[M- Group: Mechanical Engineering, Civil Engineering, Metallurgy & Materials Science, Production Engineering and Industrial Management]

Semester I

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1	BSC	MA-19001	Linear Algebra	2	1	0	3
2	BSC	PH-19001	Optics and Modern Physics	3	0	0	3
3	ESC	EE-19002	Basic Electrical Engineering	3	0	0	3
4	ESC	ME-19002	Engineering Graphics and Design	2	0	4	4
5	ESC	CE-19002	Engineering Mechanics	3	1	0	4
6	SBC	PE-19001	Mechanical Fab Shop	0	0	3	1
7	LC	PH-19002	Optics and Modern Physics Laboratory	0	0	2	1
8	LC	EE-19001	Basic Electrical Engineering Laboratory	0	0	2	1
9	LC	CE-19001	Engineering Mechanics Laboratory	0	0	2	1
				13	2	13	21
			Total Academic Engagement and Credits	28			21

[MA-19002] Linear Algebra **Credits: 3**

Teaching Scheme
Lectures: 2 hrs / week
Tutorial: 1 hr / week

Examination Scheme
Test 1: 20 marks
Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:
Students will be able to

a. Know and recall core knowledge of the syllabus. (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
b. Understand basic concepts. (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
c. Analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
d. Give reasoning. (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
e. Apply core concepts to new situations. (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Unit I: **[10 Hrs]**
Matrices and linear equations: basic properties of matrices, row operations and Gauss elimination, Determinants and their basic properties. Basic concepts in linear algebra: vector spaces, subspaces, linear independence and dependence of vectors, bases, dimensions. Row and Column spaces, rank. Applications to systems of linear equations.

Unit II: **[08 Hrs]**
Linear mappings, representation by matrices, rank-nullity theorem, Eigen values, Eigen vectors and their basic properties.

Unit III: **[08 Hrs]**
Inner product spaces, orthogonality, Gram-Schmidt process, Diagonalization of special matrices, Geometric applications of linear transformation, quadratic forms: positive definiteness.

Text Book:

- Introduction to Linear Algebra (2^{nd} edition) by Serge Lang, Springer.

References:

- Linear Algebra (3^{rd} edition) by Serge Lang, Springer.
- Elementary Linear Algebra (10^{th} edition) by Howard Anton and Chris Rorres, John Wiley and sons.
- Schaum's outlines of Linear Algebra (5^{th} edition) by Seymour Lipschutz, Marc Lipson, McGraw-Hill Education (India) Private Limited, New Delhi.

- Linear Algebra by Hoffman and Kunze, (2nd edition) Prentice Hall Publication, New Delhi.
- Advanced Engineering Mathematics (10th edition) by Erwin Kreyszig, Wiley eastern Ltd.
- Linear Algebra and its applications (4th edition) by Gilbert Strang, Cengage Learning (RS).
- Advanced Engineering Mathematics by Chandrika Prasad and Reena Garg, Khanna Publishing Company Private Limited, New Delhi.

[PH-19001] Optics and Modern Physics Credits: 3

Teaching Scheme
Lectures: 3hrs/week

Examination Scheme
Test1: 20
Test2: 20 marks
End-Sem Exam- 60

Course Outcomes:
Student will be able to:

a. Analyze the intensity variation of light due to interference, diffraction and polarization.
b. They will be able to implement these phenomena to design advanced optical instruments.
c. Understand the principle, construction and working of lasers in order to implement Laser Technology in engineering field.
d. Understand fundamentals of quantum mechanics and apply to one dimensional motion of particles.
e. Understand the principle, production and transmission of ultrasonic waves and understand the working of various instruments based on ultrasonic.

Unit 1 **[7 Hrs]**

Interference and Diffraction

Interference due to wedge shaped thin film (with derivation); conditions of minima maxima, Newton's rings, Applications of interference.
Fraunhofer diffraction at a single slit; condition of maxima and minima, Plane diffraction grating (Diffraction at multiple slits) and applications based on diffraction.

Unit 2 **[7 Hrs]**

Polarization

Polarization of light, elliptical and circular polarization, quarter and half wave plate, Polarization by selective absorption; dichroism, polaroids (H and K), Polarization by double refraction, Nicol prism, Fresnel's theory of optical rotation, Kerr effect and magneto-optic kerr effect.

Unit 3 **[7 Hrs]**

Laser Physics

Introduction to laser, Laser and ordinary light, Laser beam characteristics, Spontaneous and stimulated emission of radiations, Thermal equilibrium, Condition for Light amplification, Population inversion, Pumping (Three level and four level pumping), Optical resonator, Ruby

laser, He-Ne Laser, Semiconductor Laser, Nd-YAG Laser, Engineering applications of Laser (Fibre optics, Laser material interaction).

Unit 4 **[7 Hrs]**

Wave Mechanics

Matter waves, De-Broglie's concept of matter waves, Properties of matter waves, Heisenberg's uncertainty principle, Schrödinger's time dependent and time independent equations, Operators, Eigen values and Eigen functions, Expectation values, Physical significance of wave function.

Unit 5 **[7 Hrs]**

Electrons in Potential Well

Applications of Schrödinger's equation; Motion of a free particle, Electron in an infinite deep potential well (rigid box), Electron in a finite deep potential well (non-rigid box), concept of quantum tunnelling, Linear Harmonic oscillator,

Unit 6 **[7 Hrs]**

Ultrasonics

Introduction to sound waves, Generation of sound waves, construction and working principle, types of ultrasound generators, Ultrasound transmission modes, Ultrasound imaging and instrumentation; Phonocardiograph, Echo ophthalmoscope, Ultrasound blood flow meter.

References:

- Fundamentals of Optics, Francis A. Jenkins and Harvey E. White; Mc-Graw Hill International Edition.
- A text book of Engineering physics, Avadhanulu and Kshirsagar, S. Chand Pub.
- A Text Book of Optics, N. Subramanyam & Brijlal; (Vikas Publishing House Pvt. Ltd).
- LASERS Theory and Applications, K. Thyagarajan, A. K. Ghatak; Macmillan India Ltd.
- Concepts of Modern Physics, Arthur Beiser; Tata McGraw – Hill Edition.
- Modern Physics, Jeremy Bernstein, Paul M. Fish bane, Stephen Gasiorowics; Pearson Education.
- Quantum Mechanics, L. J. Schiff; Mc-Graw Hill International Edition.
- PHYSICS (Volume I & II), Resnick Halliday and Krane; Willey India 5th Edition.

[EE-19002] Basic Electrical Engineering **Credit: 3**

Teaching Scheme:

Lectures: 3 Hrs/week

Examination Scheme:

T1 : 20 Marks

T2: 20 Marks

End-Sem Exam: 60 Marks

Course Outcomes:
Student will be able to

a. To understand and analyze basic electric and magnetic circuits.
b. To study the working principles of electrical machines and power converters.
c. To introduce the components of low-voltage electrical installations.

Unit I: **[8 Hrs]**

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

Unit II: **[8 Hrs]**

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

Unit III: **[8 Hrs]**

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

Unit IV: **[6 Hrs]**

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

Unit V: **[6 Hrs]**

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

Unit VI: **[6 Hrs]**

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

Lamps- fluorescent, CFL, LED. Electrical measuring instruments principle and applications- energy meter, megger, tong tester.

Text Books:

- D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
- D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
- L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.

Reference Books:

- E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
- Vincent Del Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

[ME-19002] Engineering Graphics and Design Credits: 4

Teaching Scheme:
Theory : 2 Hr/week

Examination Scheme:
T1 : 20 Marks
T2 : 20 Marks
End-Sem Exam: 60 Marks

Course Outcomes:
Students will be able to:

a. familiarize with its accepted conventions and abbreviations.
b. develop the ability to visualize and communicate three dimensional shapes by representing three-dimensional objects into two-dimensional views.
c. plan and prepare neat isometric drawings of regular planes and solids.
d. draw the representation of various machine features.
e. develop lateral surfaces of solids for various applications.

Unit I : Orthographic Projections [7 hrs]
Principles of Orthographic Projections, types of orthographic projections–First angle and third angle projections, Obtaining orthographic projections of given pictorial views by using first angle projection method along with sectional views.

Unit II : Projections and section of solids: [5 hrs]
Projection of solids (Prism, Pyramid, Cone)inclined to both the reference planes, auxiliary planes, projections of above solids cut by different section planes, True shape of cut surfaces.

Unit III : Development of lateral surfaces (DLS) of solids: [5 hrs]
Applications of DLS, method of development, development and antidevelopment of lateral surface of cut and uncut solids (Prism, Pyramid, and Cone)

Unit IV : Isometric Projections: [7 hrs]
Principles of Isometric projection – Isometric and natural Scale, Isometric views of simple and compound solids, drawing isometric views from given orthographic views.

Unit V: Missing Views: [5 Hrs]
Interpretation of given views, visualization of given orthographic views, adding a missing/third view, adding a sectional view, to convert a given view in to a sectional view.

Text Books:

- N.D.Bhatt, Elementary Engineering Drawing, Charotar Publishing House, Anand(India)
- M.L.Dabhade Engineering Graphics I, Vision Publications, Pune

Reference Books:

- Warren Luzzader, Fundamentals of Engineering Drawing, Prentice Hall of India, New Delhi.
- David A. Madsen, Engineering Drawing and Design, Cengage Publication
- Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
- Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication

Laboratory Assignments

Teaching Scheme:
Practical : 4 hrs / week

Examination Scheme:
Continuous evaluation: 100 marks

Course Outcomes:

Students will be able to

a. Familiarize with its accepted conventions and abbreviations.
b. Dimension and annotate two-dimensional engineering drawings.
c. Communicate ideas graphically.
d. Be aware of drafting practices used in industry.
e. Plan and prepare neat orthographic drawings of solids.
f. Use surface and solid modelling techniques.
g. Use parametric solid modelling for representation of various machine features and components.

Sheet No. 1: ORTHOGRAPHIC VIEWS
Two problems on orthographic views one with principal views and another with sectional view.

Sheet No.2: PROJECTION AND SECTION OF SOLIDS:
One problem on projection of solid and another on sections of solids.

Sheet No.3: DEVELOPMENT OF LATERAL SURFACES OF SOLIDS
One problem on development of solid and another on antidevelopment of solid.

Sheet No. 4: ISOMETRIC VIEWS
Two problems only on Isometric views.

Sheet No. 5 : INTERPRETATION OF GIVEN VIEWS/MISSING VIEWS
Two problems on Interpretation of given views.

Sheet No. 6: ORTHOGRAPHIC VIEWS (Using CAD software/package)
Fpur problems on orthographic views one with principal view and another with sectional view.

Sheet No. 7 : ISOMETRIC VIEWS (Using CAD software/package)
Four problems only on Isometric views.

[CE-19002] Engineering Mechanics Credits: 4

Teaching Scheme
Lectures: 3 hr / week
Tutorial: 1 hr / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:
Students will be able to:

a. solve real life engineering problems using principles of Statics
b. solve real life engineering problems using principles of Dynamics

Unit I: General force system [7 hrs]
Resultant and equilibrium of General force system (3D and 2D), Moment about a point. Moment about an axis.

Unit II: Engineering applications [7 hrs]
Engineering applications to Beams, Trusses, Frames and Cables.

Unit III: Friction and Virtual work [7 hrs]
1) Laws of dry friction, applications to wedges, flat belt friction, inclined planes, ladder friction.
2) Principle of virtual work: Applications to beams

Unit IV: Kinematics of particles [7 hrs]
Motion related to (1) Cartesian coordinates, (2) normal & tangential coordinates and, (3) polar coordinates. Relative motion. Dependent motion.

Unit V: Kinetics of particles [7 hrs]
Newton's second law, Energy principles, Impulse momentum principle, Direct central impact.

Unit VI: Rigid body dynamics [7 hrs]
Kinematics of rigid bodies, General Plane Motion, ICR. Kinetics of Rigid Bodies, Applications to Newton's Second law.

Text Books:

- Hibbeler R. C. , " Engineering Mechanics - Statics ", 14"th Edition, Prentice Hall
- Hibbeler R. C. , " Engineering Mechanics - Dynamics " , 14"th Edition, Prentice Hall

Reference Books:

- Meriam J. L., Kraige L. G.,"Engineering Mechanics - Statics ", John Wiley and Sons, 8th Edition
- Meriam J. L., Kraige L. G., " Engineering Mechanics - Dynamics ", John Wiley and Sons, 8th Edition
- Beer F. P. and Johnston E. R., "Vector Mechanics for Engineers - Statics and Dynamics", 11th Edition, Tata McGraw Hill Publishing company Ltd., New Delhi.

[PE-19001] Mechanical Fab Shop Credits: 1

Teaching Scheme
Practical : 3 hrs/week

Examination Scheme
Term work : 60 marks, Oral : 40 Marks

Course Outcomes:
Students will be able to

a. Understand basic Manufacturing Processes used in the industry
b. Fabricate components with their own hands.
c. Make electrical circuits and assembly of components
d. Understand importance of safety

Contents:
Term work shall consist of three jobs and journal consisting of six assignments one on each of the following topics.

Carpentry - 1 job (Common for Electrical & Non electrical Group)
Introduction to wood working, kinds of woods, hand tools & machines, Types of joints, wood turning. Pattern making, types of patterns, contraction, draft & machining allowances
Term work includes one job involving joint and woodturning.

Fitting- (1 Job for Non Electrical Group & Demonstration for Electrical Group)
Types of Fits, concepts of interchangeability, datum selection, location layout, marking, cutting, shearing, chipping, sizing of metals, drilling and tapping.
Term work to include one job involving fitting to size, male-female fitting with drilling and tapping.

Sheet Metal Practice– (1 Job for Electrical Group & Demonstration for Non Electrical Group)
Introduction to primary technology processes involving bending, punching and drawing various sheet metal joints, development of joints.
Term work to include a utility job in sheet metal.

Joining – 1 job (Common for Electrical & Non electrical Group)
Includes making temporary and permanent joints between similar and dissimilar material by processes of chemical bonding, mechanical fasteners and fusion technologies.
Term work includes one job involving various joining processes like riveting, joining of plastics, welding, brazing, etc.

Assembly and Inspection. (Common for Electrical & Non electrical Group)
Assembly and Disassembly of some products, tools used. Videos of advancement in manufacturing technology. Inspection of various components using different measuring instruments.

Safety in Workshop (Demonstration Common for Electrical & Non electrical Group)
Fire hazards, electric short circuit –causes and remedies, Machine protection, Human protection, Accident prevention methods, developing ability to observe safe working habits. Introduction to measuring equipments used in Quality Control.

Forging (Demonstration Common for Electrical & Non electrical Group)
Hot working, cold working processes, forging materials, hand tools & appliances, Hand forging, Power Forging.

Moulding (Demonstration Common for Electrical & Non electrical Group)
Principles of moulding, methods, core & core boxes, preparation of foundry sand, casting, Plastic moulding.

Electrical Board Wiring (Demonstration Common for Electrical & Non electrical Group)
Electric power utilization, energy audit, Types of wiring - House wiring, stair case wiring, two-way switch wiring, Types of fuses and their uses, circuit breaker, Three phase wiring for electrical motors, earthing, minor fault finding.

Plumbing (Demonstration Common for Electrical & Non electrical Group)
Types of pipe joints, threading dies, Pipe fittings.

PCB Making (Demonstrations Common for Electrical & Non electrical Group)
Layout drawing, positive & negative film making, PCB etching and drilling

References:

- K.C. John, Mechanical Workshop Practice, PHI learning Pvt. Ltd., 2010
- Hajra Choudhury & A.K. Hajra Choudhury & Nirjhar Roy S.K, "Elements Of Workshop Technology - Volume I - Manufacturing Processes, Media Promoters and Publishers Pvt Ltd, 2010

[PH-19002] Optics and modern physics Laboratory Credit: 1

Teaching Scheme
Practical: 2-hrs/week

Examination Scheme
Oral +Practical Exam: 50 Marks
Term work: 50 marks

Course Outcomes:

a. Hands on experience over basic optical instruments
b. Verification of Laws of optics
c. Analyze interference pattern
d. Measurement of Wavelength
e. A basic foundation over quantum theory

List of Experiments:

1. Cosine square law of Malus
2. Brewster's Law
3. Polari meter
4. Wave length by Diffraction Grating
5. Newton's Rings
6. Diffraction experiment with Laser
7. Frank and Hertz
8. Planks Constant
9. Characteristic of GM counter
10. Numerical Aperture of Optical fiber

[EE-19001] Basic Electrical Engineering Laboratory Credit: 1

Teaching Scheme:
Laboratory: 2 Hrs/week

Examination Scheme:
T1 and T2: 20 Marks each
End-Sem Exam: 60 Marks

Course Outcomes:
Student will be able to

a. Get an exposure to common electrical components and their ratings
b. Understand the usage of common electrical measuring instruments
c. Understand the basic characteristics of transformers and electrical machines
d. Get an exposure to the working of power electronic converters

Student must perform minimum eight experiments from the following list

1. Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multimeter, oscilloscope. Real-life resistors, capacitors and inductors

2. Verification of Kirchoff's laws for a given circuit
3. Verification of Thevenin's and Norton's theorems
4. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope)
5. Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.
6. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor)
7. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor
8. Determine efficiency and regulation of a single phase transformer by direct loading. To plot the characteristics at various loading conditions.
9. To perform open circuit and short circuit test on a single phase transformer and to evaluate its performance indices.
10. Speed control of a DC shunt motor by different approaches
11. Measurement of insulation resistance of an electrical system using megger.
12. Measurement of power in three phase circuit by two wattmeter method

Laboratory Course Outline

The course involves writing code for solved, unsolved and practice programming problems given in the lab manual.

List of suggested experiments

- Write a program to enter two numbers and perform all arithmetic operations.
- Program to find area of a triangle using Heron's Formula
- Take two integers as input and divide the first by the second. Prevent division by zero.
- Write a program to print `n' terms of an Arithmetic series, with the first term `a' and a constant difference `d'. Take `a,d,n' from user.
- Take a real value `x' from the user and find the value of tan (x), log (x), square root of x
- Write a program to display all the prime numbers between 1 and 100
- Write a program to take as input, 10 integers and put them in an array and display their values. Then, find the sum of all elements in the array and the position of the largest element. (Hint: use the logic of the algorithm to find maximum)
- Declare a 3x3 matrix. Initialise it to zero using nested loops. Then fill some user-given values into it. Print the matrix in proper format to make sure the inputs are correctly taken.

- Write your own function to find the minimum element of an array of integers. (Input to the function is integer array, output is the position number of the minimum element)
- Declare an array of 10 integers. Declare a pointer and point it to the base of the array. Print all the elements of the array using this pointer and not using the original name of the array.
- Write a program which is a copy of the terminal program `cat'. It should take the name of the input file from the user and display the entire file on the terminal.
- Write a recursive function to raise a number to a given power.
- Write a function to carry out insertion sort of a set of strings given in a file, and write the data back to the file.

The instructors are encouraged to update the list of assignments from time to time

[CE-19001]Engineering Mechanics Laboratory **Credit: 1**

Teaching Scheme
Lab: 2 hr / week

Examination Scheme
Mid Sem. Exam: 40 marks
End Sem. Exam: 60 marks

Course Outcomes:
Students will be able to:

a. Verify principles of mechanics through experiments.
b. Solve simple engineering problems using computer programs.

Contents:
PART A: Experiments
1. Verification of law of polygon of forces
2. Study of Space forces system
3. Determination of beam reactions
4. Belt friction
5. Curvilinear motion
6. Direct central impact

PART B: Assignments
There will be six assignments, one on each unit from the theory course, based on graphical and computer solutions of Engineering Mechanics problems. Each assignment shall have minimum two problems.

[M- Group: Mechanical Engineering, Civil Engineering, Metallurgy & Materials Science, Production Engineering and Industrial Management]

Semester II

Sr. No.	Course Type	Course Code	Course Name	Teaching Scheme			Credits
				L	T	P	
1	BSC	MA-19003	Univariate Calculus	2	1	0	3
2	BSC	PH-19005	Solid State Physics and Statistical Thermodynamics	3	0	0	3
3	BSC	AS-19001	Applied Chemistry	3	0	0	3
4	ESC	ETC-19003	Basic Electronics Engineering	3	0	0	3
5	ESC	CT-19001	Programming for Problem Solving	3	0	2	4
6	HSMC	HS-19002	Design Thinking	0	0	2	1
7	HSMC	HS-19001	Effective Communication Skills	0	0	2	1
8	SBC	ETC-19001	Electronics and Computer Workshop	0	0	2	1
9	LC	PH-19004	Solid State Physics Laboratory	0	0	2	1
10	LC	AS-19002	Applied Chemistry Laboratory	0	0	2	1
				14	1	12	21
			Total Academic Engagement and Credits	27			21

[MA-19003]Univariate Calculus **Credits: 3**

Teaching Scheme
Lectures: 2 hrs / week
Tutorial: 1 hr / week

Examination Scheme
Internal Test 1: 20 marks
Internal Test 2: 20 marks
End Sem. Exam: 60 marks

Course Outcomes:
Students will be able to

a. Know and recall core knowledge of the syllabus (To measure this outcome, questions may be of the type- define, identify, state, match, list, name etc.)
b. understand basic concepts (To measure this outcome, questions may be of the type- explain, describe, illustrate, evaluate, give examples, compute etc.)
c. analyze the problem and apply the appropriate concept. (To measure this outcome, questions will be based on applications of core concepts)
d. give reasoning (To measure this outcome, questions may be of the type- true/false with justification, theoretical fill in the blanks, theoretical problems, prove implications or corollaries of theorems, etc.)
e. apply core concepts to new situations (To measure this outcome, some questions will be based on self-study topics and also comprehension of unseen passages.)

Unit I **[05 Hrs]**
Review of limits, continuity and differentiability of univariate functions, Mean value theorems, Taylor's theorem, local extrema, increasing and decreasing functions, concavity, points of inflection, Jensen's inequality.

Unit II **[07 Hrs]**
Integrals as limits of Riemann sums, fundamental theorem of calculus, logarithm and exponential functions through integrals, integrals by special techniques: reduction formulae, arc length, solids of revolution, surface area, improper integrals, Gamma and Beta functions, tests for convergence.

Unit III **[14 Hrs]**
Sequences, recursively defined sequences, limits, subsequences, monotone sequences, infinite series, tests for convergence (Geometric series, p-series test, Ratio test, Root test, Comparison test, Leibnitz's test for alternating series), absolute convergence, power series and its convergence. Fourier series: definition, full and half range expansions of functions of arbitrary period.

Text Books:

- Thomas' Calculus (14^{th} edition) by Maurice D. Weir, Joel Hass, Frank R. Giordano, Pearson Education.
- Advanced Engineering Mathematics (10^{th} edition) by Erwin Kreyszig, Wiley eastern Ltd.

References :

- Calculus for Scientists and Engineers by K.D Joshi, CRC Press.
- A Course in Calculus and Real Analysis (1^{st} edition) by Sudhir Ghorpade and Balmohan Limaye, Springer-Verlag, New York.

- Advanced Engineering Mathematics by C.R. Wylie, McGraw Hill Publications, New Delhi.
- Advanced Engineering Mathematics (7^{th} edition) by Peter V. O' Neil, Thomson.Brooks / Cole, Singapore.
- Differential Calculus by Shanti Narayan, S. Chand and company, New Delhi.

[PH-19005] Solid State Physics and Statistical thermodynamics Credits: 3

Teaching Scheme	**Examination Scheme**
Lectures : 3hrs/week	T1- 20 Marks, T2- 20 Marks End Sem Exam:60 Marks

Course Outcome:
Students will be able to understand

a. different types of structure of solids and its characterization by x-ray technique.
b. band structure of solids, categorization of solids based on band structure, ideas about Fermi level positions in semiconductors.
c. foundation of statistical mechanics, basic concepts and various terms and formulations.
d. the connection between statistics and thermodynamics, understanding thermodynamics by statistical point of view and its techniques.
e. Thermal properties of solids, specifically, specific heat and some models for specific heat calculation.
f. origin of magnetism, various types of magnetic materials and its use in modern technology.

Unit 1 **[7 Hrs]**

Structure of Solids and its Characterization

Crystalline state, lattice, space lattice, basis and crystal structure, unit cell and primitive cell, lattice parameters, crystal systems in brief (cubic, monoclinic …Triclinic), Miller indices, inter planer distance of lattice plane, linear density, planar density and density of crystals, X-ray diffraction: Bragg spectrometer, analysis of XRD spectra for cubic system.

Unit 2 **[10 Hrs]**

Solid State Physics

Sommerfield's free electron theory, Density of states (1D, 2D, 3D), Nearly free electron theory, origin of band gap, magnitude of band gap, classification of solids on the basis of band theory, Fermi energy level, Fermi-Dirac probability function, position of Fermi level in intrinsic (with derivation), carrier concentration: intrinsic and Extrinsic, semiconductor conductivity: intrinsic and Extrinsic

Unit 3 **[8 Hrs]**

Statistical Thermodynamics

Micro and macro states, basic postulate of statistical mechanics, concept and types of ensembles, partition function, classification of statistical distribution function, Corollary of first law of thermodynamics, second and third law, statistical interpretation of basis thermodynamic variables; pressure, work, energy, entropy, Helmholtz free energy, Gibb's free energy

Unit 4 **[5 Hrs]**

Thermal properties of solids

Thermal vibrations, specific heat of solids, Dulong Petit law, Einstein's theory of specific heat, Debye's theory of specific heat: vibrational modes, density of vibrational mode, Debye's approximation

Unit 5 **[6 Hrs]**

Magnetism

Introduction to magnetic materials (dia, para, ferro, antiferro, ferri), types of magnetic interactions, concept of magnetoresistance, Curie law in paramagnetism (using statistical partition function), Ferrites: types and structures, application: magnetic storages, Vibrating sample magnetometer (VSM).

Unit 6 **[6 Hrs]**

Superconductivity

Introduction to superconductivity, properties of superconductor, Type-I and Type-II superconductors, Concept of cooper pair, AC/DC Josephson effect, SQUID magnetometer: principle and working.

References:

- Elements of X-ray Diffraction, B. D. Cullity, Addison-Wesley Publishing Company, Inc.
- Introduction to Solid State Physics, Charles Kittel, Wiley.
- Solid State Physics, S. O. Pillai, New Age International Publishers.
- *Solid state electronic devices, Ben G. Streetman, Sanjay Banerjee* Pearson Prentice-Hall.
- Fundamentals of statistical Mechanics, B. B. Laud, New Age International Publishers
- Fundamentals of Statistical and Thermal Physics by F. Reif, Levant Pub.
- Statistical Mechanics, Shang-Keng Ma.
- Text Book of Engineering Physics by Avadhanulu & Kshirsagar, S. Chand Pub.
- Introduction to Magnetic Materials, B. D. Cullity, Wiley.
- Introduction to Magnetism and Magnetic Materials, David Jiles, Springer-Science.

[AS-19001] Applied Chemistry **Credits: 3**

Teaching Scheme:
Lectures: 3hrs / week

Evaluation Scheme:
T1-20 Marks,
T2-20 Marks
End-Sem Exam:60 marks

Course Outcomes:
Student will able to

a. Appreciate the role and impact of chemistry in various engineering field
b. Analyze engineering problems and also derive solution based on the knowledge of chemistry
c. Select appropriate materials and processes for specific applications
d. Select appropriate materials and processes for specific applications
e. Consolidate theoretical knowledge into practical experience

Unit 1: Material Chemistry **[9 Hrs]**

(A) Introduction to the basics of chemistry, Relevance of Chemistry to different Engineering specializations, Classification of Materials: Metals and alloys, Ceramics and glasses, refractories, cement ,polymers, composites, nanomaterials etc. and their properties.

(B) Corrosion and corrosion control

Electrochemistry of corrosion**,** Mechanism of dry corrosion& wet corrosion ,Factors affecting corrosion, Testing of corrosion- Weight-loss and weight-gain method, Microscopic exam, Methods of prevention of Corrosion- cathodic (Sacrificial, impressed current) and anodic protection, Proper selection of materials, Protective coatings- 2 examples of Metallic coatings, 2 examples of non-metallic coatings, paints

Unit 2: Polymer Chemistry **[7Hrs]**

Introduction, Classification of polymers, Use and disposal of polymers, Polymer terminologies, commercially important polymers with synthesis and applications (plastics, fibres, adhesives, elastomers, conducting polymers), properties of polymers-Solubility, Molecular Weight, Crystallinity, Glass transition temperature, Role of additives in polymers, Reinforced plastics .

Unit 3: Instrumental methods of Chemical Analysis **[7Hrs]**

Qualitative and quantitative analysis, Conventional methods of analysis: Titrimetry, gravimetry, Modern analytical techniques: an overview, electro-analytical, chromatography, thermo-analytical, Spectroscopy, XRD, TEM,SEM, nephelometry, turbidimetry,
Spectroscopy: Principle, Basic instrumentation, Ultraviolet-Visible spectroscopy, Infra-Red Spectroscopy, Spectroscopy as an analytical tool, Accuracy, Precision, Reliability of Analytical data, confidence limits

Unit 4: Energy Storage systems **[7Hrs]**

Introduction and overview, Basic principles &electrochemistry, batteries- characteristics, Li ion batteries
Fuel cells- Principle of Fuel Cell, , Components of fuel cell. Various types of Fuel cell AFC,

PEMFC, methanol based fuel cell and their applications. Hydrogen production; Hydrogen storage system

Unit 5: Water Chemistry **[6 Hrs]**

Specifications for water, Impurities in water (Suspended, Biological & Dissolved chemical), Water quality parameters, Analysis of water : alkalinity, hardness(boiler feed water), chloride content, methods & problems, DO, BOD, COD, ion transport, conductivity , Treatment of water and waste water-membrane filtration, RO

Unit 6: Green Chemistry **[6 Hrs]**

12 principles of green chemistry **,**Synthesis of chemicals by green chemistry routes**,** 3Rs-Reduce,Reuse and Recycle, disposal of plastics, Biodegradable polymers-need, constituents required, factors ,properties, applications

Text Books

- A textbook of Engineering Chemistry: Jain and Jain, Dhanpatrai Publication.
- A textbook of Engineering Chemistry: S. S. Dara, S. Chand Publication 2010 edn.
- A textbook of Engineering Chemistry: Shashi Chawla, Dhanpatrai Publication.

References

- Polymer Science: V.R.Gowariker, New Age International Publication
- Introduction to Nanotechnology: Charles P. Poole, Frank J. Owens.
- Fuel Cells- Shripad Revankar, Pradeep Majumdar
- Fuel Cell Fundamentals-Ryan O'Hayre, Suk-Won Cha,John wiley & Sons
- Recent trends in Fuel Cell Science and Technology-Suddhasatwa Basu,Anamaya Publishers, New Delhi
- Instrumental Methods of Chemical analysis, Willard Dean, Merrittee, Tata MacGrow Hill Limited.

[ETC-19003]Basic Electronics Engineering Credits: 3

Teaching Scheme:
Lectures: 3 hrs/week

Examination Scheme:
T1: 20 marks
T2: 20 marks
End Sem Exam: 60 marks

Course Outcomes:

Students will be able to:

a. Analyze the characteristics of PN junction diode and bipolar junction transistor.
b. Design basic circuits usingIC741 and IC555.
c. Compare different analog modulation schemes on the basis of bandwidth and power requirements.
d. Design combinational and sequential logic circuits.
e. Write the software program for 8051microcontrollers to develop a suitable application.

Unit I: Semiconductor Devices and Applications [8 hrs]

Semiconductor theory: Intrinsic and extrinsic semiconductors, Introduction to P-N Junction Diode, Forward and Reverse biasing, V-I characteristics, Breakdown phenomenon in PN Junction diodes; Full wave rectifiers, capacitor filter; Zener diode and its V-I characteristics,Zener diode as a voltage regulator; Introduction to BJT,Types of Biasing, DC load line concept, I/O characteristics, transfer characteristics, BJT as a Single stage CE amplifier, Frequency response and bandwidth.

Unit II: Operational Amplifiers [6 hrs]

Differential Amplifier, Block diagram of OPAMP Schematic symbol and Pin configuration, Characteristics of the ideal OPAMP, OPAMP without feedback, Effect of negative feedback on amplifier, Virtual ground concept, OPAMP with feedback, Parameters of OPAMP, Inverting and non-inverting amplifier, IC 741 Linear applications: Summing amplifier, Difference amplifier, and unity gain buffer.

Unit III: Fundamentals of Digital Electronics [8 hrs]

Difference between analog & digital signals, Basics of Boolean algebra, logic Gates: Symbols, Truth tables, Boolean Expressions; Boolean Laws, Standard representation for logic functions(SOP and POS forms), Minimisation of logic expressions using Boolean Laws and k-map, Number Systems: Binary,octal,decimal,hexadecimal;Combinational logic design: Adder/Subtractor, Multiplexers/de-multiplexers; Sequential Circuits: Flip-Flops using NAND gates-R flip flop, clocked S-R flip flop, Preset and clear asynchronous inputs, J-K flip flop, race around condition in J-K flip-flop, Asynchronous counter (3/4 Bit).

Unit IV: Timing Circuits and Signal Generators [4 hrs]

Principles of sine wave oscillators, Barkhausen's Criterion, RC phase shift oscillator, Wien bridge oscillator, Functional diagram of IC 555 and its applications as Astable and Monostable Multivibrator.

Unit V: Introduction to Microcontrollers [6 hrs]

The architecture of 8051, Addressing modes, Interrupt handling, Instruction execution, Instruction set – data movement; arithmetic; bit operators, Timers.

Unit VI: Introduction to Electronic Communication Systems [8 hrs]

Block diagram of communication system, need of modulation, Concept of modulation, Amplitude Modulation: Definition, modulation index, time domain equation for AM, power calculations, modulation efficiency, Demodulation of AM using envelope detector; Frequency Modulation: Definition, General expression for FM signal, narrow band FM, wideband FM, applications of FM.

Text Books:

- Malvino, "Electronic Principles", Tata McGraw Hill, 7th edition, 2017
- R.P. Jain, "Modern Digital Electronics", Tata McGraw Hill, 3rdedition, 2005
- Mazidi, "8051 Microcontroller & Embedded System", Pearson, 3rdEdition, 2008

References:

- Allen Mottershed, “Electronic Devices and Circuits", 2nd Edition,2003
- Frenzel, “Communication Electronics”, Tata McGraw Hill,3rd edition,2012

[CT-19001] Programming for Problem Solving Credits: 4

Teaching Scheme:
Lectures : 3 Hrs/week
Laboratory: 2 Hrs/week

Examination Scheme:
Lab. Assignements: 20 Marks
Quiz T1/T2 : 20 Marks
Practical Exam :20 marks
End Sem Exam:40 marks

Course outcomes
Students will be able to

a. Represent real life data using data types and variables provided by programming language.
b. Write flow chart, using standard notation, for given problems.
c. Solve a given problem using expressions, conditional statements, arrays and loops.
d. Design a modular solution using functions, by breaking down the problem into parts, using programming language.

Unit 1 **[4 hrs]**

Fundamental Operations of a Modern Computer

Von Neumann Architecture. Design of a computer. Basic hardware components (RAM, disk, processor, keyboard, mouse). Basic Software components (applications, operating system, system software, compiler, etc.). Basics of I/O and data transfer between I/O devices and RAM/variables

Unit 2 **[4 hrs]**

Basic programming constructs

Basic Data types (Numerical, String).Variables. Expressions. statements. I/O statements for keyboard handling. Editing, compiling/interpreting/running programs. Syntax errors and runtime errors. Comparison of language model with Von Neumann architecture.

Unit 3 **[8 hrs]**

Introduction to problem solving using computers

Manual solutions to real life problems. Algorithmic representation of the solutions. **Basic Problems. Variables. Expressions. Conditional statements.** Multiplication. Exchange values of two variables. Finding maximum of three numbers. What is problem?, Identifying problem, Understanding a problem: Framing a problem in simple terms – mathematical, graphical, other abstractions. **Files.** Files as an alternative I/O medium. I/O functions to transfer data from file to variables. Comparison of keyboard and file I/O functions. operations to read, write, close, open files.

Unit 4 **[8 hrs]**

Iterative problems.

Problems without arrays. Introduction to iterative constructions in language. Find Sum, average of a given set of numbers. Loop design techniques: While loop - *body, iterative step, loop condition.* Emphasis on while loop against for loop. Factorial. Sine function computation. Fibonacci sequence generation. Some problems to read data from files. **Array techniques.** Arrays as homogenous collection of elements. Array properties. Reversing elements of an array. Finding maximum. Finding second maximum. Algorithms for substring search. **Search problems.** linear search. linear search in sorted array. binary search.

Unit 5 **[8 hrs]**

Modular solutions

Functions Introduction to functions. Importance of design of functions. Rewriting earlier solutions using functions. Taking care of all possible values of arguments. Parameters, return values, signature, local and global scope. Modular code. Reusability. **Recursion.** Basic rules of recursion: recursive formulation, terminating case, handle all cases, recursion leading to terminating case. Factorial: iterative vs recursive. Recursive formulation for: multiplication, gcd, towers of Hanoi, binary search. Recursion vs iteration in general. When to use recursion.

Unit 6 **[8 hrs]**

Advanced Problems.

Convert a number into one with digits reversed. Convert decimal to binary. Generating prime numbers. Generating random numbers. Computing x power y. Partitioning an array. Finding the kth smallest element of an array. **Sorting:** Selection sort. Insertion sort. bubble sort.

Text Books:

- R. G. Dromey, "How to solve it by Computer", Pearson Education, ISBN 0-13-433995-9
- Reema Thareja, "Python Programming: Using Problem Solving Approach", Oxford University Press; First edition, 978-0199480173

References:

- Stephen G. Krantz, "Problem Solving Techniques" , Universities Press.
  Kernighan and Ritchie, "The 'C' programming language", Prentice Hall

[HS-19002] Design Thinking **Credit: 1**

Teaching Scheme:
Practical: 2hrs/week

Evaluation Scheme
CCE: 50 Marks,
ESE: 50 Marks

Course Outcomes:

Student will able to

a. relate with and Compare the various learning styles and memory techniques and Apply them in their engineering education

b. analyze emotional experience and Experiment with emotional expressivity to better understand users while designing products
c. appreciate the importance of design thinking, Develop new ways of thinking and Learn the innovation cycle for creating innovative products
d. understand individual differences and its impact on everyday decisions so as to demonstrate frameworks, strategies, techniques while creating innovative products
e. develop skills for evaluating, articulating, refining, and creating an innovative engineering product that solves customer problems(s)

Unit 1: An Insight to Learning
Understanding the Learning Process, Kolb's Learning Styles, Assessing and Interpreting

Unit 2: Remembering Memory
Understanding the Memory process, Problems in retention, Memory enhancement techniques

Unit 3: Emotions: Experience & Expression
Understanding Emotions: Experience & Expression, Assessing Empathy, Application with Peers

Unit 4: Basics of Design Thinking
Definition of Design Thinking, Need for Design Thinking, Objective of Design Thinking, Concepts & Brainstorming, Stages of Design Thinking Process (explain with examples) – **Empathize, Define, Ideate, Prototype, Test**

Unit 5: Being Ingenious & Fixing Problem
Understanding Creative thinking process, Understanding Problem Solving, Testing Creative Problem Solving,

Unit 6: Process of Product Design
Process of Engineering Product Design, Design Thinking Approach, Stages of Product Design, Examples of best product designs and functions, **Assignment – Engineering Product Design**

Unit 7: Prototyping & Testing
What is Prototype? Why Prototype? Rapid Prototype Development process, Testing, **Sample Example,** Test Group Marketing

Unit 8: Celebrating the Difference
Understanding Individual differences & Uniqueness
Group Discussion and Activities to encourage the understanding, acceptance and appreciation of Individual differences

Unit 9: Design Thinking & Customer Centricity
Practical Examples of Customer Challenges, Use of Design Thinking to Enhance Customer Experience, Parameters of Product experience, Alignment of Customer Expectations with Product Design

Unit 10: Feedback, Re-Design & Re-Create
Feedback loop, Focus on User Experience, Address "ergonomic challenges, User focused design, rapid prototyping & testing, final product, **Final Presentation – *"Solving Practical Engineering Problem through Innovative Product Design & Creative Solution"***

[HS-19001] Effective Communication Skills Credit: 1

Teaching Scheme:
Practical: 2 hrs / week

Evaluation Scheme:
6 Assignments
90 Marks: 15 marks each
10 Marks: Attendance

Course Outcomes:
Student will be able to

a. analyze aspects of effective communication and its usage in various fields
b. reflect on basic language skills – listening, speaking, reading and writing and attempt tasks by using functional grammar and vocabulary effectively
c. reproduce their understanding of concepts / principles of communication skills
d. present themselves well in front of large audience on a variety of situations related to group communication and presentation in a relevant scenario. Moreover, they will get the knack for structured conversation to make their point of views clear to the listeners

Unit 1: Foundation of Language [6 Hrs]
Effective communication, grammaticality and acceptability, accuracy and appropriateness, common errors, vocabulary enhancement

Unit 2: Listening [6 Hrs]
Stages of listening (pre, while and post), strategies to develop listening skills, listening comprehension, problematic sounds

Unit 3: Speaking [6 Hrs]
Oral communication, pronunciation, stress, connected speech, intonation and pauses, formal and informal expressions, conversation skills, group discussion, presentation skills

Unit 4: Reading and Writing [6 Hrs]
Types of reading, techniques of reading, reading comprehension, reading manuals, formal emails, memos, etc. Stages of writing (pre, while and post), 7 Cs of technical communication, drafting, editing, summarizing, letter / email writing

References

- Communication Skills for Engineers by S. Mishra & C. Mural Krishna (Pearson)
- Communication Skills for Technical Students by T.M. Farhathullah (Orient Longman)
- Written Communication in English by Saran Freeman (Orient Longman)
- Essential English Grammar (Elementary & Intermediate) Raymond Murphy (CUP)

- Communication for Business: A Practical Approach by Shirley Tailor (Longman)
- Developing Communication Skills by Krishna Mohan & Meera Banerji (Macmillan)
- Business Correspondence and Report Writing, R. C. Sharma & Krishna Mohan (Tata McGraw Hill)

[ETC-19001]Laboratory Course: Electronics and Computer Workshop Credit: 1

Teaching Scheme:
Lectures: 2 hrs/week

Examination Scheme:
100 marks

Course Outcomes:
Students will demonstrate the ability to:

a. Identify and use various electronic components and instruments.
b. Develop basic electronic circuits on breadboard.
c. Design and test the performance of OPAMP and IC555 circuits.

(Part A) Electronics

Activity I:Introduction to Basic Electronic Components and Devices
Introduction to various electrical passive components such as Resistors, inductors and capacitors, introduction to active components, introduction to breadboard, Measurement of resistance using the colour code, series and parallel connection of the resistances and its implementation on breadboard.

Activity II:Introduction to Electronics Instruments
Exposure to usual electronic equipment/instruments such as Multi-meter, Oscilloscope, Function generator, Power supply, Information about their front panels, Demonstrations on their working, Hands-on for measurement of component values and DC voltage using multi-meter, measurement of amplitude, time period and frequency of the waveform Square wave/any small signal from function generator on Oscilloscope, Measurement of the voltage and current in the circuit implemented on breadboard using multimeter.

Activity III: Operational amplifiers using IC-741
Verification of distorted output for OPAMP in open loop configuration (without feedback) on CRO, Calculation and verification of the voltage gain using the virtual ground concept of Inverting and Non-inverting OPAMP, verification of phase shift between input and output on CRO.

Activity IV: Application of OPAMP (IC-741)
Verification of the output on CRO for OPAMP as an Integrator, differentiator and buffer.

Activity V: Application of IC-555 as an A stable mode
Calculation of duty cycle and frequency of IC 555 in a stable mode.

(Part B) Computer

Activity I:
1) Name and identify various PC hardware components: USB Mouse, PS/2 Mouse, Keyboard, LCD/LED Monitor, VGA, HDMI, CAT5, CAT6, server, routers, fiber cable, Hard disk, RAM, CMOS battery, SMPS, cache, ROM, BIOS
2) Type using all your fingers and achieve a speed of 30 words per minute

Activity II:
Introduction to various important software: Ubuntu, Windows, Mac, Libreoffice and Microsoft Office; Firefox, Google Chrome, Tor; Linux Command Line (few basic commands); Photoshop, Gimp
Understand the broad structure and functioning of the Internet; Learn the following terms and concepts: LAN, DNS, Proxy, Router, Hub, Switch, Server, Client, Website, Web-server;
Understand basic networking commands, applications and services: ssh, telnet, ftp, winscp, ping, http, https, various search services (google, startpage, aggregator search services)
Prepare a working LAN cable by using crimping tools.

Activity III:
Assemble a Desktop PC from it's components
Install any two operating systems on a PC making it dual boot, including latest version of Ubuntu Linux, Windows 7/8
Connect 2-4 computers together using a network hub to create a LAN

Activity IV:
Setup a working desktop system using a Raspberry Pi board. Download the OS image from web. Try installing one of the various operating systems on the board: Raspbian, Ubuntu Mate, Openelec, OSMC, Pidora, RISC OS, Arch Linux ARM, etc.

Resources:
Electronics Workshop

- Consumables such as passive components, devices, ICs, bread-boards, wires, solder metal, flux, displays, switches, relays, transformers, copper clad laminates, chemicals for PCB fabrications etc.

- Equipment such as Oscilloscope, function generators, power supplies, solder stations/guns, de-soldering pumps, PCB drilling and de-burring machines, Open source PCB design software hosted on Desktops.

- Data sheets, application notes, volumes of magazines such as Electronics For You etc.

Computer Workshop

- PC Hardware components: Motherboard, processor, SMPS, RAM, DVD-RW drive, Hard disk drives, power cables, VGA/HDMI connectors, Keyboard, Mouse (PS2/USB), Cabinet, LED displays
- Raspberry Pi Complete Kit: Raspberry Pi 2, Micro SD Card, Plastic case, Power adapter, HDMI cable, RCA Video/Audio cable, Cat5 cable
- Network Hub (4/8 ports), CAT5 cables network tool kit (Network crimper, Cable Tester, Wire stripper)

[PH-19004] Solid State physics Laboratory Credit:1

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Oral +Practical Exam: 50 Marks
Term work: 50 marks

Course Outcomes:

a. Measurement of resistivity and band gap of Semiconductors
b. Parameters for classification of magnetic materials
c. Basic understanding of electromagnetic force

List of Experiments:

1. Measurement of e/m of an electron by Thomson's method
2. Band gap of a semiconductor by four probe methods
3. Structural study of crystalline material
4. Hall effect in Semiconductor
5. Magneto resistance measurement of semiconductor
6. Dielectric Constant
7. Measurement of magnetic susceptibility by Quince's method
8. PN junction diode
9. Study of Biot-Savart's law
10. Faraday Effect

[AS-19002] Applied Chemistry Laboratory Credits: 1

Teaching Scheme:
Practical 2hrs/week

Evaluation Scheme:
CCE: 70 Marks
ESE: 30 Marks

1. Preparation and Standardization of Analytical Reagents (importance of distilled water)
2. Determination of chloride content of water by Mohr's method
3. Estimation of copper from brass by iodometry
4. pH-metric titration of Acid/Base
5. Colorimetric determination of concentration of given inorganic sample.
6. Preparation of a polymer
7. Determination of molecular weight of a polymer using Ostwald's viscometer
8. Determination of temporary and permanent hardness of water sample by EDTA method.
9. Determination of total alkalinity of water sample.
10. Preparation of a nanomaterials
11. Preparation of a chemical compound using green chemistry pathway