantics, and R objects.
6. Implement control flow statements, loop and function.
7. Write program using packages and statistical methods.
8. Understand R graphics.

Programming in Matlab

Objectives of the course:

This course will expose students to the following

1. Learn the core syntax and semantics
2. Learn fundamental problem solving and programming techniques.

Detailed contents:

Module	Content	No. of Lecture
1	**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	3
2	**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	3
3	**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	3
4	**2D Plotting**: In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface **3D Plotting:** Use of mesh grid function, Mesh plot, Surface plot, Plots with special graphics	3

Suggested Text Book:

1. "Matlab: A Practical Introduction to Programming and Problem Solving" by Stormy Attaway.

Course outcomes:

1. Write, Test and Debug Matlab Programs, interpret correct syntax and semantics.
2. Implement conditional branching, loop, and iteration.
3. Implement vector, matrix, array, function and file.
4. Apply 2D and 3D plotting.

Programming in Scilab

Objectives of the course:

This course will expose students to the following

1. Learn the core syntax and semantics
2. Learn fundamental problem solving and programming techniques.

Detailed contents:

Module	Content	No. of Lecture
1	**Introduction:**About Scilab, History, Its strengths, Competitors, Starting Scilab, Using Scilab as a calculator, Quitting Scilab **Basics**:Scilabdatatypes, variables and constants.	3
2	**Matrices and Arrays:**Matrix and basic matrix operations of addition and multiplication, transpose, Determinants of 2 × 2 and 3×3 matrices, and array. **Expression:**Variables Numbers, Operators Functions, Expressions.	3
3	**Conditional statements and Loop:** If, else, else if, switch, for, while, continue, break, try, catch, return, etc.	3
4	**Graphics:**Plotting Process, Editing Process, Preparing Graphs, Basic Plotting Functions,Plotting math functions in Scilab, Plotting Bar graphs in Scilab,Changing axes properties in scilab plots, Image Reading & Writing, Printing graphics.	3

Suggested Text Book:

1. "Scilab from Theory to Practice - I. Fundamentals" by Philippe Roux.

Course outcomes:

1. Write, Test and Debug Scilab Programs, interpret correct syntax and semantics.
2. Implement conditional branching, loop, and iteration.
3. Implement matrix and array.
4. Apply plotting function and graphics.

Syllabus of IT Workshop - (Python/R/MATLAB/Sci Lab)

Subject Code: PCC CS393	**Category:** Professional core course
Course Title: IT Workshop - (Python/R/MATLAB/Sci Lab)	**Semester:** III
1L : 0T: 4P	**Credits:** 3
Pre-requisites: No-prerequisite	

[L= Lecture, T = Tutorials, P = Practicals]

Objectives of the course:

This course will expose students to the following

1. Learn python scripting syntax and semantics
2. Learn fundamental problem solving and programming techniques.
3. Understand the need to work with python data structures and their implementation.
4. Develop the concept of working with files, modules, and exceptions handling efficiently.

Laboratory Experiments:

1. Familiarization with programming environment.
2. Familiarization with variable, data types and operator.
3. Problems involving if-else structures.
4. Problems involving Loops, Break, Continue, and Pass.
5. Problems on String manipulation and Functions.

6. Problems using List, Dictionary, and Tuple.
7. Problems using files.
8. Problems to explore modules.
9. Problems to handle exceptions.

Suggested text books:

1. "Introducing Python: Modern Computing in Simple Packages"- O'Reilly Media by Bill Lubanovic.

Suggested reference books:

1. "Python Cookbook: Recipes for Mastering Python 3" by David Beazley, Brian K. Jones.
2. "Think Python: How to Think Like a Computer Scientist" by Allen B. Downey.

Course outcomes:

1. Write, Test and Debug Python Programs, interpret correct syntax and semantics, and implement conditional branching, iteration.
2. Implement and handle string efficiently, decompose a problem into functions and implement a program using function efficiently.
3. Implement and manipulate a python program using python data structure list, tuple and dictionaries.
4. Implement a python program to read and write data from & to files, handle exceptions, and import modules.

Course Code: **BS-M301**	Category: Professional Core Courses
Course Title: Mathematics-III (Differential Calculus)	Semester: 4th Semester
L-T-P: 2-0-0	Credit: 2
Teaching Scheme Theory:2 hrs./week Tutorial: NIL Practical: NIL	**Examination Scheme** Class Tests & Assignments: 25 marks Attendance: 5 marks End Semester Exam: 70 marks
Objective: 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' sequations, Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph.	
Pre-requisites: 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
1	Convergence and sequence 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. Second order linear differential equations with constant coefficients, D-operator method, method of variation of parameters, Cauchy-Euler equation. [4L]	9
5	Basic Concept of graph, Walk, Path Circuit, Euler and Hamiltonian graph, diagraph. Matrix Representation: Incidence & Adjacency matrix. Tree: Basic Concept of tree, Binary tree, Spanning Tree, KrusKal and Prim's algorithm for finding the minimal spanning tree.	8

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 & Reena Garg, Khanna Publishing House (AICTE Recommended Textbook -2018)

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.

YEAR- 2ND		SEMESTER- III	
PCC-CS 391	Principles of Programming Language Lab	0L:0T:4P	Credit 2
Pre-requisites			

Course Code: PCC-CS 391
Course Name: Principles of Programming Languages Lab (PPL Lab) Credits: 2 (Lab: 4hrs/week)

Course Objectives:

This is the Practical part associated with the PPL course (PCC-CS 301). The objective is to impart a hands on exposure to the key concepts introduced in PCC-CS 301.

Course Outcomes:

After successfull completion of this course, students should be able to

1. Write simple programs using an OO programming language such as C++/Python/Ruby
2. Write simple programs using a logic programming language such as Prolog/Lisp
3. Write simple programs using a functional programming language such Haskell/ML/SML/Scheme/Clojure

Syllabus:

Introduction to OO programming concepts using Python/Ruby/C++ [~4 weeks]

Introduction to Functional programming using SML/Ocaml/Haskell/Scheme [~4 weeks]

Introduction to Logic programming using Prolog/Lisp [~4 weeks]

Textbook:

Programming Language Pragmatics by Michael Scott. Fourth Edition, Morgan Kaufmann Publishers, 2015. ISBN-13: 978-0124104099

Relevant online documentation for the respective programming languages used.

YEAR- 2ND		SEMESTER- III	
ES-CS 391	Digital Electronics Laboratory	0L:0T: 4P	Credit 2
Pre-requisites			

List of Experiments

1. Realization of basic gates using Universal logic gates.
2. Code conversion circuits- BCD to Excess-3 and vice-versa.
3. Four-bit parity generator and comparator circuits.
4. Construction of simple Decoder and Multiplexer circuits using logic gates.
5. Design of combinational circuit for BCD to decimal conversion to drive 7-segment display using multiplexer.
6. Construction of simple arithmetic circuits- Adder, Subtractor.
7. Realization of RS-JK and D flip-flops using Universal logic gates.
8. Realization of Universal Register using JK flip-flops and logic gates.
9. Realization of Universal Register using multiplexer and flip-flops.
10. Realization of Asynchronous Up/Down counter.
11. Realization of Synchronous Up/Down counter.
12. Realization of Ring counter and Johnson's counter.
13. Construction of adder circuit using Shift Register and full Adder.
14. Code conversion circuits – Binary to Gray & Vice-Versa. **(Innovative).**
15. Design of Sequential Counter with irregular sequences. **(Innovative)**

YEAR- 2ND		SEMESTER- III	
PCC-CS392	Data Structure & Algorithms LAB	3L:0T: 4P	Credit: 5
Pre-requisites			

Detailed contents:

Experiments should include but not limited to :

1. Implementation of array operations; Merging of two arrays; Sparse Matrices : Addition, Multiplication.

2.Stacks and Queues: adding, deleting elements; Circular Queue: Adding & deleting elements;

Evaluation of expressions;

3. Implementation of linked lists: inserting, deleting, inverting a linked list; Implementation of stacks & queues using linked lists; Polynomial addition, Polynomial multiplication

4. Recursive and Nonrecursive traversal of binary trees; Threaded binary tree

traversal; AVL tree implementation; Application of Trees.

5. Searching & sorting techniques; Application of sorting and searching algorithms
6. Hash tables implementation: searching, inserting and deleting,

Semester-IV

Course Code: PCC-CS401	Category: Professional Core Courses
Course Title: Discrete Mathematics	Semester: 4th Semester
L-T-P: 3-1-0	Credit: 4
Teaching Scheme Theory: 3hrs/week Tutorial: 1hr/week	**Examination Scheme** Class Tests & Assignments: 25 marks Attendance: 5 marks End Semester Exam: 70 marks
Objective: Throughout this course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following: 1. Use mathematically correct terminology and notation. 2. Construct correct direct and indirect proofs. 3. Use division into cases in a proof. 4. Use counterexamples. 5. Apply logical reasoning to solve a variety of problems.	
Pre-requisites: Some concepts from basic math – algebra, geometry, pre-calculus	

Detailed Syllabus

Unit	Content	Hrs/Unit (L+T)	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	8+3	

	Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic.		
2	**Basic Counting Techniques:** Inclusion and Exclusion, Pigeon-Hole Principle, Permutation and Combination.	5+1	
3	**Propositional Logic:** Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency.	8+3	
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+2	
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+3	

Suggested Text books

1. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Tata McGraw Hill
2. Susanna S. Epp, “Discrete Mathematics with Applications”, 4th edition, Wadsworth Publishing Co. Inc.

3. C L Liu and D P Mohapatra, "Elements of Discrete Mathematics A Computer Oriented Approach", 3rd Edition, Tata McGraw Hill.

Suggested Reference books

1. J.P. Tremblay and R. Manohar, "Discrete Mathematical Structure and It's Application to Computer Science", Tata McGraw Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press
3. Seymour Lipschutz, Marc Lipson, "Schaum's Outline of Theory and Problems of Discrete Mathematics", Tata McGraw Hill

Course Outcomes

On completion of the course students will be able to:

PCC-CS401.1 For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives

PCC-CS401.2 For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference

PCC-CS401.3 For a given a mathematical problem, classify its algebraic structure

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.

Syllabus of Computer Organization & Architecture

Subject Code: PCC-CS402	**Category:** Professional core course
Course Title: Computer Organization & Architecture	**Semester:** IV
3L : 0T: 4P	**Credits:** 5
Pre-requisites: ESC 302	

[L= Lecture, T = Tutorials, P = Practicals]

Objectives of the course:

This course will expose students to the following

1. How Computer Systems work & the basic principles.

2. Instruction Level Architecture and Instruction Execution.
3. The state of art in memory system design.
4. How I/O devices are accessed and its principles.
5. To provide the knowledge on Instruction Level Parallelism.
6. To impart the knowledge on micro programming.
7. Concepts of pipelining techniques.

Detailed contents:

Module	Content	No. of Lecture
1	**Functional blocks of a computer:** CPU, memory, input-output subsystems, control unit. Instruction set architecture of CPU–registers, instruction execution cycle, addressing modes, instruction set. **Data representation:** Signed number representation, fixed and floating point representations, character representation. Computer arithmetic –integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, Division restoring and non-restoring techniques, Floating point - IEEE 754 standard, floating point arithmetic.	10
2	**Memory organization:** Memory interleaving, concept of hierarchical memory organization, semiconductor memory technologies, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.	10
3	Introduction to x86 architecture. **CPU control unit design:** hardwired and micro-programmed design approaches. **Peripheral devices and their characteristics:** Input-output subsystems, I/O device interface, I/O transfers–program controlled, interrupt driven and DMA, interrupts.	8
4	**Pipelining:** Basic concepts of pipelining, throughput and speedup, pipeline hazards. **Parallel Processors:** Introduction to parallel processors.	8

Suggested text books:

1. "Computer Organization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.

2. “Computer Organization and Embedded Systems”, 6th Edition by Carl Hamacher, McGraw Hill Higher Education.
3. “Computer System Architecture”, by M. Morris Mano.
4. “ Computer Architecture”, Oxford University Press by Behrooz Parhami

Suggested reference books:

1. “Computer Architecture and Organization”, 3rd Edition by John P. Hayes, WCB/McGraw-Hill.
2. “Computer Organization and Architecture: Designing for Performance”, 10th Edition by William Stallings, Pearson Education.
3. “Computer System Design and Architecture”, 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course outcomes:

1. Draw the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, addressing modes, instruction set.
2. Given a CPU organization and instruction, design a memory module; analyze its operation by interfacing with the CPU and mapping techniques.
3. Write assembly language program for specified microprocessor, ability to explain the concept of control unit and I/O operations.
4. Given a CPU organization, apply design techniques to enhance performance using pipelining, and understand the concept of parallelism.

B.Tech Computer Science & Engineering
PCC-CS403
OPERATING SYSTEMS
3L:0T:4P 5 Credits
Total Number of Lectures: 36

Course Code	PCC-CS403
Course Name	OPERATING SYSTEMS
Credits	3L:0T:4P 5 Credits
Pre-Requisites	Basic understanding of Computers, Data structure & Algorithms

Total Number of Lectures: 36

COURSE OBJECTIVES
1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management and virtual memory in contemporary OS
3. To gain knowledge on deadlock related issues
4. To know the concepts of I/O, File and Disk Management

Syllabus:

Module 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.

Module 2:

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Module 3:

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer-Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Module 4:

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.

Module 5:

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

Module 6:

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Module 7:

I/O Management: I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.

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 (linearlist, hash table),efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Module 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]**
Module 2: **Processes:** Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching **Thread:** Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,	**[4]**

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.	
Module 3: **Inter-process Communication:** Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer-Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.	**[4]**
Module 4: **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.	**[6]**
Module 5: **Virtual Memory:** Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).	**[6]**
Module 6: **Deadlocks:** Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.	**[6]**
Module 7: **I/O Management:** I/O hardware, polling, interrupts, DMA, application I/O interface (block and character devices, network devices, clocks and timers, blocking and nonblocking I/O), kernel I/O subsystem (scheduling, buffering, caching, spooling and device reservation, error handling), performance.	**[7]**

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Free-space management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance. **Disk Management:** Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks	

COURSE OUTCOMES
After completion of course, students would be able to:
CO1: Create processes and threads and analyse the concepts of processes and threads in operating system and illustrate the scheduling of processor for a given problem instance.
CO2: 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.
CO3: Identify and handle deadlock related issues.
CO4: Understand the implement file systems and directories along with the interfacing of IO devices with the operating system and disk management.

Textbooks/References:

Suggested books:

1. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Suggested reference books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Code	**PCC-CS404**
Course Name	**Design and Analysis of Algorithms 3L:0T: 4P**
Credits	5
Pre-Requisites	ESC 201

Total Number of Lectures:36

COURSE OBJECTIVE
• Analyze the asymptotic performance of algorithms.
• Demonstrate a familiarity with major algorithm paradigms, their analysis and applications to different problem domains.
• To classify problems according to hardness and to solve computationally hard problems.

Lecture Distributions	Hours
Unit 1 Introduction: Characteristics of algorithm: Correctness and Efficiency: Case Study Asymptotic analysis, Notations and their properties: Complexity bounds – Upper, lower and tight bound: Case Study Design Strategy: Sorting by Divide and Conquer: Heap Sort Performance measurements of Algorithm: Time complexity analysis: Sorting: Lower bound: Matrix Multiplications Analysis of recursive algorithms through recurrence relations: Substitution method: Case study: Recursion tree method and Masters' theorem: Case study	10

Unit 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	9
Unit 3 Graph and Tree Algorithms: Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS): Shortest path algorithms: Transitive closure: Minimum Spanning Tree: Topological sorting: Network Flow Algorithms	9
Unit 4 Tractable and Intractable Problems: Computability classes – P, NP, NP-complete and NP-hard: Cook's theorem: Standard NP-complete problems and Reduction techniques	4
Unit 5 Advanced Topics: Approximation algorithms: Vertex cover: Set Cover: TSP: Randomized algorithms: Class of problems beyond NP – P SPACE	4

COURSE OUTCOMES
After completion of course, students would be able to:
1. Analyze the worst-case running times of algorithms based on asymptotic analysis.
2. Model a problem and develop the appropriate algorithm from divide and conquer, greedy, dynamic programming and other paradigms
3. Classify problems in appropriate complexity classes and apply approximation and randomized algorithms in solving computationally hard real life problems

References:

Suggested 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.

Suggested reference books

1. Algorithm Design, 1ST Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition,
Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley,Reading, MA.

Course Code	**HSMC-401**
Course Name	**Management1(Organizational Behaviour/Finance & Accounting)**
Credits	3
Pre-Requisites	

Objective: the objective of this course is to identify and understand the importance and significance of human behaviour in the organizational setting. It also illuminates the philosophy, tools and relevance of organizational behaviour and its role for individual and organizational growth.

Sl.	Contents	**Lecture Hour**
1.	OB – Overview – Meaning of OB, Importance of OB, Field of OB, Contributing Disciplines, Applications in Industry, Role of Managers in OB- Interpersonal Roles-Informational Roles-Decisional Roles, Challenges and Opportunities for OB	04
2.	Personality– Meaning of Personality, Determinants of Personality, Theories of Personality, Measurement of Personality, Development of Personality	04
3.	Perception – Process and Principles, Nature and Importance, Factors Influencing, Perception, Perceptual Selectivity, Social Perception, Fundamentals of Decision making	04
	Communication- Meaning and Importance, Process, Function & Types of Effective Communication, Interpersonal Communication, Organizational Communication,	04
4.	Motivation in OB – Approaches to Work Motivation, Theories of Motivation – Maslow's Hierarchy of Need Theory, Alderfer's ERG Theory, Herzberg's Motivation-Hygiene Theory,	06

	McClelland's Achievement – Motivation Theory, McGregor's Theory X & Y, Vroom's Expectancy Theory, Porter Lawler Expectancy Model	
5.	Attitudes and Job Satisfaction – Sources of Attitudes, Types of Attitudes, Attitudes and Consistency, Cognitive Dissonance Theory, Attitude Surveys.	02
6.	Organization - Mission, Goals, Characteristics, Types, Organizational Theory- Classical Theories: Scientific Management, Administrative Principals, Bureaucracy, Human Relation Approach, Modern Theories: System Approach, Contingency Approach, Quantitative Approach, Behavioural Approach, Managing Organizational Culture.	06
7.	Group Behaviour - Characteristics of Group, Types of Groups, Stages of Development, Group Decision-making, difference work group and work team, Why work Teams, Work Team in Organization, Team Building, Group Dynamics, Organizational Politics.	04
8.	Leadership - Leadership Theories, Leadership Styles, Skills and influence process, Leadership and power, Examples of Effective Organizational Leadership in India, Cases on Leadership, Success stories of today's Global and Indian leaders.	04
9.	Conflict in Organization - Sources of Conflict, Types of Conflict, Conflict Process, Johari Window, Conflict Resolution, Cases on Conflict Resolution.	04
10.	Organizational Change - Meaning and Nature of Organizational Change, Types of Organizational Change, Forces that act as a stimulant to change. Resistance to change, How to overcome resistance to change, Approaches to Managing Organizational Change, Kurt Lewin's three Step model, Action research model, Kotter's Eight Step model.	06
	Total	48

Suggested Reading

1. Robbins, S.P. Judge, T.A. & Sanghi, S.: Organizational Behaviour, Pearson
2. Luthans, Fred: Organizational Behaviour, McGraw Hill
3. Newstrom J.W. &Devis K.: Organizational Behaviour, McGraw Hill
4. Aswathappa ,K : Organisational Behaviour ,Himalaya Publishing House

5. Shukla, Madhukar : Understanding Organizations – Organizational Theory & Practice in
India, Prentice Hall
6. Sekharan, Uma: Organisational Behaviour , The Mc Graw –Hill Companies

Subject Code: PCC-CS492	**Category:** Professional core course
Course Title: Computer Organization & Architecture Lab	**Semester:** IV
3**L** : 0**T**: 4**P**	**Credits:** 5

[L= Lecture, T = Tutorials, P = Practicals]

Objectives of the course:

This course will expose students to the following

1. To be able to understand the behavior logic gates, adder, decoder and multiplexer.

2. How Computer Systems work & the basic principles.

Detailed contents: All laboratory assignments are based on Hardware Description Language (VHDL or Verilog) Simulation.

Module	Content
1	HDL introduction.
2	Basic digital logic based programming with HDL.
3	8-bit Addition, Multiplication, Division.
4	Design a BCD adder.
5	Design an 8×1 multiplexer.
6	Design a Decoder.
7	8-bit Register design.

8	Memory unit design and perform memory operations.
9	8-bit simple ALU design.
10	8-bit simple CPU design.
11	Interfacing of CPU and Memory.

Course Outcome:

1.Understand basic logic gates and efficiently verify the behavior of the circuit.
2.Acquire in-depth knowledge to implement different arithmetic operations.
3.Understand the working principle of the memory system.
4.Understand the working principle of CPU, and interfacing of CPU and Memory.

Course Code	PCC-CS493
Course Name	OPERATING SYSTEMS LAB
Credits	0L:0T:4P 2 Credits
Pre-Requisites	Programming for Problem Solving, Data Structure & Algorithm

Total Number of Lectures: 48

COURSE OBJECTIVES
1. To write shell scripts, make a script executable, and learn varying shell syntax (variables, conditions, control structures, functions, commands).
2. To create process and handle the concepts of process, signal and semaphore in operating system.
3. To understand how to implement thread and thread synchronization, Inter-process communication

Syllabus:

1. Shell programming [9P]: creating a script, making a script executable, shell syntax (variables, conditions, control structures, functions, commands).

2. Process [6P]: starting new process, replacing a process image, duplicating a process image, waiting for a process, zombie process.

3. Signal [9P]: 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 [9P]: programming with pthread functions(viz. pthread_create, pthread_join, pthread_exit, pthread_attr_init, pthread_cancel)

6. Inter-process communication [9P]: pipes(use functions pipe, popen, pclose), named pipes(FIFOs, accessing FIFO)

COURSE OUTCOMES
After completion of course, students would be able to:
CO1: Use a UNIX text editor to create a shell script and run scripts efficiently from the command line and write varying shell syntax.
CO2: Create process and handle the concepts of process, signal and semaphore in operating system.
CO3: Implement thread and thread synchronization, Inter-process communication

Textbooks/References:

- Unix Shell Programming, Yahhwant P. Kanetkar
- Unix and Shell Programming, Sumitabha Das
- Advanced Programming in the UNIX Environment 2nd Edition (English, Paperback, W. Richard Stevens)
- Milenkovie M., "Operating System : Concept & Design", McGraw Hill.
- Tanenbaum A.S., "Operating System Design & Implementation", Practice Hall NJ.
- Silbersehatz A. and Peterson J. L., "Operating System Concepts", Wiley.
- Dhamdhere: Operating System TMH
- Stalling, William, "Operating Systems", Maxwell McMillan International Editions, 1992.
- Dietel H. N., "An Introduction to Operating Systems", Addison Wesley