Structure of Course & Syllabus
of
B. Tech. (UG Programme)
First Year and Second Year
Department of Computer Science and Engineering

(As per National Education Policy-2020)

Department of Computer Science and Engineering
School of Engineering and Technology,
H. N. B. Garhwal University,
Srinagar Garhwal, Uttarakhand- 246174

Semester- wise List of Subjects (As per NEP 2020)

Semester I

S. No.	Category	Course Code	Course Code and Title	L	T	P	Contact Hrs./Week	Credits
1	Basic Science/Multidisciplinary	SET/SH/BT/C101	Mathematics I	3	1	-	4	4
2		SET/SH/BT/C103	Chemistry	3	1	-	4	4
3	Core Basic Engineering Subjects	SET/ME/BT/C104	Engineering Mechanics	3	1	-	4	4
4		SET/ME/BT/C102	Basic Mechanical Engineering	3	1	-	4	4
5		SET/CS/BT/C105	C Programming	3	1		4	4
6	Core/Basic Engineering Subjects Labs	SET/SH/BT/C108	Chemistry Lab	-		1	2	1
7		SET/CS/BT/C109	C Programming Lab			1	2	1
8	Extracurricular Courses/CC	AECC106	Connecting Student with Environment*	2	-	-	2	2
9	Skill Course	SET/CS/SC/C110	Internet Technology Lab-I (Skill Enhancement Course)	-	-	1	4	2
Total				17	5	3	30	26

***** University will prepare a course with focus on connecting student with environment to make student more environment sensitive.

Semester II

S. No.	Category	Course Code	Course Code and Title	L	T	P	Contact Hrs./Week	Credits
1	Basic Science/Multidisciplinary	SET/SH/BT/C201	Mathematics II	3	1	-	4	4
2		SET/SH/BT/C202	Physics	3	1	-	4	4
3	Core Basic Engineering Subjects	SET/EE/BT/C203	Basic Electrical Engineering	3	1	-	4	4
4		SET/EC/BT/C204	Basic Electronics	3	1	-	4	4
5		SET/IT/BT/C205	Fundamental of Information Technology	3	1		4	4
6	Core/Basic Subjects Based Labs	SET/SH/BT/C207	Physics Lab	-		1	2	1
7		SET/ME/BT/C208	Engineering Graphics and Workshop Practice			1	2	1
8	Life Skills and personality development	AECC206	Life Skills and personality development#	2	-	-	2	2
9	Skill Course	SET/CS/SC/C210 or SET/CS/SC/C211	Internet Technology Lab-II or Basics of Python Lab (Skill Enhancement Course)	-	-	1	4	2
Total				17	5	3	30	26

University will prepare the course on Life skills and personality development, which will focus on the subjects such as stress management through Yoga, teamwork, cooperation, work ethics and personality development issues.

Semester III

S. No.	Category	Course Code	Course Code and Title	L	T	P	Contact Hrs./Week	Credits
1	Basic Science/Multidisciplinary	SET/AH/BT/C301	Mathematics III	3	1	-	4	4
2	Core Subjects	SET/CS/BT/C302	Computer Based Numerical & Statistical Techniques	3	1	-	4	4
3		SET/CS/BT/C304	Data Structures Using C	3	1	-	4	4
4		SET/CS/BT/C305	Discrete Structures	3	1	-	4	4
5	Interdisciplinary Subject	SET/EC/BT/C303	Digital Electronics	3	1		4	4
6	Core Subjects Based Labs	SET/CS/BT/C306	Computer Based Numerical & Statistical Techniques lab	-		1	2	1
7		SET/CS/BT/C307	Digital Electronics Lab			1	2	1
8	Extracurricular Courses/CC	**VAC3**	Indian Knowledge System-I*	2	-	-	2	2
9	Skill Course	SET/CS/SC/C308	Data Structures Using C Lab	-	-	1	4	2
Total				17	5	3	30	26

***** Compulsory for all U.G. students, to be prepared by University.

SET/SH/BT/C101 MATHEMATICS- I		
Course Objective	To provide essential knowledge of basic tools of Differential Calculus, Vector Calculus and Matrix Algebra for engineering students.	
Course Outcome	Implementation of calculus in designing the different structural and mechanical components while matrix algebra is applied in the study of electrical circuits, quantum mechanics and optics.	
Module Name	**Content**	**No. of Hrs.**
Differential Calculus	Limit, continuity and differentiability of single and two variables, mean value theorems, indeterminate forms; partial derivatives, total derivative, Euler's formula, Taylor series (in one and two variables), maxima and minima, Extrema of function of several variables, Lagrange"s method.	**15**
Vector Calculus	Interpretation of vectors and scalars, directional derivatives, line, surface and volume integrals, gradient, divergence and curl of a vector and their physical interpretation, Gauss's divergence, Green's and Stoke's theorem.	**12**
Matrices	Vector space, basis, matrices, determinants, Elementary row and column transformation, linear dependence and independence, rank of matrix, consistency of system of linear equation and solution of linear system of equations. Characteristic equation, Cayley-Hamilton theorem, eigen values and eigen vectors, diagonalization, complex matrices.	**15**
	Total No. of Hrs.	**42**
Textbooks	1. R. K. Jain and S. R. K. Iyengar "Advanced Engineering Mathematics", Narosa Publications, 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 3. H K Das, "Advanced Engineering Mathematics", S Chand, 4. Erwin Kreyszig, "Advanced Engineering Mathematics".	

SET/SH/BT/C103 CHEMISTRY

Course Objective	1. Apply the electrochemical principles in batteries, understand the fundamentals of corrosion. 2. Analysis of water for its various parameters and its significance in industrial and domestic Applications. 3. Analyze microscopic chemistry in terms of atomic, molecular orbitals and Intermolecular forces 4. Analysis of major chemical reactions that are used in the synthesis of molecules. 5. V. Understand the chemistry of various fuels and their combustion.	
Course Outcome	1. Describe and understand the operation of electrochemical systems for the production of electric energy, i.e. batteries. 2. Explain the mode by which potable water is produced through the processes of screening, micro Straining, aeration, coagulation and flocculation, sedimentation, flotation, filtration and disinfection. 3. Recognize that molecular orbital theory is a method used by chemists to determine the energy of the electron in a molecule as well as its geometry. 4. Demonstrate an ability to design, implement, and evaluate the results of experimentation using standard scientific methodologies such as hypothesis formulation and testing. 5. Understand and analyze the combustion mechanisms of various fuels	
Module Name	**Content**	**No. of Hrs.**
Advanced Theory of Chemical Bonding	Valence bond and molecular orbital theory. Structure of NH3, H2O, SO3, PCl5, XeO2 molecules. Types of linkages, Hybridization, Hydrogen bonding, Metallic bonding.	4
Equilibrium on Reactivity	Bronsted and Lewis Acids, pH, pka, pkb scale, buffer solution.	4
Polymers	Structures of the following polymers, viz, Natural and synthetic rubbers, Polyamide and Polyester fibres, polymethylmethacrylate, poly acrylonitrile and polystyrene. A brief account of conducting polymers (polypyrrole & polytiphene) & their applications.	3
Complex Compounds	Introduction, Valence bond and crystal field theory.	4
Chemical Kinetics & Catalysis	Order of reactions, Parallel and reversible reactions. Catalysis- homogeneous and heterogeneous catalysis. Characteristics of catalytic reactions, catalytic promoters and poisons, auto catalysis and negative catalysis. Activation energy of catalysis, intermediate compound formation theory and adsorption theory.	3
Atmospheric Chemistry& Air Pollution	Environment and ecology, environmental segments, structure and composition of atmosphere, radiation balance of earth and Green House Effect, formation and depletion of Ozone layer, chemical and photochemical reactions of various species in atmosphere, air pollution- sources, reactions and sinks for pollutants, acid rains and smog formation. Pollution control methods.	5
Corrosion & Lubricants	Introduction, causes of corrosion, theories of corrosion- direct chemical attack, electrochemical theory of corrosion, factors influencing corrosion, corrosion inhibitors, passivity, types of corrosions, protection from corrosion and protective coatings. Theory, classification and mechanism of lubrication.	5
Water and Waste Water Chemistry	Introduction, hardness of water, characteristics imparted by impurities, analysis of contaminants, treatment of water by Zeolite, L-S process, boiler feed water, waste water treatment.	6
Fuels & Combustion	Classification of fuels, non-conventional energy, biogas, biomass and solar energy, calorific value – gross and net, characteristics of good fuel, determination of calorific value, solid fuels, analysis of coal, liquid fuels.	5
Stereochemistry of organic-compounds	Mechanism of chemical reaction, Beckman, Hoffman, Reimer Tiemann, Cunnizzaro, Diels- Alder and Skraup synthesis.	3
	Total No. of Hours	**42**
Textbooks	1. Jain, Jain, "Engineering Chemistry" 2. Sharma, Kumar, "Engineering Chemistry"	
References	1. R. T. Morrison and R N Boyd, "Organic Chemistry", 6th Edition, Prentice Hall, New Delhi, 2. J. D. Lee, "Concise Inorganic Chemistry", Chapman & Hall 3. W. L. Jolly, "Modern Inorganic Chemistry", McGraw-Hill 4. P.W. Atkins, "Physical Chemistry", 6th Edition, Oxford University Press 5. Barrow, "Physical Chemistry" 6. Manahan, "Environmental Chemistry"	

	7. D. L. Pavia, GM. Lampman, GS. Kriz and J.R Vyvyan, I, “Spectroscopy”, Cengage Learning India Pvt. Ltd, New Delhi, 2007 8. R.M. Silverstein, F.X. Webster and D.J. Kiemle, “Spectrometric Identification of Organic Compounds”, 7th edition, John-Wiley and Sons, New York, 2005 9. William Kemp, “Organic Spectroscopy”, 3rd edition, Palgrave, New York, 2005 10. C.N. Banwell and E. M. McCash, “Fundamentals of Molecular Spectroscopy”, McGraw- Hill, International, UK, 1995 11. F. Carey, “Organic Chemistry”, 5th Edition, McGraw Hill Publishers, Boston, 2003

SET/ME/BT/C104	ENGINEERING MECHANICS	
Course Objective	1. To understand distributed force systems, centroid/ center of gravity and method of finding centroids of composite figures and bodies. 2. To understand the moment of inertia and method of finding moment of inertia of areas and bodies. 3. To understand types of frames and analyze for the forces in the members of the truss by method of joints and method of sections. 4. To understand dynamics of a particle. 5. To interpret the simple given dynamic problems and solve them for positions, velocities and accelerations, etc., 6. To understand the kinetics of the rigid bodies and solve simple problems using work-energy method. • To understand virtual work method and solve simple problems.	
Course Outcome	1. Identify the significance of centroid/ center of gravity and find centroids of composite figures and bodies. 2. Understand the moment of inertia and method of finding moment of inertia of areas and bodies. 3. Identify the type of frame and analyze for the forces in the members of the truss (frame) by method of joints and method of sections. 4. Understand dynamics of a particle. 5. Interpret the simple given dynamic problems and solve them for positions, velocities and accelerations, etc., 6. Understand the kinetics of the rigid bodies and solve simple problems using work-energy method. • Understand virtual work method and solve simple problems.	
Module Name	**Content**	**No. of Hrs.**
Force System	Introduction: Force system, dimensions and units in mechanics, laws of mechanics, vector algebra, addition and subtraction of forces, cross and dot products of vectors, moment of a force about a point and axis, couple and couple moment, transfer of a force to a parallel position, resultant of a force system using vector method, Problems involving vector application Equilibrium: Static and dynamic equilibrium, static in determinacy, general equations of equilibrium, Varingnon's theorem, Lami's theorem, equilibrium of bodies under a force system, Problems.	8
Trusses And Frames	Truss and Frames: Truss, classification of truss, assumptions in truss analysis, perfect truss, analysis of perfect plane truss using method of joints and method of sections, Problems.	8
Centre Of Gravity And Moment Of Inertia	Centroid, Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems, Moment of Inertia: Area moment of inertia, mass moment of inertia, parallel axis and perpendicular axis theorems, radius of gyration, polar moment of inertia, product of inertia, principle axis, problem based on composite figures and solid objects.	10
Friction and Virtual Work	Friction-characteristics of dry friction, problems involving friction of ladder, wedges and connected bodies. Definition of virtual work, principle of virtual work for a system of connected bodies	7
Kinematics And Dynamics	Kinematics: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problems. Particle Dynamics: Energy methods and momentum methods, Newton's laws, work energy equation for a system of particles, linear and angular momentum equations, projectile motion, problem.	12
	Total No. of Hours	**45**
Textbooks	1. R S Khurmi, "Engineering Mechanics". 2. P K Nag "Engineering Thermodynamics".	
References	1. Van Wylen G.J. & Sonnlog R.E.: Fundamentals of classical thermodynamics, John Wiley & Sons,Inc. NY. 2. Wark Kenneth: Thermodynamics (2nd edition), Mc Graw Hill book Co. NY. 3. Holman, J.P.: Thermodynamics, MC Graw Hill book Co. NY. 4. Yadav R.: Thermodynamics and Heat Engines, Vol I & II (Sl Edition) Central Publishing House Allahabad. 5. Yadav R.: Steam & Gas Turbines. 6. Kshitish Chandra Pal: Heat Power, Orient Longman Limited, 17, Chittranjan Avenue, Calcutta. 7. S. Rao, B.B. Parulekar, 'Energy Technology', Khanna Pub., New Delhi. 8. G. H. Ryder: "Strength of Materials". 9. F. L. Singer: "Strength of Materials". 10. Timoshenko: "Strength of Materials".	

SET/ME/BT/C102	BASIC MECHANICAL ENGINEERING	
Course Objective	1. To use mechanical principles to solve real-world engineering issues. 2. To identify appropriate structural system for studying a given problem and isolate it from its environment. 3. Develop a simple mathematical model for an engineering problem and perform a static analysis. 4. To carry out kinematics and Kinetics analysis for practices and system of particles.	
Course Outcome	1. Students will be able to apply and demonstrate the concept of mechanics to practical engineering problems. 2. Students will be able to determine the properties of planes and solids. 3. Students will be able to apply the basic concept of dynamics to practical problems.	
Module Name	**Content**	**No. of Hrs.**
Fundamental concept of thermodynamics	Definition of thermodynamics, System, Surrounding and Universe, Phase, Concept of continuum, Macroscopic & microscopic point of view. Thermodynamic equilibrium, Property, State, Path, Process, Cyclic and non-cyclic processes, Reversible and irreversible processes, Quasi static process, Energy and its forms, Enthalpy, Zeroth law, first law, second law and third law of thermodynamics, Steady flow energy equation, Limitations of first law of thermodynamics, Essence of second law, Thermal reservoir, Heat engines. COP of heat pump and refrigerator, Carnot cycle, Carnot theorem, Clausius inequality, Concept of entropy.	8
Properties of gases and steam	Boyle's law, Charles's law, Gay-Lussac's law, Avogadro's law, Combined gas law, Gas constant, Relation between c_p and c_v, Various non-flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Polytropic process. Steam formation, Enthalpy, Specific volume, Internal energy and dryness fraction of steams, steam calorimeters.	5
Thermodynamic Cycle	Rankine cycle, Actual vapour cycle processes, Comparison of Rankine and Carnot cycles, Air standard cycles - Otto, Diesel, dual and Brayton cycles, Vapour compression refrigeration cycles.	8
Introduction to Mechanics of Solid:	Normal and shear Stress, strain, Hookes' law, Poisson's ratio, elastic constants and their relationship, stress-strain diagram for ductile and brittle materials, factor of safety. Basic Numerical problems, temperature stresses, shear stress, complementary shear stress, shear strain.	8
Compound Stresses and Strains	State of stress at a point, oblique stress, simple tension, pure shear, general two dimensional stress system, principal planes, principal stresses and strains, maximum shear stress.	8
Bending Stress and Torsion	Pure bending, moment of inertia, section modulus, bending stresses, combined bending and direct stress, beam of uniform strength, middle third and middle quarter rules for rectangular and circular sections, Circular shafts, torsional shear stress, strain energy in torsion, shafts under varying torque, compound shafts, combined bending and twisting.	8
	Total No. of Hours	**45**
Textbooks	1. R S Khurmi, "Engineering Mechanics". 2. P K Nag "Engineering Thermodynamics".	
References	1. Van Wylen G.J. & Sonnlog R.E.: Fundamentals of classical thermodynamics, John Wiley & Sons,Inc. NY. 2. Wark Wenneth : Thermodynamics (2nd edition), Mc Graw Hill book Co. NY. 3. Holman, J.P.: Thermodynamics, MC Graw Hill book Co. NY. 4. Yadav R.: Thermodynamics and Heat Engines, Vol I & II (Sl Edition) Central Publishing House Allahabad. 5. Yadav R.: Steam & Gas Turbines. 6. Kshitish Chandra Pal: Heat Power, Orient Longman Limited, 17, Chittranjan Avenue, Calcutta. 7. S. Rao, B.B. Parulekar, 'Energy Technology', Khanna Pub., New Delhi. 8. G. H. Ryder: "Strength of Materials". 9. F. L. Singer: "Strength of Materials". 10. Timoshenko: "Strength of Materials". 11. Beer, Johnson, Statics".	

SET/CS/BT/C105	C PROGRAMMING	
Course Objective	The course is designed to provide complete knowledge of programming in C language. Students will be able to develop logics which will help them to create programs and applications in C. Also, by learning the basic programming concepts in C, help them to learn any other programming language in future.	
Course Outcome	1. Develop programs in C programming language. 2. Analyze the problem and find appropriate solution 3. Evaluate the correctness of the developed solution. **4.** Develop basic and advanced level applications using C programming language.	
Module Name	**Content**	**No. of Hrs.**
Introduction	Introduction, The C character set, Constants, Variables, Identifiers, Keywords, Data types, Declarations, The First C Program, Compilation and Execution.	6
Operators and Expressions	Arithmetic, Relational, Equality, Logical, Unary, Conditional, Bitwise, Assignment, Comma and Sizeof operator. Type Conversion and Typecasting.	6
Control Statements	if, if-else, while, do-while, for loop, nested loops, switch, break, continue and goto statements.	5
Functions & Pointers	Defining and accessing functions, Function prototype, Passing arguments, Recursion, Use of library functions. Introduction to pointers, Declarations, Passing to a function, Operations on pointers, Dynamic memory allocation, Array of pointers.	11
Arrays	Single and Multi-dimensional arrays, Row major and Column major form of an array, Character strings and arrays.	4
Storage classes	Automatic, Register, Static and External storage class.	4
Structures and Unions	Basics of structures, Structures and functions, Arrays of Structures, Pointers to structures, Self-referential structures, Unions.	4
File Input/output	Opening a File, Reading from a file, closing the file, Writing to a file.	4
Total No. of Hours		**44**
Textbooks	1. E. Balagurusamy, "Programming in ANSI C"	
References	1. Byron S. Gottfried, "Programming With C" 2. Yashwant Kanitker, "LET US C" 3. B. W. Kernighan and D. M. Ritchie, "The C Programming Language" 4. B. W. Kernighan, "The Practice of Programming", Addison-Wesley, 1999. 5. C. L. Tondo and S. E. Gimpel, "The C Answer Book", (2/e), Prentice Hall, 1988.	

SET/SH/BT/C108	CHEMISTRY LAB	
Module Name	**Content**	**No. of Hrs.**
1. To determine the percentage of available chlorine in the supplied sample of bleaching powder. 2. To determine the ferrous content in the supplied sample of iron ore by titrimetric analysis against standard K2Cr2O7 solution using K3Fe(CN)6 as external indicator. 3. To determine the chloride content in supplied water sample using Mohr's method. 4. To determine the constituents and amount of alkalinity of the supplied water sample. 5. To determine the temporary and permanent hardness of water sample by complexometry. 6. To find chemical oxygen demand of a waste water sample using Potassium Dichromate. 7. To determine iron concentration in the sample of water by Spectrophotometric method. 8. To determine the molecular weight of a polystyrene sample by using viscometric method. 9. To determine pH of a solution by using digital pH meter and titration of such a solution pH metrically. 10. Analysis of a coal sample by proximate analysis method.		3 x 10
Total No. of Hours		**30**

SET/CS/BT/C109	C PROGRAMMING LAB	
Course Objective:	1. To make the student learn a programming language. 2. To learn problem solving techniques. 3. To teach the student to write programs in C and to solve the problems.	
Course Outcome:	1. After Completion of this course the student would be able to 2. Read, understand and trace the execution of programs written in C language. 3. Write the C code for a given algorithm. 4. Implement Programs with pointers and arrays, perform pointer arithmetic, and use the pre-processor. 5. Write programs that perform operations using derived data types.	
Content		**No. of Hrs.**
This lab shall have minimum 25 programs in C. There shall be minimum two programs per module as taught in theory. Programming shall follow logic/algorithm and flowchart wherever applicable. Exercises shall also enhance analytical and debugging abilities.		2x16
	Total No. of Hours	**32**

AECC106	ENVIRONMENTAL SCIENCE
As per University Proposal and Approval	

SET/CS/SC/C110 Internet Technology Lab-I (Skill Enhancement Course)		
Course Objective:	1. To make the student learn a programming language. 2. To learn Microsoft office techniques. 3. To learn computer network and trending techniques	
Course Outcome:	1. After Completion of this course the student would be able to know about the office automation techniques and implement on day to day activities 2. Working with computer networking equipment and email.. 3. Implement Programs to design web development	
Module Name	**Content**	**No. of Hrs**
Module I	Working with Microsoft Office (Word, Excel, Power Point, Access)	10
Module II	Use of Search Engine and World Wide Web, Creation of email id and working with email, Use of FTP service	10
Module III	Basics of Cloud computing, Internet of things (IoT), Data Science, Artificial Intelligence, Block-Chain Technology, Client-Server Architecture, P2P Networks	10
	Besides these additional experiments can be included to give hands on experience to students.	
	Total Hours	**30**

SET/SH/BT/C201	MATHEMATICS-II	
Course Objective:	To introduce different types of integrations, transformations and distributions for graduate students.	
Course Outcome:	Applying the Fourier series in signal processing and implementation of various transformations to solve complex engineering problems.	
Module Name	**Content**	**No. of Hrs.**
Multiple Integral	Evaluation of definite integral; double and triple integrals; change of order of integration. Change of variables, application to area, volume, centre of gravity, moment of inertia and product of inertia. Gamma and Beta functions, Dirichlet's integral and its application.	**12**
Fourier Series	Periodic functions, Fourier series of functions with period 2n, change of interval, half range sine and cosine series	**6**
Integral Transform	Laplace transforms, existence theorem, Laplace transform derivatives, inverse Laplace transform, application to solve linear differential equations, unit step function, Dirac delta function, Laplace transforms of periodic functions. Application of Laplace transforms. Definitions of Fourier transform and its simple applications	**14**
Probability and Statistics	Random variables. Uniform, normal, exponential, Poisson and binomial distributions. Mean, median, mode and standard deviation, Correlation and regression, Conditional probability and Bayes theorem	**12**
	Total No. of Hrs.	**44**
Textbooks	1. R. K. Jain and S. R. K. Iyengar "Advanced Engineering Mathematics", Narosa Publications, 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 3. H K Das, "Advanced Engineering Mathematics", S Chand, 4. Erwin Kreyszig, "Advanced Engineering Mathematics".	

SET/SH/BT/C202	PHYSICS	
Course Objective	1. To introduce the student to the basic of wave optics, lasers, and demonstrate their applications in technology. 2. To make students aware about quantum physics phenomena. 3. Give the beginning student an appreciation of recent developments in materials science & engineering within the framework of this class. 4. To review physics in the context of materials science & engineering. 5. Give an introduction to the relation between processing, structure, and physical properties. 6. To make the students aware about Electromagnetic wave fundamentals.	
Course Outcome	1. Demonstrate interference, diffraction and polarization of light and explain the working principle of Lasers. 2. Student will understand quantum mechanical aspects of physics. 3. Enable to explain the phenomenon of crystal structure and crystallographic, qualitatively description of X-ray diffraction and its general physical properties, as well as possible applications. 4. Students will understand the phenomenon of defects in solids and their physical properties, band theory of solids and classification of energy bands, electric and magnetic properties of solids and able to explain qualitative idea of superconductivity in materials. 5. This will enable the students to learn physical concepts associated with electromagnetic radiation and devices. 6. Use Maxwell's equations to describe propagation of EM waves in a medium.	
Module Name	**Content**	**No. of Hrs.**
Optics	Interference: Coherent Sources, Conditions of Interference, Fresnel's Biprism Experiment, Interference in Thin Films, Newton's Rings; Single and n-Slit Diffraction, Diffraction Grating, Raleigh's Criterion of Resolution, Resolving Power of Telescope, Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicol Prism, Circularly and Elliptically Polarized Light, Fresnel Theory, Optical Activity, Specific Rotation; Laser: Principle of Laser Action, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser, Applications of Laser.	15
Origin of Quantum Mechanics and its Applications	Black body radiation, Planck's Radiation Law, Wave Particle Duality, de-Broglie hypothesis, Photoelectric effect, Wave Function and its Normalization, Born Interpretation, Schrodinger equation, Particle in a Box, Potential Step ($E < Vo$), Tunneling effect (Qualitative idea).	10
Basics Material Science	Introduction to crystal structure of materials, Miller indices for crystallographic planes and directions. Diffraction of X-Rays, Bragg's Law, Determination of crystal structure using X-rays Diffraction and its applications. Defects in solids: point, line and planar defects and their effect on properties of materials. Band theory of solids, conductors, semi-conductors and insulators, metals. Fermi Level. Magnetism: dipole moments, paramagnetism, Curie's law, magnetization and hysteresis, Ferromagnetism and Anti- Ferromagnetism. Ferro electricity and Piezoelectricity. Superconductivity in materials.	15
Electromagnetics	Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, Poynting Theorem.	8
Total No. of Hours		**48**

Textbooks	1. Gaur, Gupta, "Engineering Physics" 2. Callister W.D., "Materials Science and Engineering: An introduction", 6th Edition, John Wiley & Sons Inc., New York 2002.
References	1. J. R. Taylor, C.D. Zafiratos and M. A. Dubson, Modern Physics for Scientists and Engineers,2nd Pearson 2. Arthur Beiser, Concepts of Modern Physics, 6th Ed., TMH, (2009) 3. D.J. Griffith : Electrodynamics 4. Charles Kittel, Introduction to Solid State Physics, 5. S.O. Pillai, Solid State Physics, 6. Ajoy Ghatak- Optics

SET/EE/BT/C203 BASIC ELECTRICAL ENGINEERING		
Course Objective	1. To impart basic knowledge of electrical quantities and provide working knowledge for the analysis of DC and AC circuits. 2. To understand the construction and working principle of DC and AC machines. 3. To understand the construction and working principle of various instruments. 4. To understand the construction and working principle of 3- phase supply system.	
Course Outcome	1. Understand the basic electric and magnetic circuits. 2. Analyze DC and AC circuits. 3. Interpret the construction and working of different types of electrical machines and instruments. 4. Analyze basic electrical components and circuits.	
Module Name	**Content**	**No. of Hrs.**
DC Networks	Concepts of linear, nonlinear, active, passive, unilateral and bilateral elements; Ideal and practical voltage & current sources, conversion from one from the other; Kirchhoff's laws, statements; Mesh Analysis; Nodal Analysis; Delta-Star & Star-Delta conversion; Superposition principle; Thevenin's theorem, statement, advantages in case of complex networks; explanation & illustration with examples; Norton's theorem, Maximum power transfer theorem, Reciprocity Theorem and its application.	10
Single Phase AC Circuits	Generation of single phase AC voltage and determination of average (mean) and RMS (effective) values of voltage and current with special reference to sinusoidal waveforms; Form factor and peak factor for various waves; Representation of sinusoidal time varying quantities as phasors; concepts of reactance, impedance and their representation in complex forms using j operator; Steady state analysis of series R-L-C circuit & its phasor diagram; Concept of power & power factor; Concept of admittance, susceptance in parallel circuits; Analysis of series parallel circuits & phasor diagrams; Resonance in series and parallel circuits.	10
Three Phase Circuits	Generation of 3-phase balanced sinusoidal voltage; star & delta connections; line & phase quantities (current & voltage); Solution of 3-phase star/delta circuits with balanced supply voltage and balanced load; phasor diagram; 3-phase, 4-wire circuits; Measurement of three phase power by two wattmeter method; phasor diagram with balanced load and determination of load power factor from wattmeter readings.	6
Transformers and Rotating Machines	Transformers: Constructional features and principle of operation, concept of ideal transformer under no load & loaded conditions and its equivalent circuit; Practical transformer rating & its equivalent circuit; Autotransformer – principle of operation & relative advantages & disadvantages; Rotating Machine: construction features (stator, rotor & air gap), conditions for production of steady electromagnetic torque; Three phase Induction motor: constructional features and operation; DC Machines: construction features, EMF and Torque expression, Classification of DC motors and generators; Stepper motor.	12
Measuring Instruments	DC PMMC instruments – constructional feature and principle of operation; Moving iron meters construction and principle of operation; Dynamometer type wattmeter; Induction type energy meter construction & principle of operation.	6
	Total No. of Hours	**44**
Textbooks	1. I.J. Nagrath, "Basic Electrical Engineering," Tata Mc. Graw Hill.	
References	1. A. E. Fitgerald, D.E., Higginbotham and A Grabel, "Basic Electrical Engineering", Mc Graw Hill. 2. Rizzoni, Principles and Applications of Electrical Engineering, TMH. 3. V. Del Toro. "Principles of electrical Engineering, "Prentice hall. 4. W.H. Hayt & J.E. Kemmerly," Engineering circuit Analysis, "Mc Graw Hill. 5. H. Cotton, "Advanced Electrical Technology" Wheeler Publishing.	

SET/EC/BT/C204	Basic Electronics	
Course Objective	To familiarize the students with electronics field. To introduce semiconductor fundamentals, electronic devices, and elementary electronic circuits. To familiarize students with digital logics and gates.	
Course Outcome	1. Understand the working and current voltage characteristics of semiconductor devices e.g. diodes and transistor. 2. Perform dc analysis of amplifier circuits. 3. Design basic OP AMP circuits. 4. Understand and use basic digital electronic concepts.	
Module Name	**Content**	**No. of Hrs.**
Semiconductor Diodes	Semiconductor materials- intrinsic and extrinsic types, Ideal Diode as a switch, Terminal characteristics, and equivalent circuit of PN diode: p-n junction under open circuit condition, p-n junction under forward bias and reverse bias conditions, p-n junction in breakdown region; Zener diode and basic voltage regulator using Zener diode; Rectifier Circuits, Clipping and Clamping circuits; LED, Photo Diode.	10
Bipolar Junction Transistors	Physical structure, physical operation and current-voltage characteristics of NPN transistor; Use of Voltage-dependent Current source as a Voltage amplifier; Transistor as an amplifier: Characteristics of CE amplifier; Active region operation of transistor; D.C. analysis of Common Emitter Amplifier: load line analysis; Transistor as a switch: cut-off and saturation modes.	10
Field Effect Transistor	Enhancement-type MOSFET: structure and physical operation, current-voltage characteristics; MOSFET as a Switch, MOSFET as a Voltage-dependent Current source and Common Source Amplifier.	8
Operation Amplifier	Ideal Op-amp; Properties of the ideal Operational Amplifier; op-amp application circuits (assuming ideal op amp): inverting amplifier, non - inverting amplifier, weighted summer, integrator, and differentiator.	6
Digital Logic and Gates	Binary, octal, and hexadecimal number systems; Methods of base conversions; Binary, octal, and hexadecimal arithmetic; Representation of signed numbers; Basic logic operations and logic gates; MOSFET Switch Implementation of Logic Gates, e.g., Inverter, NAND, NOR. Basic postulates and fundamental theorems of Boolean algebra.	8
	Total No. of Hours	**42**
Textbooks	1. Agarwal, Anant; Lang, Jeffrey H, "Foundations of Analog and Digital Electronic Circuits", Elsevier Science & Technology Books.	
References	1. V. Del Toro, Principles of Electrical Engineering, PHI. 2. Rizzoni, Principles and Applications of Electrical Engineering, TMH. 3. Malvino, Electronic Principles. 4. R.L.Boylestad & L.Nashelsky, Electronics Devices & Circuit Theory, PHI. 5. Sedra, Smith, "Microelectronic Circuits", Oxford University Press.	

SET/IT/BT/C205	Fundamentals of Information Technology	
Course Objective	1. Take on significant positions In various IT work 2. Collaborate in diverse team environments 3. Contributions in the field of IT 4. Work effectively in the IT field to make a positive contribution to society	
Course Outcome	1. Develop information technology solutions by evaluating user requirements in the systems development environment. 2. Apply knowledge of IT requirements for technology solutions in cutting edges applications. 3. Analyze a problem and identify and define the computing requirements for the appropriate solutions. **4.** Create, select and apply appropriate techniques, resources, and modern engineering and IT tools.	
Module Name	**Content**	**No. of Hrs.**
Introduction	Definition of Electronic Computer, Generations, Classification of Computers, Computer Hardware and Basic Computer Organization: CPU- ALU, CU; RAM/ROM, Various I/O devices, Peripherals, Storage Media	4
Computer Languages	Binary, Hexadecimal Number System; Basic Binary Logic Operations; Binary Addition and Subtraction; Generation of Languages, Assembly Language, High level language; Translators, Interpreters, Compilers, Compilers; Flow Charts, Dataflow Diagram,	6
OS & Office	Software- System and Application Software; Elementary Concepts in Operating System; Textual Vs GUI, Introduction to DOS, MS Windows, UNIX/Linux	4
Computer Networks	Elements of Communication system; Brief Introduction to Computer Networks- Introduction of LAN and WAN. Network Topologies, Client-server Architecture, IoT, Cloud Computing	6
Internet	Internet & World Wide Web, Hypertext Markup Language, DHTML, Python, WWW, Gopher, FTP, Telnet, Web Browsers, Net Surfing, Search Engines, Email; Introduction to Web Development, Static and Dynamic Pages	6
IT Application and Multi media	Basic Awareness of NICNET and ERNET; E Commerce, E governance; Brief Introduction to Different Formats of Image, Audio, Video	6
Information Concepts & Processing	Definitions of Information, Need of information, quality of information, value of information, concept of information, Entropy category and Level of information in Business Organization, Data Concepts and Data Processing, Data Science, Data Representation, Application of IT to E-commerce, Electronic Governance, Multimedia, Entertainment, Introduction to Information System.	8
	Total No. of Hours	**40**
Textbooks	1. Sinha, Sinha, “Computer Fundamentals”, 2. Yadav R. P. , “Information Technology”	
References	1. D S Yadav, “Foundations of IT”, New Age, Delhi 2. Rajaraman, “Introduction to Computers”, PHI 3. Peter Nortans “Introduction to Computers”, TMH. 4. Patterson D.A. & Hennessy J.L., "Computer Organization and Design", Morgan Kaufmann Publishers	

SET/SH/BT/C207	PHYSICS LAB	
Course Objective	To make students aware about experimental verification behind the theory, familiarize the student to the basic of spectroscopy, lasers, and semiconductor lab experiment and demonstrate their applications. Give the brief introduction about the Planck's constant, Hall Effect, Ohm's law, Thomson's experiment, conversion of Galvanometer to Voltmeter and Ammeter and unknown resistance using post office box.	
Course Outcome	1. After Demonstration the student will able to perform the experiment and learn about the practical knowledge of various theory part. 2. Student will enable to find the refractive index of material, wavelength of monochromatic source of light. 3. Enable to find the efficiency of electric kettle, band gap of materials, behaviour of semiconductor, charge density and hysteresis curve in ferromagnetic materials	
Sr. No.	**Experiments**	**No. of Hrs.**
1.	To determine refractive index of glass and liquid using spectrometer.	1x2
2.	To determine the wavelength of spectral lines using plane diffraction grating (Use Hg source).	1x2
3.	To determine the wavelength of sodium light by Newton's Ring method.	1x2
4.	To measure an accessible (Horizontal and vertical) height using sextant.	1x2
5.	Determination of wavelength of He-Ne laser using single slit /N slit diffraction pattern.	1x2
6.	To study the photoelectric effect and determine the value of Planck's constant.	1x2
7.	To determine the heating efficiency of an electric kettle with varying voltage.	1x2
8.	To Determine the wavelength of the semiconductor diode laser.	1x2
9.	Measurement of forward/reverse saturation current in p-n-junction diode at various temperatures and to find the approximate value of energy gap.	1x2
10.	To study the Hall effect and determine Hall coefficient, carrier density and mobility of a given semiconductor material.	1x2
11.	To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility	1x2
12.	Measurement of e/m of electron e/m- Thomson's Experiment	1x2
13.	To verify Ohm's law.	1x2
14.	Conversion of Galvanometer into Voltmeter and Ammeter.	1x2
15.	To determine the unknown resistance by a post office box.	1x2
	Total No. of Hours	**30**

References	
	1. Practical Physics, C.L. Arora, S. Chand & Co. 2. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd. 3. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, Asia Publishing House. 4. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers. 5. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

SET/ME/BT/C208	Engineering Graphics and Workshop Practice	
Course Objective	The Engineering Graphics course aims at the following educational objectives: Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, sections).Dimension and annotate two-dimensional engineering drawings. The application of industry standards and best practices applied in engineering graphics. Emphasize freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically.	
Course Outcome	1. Sketch engineering objects, lettering and dimensioning by freehand. 2. Create geometric constructions; drawing parallel and perpendicular lines, and to construct circles, arcs, tangencies, and irregular curves 3. Apply orthographic projection method to obtain: Multiview , auxiliary view and section view of an object	
Module Name	**Content**	**No. of Hrs.**
Introduction to Engineering Graphics & Projection of Points	Drawing instruments and their use, Different types of lines, Lettering & dimensioning Familiarization with current Indian Standard Code of Practice for Engineering Drawing. Scales, Plain scales, Diagonal scales, Vernier scales. First angle and third angle projections Projection of points in different coordinates, Projections of lines inclined to one of the reference planes.	08
Projections of lines and planes	Projections of lines inclined to both the planes, True lengths of the lines and their angles of inclination with the reference planes, Traces of lines. Projection of plane lamina of geometric shapes inclined to one of the reference planes, inclined to both the planes, Traces of planes. Projections on auxiliary planes.	08
Projections of polyhedral and solids	Projections of polyhedral and solids of revolution, projection of solids with axis parallel to one of the planes and parallel or perpendicular to the other plane, Projections with the axis inclined to one of the planes.	08
Orthographic Projection	Concept of orthographic projection, Rules of Drawing orthographic projection, Conversion of pictorial views into orthographic projection, Drawing of orthographic projection of Machine components.	08
Carpentry, Fitting and Black smithy	Minimum two experiments from Carpentry, Fitting and Black smithy. And Development of jobs carried out and soldering, Black Smithy, House Wiring, Foundry (Molding only), Plumbing.	08
Welding & Machining	Practice of minimum two experiments of welding joints. Overview of Lathe, Shaper, Milling and Drilling machine. Perform one job on each machine.	08
	Total No. of Hours	**48**
Textbooks	4. Bhatt N. D, Elementary Engineering Drawing, Charotar Publishing House, Anand, 2002. 5. Elements Of Workshop Technology Vol-1 by Hazra Chaudhary	
References	1. Narayana K L & Kannaiah P, Engineering Graphics, Tata McGraw Hill, New Delhi, 1992. 2. Luzadder W J, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi, 2001. 3. Thomas E French & Charkes J V, Engineering Drawing & Graphing Technology, McGraw Hill Book Co, New York, 1993. 4. Venugopal K, Engineering Drawing & Graphics, New Age International Pvt. Ltd., New Delhi, 1994. 5. Workshop Technology, Raghubanshi.	

AECC206	**General English**
(Life Skill and Personality Development)	
As per University Proposal and Approval	

SET/CS/SC/C210 Internet Technology Lab-II (Skill Enhancement Course)		
Course Objective:	1. To make the student learn about web development. 2. To learn about static and dynamic web pages.	
Course Outcome:	1. After Completion of this course the student would be able to know about the web development . 2. Working with HTML/CSS/Javascript for designing web pages.	
Module Name	**Content**	**No. of Hrs**
Module I	Introduction to Web Development	10
Module II	Creation of Static Web Pages using HTML/CSS	10
Module III	Creation of Page Using Java Script	10
	Besides these additional experiments can be included to give hands on experience to students.	
	Total Hours	**30**

SET/CS/SC/C211 Basics of Python Lab (Skill Enhancement Course)		
Course Objective:	1. To make the student learn about Python programming language. 2. To develop basic programs using primitive data structures.	
Course Outcome:	After Completion of this course the student would be able to know about the basic Python programming.	
Module Name	**Content**	**No. of Hrs**
Module I	Install Python and write your first program	5
Module II	Describe the basics of the Python programming language	10
Module III	Use variables to store, retrieve and calculate information, Utilize core programming tools such as functions and loops	15
	Besides these additional experiments can be included to give hands on experience to students.	
	Total Hours	**30**

Semester III

S. No.	Category	Course Code	Course Code and Title	L	T	P	Contact Hrs./Week	Credits
1	Basic Science/Multidisciplinary	SET/AH/BT/C301	Mathematics III	3	1	-	4	4
2	Core Subjects	SET/CS/BT/C302	Computer Based Numerical & Statistical Techniques	3	1	-	4	4
3		SET/CS/BT/C304	Data Structures Using C	3	1	-	4	4
4		SET/CS/BT/C305	Discrete Structures	3	1	-	4	4
5	Interdisciplinary Subject	SET/EC/BT/C303	Digital Electronics	3	1		4	4
6	Core Subjects Based Labs	SET/CS/BT/C306	Computer Based Numerical & Statistical Techniques lab	-		1	2	1
7		SET/CS/BT/C307	Digital Electronics Lab			1	2	1
8	Extracurricular Courses/CC	**VAC3**	Indian Knowledge System-I*	2	-	-	2	2
9	Skill Course	SET/CS/SC/C308	Data Structures Using C Lab	-	-	1	4	2
Total				17	5	3	30	26

***** Compulsory for all U.G. students, to be prepared by University.

SET/CS/BT/C301 MATHEMATICS- III		
Course Objective	To provide essential knowledge of methods to analytical and approximate solutions for different types of ordinary and partial differential equations which leads to complex variables.	
Course Outcome	Solutions of different types of ordinary and partial differential applications leads to the analysis of complex problems in engineering such as hydraulic flow, heat transfer, level controller of a tank, vibration isolation, electrical circuits, etc.	
Module Name	**Content**	**No. of Hrs.**
Ordinary Differential Equations	Introduction to order, degree and arbitrary constants, solution methods for differential equations of first order , linear differential equations of n^{th} order with constant coefficient, complimentary functions and particular integrals, Homogeneous differential equations, Cauchy's and Euler's equations, Method of variation of parameters, equations of the form $y'' = f(y)$, applications to engineering problems.	**12**
Partial Differential Equations	Linear PDE with constant coefficients of 2nd order and their classifications, Initial and boundary value problems, PDE of parabolic, elliptic and hyperbolic type. Separation of variables method for solving PDE, heat equations, wave equations and Laplace equations.	**10**
Numerical Methods	Direct and iterative methods to solve of linear algebraic equations, numerical integration, integration by trapezoidal and Simpson's rules.	**08**
Complex Variables	Analytic functions; Cauchy-Riemann equations; Harmonic functions, Cauchy's integral theorem and integral formula; sequences, series, convergence tests, Taylor and Laurent series, poles and singularity of zeros, residue theorem.	**12**
	Total No. of Hrs.	**42**
Textbooks	1. R. K. Jain and S. R. K. Iyengar "Advanced Engineering Mathematics", Narosa Publications, 2. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 3. H K Das, "Advanced Engineering Mathematics", S Chand, 4. Erwin Kreyszig, "Advanced Engineering Mathematics".	

SET/CS/BT/C302 COMPUTER BASED NUMERICAL & STATISTICAL TECHNIQUES		
Course Objective	To demonstrate understanding of numerical and statistical methods in support of the analysis, design and application for problem solving in the field of information technology.	
Course Outcome	1. Recognize the error in the number generated by the solution. 2. Compute solution of algebraic and transcendental equation by numerical methods like Bisection method and Newton Rapshon method. 3. Apply method of interpolation and extrapolation for prediction. 4. Recognize elements and variable in statistics and summarize qualitative and quantitative data. 5. Calculate mean, median and mode for individual series. 6. Outline properties of correlation and compute Karl-Pearson's coefficient of correlation.	
Module Name	**Content**	**No. of Hrs.**
Errors in numerical computations	Errors in numerical computations, mathematical preliminaries, errors and their analysis, machine computations, computer software	6
Algebraic & Transcendental Equation	Bisection method, iteration method, method of false position, rate of convergence, method for complex root, Muller's method, quotient difference method, Newton's-Raphson methods.	6
Interpolation	roduction, errors in polynomial interpolation, finite difference, decision of errors, Newton's formulae for interpolation, Guass, Stirling, Bessel's, Everett's formulae, interpolation by unevenly spaced points, Lagrange interpolation formula, divided difference, Newton's general interpolation, formula. Curve Fitting.	10
Cubic Spline & Approximation	Introduction, method of least square curve fitting procedures, fitting a straight line, curve fitting by sum of exponentials, data fitting with cubic splines, approximation of functions..	8
Numerical Integration & Differentiation	Introduction, numerical differentiation, numerical integration, trapezoidal rule, Simpson 1/3 rule, Simpson 3/8 rule, Booles and Weddles rule, Euler- Maclariaun formula, Gaussian formula, numerical evaluation of singular integrals.	6
Statistical Computation	Frequency chart, regression analysis, least square fit, linear & non-linear regression, multiple regression, statistical control methods.	6
	Total No. of Hours	**42**
Textbooks	1. Sashtry : Introductory Method of Numerical Analysis, PHI 2. 2. Balaguruswamy : Numerical Methods, TMH	
References	1. Jain, Iyengar, Jain : Numerical Methods for Scientific& Engg. Computation, New Age 2.Gerald & Wheatley : Applied Numerical Analysis, Addison Wesley	

SET/CS/BT/C304	Data Structures Using C	
Course Objective	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, and trees, etc. 4. To understanding about writing algorithms and step by step approach in solving problems with the help of fundamental data structures	
Course Outcome	1. Ability to analyze algorithms and algorithm correctness. 2. Ability to summarize searching and sorting techniques 3. Ability to describe stack, queue and linked list operation. 4. Ability to have knowledge of tree and graphs concepts.	
Module Name	**Content**	**No. of Hrs.**
Elementary Data Organization	Introduction to Field, Record, Data and Elementary Data Organization, Basic operations, Algorithm Complexity and Time-Space trade-off.	6
Arrays and Linked list	Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, String in C, Array as Parameters, Ordered List, Sparse Matrices, Representation and Implementation of Singly Linked Lists, Two-way Header List, Traversing and Searching of Linked List, Overflow and Underflow, Insertion and deletion to/from Linked Lists, Insertion and deletion Algorithms, Doubly linked list, Linked List in Array, Polynomial representation and addition, Garbage Collection and Compaction.	12
Stacks and Queues	Array Representation of Stack, Linked Representation of Stack, Operations Associated with Stacks, Application of stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. Array and linked representation and implementation of queues, Create, Add, Delete, Full and Empty, Circular queues, D-queues and Priority Queues.	8
Trees	General Trees Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Threaded Binary trees, Traversing, Threaded Binary trees, Huffman algorithm, Binary Search Tree, Insertion and Deletion in BST, AVL Trees, B-trees.	8
Searching and Sorting	Sequential search, binary search, comparison and analysis, Insertion Sort, Bubble Sorting, Quick Sort, Two Way Merge Sort, Heap Sort, Sorting on Different Keys, Complexity of Search Algorithm.	8
	Total No. of Hours	**42**
Textbooks	1. Seymour Lipschutz, "Data Structures", TMH.	
References	2. R. Kruse etal, "Data Structures and Program Design in C", Pearson Education Asia, Delhi-2002. 3. A. M. Tenenbaum, "Data Structures using C & C++", Prentice-Hall of India Pvt. Ltd., New Delhi. Holman, J.P.: Thermodynamics, MC Graw Hill book Co. NY.	

SET/CS/BT/C305 Discrete Structure		
Course Objective	Understand countable and uncountable sets, relations, functions, mathematical induction, pigeonhole principle, algebraic structures, partially ordered sets, propositional and first-order logic, and permutations and combinations, and their applications to discrete mathematics.	
Course Outcome	Develop an understanding of fundamental concepts in set theory, algebraic structures, partially ordered sets, propositional and first-order logic, and permutations and combinations.	
Module Name	**Content**	**No. of Hrs.**
Set Theory	Countable and uncountable sets, Venn Diagrams, proofs of some general identities on sets Relation: Definition, types of relation, composition of relations, Pictorial representation of m relation, equivalence relation, partial ordering relation, Type of functions, one to one, into and onto function, inverse function, composition of functions, recursively defined functions, mathematical induction (simple and strong), pigeonhole principle, prove by contradiction.	12
Algebraic Structures	Properties, Semi Groups, Monoid, Groups, Abelian group, properties of groups, Subgroup, cyclic groups, Cosets, factor group, Permutation groups, Normal subgroup, Homomorphism and isomorphism of Groups, Rings and Fields.	6
Posets, Hasse Diagram and Lattices	Introduction, ordered set, Hasse diagram of partially, ordered set, isomorphic ordered set, well ordered set, properties of Lattices, bounded and complemented lattices.	6
Propositional Logic	Proposition, First order logic, Basic logical operation, truth tables, tautologies, Contradictions, Algebra of Proposition, logical implications, logical equivalence, predicates, Universal and existential quantifiers.	10
Permutation & Combination	Recurrence Relation, Generating function., Permutation & Combination, Probabilistic Permutation & Combination.	8
	Total No. of Hours	**42**
Textbooks	1. Liptschutz, Seymour, " Discrete Mathematics", McGraw Hill. 3rd edition 2. Trembley, J.P & R. Manohar, "Discrete Mathematical Structure with Application to Computer Science", McGraw Hill, Reprint 2010	
References	1. Discrete Mathematics & its application with combinatory and graph theory, K.H.Rosen, TMH (6th ed). 2. C.L.Liu, 'Discrete Mathematics' TMH.	

SET/EC/BT/C303	DIGITAL ELECTRONICS	
Course Objective	1. To revise and extend the basic knowledge of number system and logic gates. Simplification of the complex Boolean expression using K-map. 2. To understand the combinational and sequential logic circuits. 3. To get the basic knowledge of logic families and semiconductor memories.	
Course Outcomes	Student should be able to: 1. Describe and demonstrate the use of digital test equipments and its operating characteristics. 2. Identify and describe the combinational and sequential logic circuits. 3. Understand the different memory devices.	
Module Name	**Content**	**No. of Hrs.**
Introduction	Positional number system; Binary, octal and hexadecimal number systems; Methods of base conversions; Binary, octal and hexadecimal arithmetic; Representation of signed numbers; Fixed and floating point numbers. Definition and specification of combination logic; Truth table; Basic logic operation and logic gates; Binary coded decimal codes; Gray codes.	**6**
Boolean Algebra and Switching Functions	Basic postulates and fundamental theorems of Boolean algebra; Standard representation of logic functions - SOP and POS forms; Simplification of switching functions - K-map.	**4**
Logic Families	Diode, BJT and MOSFET as a switch. Introduction to different logic families; Electrical characteristics of logic gates – logic levels and noise margins, fan-out, propagation delay, transition time, power consumption and power-delay product; circuit description and operation; RTL; DTL, HTL, TTL and sub families, Brief idea of ECL, CMOS BI-CMOS.	**10**
Combinational Logic	Arithmetic modules: adders, subtractors and ALU; Design examples. Decoders, encoders, multiplexers and de-multiplexers; Parity circuits and comparators.	**6**
Sequential Logic	Basic sequential circuits- latches and flip-flops: SR-latch, D-latch, D flip-flop, JK flip-flop, T flip-flop and their inter-conversions; Timing hazards and races; Meta-stability; Analysis of state machines using D flip-flops and JK flip-flops; Definition of state machines, synchronous sequential logic, shift register, counters-ripple and mod counters.	**12**
Semiconductor Memories	RAM, ROM, Content Addressable Memory, Charge Coupled Device Memory. PLAs, PALs and their applications; Sequential PLDs and their applications.	**4**
	Total No. of Hours	**42**
Textbooks	1. M. Morris Mano, “Digital Design”.	
References	1. Taub, Schilieng, “Digital Integrated Electronics”. 2. Anad Kumar, “Digital principles and application”. 3. John F Wakerly, “Digital Design: Principles and Practices”, Prentice Hall. 4. Thomas L. Floyd, “Digital Fundamentals”, Pearson/ Prentice Hall. 5. Ronald J. Tocci, “Digital Systems: Principles and Applications”, Pearson/ Prentice Hall. 6. Charles Roth, “Fundamentals of Logic Design”, Jaico Publishing House.	

SET/CS/BT/C306	COMPUTER BASED NUMERICAL & STATISTICAL TECHNIQUES LAB	
Course Objective	1. Develop skills in polynomial interpolation and error analysis. 2. Implement numerical methods for solving equations and analyze root convergence rates. 3. Apply Bessel's, Newton's, Stirling's, and Lagrange's methods for solving mathematical problems. 4. Implement the method of least square curve fitting. 5. Implement numerical differentiation using trapezoidal and Simpson 3/8 rules. 6. Analyze data using frequency chart, regression analysis, linear and polynomial fits.	
Course Outcome	1. Implement polynomial interpolation and analyze errors. 2. Apply numerical methods for solving algebraic and transcendental equations and analyze root convergence rates. 3. Apply various methods (Bessel's, Newton's, Stirling's, Lagrange's) to solve mathematical problems. 4. Implement the method of least square curve fitting. 5. Implement numerical differentiation using trapezoidal and Simpson 3/8 rules. 6. Analyze data using frequency chart, regression analysis, linear and polynomial fits.	
Module Name	**Content**	**No. of Hrs**
Module I	Write a Program to deduce errors involved in polynomial interpolation.	6
Module II	Write a Program for algebraic and transcendental equations using bisection, iterative, method of false position, also give rate of conversions of roots in tabular form for each of these methods.	6
Module III	Write a Program to implement Bessel's functions, Newton's, Stirling's, Lagrange's.	6
Module IV	Write a Program to implement method of least square curve fitting.	6
Module V	Write a Program to Implement numerical differential using trapezoidal, Simpson 3/8 rules.	6
Module VI	Write a Program to show frequency chart, regression analysis, linear square fit and polynomial fit.	6
	Total Hours	**36**

SET/CS/BT/C307 DIGITAL ELECTRONICS LAB		
Module Name	**Content**	**No. of Hrs.**
Experiments	1. Combinational Logic design using basic gates (Code Converters, Comparators). 2. Combinational Logic design using decoders and MUXs. 3. Arithmetic circuits - Half and full adders and subtractors. 4. Arithmetic circuits – design using adder ICs, BCD adder. 5. Flip flop circuit (RS latch, JK & master slave) using basic gates. 6. Asynchronous Counters. 7. Synchronous counters, Johnson & Ring counters. 8. Sequential Circuit designs (sequence detector circuit). 9. Transfer Characteristics , Measurement of Sinking and Sourcing currents etc. of TTL gates.	10x2
Model Sim Simulations	Writing and simulating programs for adder, decoder, multiplexer, de-multiplexer, up/down counter, universal shift register, Sequence Detector etc.	4x2
	Total No. of Hours	**28**

SET/CS/SC/C308 DATA STRUCTURES LAB		
Course Objective	1. Implement Stack, Queue, and Circular Queue using arrays and lists. 2. Implement Tree, Binary Tree, Tree Traversal, Binary Search Tree, and operations for insertion and deletion. 3. Implement popular Searching and Sorting Algorithms. 4. Develop problem-solving skills using data structures.	
Course Outcome	1. Develop proficiency in implementing data structures. 2. Gain practical experience in using arrays and lists to implement Stack, Queue, and Circular Queue. 3. Understand the concepts of Tree, Binary Tree, and Binary Search Tree, and learn to implement them efficiently. 4. Learn various searching and sorting algorithms and gain experience in implementing them.	
Module Name	**Content**	**No. of Hrs**
Module I	Array implementation of Stack, Queue, Circular Queue.	9
Module II	List implementation of Stack, Queue, Circular Queue.	9
Module III	Implementation of Tree, Binary Tree, Tree Traversal, Binary Search Tree, Insertion and Deletion in BST.	9
Module IV	Implementation of Searching and Sorting Algorithms.	9
	Total Hours	**36**

Semester IV

S. No.	Category	Course Code	Course Title	L	T	P	Contact Hrs./Week	Credits
1	Core Subjects	SET/CS/BT/C401	Object Oriented Programming using C++	3	1	-	4	4
2		SET/CS/BT/C402	Operating System	3	1	-	4	4
3		SET/CS/BT/C403	Computer Organization and Architecture	3	1	-	4	4
4		SET/CS/BT/C405	Theory of Computation	3	1	-	4	4
5	Interdisciplinary Subject	SET/CS/BT/C404	Data Communication and Computer Network	3	1		4	4
6	Core Subjects Based Labs	SET/CS/BT/C406	Object Oriented Programming using C++ Lab	-		1	2	1
7		SET/CS/BT/C407	Operating System Lab			1	2	1
8	IKS-2		**Indian Knowledge System-2***	2	-	-	2	2
9	Skill Course	SET/CS/SC/C408	Mini Project (Based on C/C++)			1	4	2
		Total		17	5	3	30	26

* Compulsory for all U.G. students, to be prepared by University.

SET/CS/BT/C401	OBJECT ORIENTED PROGRAMMING USING C++	
Course Objective	1. Introduces Object Oriented Programming concepts using the C++ language. 2. Introduces the principles of data abstraction, inheritance and polymorphism 3. Introduces the principles of virtual functions and polymorphism. 4. Introduces handling formatted I/O and unformatted I/O. 5. Introduces exception handling.	
Course Outcome	1. Able to develop programs with reusability. 2. Develop programs for file handling. 3. Handle exceptions in programming. 4. Develop applications for a range of problems using object-oriented programming techniques.	
Module Name	**Content**	**No. of Hrs.**
Fundamental Concept	Object Oriented Programming Paradigm, Basic concepts of OOP, Objects,Classes, Data abstraction and Encapsulation, Inheritance, Polymorphism,Dynamic binding, Message passing, Applications of OOP. Introduction toC++, structure of C++ Program. Tokens, Keywords, Identifiers andConstants, Data Types, Declaration and Dynamic Initialization of Variables, Reference Variables, Operators in C++, Expressions and their types, Control Structure, Functions in C++, Function Overloading.	10
Classes, Objects and Constructors	C Structure Revisited, Specifying a class, Defining Member functions, Making an Outside function inline, nesting of member function, Private member function, arrays within class, Memory allocation for objects, static data members and member functions, Arrays of objects, Object as a function arguments, Friend function, Returning objects, pointers to members local classes. Constructors, Parameterized constructors, Multiple constructors in a class, constructors with default arguments, dynamic initialization of objects, copy constructor, dynamic constructors, constructing 2-D arrays, Destructors.	8
Inheritance	Derived class declaration, forms of inheritance, inheritance and member accessibility, constructors and destructors in derived classes, constructors invocation and data members initialization, overloaded member functions, types of inheritance.	8
Polymorphism	Defining operator overloading, Overloading Unary and Binary operators, Operator Overloading using friends, Manipulation of strings using operators, Rules for overloading operators. Need for virtual functions, pointer to derived class objects, array of pointers to base class objects, pure virtual functions, virtual destructor, Concatenation of strings.	6
Streams computation & Exception Handling	Predefined console streams, hierarchy of console stream classes, unformatted and formatted console I/O operations, manipulators, Files: Hierarchy of file stream classes, opening and closing, testing for errors, modes, pointers and their manipulators, sequential access. Exceptions and Exception handling mechanism, throwing and catching mechanism, Re-throwing an exception, list of exceptions, handling uncaught exceptions.	10
	Total No. of Hours	**42**
Textbooks	1. Balagurusamy "Object Oriented Programming with C++ " , TMH	
References	1. Budd,"Object Oriented Programming ", Addison Wesley. 2. Mastering C++ K.R Venugopal Rajkumar, TMH. 3. C++ Primer , "Lip man and Lajole", Addison Wesley.	

SET/CS/BT/C402 OPERATING SYSTEM		
Course Objective	1. Students will learn how Operating System is Important for Computer System. 2. To make aware of different types of Operating System and their services. 3. To learn different process scheduling algorithms and synchronization techniques to achieve better performance of a computer system. 4. To know virtual memory concepts. To learn secondary memory management	
Course Outcome	1. Understands the different services provided by Operating System at different level. 2. They learn real life applications of Operating System in every field. 3. Understands the use of different process scheduling algorithm and synchronization techniques to avoid deadlock. 4. They will learn different memory management techniques like paging, segmentation and demand paging etc.	
Module Name	**Content**	**No. of Hrs.**
Fundamental Concept	Operating System and Function, Evolution of Operating System, Batch, Interactive, Time Sharing and Real Time System, System Protection. Operating System Structure: System Components, System Structure, Operating System Services.	6
Concurrent Processes	Process Concept, Principle of Concurrency, Producer / Consumer Problem, Critical Section, Problem, Semaphores, Classical Problems in Concurrency, Inter Processes Communication, Process Generation, Process Scheduling. CPU Scheduling: Scheduling Concept, Performance Criteria Scheduling Algorithm, Evolution, Multiprocessor Scheduling.	8
Deadlock	System Model, Deadlock Characterization, Prevention, Avoidance and Detection,Recovery From Deadlock Combined Approach.	6
Memory Management	Basic Machine, Resident Monitor, Multiprogramming with Fixed Partition, Multiprogramming With Variable Partition, Multiple Base Register, Paging, Segmentation, Paged Segmentation, Virtual Memory Concept, Demand Paging, Performance, Paged Replaced Algorithm, Allocation of Frames, Thrashing, Cache Memory Organization, Impact on Performance.	8
I/O Management & Disk Scheduling	I/O Devices and The Organization of I/O Function, I/O Buffering, Disk I/O, Performance criteria in scheduling algorithms, Concept of FCFS schedulingalgorithm, Concept of priority scheduling algorithm like SJF, Concept of non-preemptive and preemptive algorithms, Concept of round-robin schedulingalgorithm, , Concept of multi-level queues, feedback queues. Operating SystemDesign Issues. File System: Basic File System, Access Control Verification, Logical File System, and Physical File System File-System Interface: File Concept, Access Methods, Directory Structure, Protection, and Consistency Semantics File-System Implementation: File-System Structure, Allocation Methods, Free-Space Management, Directory Implementation, Efficiency and Performance, Recovery. .	10
Unix Operating System	Development Of Unix, Role & Function Of Kernel, System Calls, Elementary unixcommand & Shell Programming, Directory Structure, System Administration, ,Case study: UNIX Operating System	4
	Total No. of Hours	**42**
Text Books	1. Tannenbaum, "Operating System Design and Implementation", PHI.	
References	1. Milenekovie, "Operating System Concept", McGraw Hill. 2. Petersons, "Operating Systems", Addision Wesley. 3. Dietal, "An Introduction to Operating System", Addision Wesley. 4. Gary Nutt, "Operating System, A Modern Perspective", Addision Wesley.	

SET/CS/BT/C403	Computer Organization and Architecture	
Course Objective	1. Discuss the basic concepts and structure of computers. 2. Understand concepts of register transfer logic and arithmetic operations. 3. Explain different types of addressing modes and memory organization. 4. Learn the different types of serial communication techniques. 5. Summarize the Instruction execution stages.	
Course Outcome	**1.** Understand the theory and architecture of central processing unit. **2.** Analyze some of the design issues in terms of speed, technology, cost, performance.\ **3.** Design a simple CPU with applying the theory concepts. **4.** Use appropriate tools to design verify and test the CPU architecture. **5.** Learn the concepts of parallel processing, pipelining and interprocessor communication. **6.** Understand the architecture and functionality of central processing unit. **7.** Exemplify in a better way the I/O and memory organization. **8.** Define different number systems, binary addition and subtraction, 2's complement representation and operations with this representation.	
Module Name	**Content**	**No. of Hrs.**
Fundamental Concepts	CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU–registers, instruction execution cycle, Performing of arithmetic or logical operations, Fetching a word from memory, storing a word in memory, Bus and Memory Transfers, Bus Architecture, Arithmetic Algorithms (addition, subtraction, Booth Multiplication), IEEE standard for Floating point numbers. General register organization, Register Transfers, Register Transfer Language.	10
Control Design	Execution of a complete instruction, Multiple-Bus organization, Hardwired Control, Micro programmed control, Microinstruction, address sequencing, Microinstruction with Next-address field, Prefetching Microinstruction.	8
Processor Design	Processor Organization: Stack organization, Addressing mode, Instruction format, Data transfer & manipulations, Program Control, Reduced Instruction Set Computer. Assembly levels programs, programming techniques such as looping, counting and indexing addressing modes, data transfer instructions, arithmetic and logic operations.	8
Input-Output Organization	I/O Interface, Modes of transfer, Interrupts & Interrupt handling, Direct Memory access, Input- Output processor, Serial Communication.	6
Memory Organization	Memory Hierarchy, Main Memory (RAM and ROM Chips), Auxiliary memory, Cache memory, Virtual Memory, Memory management hardware.	6
Pipelining and Parallel Processors	Basic concepts of pipelining, throughput and speedup, pipeline hazards. Introduction to parallel processors, Concurrent access to memory and cache coherency.	4
	Total No. of Hours	**44**
Textbooks	1. Morris Mano, "Digital Design" 2. Computer System Architecture, M. Mano(PHI)	
References	1. Computer Organization, Vravice, Zaky & Hamacher (TMH Publication) 2. Structured Computer Organization, Tannenbaum(PHI) 3. Computer Organization, Stallings(PHI).	

SET/CS/BT/C404 Theory Of Computation		
Course Objective	1. Understand basic properties of formal languages and formal grammars. 2. Understand basic properties of deterministic and nondeterministic finite automata. 3. Understand the relation between types of languages and types of finite automata. 4. Understanding the Context free languages and grammars, and also Normalising CFG. 5. Understanding the minimization of deterministic and nondeterministic finite automata. 6. Understand basic properties of Turing machines and computing with Turing machines. 7. Understand the concept of Pushdown automata and its application. 8. Know the concepts of tractability and decidability, the concepts of NP-completeness and NP-hard problem. 9. Understand the challenges for Theoretical Computer Science and its contribution to other **sciences.**	
Course Outcome	1. Knowledge Acquire a full understanding and mentality of Automata Theory as the basis of all computer science languages design - Have a clear understanding of the Automata theory concepts such as RE's, DFA's, NFA's, Turing machines, Grammar, halting problem, computability and complexity. 2. Cognitive skills (thinking and analysis). - Be able to design FAs, NFAs, Grammars, languages modelling, small compilers basics - Be able to design sample automata - Be able to minimize FA's and Grammars of Context Free Languages. 3. Professional Skill - Perceive the power and limitation of a computer - Solve the problems using formal language. Attitude- Develop a view on the importance of computational theory.	
Module Name	**Content**	**No. of Hrs.**
Finite Automata	Introduction to defining language, Kleene closures, Arithmetic expressions, defining grammar, Chomsky hierarchy, Finite Automata (FA), Transition graph, generalized transition graph. Nondeterministic finite Automata (NFA), Deterministic finite Automata (DFA), Construction of DFA from NFA and optimization, FA with output: Moore machine, Mealy machine and Equivalence, Applications and Limitation of FA, Arden Theorem, Pumping Lemma for regular expressions, Myhill - Nerode theorem.	12
Context freegrammar	Ambiguity, Simplification of CFGs, Normal forms for CFGs, Pumping lemmafor CFLs, Decidability of CFGs, Ambiguous to Unambiguous CFG.	8
Push Down Automata	Description and definition, Working of PDA, Acceptance of a string by PDA,PDA and CFG, Introduction to auxiliary PDA and Two stack PDA.	10
Turing Machines	Basic model, definition and representation, Language acceptance by TM, TM and Type – 0 grammar, Halting problem of TM, Modifications in TM, Universal TM, Properties of recursive and recursively enumerable languages, unsolvable decision problem, undecidability of Post correspondence problem, Church's Thesis, Recursive function theory, Godel Numbering.	10
	Total No. of Hours	**42**
Text Books	1. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science (Automata, Languages and Computation)", PHI	
References	1. Hopcroft, Ullman, "Introduction to Automata Theory, Language and Computation", Nerosa Publishing House 2. Cohen D. I. A., "Introduction to Computer theory", John Wiley & Sons	

SET/CS/BT/C405	Data Communication and Computer Networks	
Course Objective	1. Build an understanding of the fundamental concepts of computer networking. 2. Familiarize the student with the basic taxonomy and terminology of the computer networking area. 3. Introduce the student to advanced networking concepts, preparing the student for entry Advanced courses in computer networking 4. Independently understand basic computer network technology. 5. Identify the different types of network topologies and protocols. 6. Enumerate the layers of the OSI model and TCP/IP. 7. Explain the function(s) of each layer.	
Course Outcome	1. Understand the concepts of Data Communication. 2. Study the functions of OSI Layers. 3. Familiarize with the Transmission Media, Flow Control and Error Detection & Correction. 4. Understand fundamental concepts in Routing, Addressing & working of Transport Protocols. 5. Gain familiarity with common networking & Application Protocols. 6. Understand Wireless LANs & Wireless Sensor Networks Operation.	
Module Name	**Content**	**No. of Hrs.**
Introduction	Introduction to Computer Networking: Use, advantage, structure of the communications network topologies the telephone network, analog to digital communication. Network classes, Repeaters Hub, Bridges, Switches, Routers, Gateways B-routers.	6
Data Communications	Fundamentals: Layered Network Architecture, Communication Between Analog Computers & Terminals Layered Protocols, Network & The OSI Models, Traffic control and accountability wide area and local area networks, connection oriented and connectionless networks, classification of communication protocols polling/selection systems, design problems, communication between layers, ISO standard. Transmission Media: Guided, Unguided; Transmission Impairments and Channel Capacity; Transmission of Digital Data, Interfaces-DTE-DCE, MODEM, The telephone network system and DSL technology;	8
Data link layer:	Introduction, Framing, and Error – Detection and Correction – Parity – LRC – CRC Hamming code, Flow and Error Control, Noiseless Channels, Noisy Channels, HDLC, Medium Access sub layer: ALOHA, CSMA/CD, IEEE LAN Standards Random access, Controlled access, Channelization. Data Link Protocols: Synchronous, Asynchronous Protocols, Point-to-Point Protocol(PPP) Switching Communication Networks: Circuit switching; Packet switching; Routing in packet switched networks; X.25; Frame Relay, ATM, ISDN.	10
Network Layer	Network Layer Design Issues, Routing Algorithms, Network Layer Protocols IP Addressing, CIDR & NAT, IP layer protocols (ICMP, ARP, RARP, DHCP, and BOOTP) and IPv6, TCP/IP and internetworking, Network Devices.	10
Transport layer and Application layer	Process to Process Delivery, UDP and TCP protocols, Data Traffic, Congestion Control, QoS, Integrated Services, Differentiated Services. Domain name space, DNS in internet, electronic mail, SMTP, FTP, WWW, HTTP, SNMP.	8
Total No. of Hours		**42**
Text Books	1. Data communication & Networking by Bahrouz Forouzan. 2. Stallings, W. (2010), Data and Computer Communications, Pearson.	
References	1. J. Kurose, K. Ross, Computer Networking: A Top - Down Approach, Pearson 2. Tannanbaum, A.S.: Computer Network, PHI 3. Black : Computer Network; Protocols, Standards and Interface PHI	

SET/CS/BT/C406 OBJECT ORIENTED PROGRAMMING USING C++ LAB		
Course Objective	1. To introduce students to the fundamental programming constructs and techniques. 2. To provide hands-on experience in implementing programs using these constructs and techniques. 3. To develop the ability to design and implement programs that solve practical problems. 4. To develop the ability to use programming concepts in the context of object-oriented programming (OOP). 5. To provide students with a foundation for further study in computer science and related fields.	
Course Outcome	Upon completing this program, students will have gained the ability to design and implement programs using various programming constructs and techniques. Specifically, they will be able to use input/output statements, control structures, functions, arrays, classes, inheritance, polymorphism, encapsulation, friend functions, static functions, and file handling.	
Module Name	**Content**	**No. of Hrs.**
Experiments /Spice Simulations	1. Implementation of input and output statements. 2. Implementation of control statements. 3. Implementation of functions. 4. Implementation of array 5. Implementation of Classes and Constructor and Destructor. 6. Implementation of files. 7. Implementation of OOP's Concepts (Inheritance, Polymorphism,Encapsulation, Friend and Static Functions)	**3x12**
	Total No. of Hours	**36**

SET/CS/BT/C407 OPERATING SYSTEMS LAB		
Course Objective	1. To introduce students to the Bourne Shell commands and constructs used in UNIX environments. 2. To provide hands-on experience in using the Bourne Shell commands and constructs for file management and scripting. 3. To develop the ability to write moderately complex Shell scripts to automate tasks and solve practical problems. 4. To teach tracing mechanisms for debugging and exporting variables for use in other scripts. 5. To provide students with the ability to execute programs written in C under the UNIX environment. 6. To develop an understanding of how to customize the user environment using the ".profile" script. 7. To provide a foundation for further study in UNIX/Linux system administration and scripting.	
Course Outcome	Upon completing this program, students will have gained the ability to use the Bourne Shell commands and constructs, write moderately complex Shell scripts, and customize user environments using Shell scripts.	
Module Name	**Content**	**No. of Hrs.**
Module 1	1. Demonstrate how to use the following Bourne Shell commands: cat, grep, ls ,more, ps, chmod, finger etc. 2. Use the following Bourne Shell constructs: test, if then, if then else, if then el if, for, while, until, and case. 3. Learn tracing mechanisms (for debugging), user variables, Bourne Shell variables, read-only variables, positional parameters, reading input to a Bourne Shell script, command substitution, comments, and exporting variables. 4. In addition, test on numeric values, test on file type, and test on character strings are covered. Copy, move, and delete files and directories. 5. Write moderately complex Shell scripts. 6. Make a Shell script executable 7. Create a ".profile" script to customize the user environment.. 8. Execute programs written in C under UNIX environment	3x12
	Total No. of Hours	**36**

SET/CS/SC/C408	MINI PROJECT	
Course Objective	Upon completing Mini Project-1, students will have gained the ability to apply the programming concepts and techniques learned in C/C++ to solve real life problem**.**	
Course Outcome	1. To provide students with an opportunity to apply the programming concepts and techniques learned in C/C++ to solve a practical problem. 2. To develop the ability to design and implement a program using C/C++ to solve a real-world problem. 3. To develop the ability to use software development tools and techniques, such as version control, debugging, and testing, in the context of a larger programming project. 4. To provide students with the experience of working in a team to develop a program. 5. To develop communication and presentation skills through the documentation and presentation of the Mini Project-1. 6. To provide students with the opportunity to apply critical thinking and problem-solving skills to a real-world problem. 7. To provide a foundation for further study and work in software development and programming.	
Module Name	**Content**	**No. of Hrs.**
Module 1	Mini Project-1 shall be based on C/C++.	3x12
	Total No. of Hours	**36**