Bharati Vidyapeeth
(Deemed to be University), Pune, India
College of Engineering, Pune
Department of Mechanical Engineering

Vision of the Department

To develop high quality Mechanical Engineers through dynamic education to meet social and global challenges

Mission of the Department

- To provide extensive theoretical & practical knowledge to the students with well-equipped laboratories & ICT tools through motivated faculty members
- To inculcate aptitude for research, innovation and entrepreneurial qualities in students
- To acquaint students with ethical, social and professional responsibilities to adapt to the demands of working environment.

Name of Programme: B. Tech. Mechanical Engineering

Programme Educational Objectives (PEOs)

- To fulfill need of industry and society with theoretical & practical knowledge
- To perform research, innovation, lifelong learning and continued professional development
- To fulfill professional ethics and social responsibilities

Programme Outcomes (POs)

The graduates will be able to

a. apply knowledge of mathematics, science and engineering fundamentals for solving complex engineering problems

b. identify the need, plan and conduct experiments, analyze data for improving the mechanical processes.

c. design and develop mechanical systems considering social and environmental constraints.

d. design and develop a complex mechanical system using research based knowledge, advanced mathematical, statistical tools and techniques.

e. use information technology (IT) tools for prediction and modeling of routine activities to enhance the work performance.

f. know social responsibilities while doing professional engineering practices.

g. familiarize with eco-friendly, sustainable and safe working environment.

h. take into account professional ethics while designing engineering systems.

i. work efficiently as a group leader as well as an individual.

j. communicate in written and verbal form with subordinates and supervisors.

k. apply project and finance management techniques in multidisciplinary environments.

l. take interest in higher education and update the knowledge.

Programme Specific Outcomes (PSOs)

- Apply the knowledge of thermal, design, manufacturing engineering and computational sciences to solve Mechanical Engineering problems.
- Apply Mechanical Engineering principles for research, innovation and develop entrepreneurial skills.
- Apply concepts of Mechanical Engineering to assess societal, environmental, health, safety issues with professional ethics.

B. TECH. MECHANICAL: COURSE STRUCTURE: CBCS: 2021-2022

B. Tech. Mechanical Sem.-I

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1		Linear Algebra, Calculus & Complex Variables	4	-	1	60	40	-	-	-	100	4	-	1	5
2		Waves & Solid State Physics	3	2	-	60	40	25#	-	-	125	3	1	-	4
3		Electrical Engineering Systems	4	2	-	60	40	25#	-	-	125	4	1	-	5
4		Computer Aided Drafting & Visualization*	4	2	-	60	40	-	50	-	150	4	1	-	5
5		Statics and Dynamics	3	-	-	60	40	-	-	-	100	3	-	-	3
6		Metal Joining Processes	-	2	-	-	-	50#	-	-	50	-	1	-	1
7		Soft Computing-I	-	4	-	-	-	-	-	100	100	-	2	-	2
	Total		**18**	**12**	**1**	**300**	**200**	**100**	**50**	**100**	**750**	**18**	**6**	**1**	**25**

*End Sem. Examination of 4 Hrs.; #: Based on TW & internal oral examination

B. Tech. Mechanical Sem.-II

Sr. No.	Course Code	Name of Course	Teaching Scheme (Hrs./Week)			Examination Scheme (Marks)						Credits			
			L	P	T	UE	IA	TW	TW & OR	TW & PR	Total	L	P TW/OR/PR	T	Total
1		Differential Equations, Probability & Statistics	3	-	1	60	40	-	-	-	100	3	-	1	4
2		Chemistry of Engineering Materials	3	2	-	60	40	25#	-	-	125	3	1	-	4
3		Mechanical Engineering Systems	4	2	-	60	40	25#	-	-	125	4	1	-	5
4		Electronics Engineering Systems	4	2	-	60	40	25#	-	-	125	4	1	-	5
5		Computer Aided Machine Drawing*	4	2	-	60	40	-	-	50	150	4	1	-	5
6		Sheet Metal Operations	-	2	-	-	-	50#	-	-	50	-	1	-	1
7		Soft Computing-II	-	2	-	-	-	-	-	75	75	-	1	-	1
	Total		**18**	**12**	**1**	**300**	**200**	**125**	**-**	**125**	**750**	**18**	**6**	**1**	**25**

*End Sem. Examination of 4 Hrs.; #: Based on TW & internal oral examination

Designation of Course	Linear Algebra, Calculus and Complex Variables		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 04 Hours/ Week	End Semester Examination	60 Marks	04
Tutorial: - 01 Hours/ Week	Internal Assessment	40 Marks	
	Tutorial	-	01
	Total	**100 Marks**	**05**

Course Prerequisites:-	1. Students should have knowledge of basic algebra. 2. Students should have knowledge of vector algebra. 3. Students should have knowledge of complex numbers.
Course Objectives:-	To provide knowledge about 1. Rank, consistency of system of equations and partial differentiation. 2. Vector differentiation and vector integration. 3. Function of complex variable.
Course Outcomes:-	On completion of the course, students will be able to– 1. **Understand** rank of matrix and apply it test consistency of linear system. 2. **Understand** the partial derivative and evaluate indeterminate forms. 3. **Understand** vector differential operator and vector identities. 4. **Understand** line, surface and volume integrals and **apply** it evaluate to work done. 5. **Understand** the analytic functions. 6. **Understand** Taylors and Laurentz series.

Course Contents

Unit-I	**Linear Algebra: Matrices**	**(08 Hrs.)**
Rank, Normal form, System of Linear Equations, Linear Dependence and Independence, Linear and Orthogonal Transformations. Eigen values, Eigen Vectors, Cayley – Hamilton Theorem. Application to problems in Engineering		
Unit-II	**Partial Differentiation and Indeterminate forms**	**(08 Hrs.)**
Functions of two or more variables, Partial derivatives, Homogeneous functions, Euler's theorem, Total derivative, Change of variables. Indeterminate forms: L' Hospital's Rule, Evaluation of Limits		
Unit-III	**Vector Differential Calculus**	**(08 Hrs.)**
Physical interpretation of Vector differentiation, Vector differential operator, Gradient, Divergence and Curl, Directional derivative, Solenoidal, Irrotational and Conservative fields, Scalar potential, Vector identities.		
Unit-IV	**Vector Integral Calculus and Applications**	**(08 Hrs.)**
Line, Surface and Volume integrals, Work-done, Green's Lemma, Gauss's Divergence theorem, Stoke's theorem. Applications to problems in Fluid Mechanics, Continuity equations, Streamlines, Equations of motion, Bernoulli's equation.		
Unit-V	**Complex Variables**	**(08 Hrs.)**
Function f(z) of complex variable, limit, continuity and differentiability of f(z),Analytic function, necessary and sufficient conditions for f(z) to be analytic (without proof),Cauchy-Riemann equations in cartesian coordinates (without proof)Milne-Thomson method to determine analytic function f(z) when real part (u) or Imaginary part (v) or its combination (u+v or u-v) is given. Harmonic function, Harmonic conjugate and orthogonal trajectories.		
Unit-VI	**Complex Integration**	**(08 Hrs.)**
Line Integral, Cauchy's Integral theorem for simple connected and multiply connected regions (without proof), Cauchy's Integral formula (without proof).Taylor's and Laurent's series (without proof). Definition of Singularity, Zeroes, poles of f(z), Residues, Cauchy's Residue Theorem (without proof).		

Assignments:

Problems and/or theory questions on following topics from previous year question papers of GATE/ESE Mechanical Engg. Examinations.

1. Linear algebra: matrices
2. Partial differentiation and indeterminate forms
3. Vector differential calculus
4. Vector integral calculus and applications
5. Complex variables
6. Complex integration

Tutorials:

Problems and/or theory questions on following topics from previous year question papers of GATE/ESE Mechanical Engg. Examinations.

1. Matrix algebra and system of linear equations.
2. Eigen values and eigenvectors.
3. Partial differentiation.
4. Indeterminate forms.
5. Fourier series; gradient, divergence, and curl.
6. Directional derivative, scalar potential and vector identities.
7. Line, surface and volume integrals.
8. Application of Gauss, Stokes and Green's theorems.
9. Analytic functions, Cauchy-Riemann equations.
10. Limit continuity and differentiability.
11. Cauchy's integral theorem and integral formula.
12. Taylor and Laurent series.

Text Books

1. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics (Volumes I)", 7th Ed., Pune Vidyarthi Griha Prakashan, Pune, 2013.
2. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics (Volumes II)", 7th Ed., Pune Vidyarthi Griha Prakashan, Pune, 2013.

References

1. B. S. Grewal, "Higher Engineering Mathematics", 42nd Ed., Khanna Publication, Delhi
2. B.V. Ramana, "Higher Engineering Mathematics", 6th Ed., Tata McGraw-Hill, New Delhi, 2008.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, Inc., 2015.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Ed., Cengage Learning, 2012.
5. Michael Greenberg, "Advanced Engineering Mathematics", 2nd Ed., Pearson Education, 1998.

Project Based Learning

Students are expected to prepare report on any one topic, write its definition, applications and analyze the hypothetical data. Also, write pseudo code for it, wherever applicable.

1. System of linear equations solution
2. Rank of matrix
3. Total derivative
4. L' Hospital's Rule
5. Dimension and basis

6. Curl and divergence
7. Work done
8. Gauss divergence theorem
9. Stokes theorem
10. Eigen values and Eigen vectors
11. Bernoulli's equation
12. Cauchy-Riemann equations in detail
13. Harmonic conjugate and orthogonal trajectories
14. Cauchy's Integral formula
15. Cauchy's Residue Theorem

Unit Test-

Unit Test-I	Unit- I, II, III
Unit Test-II	Unit- IV, V, VI

Designation of Course	**Waves & Solid State Physics**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	60 Marks	03
Practical:- 02 Hours/ Week	Internal Assessment	40 Marks	
	Term Work	25 Marks	01
	Total	**125 Marks**	**04**

Course Prerequisites:-	Students are expected to have a basic understanding of physics and calculus.
Course Objective	1. To impart knowledge of basic concepts in physics relevant to engineering applications in a broader sense with a view to lay foundation for the Mechanical Engineering.
Course Outcomes:-	1. Infer the wave nature of light and apply it to measure stress, pressure and dimension etc. 2. Summarize the structure and properties of lasers to their performance and intended applications. 3. Explain mechanical properties of solid matter, and connect to applications in the field of engineering. 4. Use the knowledge of nanoscience to develop new materials with tunable properties. 5. Use analytical instruments for understanding the nanomaterials. 6. Interpret the superconductivity and perfect diamagnetism, and give a qualitative description of the Meissner effect and its applications.

Course Contents

Unit-I	**Wave Optics**	**(06 Hrs)**
Interference- Interference of waves, interference due to thin film (Uniform and non-uniform), Applications of interference (optical flatness, interference filter, non-reflecting coatings. **Diffraction-** Introduction, Classes of diffraction, Diffraction at a single slit (Geometrical method), Conditions for maximum and minimum, Plane diffraction grating, Conditions for principal maxima and minima. **Polarisation -**Introduction, Double refraction and Huygen's theory, Positive and negative crystals, Nicol prism, Dichroism.		
Unit-II	**Lasers**	**(06 Hrs.)**
Principle of laser, Einstein's coefficients, Spontaneous and stimulated emission, Population inversion, Ruby laser, Helium-Neon laser, Semiconductor laser, Single Hetro-junction laser, Gas laser: CO_2 laser, Properties of lasers, Laser speckles, Applications of lasers (Engineering/ industry, medicine, communication, Computers), Holography.		
Unit-III	**Solid State Physics**	**(06 Hrs.)**
Free electron theory, Density of states, Bloch theorem (Statement only), Origin of band gap, Energy bands in solids, Effective mass of electron, Fermi-Dirac probability function and position of Fermi level in intrinsic semi-conductors (with derivation) and in extrinsic semi-conductors, Band structure of p-n junction diode under forward and reverse biasing, Conductivity in conductor and semi-conductor, Hall effect and Hall coefficient, Photovoltaic effect, Solar cell and its characteristics.		
Unit-IV	**Nano-science**	**(06 Hrs.)**
Introductions of nanoparticles, properties of nanoparticles (Optical, electrical, Magnetic, structural, mechanical), synthesis of nanoparticles (Physical and chemical), synthesis of colloids, growth of nanoparticles, synthesis of nanoparticles by colloidal route, applications, quantum dots – wide band semiconductors, direct/indirect band gap semiconductors.		

Unit-V	Analytical Instruments	(06 Hrs.)
Motion of a charged particle in electric and magnetic fields, Electrostatic and Magnetostatics focusing, Electron sources, Wavelength and resolution, Specimen limitation, Depth of field and focus, Transmission electron microscope (TEM), Scanning electron microscope (SEM), Field emission scanning electron microscope (FESEM), X-ray Spectroscopy, Energy Dispersive X-ray Spectroscopy(EDS), Atomic force microscopy(AFM), X-ray diffraction(XRD), Bragg's law, Powder X-ray diffraction.		
Unit-VI	**Smart Materials and Superconductors**	**(06 Hrs)**
Introduction to smart materials, active smart polymers, shape memory alloys, Electro and Magneto Rheological Fluids, Introduction to composites, types of composites. Introduction to superconductivity; Properties of superconductors: zero electrical resistance, critical fields, persistent current, Meissner effect - Type I and Type II superconductors, Low and high temperature superconductors (introduction and qualitative)		

Term Work:

Practical (Any Eight of the Following)

1. Determination of radius of plan convex lens/wavelength of light/Flatness testing by Newton's rings
2. Determination of wavelength of light using diffraction grating
3. Determination of resolving power of telescope
4. Determination of thickness of a thin wire by air wedge
5. Determination of refractive index for O-ray and E-ray
6. Determination of divergence of a laser beam
7. Particle size by semiconductor laser
8. Determination of wavelength of laser by diffraction grating
9. To study Hall effect and determine the Hall voltage
10. Calculation of conductivity by four probe method
11. Study of solar cell characteristics and calculation of fill factor
12. Determination of band gap of semiconductor
13. Synthesis of metal oxide nanoparticles (ZnO/ZnS/Gold)
14. UV-VIS spectra of synthesized semiconductor nanoparticles
15. To determine the velocity of sound
16. Measurement of average SPL across spherical wave front and behavior with the distance
17. Expansion chamber muffler: investigation of muffler response as a filter in the low frequency approximation by determining insertion loss.
18. Interference of sound using PC speakers
19. Determination of velocity of sound in liquid by ultrasonic interferometer
20. Ultrasonic probe - a study
21. Mini-project based on contents of syllabus.

Assignments

Six assignments to be given by the subject teacher (Theory)-one from each unit/one mini project with report-students can work in group of 4 Maximum

Text Books

1. A Textbook of Engineering Physics, M N Avadhanulu, P G Kshirsagar and TVS Arun Murthy, S. Chand Publishing (2018)
2. Engineering Physics, R K Gaur and S L Gupta, Dhanpat Rai Publishing Co Pvt Ltd (2015)
3. Concepts of Modern Physics, Arthur Beiser, Shobhit Mahajan and S. Rai Choudhury, McGraw Hill Education (2017)

Reference Books

1. Fundamentals of Physics, Jearl Walker, David Halliday and Robert Resnick, John Wiley and Sons(2013)
2. Optics, Francis Jenkins and Harvey White, Tata Mcgraw Hill (2017)
3. Principles of Physics,John W. Jewett,Cengage publishing (2013)
4. Introduction to Solid State Physics, C. Kittel, Wiley and Sons(2004)
5. Principles of Solid State Physics, H. V. Keer, New Age International (1993)
6. Laser and Non-Linear Optics, B. B. Laud,New Age International Private Limited (2011)
7. Nanotechnology: Principles and Practices, Dr. S. K. Kulkarni, Capital Publishing Company (2014)
8. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan, New AgeInternational Pvt.Ltd. (1997)
9. Introduction to Electrodynamics –David R. Griffiths, Pearson (2013)
10. Renewable Energy: Power for a Sustainable Future, Boyle, Oxford University Press (2012)

Project Based Learning

Following is the list of topics for project based learning (Not Limited to) based on the syllabus contents:

1. Case study on measurement and effect of environmental noise in the college
2. To develop a demonstration model of heat sensor in process control
3. To develop a demonstration model of automatic solar powered time regulated water pumping
4. Case study on solar technology: an alternative source of energy for national development
5. To develop a demonstration model of double pendulum.
6. The study on the effect of length on the resistance of a copper wire (verification of ohms law r directly proportional to l)
7. To prepare a chart on comparison of various method used in measuring the gravitational constant g
8. To develop a demonstration model of digital distance measuring instrument
9. Case study on electric power generation by road power
10. Case study on vibration of bars.
11. To determine absorption coefficient of sound absorbing materials
12. To develop a demonstration model to understand quantum confinement effect in wide band semiconductors
13. To develop a demonstration model of Tesla Coil
14. To develop a demonstration model of thin film interference in soap film-formation of colours
15. To develop a demonstration model of LiFi- wireless data transfer system using light

Unit Tests

Unit Test-I	Unit-I, II, III
Unit Test-II	Unit-IV, V, VI

Designation of Course	Electrical Engineering Systems		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 04 Hours/ Week	End Semester Examination	60 Marks	04
Practical: - 02 Hours/ Week	Internal Assessment	40 Marks	
	Term Work	25 Marks	01
	Total	**125 Marks**	**05**

Course Perquisites: -	Students should have basic knowledge of Physics, Chemistry and Mathematics
Course Objectives: -	1. The course introduces fundamental concepts of DC and AC Circuits, Electrical Measurement, Transformers, Induction Machines, DC Machines, Basics of power transmission, distribution & safety measures.
Course Outcomes: -	1. **Understand** and **apply** knowledge of Basic laws and network theorems to solve electrical networks 2. **Understand** and **apply** knowledge of AC Circuits, Switch gear and electrical measuring instruments 3. **Understand** and **apply** fundamental concept of magnetic and electromagnetic circuits for operation of Transformers 4. **Understand** AC motors, it's control techniques for various mechanical engineering applications 5. **Understand** DC motors, it's control techniques for various mechanical engineering applications 6. **Understand** working of Transmission, Distribution of power use of safety rules.

Course Contents

Unit-I	**DC Circuit Analysis and Network Theorems**	**(08 Hrs.)**

Circuit Concepts: Concepts of network, active and passive elements, voltage and current sources, concept of linearity and linear network, unilateral and bilateral elements, R, L and C as linear elements, source transformation, Kirchhoff's laws, loop and nodal methods of analysis, star-delta transformation.

Network Theorems: Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power Transfer Theorem (simple numerical problems).

Unit-II	**AC Circuits and Switch Gear, Electrical Measurement**	**(08 Hrs.)**

AC Circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation of AC quantities, 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), series and parallel resonance. Three phase balanced circuits, voltage and current relations in star and delta connections.

Measuring Instruments: Power measurement in three phase circuits. Electrical instruments such as wattmeter, energy meter, tong-tester, megger and power analyzer.

Switch Gear: Introduction to LT Switchgear, NO and NC Contacts, Contactors, relay, timers, use in control panel, application in interlocking and protection, symbols.

Unit-III	**Magnetic Circuit and Electromagnetic Induction**	**(08 Hrs.)**

Magnetic Circuit:flux, flux density, field strength, analogy between electric & magnetic circuits, magnetic circuits with DC and AC excitations, magnetic leakage, B-H curve, hysteresis and eddy current losses, magnetic circuit calculations, mutual coupling.

Electromagnetic Induction: Faradays law of EMI, induced emf, lenzs law, self inductance, coefficient of self inductance (L), mutual inductance, coefficient of mutual inductance (M), self induced emf and mutually induced emf, coefficient of coupling, inductance in series, types of inductor, their application and energy stored in magnetic field

Transformers: Single phase and Three phase: Working principle, Construction, Types, applications.

Unit-IV	Induction Machines	(08 Hrs.)

Three Phase Induction Motor: construction, types, rotating magnetic field, principle of operation, slip, frequency of rotor current, rotor emf, rotor current, expression for torque, conditions for maximum torque, torque slip characteristics, starting torque in squirrel cage and slip ring motors, effect of change in supply voltage on torque, slip and speed , relation between full load torque and maximum torque, power stages in induction motor, vector diagram and equivalent circuit, no load and block rotor test, speed control of 3 phase motor, starting methods for 3 phase induction motor, circle diagram, construction and calculation.

Single Phase Motor: construction, double revolving field theory, starting methods & types of single-phase motor, equivalent circuit.

Servomotor: construction, types, working, characteristics, application in automation and robotics.

Unit-V	DC Machines	(08 Hrs.)

DC Generator: construction, emf equation of dc generator, methods of excitation, losses, condition for maximum efficiency, armature reaction, interpoles and compensating winding, commutation, methods of improving commutation, characteristics of separately excited and self excited dc generator.

DC Motor: Working principle, voltage equation, condition for maximum power, torque developed, operating characteristics of dc motor, starting: 3 point and 4 point starter, speed control methods, Swinburne's and brake test of dc shunt motor. Soft-starting of dc motors.

Unit-VI	Basic of Power transmission and distribution, Safety Measures	(08 Hrs.)

Basic of Power transmission and distribution:classification of transmission lines, transmission line parameters, ABCD constants, voltage regulation, ferranti effect, efficiency of transmission line. 3-phase 3-wire and 3-phase 4-wire distribution system, feeders, distributors, main lines, comparison of various distribution systems, load power factor improvement techniques.

Safety Measures: Safety measures in electrical system, safety rules, basic principles of earthing-types of earthing.

List of Assignments:

The students will be given total **twelve** assignments (Twoassignments on each Unit respectively).

1. DC Circuit Analysis
2. Network Theorems
3. AC Circuits and Switch Gear
4. Electrical Measurement
5. Single Phase Transformer
6. Three Phase Transformer
7. 3 Phase induction motor
8. Single phase motor
9. DC Generator
10. DC Motor
11. Power transmission and distribution
12. Safety Measures

List of Experiments:

Note: Term work shall consist of Minimum **Eight** Experimentsfrom the following list.

List of Practicals to be performed in the laboratory:

1. Plotting B-H characteristics for a material
2. Verification of Kirchhoff"s Laws
3. Verification of Superposition Theorem
4. Verification of Thevenin"s Theorem
5. Verification of Maximum Power Transfer Theorem
6. Study of R-L series, R-C series, R-L-C series circuit

7. Time response of R-L series and R-C series circuit
8. Verification of voltage and current relationships in star and delta connected 3-phase networks
9. Single lamp controlled by two different switches (staircase)
10. Two lamps controlled independently from two different switches (parallel)
11. Series connected lamps
12. Study of Electricity bill(Industrial / commercial)
13. Direct loading tests on single phase transformer
14. Mini-project based on contents of syllabus.

Text Books

1. Basic Electrical Engineering - D. P. Kothari, J Nagarath (TMC)

Reference Books

2. Electrical Technology - Edward Huges (Pearson)
3. Electrical power system technology - S. W. Fordo, D. R. Patric (Prentice Hall)
4. Principles of Electronics-Dr. H. M. Rai (SatyaPrakashan)
5. Electronic Devices and Circuit Theory- R. L. Boylestad and L. Nashelsky (PHI)
6. Electrical, Electronics Measurements and Instruments - (SatyaPrakashan)

Project Based Learning

Following is the list of topics for project based learning (Not Limited to) based on the syllabus contents:

1. To develop a practical kit for verification of Thevenin's theorem.
2. To develop apractical kit for verification of Superposition theorem.
3. To develop apractical kit for verification of Maximum power transfer theorem
4. To develop apractical kit for verification of Norton's theorem.
5. To develop a practical kit for study of R-L-C Series circuit.
6. To develop apractical kit for study of R-L-C parallel circuit.
7. To develop apractical kit for study of voltage and current relationships in starconnected network.
8. To develop apractical kit to understand voltage and current relationships in delta connected network.
9. To develop a demonstration model of single-phase transformer for practical application.
10. Case study on transformer operation and testing by using professional software.
11. To develop a demonstration model of Smart Energy meter using GSM
12. To develop a demonstration model of Safety measures in electrical system.
13. Case studies on – Learning industrial Safety through films/Videos
14. Case studies on – Learning industrial Safety through posters/charts

Unit Tests

Unit Test-I	Unit-I,II, III
Unit Test-II	Unit- IV, V, VI

Designation of Course	**Computer Aided Drafting & Visualization**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 04 Hours/ Week	End Semester Examination	60 Marks	04
Practical: - 02 Hours/Week	Internal Assessment	40 Marks	
	Term Work and Oral	50 Marks	01
	Total	**150 Marks**	**05**

Course Prerequisites: -	Fundamentals of Mathematics
Course Objectives: -	1. To understand the basic principles of engineering drawing and highlight the importance of Computer Aided Drafting in engineering. 2. To develop the graphical skills for communication of concepts & idea through technical drawings.
Course Outcomes:-	1. **Understand**the fundamental concepts of CAD Drawing, its applications, different types of lines, curves and dimension technique with practical application. 2. **Understand** the concept of Orthographic projections and **apply** it to draw detail views by using 1st angle projection method. 3. **Understand** the concept of isometric projection and **apply** it to construct 3D view of a component. 4. **Understand** the concept of projections of Point, Line and plane; and **apply** to draw its projection by using 1st angle projection method and to locate its traces. 5. **Understand** the concept of projections of different types of solids and sectioned solids; and **apply** to draw its projection by using 1st angle projection method. 6. **Understand** the concept of Development of Lateral surfaces; and **apply** to development of simple and sectioned Solids.

Course Contents

Unit-I	**Fundamentals of CAD and Engineering Curves**	**(08 Hrs.)**
Introductionto Engineering Drawing, Types of lines and Dimensioning, Layout and size of drawing sheets, Scales.**Engineering Curves**-Ellipse drawing by Focus-Directrix Circle Method and Concentric CircleMethod, Involutes of a circle, Cycloid, Archimedean Spiral, Helix on cone and Cylinder. Fundamentals of Computer Aided Drafting (CAD) and its applications, Various softwares for Computer Aided Drafting. AutoCAD initial setting and AutoCAD commands		
Unit-II	**Orthographic Projection**	**(08 Hrs.)**
Basic principle planes of Projections, First and Third angle method of Projection, Orthographic Projections of given Pictorial view by first angle projection method only, Sectional orthographic Projection.Orthographic Drawing by using AutoCAD.		
Unit-III	**Isometric Projections**	**(08 Hrs.)**
Principles of Isometric Projections-Isometric Scale, Isometric Axes, Isometric Projections and Isometric Drawing. Constructions of Isometric view from given Orthographic Views and given origin. Isometric Drawing by using AutoCAD.		
Unit-IV	**Projection of Points, Lines and Plane Surfaces**	**(08 Hrs.)**
Projections of Points, Projections of Oblique lines in First Quadrant, Traces. **Projections of Planes-** Projection of perpendicular and oblique planes(polygonal and circular surfaces), Obtaining true shape of plane surface. Projection of Points, Lines and Plane Surfaces by using AutoCAD.		

Unit-V	Projection of Solidsand Sectioned Solids	(08 Hrs.)
Introduction of solids-Types of solids, Projection of solid inclined both references plane, Projection ofcommon solids such as prism, pyramid, cylinder and cone. Projection of solids cut by AIP and AVP, obtaining true shape of a section.Projection of Solids and Sectioned Solids by using AutoCAD.		
Unit-VI	**Development of Lateral Surfaces**	**(08 Hrs.)**
Development of the lateral surfaces ofsolids like Prisms, pyramids, cylinders and cones.Development of cut solids.Development of Lateral Surfaces by using AutoCAD.		

Term work

Term work shall consist of **seven** A2 size (594 mm x 420 mm) sheets using **AutoCAD.**

1. Types of lines, Dimensioning practice, 1st and 3rd angle methods symbol.
2. Engineering Curves
3. Orthographic Projections
4. Isometric views
5. Projections of Points and Lines and planes
6. Projection of Solids and Section of solids
7. Development of Lateral surfaces

Assignments: Minimum fiveproblems on each unit in A3 size Drawing Book

Textbooks

1. "Elementary Engineering Drawing", N.D. Bhatt, Charotar Publishing house, Anand India.
2. "Text Book on Engineering Drawing", K.L.Narayana&P.Kannaiah, Scitech Publications, Chennai.

Reference Books

1. "Fundamentals of Engineering Drawing", Warren J. Luzzader, Prentice Hall of India, New Delhi.
2. "Engineering Drawing and Graphics", Venugopal K., New Age International publishers.
3. M. B. Shah and B. C. Rana, "Engineering Drawing", 1st Ed, Pearson Education, 2005.
4. P. S. Gill, "Engineering Drawing (Geometrical Drawing)", 10 Edition, S. K. Kataria and Sons, 2005.
5. P. J. Shah, "Engineering Drawing", C. Jamnadas and Co., 1 Edition, 1988.

Project Based Learning

Following is the list of topics for project-based learning (Not Limited to) based on the syllabus contents:

1. To obtain industrial drawings to identify the types of lines, dimensioning methods and method of projection.
2. To develop the model/charts based on engineering curves.
3. To prepare model/chart for identification of engineering curves in nature for industrial, societal, etc application.
4. To demonstrate different methods of orthographic projection.
5. To demonstrateprojection of Points.
6. To demonstrate projection of Lines.
7. To demonstrateprojection of Planes.
8. To demonstrate projection of Solids.
9. To demonstrate developments of surfaces for solids.
10. To demonstrateindustrial application of development of surfaces such as steam carrying pipes, Ducts of air conditioning systems, etc.
11. To demonstrateIsometric projection method through model of a cube.

Unit Tests

Unit Test-I	Unit-I, II, III
Unit Test-II	Unit-IV, V, VI

Designation of Course	Statics and Dynamics		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 03 Hours/ Week	End Semester Examination	60 Marks	03
	Internal Assessment	40 Marks	
	Total	**100 Marks**	**03**

Course Prerequisites:-	1. Engineering Physics 2. Engineering mathematics
Course Objective	1. To study different types of forces in a plane. 2. To study Centroid and moment of inertia 3. To study friction in machines 4. To study Kinetics of linear and circular motion 5. To study basics of civil engineering
Course Outcomes:-	The students should be able to 1. **Understand** the concept of force and **apply** it along with the concept of equilibrium in 2D and 3D system with the help of free body diagram. 2. **Understand** the significance of centroid and moment of inertia 3. **Understand** the concept of friction and estimate required force to overcome friction**.** 4. **Analyze** body in motion using force and acceleration, work energy, impulse momentum principles 5. **Analyze** body in motion using centripetal and centrifugal force principles 6. **Understand** the basic concept of civil material, building component and foundation techniques.

Course Content

Unit-I	**Resultant and Equilibrium**	**(06 Hrs.)**
Types and Resolution of forces, Moment and Couple, Free Body Diagram, Types of Supports, Classification and Resultant of a force system in a Plane - Analytical and Graphical approach. Equilibrant, Conditions of Equilibrium, Equilibrium of a force system in a Plane, Force and Couple system about a point, Virtual work.		
Unit-II	**Centroid, Moment of Inertia and Friction**	**(06 Hrs.)**
Centroid of line and plane areas, Moment of Inertia of plane areas, parallel and perpendicular axis theorem, radius of gyration, least moment of inertia. Introduction to frictional force, preliminary concepts, laws of friction. Introduction to machines, Relation between Mechanical advantage, Velocity ratio and efficiency, Reversible and non-reversible Machines. Simple lifting machines and their velocity ratio, gear train.		
Unit-III	**Analysis of Trusses, Frames and Cables**	**(06 Hrs.)**
Two force members: Introduction to trusses, types of trusses, perfect and redundant trusses, Analysis of plane trusses by method of joint and method of section, cables subjected to point loads. Multi force member: plane frame.		
Unit-IV	**Kinematics of particles and rigid body**	**(06 Hrs.)**
Rectilinear motion, velocity and acceleration in terms of rectangular coordinate system, Motion along plane curve path, tangential and normal component of acceleration, motion curves (a-t, v-t, s-t), Projectile motionRigid body- Introduction to general plane motion,		
Unit -V	**Kinetics of Particle**	**(06 Hrs.)**
Force and acceleration, introduction to basic concepts, D'Alembert's principle, equation of dynamic equilibrium, Newton's second law of motion. Work energy principle and law of conservation of energy, impulse and momentum, law of conservation of momentum, Impact and collision.		

Unit-VI	Structural Materials and Foundations	(06 Hrs.)
Types of structures based on loading, material and configuration; structural materials: concrete, construction steel, bricks, flooring material and tiles, paints, plywood, glass and aluminium **Foundations-** Function of foundation, concept of bearing capacity and its estimation, types of foundation and its suitability, causes of failure of foundation.		

List of Assignments

Numerical and/or theory questions on following topics from previous year question papers of GATE/ESE Mechanical Engg. examinations.

1. Resultant and equilibrium of forces
2. Centroid & Moment of Inertia
3. Friction
4. Trusses, frames and cables
5. Kinematics of particles
6. Kinematics of rigid body
7. Kinetics of particle
8. Structural materials and foundations

Text Books

1. "Engineering Mechanics", Bhavikatti S.S. and Rajashekarappa K. G., New Age International (P) Ltd.
2. "Engineering Mechanics (Statics and Dynamics)",Tayal A.K., Umesh Publication.
3. "Engineering Mechanics-I and II (Statics and Dynamics)", Mokashi V.S., Tata McGraw Hill Publication.

Reference Books

1. "Engineering Mechanics (Statics and Dynamics)", Hibbeler R. C., McMillan Publication.
2. "Vector Mechanics for Engineers-Vol.-I and Vol.-II (Statics and Dynamics)", Beer F.P. and Johnston E.R., Tata McGraw Hill Publication.
3. "Engineering Mechanics (Statics and Dynamics)", Shames I.H., Prentice Hall of India (P) Ltd.
4. "Engineering Mechanics (Statics and Dynamics)", Singer F.L., Harper and Row Publication
5. "Engineering Mechanics (Statics and Dynamics)", Meriam J.L. and Kraige L.G., John Wiley and Sons Publication.
6. "Engineering Mechanics (Statics and Dynamics)", Timoshenko S.P. and Young D.H., McGraw Hill Publication.

Project Based Learning

Following is the list of topics for project based learning (Not Limited to) based on the syllabus contents:

1. To prepare demonstration model for various types of beams.
2. To prepare demonstration model for various types supports.
3. To prepare chart for various types of force system with suitable real-life examples.
4. Case study on various situations where varignon's theorem is used.
5. To prepare demonstration model or to prepare a chart on equilibrium system of forces of various engineering applications.
6. To prepare chart on different types for trusses with showing various members.
7. To prepare demonstration model of any one type of truss.
8. To prepare demonstration model of the basic geometrical figures and locate the centroid of them.

9. To prepare demonstration model of the I and T section and locate the centroid of them.
10. To prepare chart for parallel axis and perpendicular axis theorem with suitable example.
11. To prepare chart on types of friction in various field conditions.
12. To prepare chart on application of friction.
13. To prepare chart on motion curves.
14. To prepare chart related to lifting machine and relevant industrial applications.
15. To development of excel sheet for projectile motion (at least three problems).
16. To development of excel sheet for work energy principle (at least three problems).
17. To prepare chart on work energy and Impulse momentum principle with suitable example.
18. Case study on different structural materials and comparison of its mechanical properties.
19. To prepare demonstration model of different types of foundations.

Unit Tests

Unit Test-I	Unit-I, II, III
Unit Test-II	Unit-IV, V, VI

Designation of Course	Metal Joining Processes		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Practical: -02 hours/Week	Term Work	50 Marks	01
	Total	**50 Marks**	**01**

Course Prerequisites:-	Students should have basic knowledge of Materials, Physics, Chemistry and Vocational Course.
Course Objectives:-	The student should 1. To acquire the knowledge of Arc and Gas Welding Processes 2. To acquire the knowledge of Resistance and Solid-state Welding Processes
Course Outcomes:-	The students should be able to– 1. **Understand** the different Arc and Gas Welding Processes and **apply** for welding Joints 2. **Understand** the different Resistance and Solid-state Welding Processes and **apply** for welding Joints.

Course Contents

Unit-I	**Introduction to Welding Processes**	**(12 Hrs.)**

Introduction, Classification of welding processes, Advantages and disadvantages of welding processes Soldering, Brazing.

Arc Welding Processes-Carbon arc, Submerged arc, Tungsten inert gas (TIG), Metal inert gas (MIG), Plasma arc, Stud welding and related arc welding processes –Theory, Comparison on merits, limitation and applications, Fluxes used in arc welding. Characteristics of Welding Processes.

Gas Welding– Processes and equipment used, Types of flames, Gas cutting– Merits, demerits and applications.

Unit-II	**Resistance Welding and Solid-State Welding**	**(12 Hrs.)**

Resistance Welding– Spot, Seam, Projection, Butt, Percussion welding, Tube welding, Electric resistance welding process, its merits, demerits, and applications.

Introduction of Solid-State Welding- Pressure, Diffusion, Ultrasonic, Explosive, Friction, Forge, Principle, Equipment used and Flux used, Merit's, demerits and application of the above process.

Term Work: List of Experiments

1. Edge Preparation of various welding Joints.
2. Making the Joint with Arc Welding Process. (One Individual Job)
3. Making the Joint with Resistance Welding Process. (One Individual Job with spot welding)
4. Making the Joint with TIG or MIG Welding Process.(One Individual Job)
5. Making the Joint with Gas Welding Process.(One Individual Job)
6. Making the Joint with Soldering Process.(One Individual Job)
7. Making the Joint with Braze Welding Process.(One Individual Job)
8. Study / Demonstration on Ultra Sonic Welding.
9. Study / Demonstration on Friction Welding
10. One Industrial Visit to get the detail Knowledge of Advanced Welding Processes and Latest Technology in Welding.

Text Books

1. O.P.Khanna , A Text Book of Welding Technilogy, DhanpatRai and Sons
2. Md. Ibrahim Khan,Welding Science and Technology, New Age International (P) Ltd.
3. Chapman W.A.J "Workshop Technology "volume I,II.III, ELBS.

Reference Books

1. P.N.Rao , Manufacturing Technology- Vol I, Mcgraw Hill Education 9 India Pvt.
2. HajraChoudhary S.K. , Bose S.K. "Elements of Workshop Technology" Volume I,II
3. Richard Little, "Welding And Welding Technology" Pearsons Education second Edition.

Designation of Course	Soft Computing- I		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Practical: -04 hours/Week	Term Work and Practical	100 Marks	02
	Total	**100 Marks**	**02**

Course Prerequisites	Basic Mathematics
Course Objective	The goal of the course is that students should develop techniques for problem solving using a programming language.
Course Outcomes	Students should 1. **Understand** basics of C++ and **apply** that knowledge to write simple programs. 2. **Understand** the uses of operators and **apply** them in writing programs. 3. **Understand** the concept of conditional statements **apply** them in writing programs. 4. **Understand** the concepts of loops in C++ **apply** them in writing programs. 5. **Understand** the concepts of user defined functions, recursion and**apply**them in writing programs 6. **Understand** the concept of overloaded functions and **apply**them in writing programs

Course Contents

Unit-I	**Introduction to C++**	**(08Hrs.)**
Introduction to C, C++; Object oriented programming; Programming Fundamentals; Data and Data Types		
Unit-II	**Operators in C++**	**(08Hrs.)**
Declarations in C++; Operators in C++; Introduction to classes and objects and strings		
Unit-III	**Conditional Statements**	**(08Hrs.)**
Relational and logical operators; If statements; Switch Statements		
Unit-IV	**Loops**	**(08Hrs.)**
Loops in C++; For loop; While loop; Do while loop; Jump statement		
Unit-V	**Functions I**	**(08Hrs.)**
Functions basic formats; Recursion		
Unit-VI	**Functions II**	**(08Hrs.)**
Overloaded functions; Local, Global and Static Variables		

Term Work

Term work shall consistof programs (not limited to)listed below based on syllabus.

1. C++ "Hello, World!" Program
2. C++ Program to Print Number Entered by User
3. C++ Program to Add Two Numbers
4. C++ Program to Find Quotient and Remainder
5. C++ Program to Find Size of int, float, double and char in Your System
6. C++ Program to Swap Two Numbers
7. C++ Program to Find ASCII Value of a Character
8. C++ Program to Multiply two Numbers
9. C++ Program to Check Whether Number is Even or Odd
10. C++ Program to Check Whether a character is Vowel or Consonant.

11. C++ Program to Find Largest Number Among Three Numbers
12. C++ Program to Find All Roots of a Quadratic Equation
13. C++ Program to Calculate Sum of Natural Numbers
14. C++ Program to Check Leap Year
15. C++ Program to Find Factorial
16. C++ Program to Generate Multiplication Table
17. C++ Program to Display Fibonacci Series
18. C++ Program to Find GCD
19. C++ Program to Find LCM
20. C++ Program to Reverse a Number
21. C++ Program to Calculate Power of a Number
22. C++ Program to Check Whether a Number is Palindrome or Not
23. C++ Program to Check Whether a Number is Prime or Not
24. C++ Program to Display Prime Numbers Between Two Intervals
25. C++ Program to Check Armstrong Number
26. C++ Program to Display Armstrong Number Between Two Intervals
27. C++ Program to Display Factors of a Number
28. C++ Programs To Create Pyramid and Pattern
29. C++ Program to Make a Simple Calculator to Add, Subtract, Multiply or Divide Using switch...case
30. C++ Program to Display Prime Numbers Between Two Intervals Using Functions
31. C++ Program to Check Prime Number By Creating a Function
32. C++ Program to Check Whether a Number can be Express as Sum of Two Prime Numbers
33. C++ program to Find Sum of Natural Numbers using Recursion
34. C++ program to Calculate Factorial of a Number Using Recursion
35. C++ Program to Find G.C.D Using Recursion
36. C++ Program to Convert Binary Number to Decimal and vice-versa
37. C++ Program to Convert Octal Number to Decimal and vice-versa
38. C++ Program to Convert Binary Number to Octal and vice-versa
39. C++ program to Reverse a Sentence Using Recursion
40. C++ Program to Calculate Power Using Recursion

TextBooks

1. "Let Us C++", KanetkarYashavant, BPB Publications

Reference Books

1. “C++ programming Today”, Barbara Johnston, Prentice Hall of India, New Delhi.
2. “C++ how to program”, Paul Deitel and Henry Deitel, Prentice Hall of India, New Delhi.
3. "Accelerated C++: Practical Programming by Example", Andrew Koenig and Barbara E. Moo, Addison-Wesley Publications
4. "C++: The Complete Reference", Herbert Schildt, McGraw Hill Publications.
5. "C++ Primer"; Barbara E. Moo, JoséeLajoie and Stanley B. Lippman; Addison-Wesley Professional
6. "Programming: Principles and Practice Using C++", BjarneStroustrup, Addison-Wesley Professional

Designation of Course	**Differential Equations, Probability & Statistics**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory:- 03 Hours/ Week	End Semester Examination	60 Marks	03
Tutorial:- 01 Hours/ Week	Internal Assessment	40 Marks	
	Tutorial	-	01
	Total	**100 Marks**	**04**

Course Prerequisites:-	Students should have knowledge of 1. Derivative and Integration 2. Partial derivative 3. Basic of statistics
Course Objectives:-	To provide knowledge about 1. Various methods to solve first order and first degree and n^{th} order differential equation. 2. Integral transform and application of partial differential equation. 3. Methods of interpretation of numerical data and probability distribution.
Course Outcome:-	Students will be able to 1. **Understand** methods of first order and first-degree differential equation. 2. **Understand** the methods of nth ordinary differential equation and **apply** it to mass spring system. 3. **Understand** Laplace transform and evaluate particular solution of wave, one- and two-dimensional heat equation. 4. **Understand** the multiple integrals and apply it to evaluate area and volume. 5. **Understand** various technique to **analyze** and numerical data. 6. **Understand** probability distribution and testing of hypothesis.

Course Contents

Unit-I	**Differential Equation**	**(06 Hrs.)**
Formation of the ordinary differential equations (ODEs), Solution of an ordinary differential equation, Equations of the first order and first degree, Linear differential equation, Bernoulli's equation, Exact differential equations, Equations reducible to exact equations		
Unit-II	**Linear Differential Equations**	**(06 Hrs.)**
Solution of nth order LDE with Constant Coefficients, Method of Variation of Parameters, Cauchy's & Legendre's DE, Solution of Simultaneous & Symmetric Simultaneous DE, Mass spring system.		
Unit-III	**Laplace Transforms and Applications of Partial Differential Equations**	**(06 Hrs.)**
Laplace transform: Definition of Laplace transforms, Properties of Laplace Transform (Properties without proof). Inverse Laplace Transform, Linearity property, use of standard formulae to find inverse Laplace Transform, finding Inverse Laplace transform using derivative, Partial fractions method & first shift property to find inverse Laplace transform. Inverse Laplace transform using Convolution theorem (without proof). Applications of partial differential equation: Basic concepts, modeling of Vibrating String, Wave equation, One- and two-dimensional Heat flow equations, method of Separation of variables.		
Unit-IV	**Multiple Integrals and its Applications**	**(06 Hrs.)**
Double and Triple integrations, Applications to Area, Volume, Mean and Root Mean Square Values.		
Unit-V	**Statistics**	**(06 Hrs.)**
Measures of central tendency, Standard deviation, Coefficient of variation, Moments, Skewness and Kurtosis, Correlation and Regression, Reliability of Regression estimates.		

Unit-VI	Probability and Probability Distributions	(06 Hrs.)
Probability, Bayes Theorem, Probability density function, Probability distributions: Binomial, Poisson, Normal, Test of hypothesis: Chi-square test, t-test.		

Assignments

Problems and/or theory questions on following topics from previous year question papers of GATE/ESE Mechanical Engg. examinations.

1. Differential equation.
2. Linear differential equations.
3. Laplace transforms and applications of partial differential equations.
4. Multiple integrals and its applications.
5. Statistics.
6. Probability and probability distribution.

Tutorials:

Problems and/or theory questions on following topics from previous year question papers of GATE/ESE Mechanical Engg. examinations.

1. First order equation (linear and nonlinear),
2. Higher order linear differential equation with constant coefficients
3. Euler-Cauchy equation
4. Legendre's DE
5. Laplace transformation
6. Applications of partial differential equation
7. Double and Triple integrations
8. Applications to area, volume, mean and root mean square values.
9. Sampling theorems, conditional probability; mean, median, mode and deviation.
10. Correlation and regression, reliability of regression estimates.
11. Probability, bayes theorem, probability density function
12. Binomial, poisson and normal distributions.

Text Books

1. P. N. Wartikar and J. N. Wartikar, "Applied Mathematics (Volumes I and II)", 7th Ed., Pune Vidyarthi Griha Prakashan, Pune, 2013.

Reference Books

1. B. S. Grewal, "Higher Engineering Mathematics", 42nd Ed., Khanna Publication, Delhi
2. B.V. Ramana, "Higher Engineering Mathematics", 6th Ed., Tata McGraw-Hill, New Delhi, 2008.
3. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, Inc., 2015.
4. Peter V. O'Neil, "Advanced Engineering Mathematics", 7th Ed., Cengage Learning, 2012.
5. Michael Greenberg, "Advanced Engineering Mathematics", 2nd Ed., Pearson Education, 1998.

Project Based learning topics:

Students are expected to prepare report on any one topic, write its definition, applications and analyze the hypothetical data. Also, write pseudo code for it, wherever applicable.

1. Formation of differential equation
2. Exact differential Equation
3. Linear differential equation
4. Solution of nth order LDE with Constant Coefficients

5. Mass spring system
6. Transform (Properties with proof).
7. Applications of partial differential equation in mechanical engineering
8. Multiple integrals applications
9. Applications of Multiple integrals applications to Area, Volume
10. Random Sampling
11. Stratified random sampling
12. Reliability of Regression estimates.
13. Bayes Theorem
14. Probability density function
15. Testing of hypothesis

Unit Test -

Unit Test-I	Unit- I, II, III
Unit Test-II	Unit- IV, V, VI

Designation of Course	**Chemistry of Engineering Materials**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 03Hour/ Week	End Semester Examination	60 Marks	03
Practical: -02 Hours/Week	Internal Assessment	40 Marks	
	Term Work	25 Marks	01
	Total	**125 Marks**	**04**

Course Prerequisites: -	Higher Secondary chemistry.
Course Objective: -	The student should acquire the knowledge of 1. To develop the interest among the students regarding chemistry and their applications in engineering. 2. To develop confidence among students about chemistry, how the knowledge of chemistry is applied in technological field. 3. The student should understand the concepts of chemistry to lay the groundwork for subsequent studies in the field such as Mechanical Engineering.
Course Outcomes: -	After completion of the course students will be able to 1. **Apply** the concept X-ray diffraction technique to study crystal structure. 2. **Understand** the concept of the metallurgy in the study of metals. 3. **Understand and apply** the knowledge of Ferrous & Non-Ferrous materials for various engineering applications. 4. **Apply** the knowledge polymer and plastics to study advanced materials. 5. **Understand** the knowledge of composite materials for various engineering applications. 6. **Understand** different types of corrosion and suggest control measures in industries.

Course Contents

Unit-I	**Crystal Structures**	**(06 Hrs.)**
Study of crystal structure, Indexing of planes and directions, Slip planes, linear and Planner density calculations, volume density calculations, Imperfections in crystals, effect of crystal structure defects on various properties, Allotropic and polymorphism of metals, formation of solid solutions.		
Unit-II	**Extractive Metallurgy**	**(06 Hrs.)**
Introduction, Occurrence of metals, types of ores, concentration of ores by physical methods, Crushing and Sizing, Froth- Flotation, Magnetic Separation, Gravity separation method. Chemical methods- calcination, Roasting, Reduction of ore by Pyrolysis, Chemical reductions, Electrolytic refining of metals.		
Unit-III	**Ferrous & Non-Ferrous Materials**	**(06 Hrs.)**
Metallic materials: Introduction, Alloy- definition and classification, purposes of making alloys. Ferrous alloys, Introduction to steel making, blast furnace and electric steel making: Plain carbon steels (mild, medium and high), Nonferrous alloys: Copper alloy (Brass), Nickel alloy (Nichrome), Aluminum alloy (Duralumin and Alnico). **Green Chemistry:** Definition, Twelve principles of Green Chemistry.		
Unit-IV	**Introduction to Polymers, Plastics and Rubbers**	**(06 Hrs.)**
Polymers: Introduction, plastics, thermo softening and thermosetting plastics, industrially important plastics like phenol formaldehyde, urea formaldehyde and epoxy resins, Conducting polymers and Biopolymers (Introduction, examples, and applications), types of rubbers, Acrylics.		
Unit-V	**Introduction to Composites**	**(06 Hrs.)**
Introduction, types of composite, different types of reinforce materials, characteristics of reinforced materials, matrix materials composition, properties and uses of fibre reinforced plastics (FRP), Carbon fibres, Boron Nylon etc, and glass reinforced plastic (GRP). Ceramic matrix composite. Metal Matrix composite.		

Unit-VI	Corrosion & Protective Coatings	(06Hrs.)
Introduction corrosion, types of corrosion, hydrogen embrittlement, stress corrosion, Pit type corrosion, corrosion prevention methods, Metallic coatings, Electroplating, Methods of cleaning articles before electrodeposition, Electroplating methods, Electroless plating, Some other metallic coatings, Modification of environment, Cathodic Protection, chemical conversion coatings, Organic Coatings, Paints, Varnishes, Enamels, Special paints. CVD and PVD coatings.		

Term Work

List of Experiments

1. Preparation of polystyrene/phenol-formaldehyde/urea-formaldehyde resin.
2. To determine molecular weight/radius of macromolecule polystyrene/ polyvinyl alcohol by viscosity measurement.
3. Estimation of percentage of Iron in Plain Carbon Steel by Volumetric Method.
4. Study of corrosion of metals in medium of different pH.
5. Determination of rate of corrosion of aluminium in acidic and basic medium.
6. Determination of percentage of Ca in given cement sample
7. Preparation of phenol-formaldehyde resin/ urea-formaldehyde.
8. Estimation of copper in brass solution.
9. Determination of rate of corrosion of aluminium in acidic and basic medium.
10. To obtain metallic coating on base metal by using both the methods, Electroplating and Electroless plating.

Assignments

1. Linear and Planner density calculations with volume density calculations.
2. Extractive Metallurgy.
3. Purposes of making alloy like Ferrous alloys.
4. Twelve principles of Green Chemistry.
5. Conducting polymers and Biopolymers.
6. Thermo softening and thermosetting plastics.
7. Fiber reinforced plastics (FRP).
8. Heat treatment oftool steels
9. Organic Coatings, Paints, Varnishes, Enamels, Special paints for corrosion prevention.
10. Types of corrosion and its preventive measures.

Test Book

1. A Textbook of Engineering Chemistry by S. S. Dara and S. S. Umare, S. Chand & Company Ltd., New Delhi.
2. A Textbook of Engineering Chemistry by C. P. Murthy, C. V. Agarwal and A. Naidu, B S Publications, Hyderabad.
3. A Text Book of Engineering Chemistry, Shashi Chawla, Dhanpat Rai & Co, 2004

Reference Books

1. Material Science and Engineering Metallurgy by V D Kodgire, Everest publications
2. Materials Science by O P Khanna, Khanna publications
3. Engineering Chemistry (16th Edition) Jain, Jain, Dhanpat Rai Publishing Company, 2013.
4. Engineering Chemistry by Dr. A. K. Pahari and Dr. B. S. Chauhan, Laxmi Publications (P) Ltd, New Delhi.
5. Polymer Science, V. R. Gowarikar, N. V. Viswanathan, jayadev Sreedhar, Wiley Eastern Limited
6. Polymer Science and technology (2nd Edition), P. Ghosh, Tata McGRAW Hill, 2008
7. Polymers: Chemistry & Physics of Modern Materials (2nd edition) J.M.G. Cowie, Blackie Academic & Professional, 1994.

Project Based Learning

Following is the list of topics for project based learning (Not Limited to) based on the syllabus contents:

1. To prepare a demonstration model on Biopolymers.
2. To prepare a epoxy resins by using suitable method.
3. To write a review paper based on applications of fibre reinforced plastics (FRP) and get it published in reputed journal (eg. Google Scholar).
4. With the help of green chemistry principles, to prepare any organic dye by using Traditional and Green pathway.
5. To prepare a demonstration model a hardware model based on Electroless plating and calculate cell voltage.
6. To write a review paper based on Conducting polymers and get it published in reputed journal (eg. Google Scholar).

Unit Test -

Unit Test-I	Unit- I, II, III
Unit Test-II	Unit- IV, V, VI

Designation of Course	**Mechanical Engineering Systems**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 04 Hour/ Week	End Semester Examination	60 Marks	04
Practical: -02 Hours/Week	Internal Assessment	40 Marks	
	Term Work	25 Marks	01
	Total	**125 Marks**	**05**

Course Prerequisites: -	Higher Secondary Physics
Course Objective: -	To teach students about 1. Introduction to systems inThermal Engineering 2. Introduction to systems inDesign Engineering 3. Introduction to systems in Manufacturing Engineering
Course Outcomes: -	Students should 1. **Understand** the fundamentals of power producing and absorbing devices. 2. **Understand** the fundamental concepts of renewable and non-renewable energy systems. 3. **Understand** the fundamentals of mechanism of machines 4. **Understand** the fundamentals of power transmitting devices. 5. **Understand** the fundamentals of machine tools and manufacturing processes. 6. **Understand** the fundamentals of robotics and its applications.

Course Contents

Unit-I	**Power Producing and Absorbing Systems**	**(08 Hrs.)**
Power Producing Systems: I. C. Engines- Basic nomenclature, Classification, S.I and C. I. Engines, Two stroke and four strike engines. Boilers- classification, water tube and fire tube boilers. Steam Turbines: Classification, simple Impulse, and reaction turbines. Water Turbines: Classification, Impulse, and reaction Turbines. Gas Turbines: classification, open and closed gas turbine. Construction, working and applications of all these devices. **Power Absorbing Systems:** Compressors; Classification, Rotary, reciprocating air compressors, Blower, Pumps: Classification, Rotary, reciprocating pumps, Household refrigerator and window air conditioner.		
Unit-II	**Renewable and Non-Renewable Energy Systems**	**(08 Hrs.)**
Renewable energy systems: Solar- P-V Cells, collectors- Flat plate, Parabolic, Trough collector, Heliostat. Wind- Classification of wind Turbines, Horizontal and vertical axis. Biomass gasification, Biogas Plant, Geothermal, Tidal, micro-hydel plant. **Non-renewable energy systems:** Thermal power plant, hydroelectric power plant, Nuclear power plant, Gas Turbine plant, I.C engine power Plant,		
Unit-III	**Introduction to Mechanisms of Machines**	**(08 Hrs.)**
Kinematic link, Kinematic pair, Types of constrained motions, Kinematic chain, Types of joints, Mechanism, Machine, Degree of freedom (Mobility), Kutzbach criterion, Grubler's criterion. Four bar chain and its inversions, Grashoff'slaw, Slider crank chain and its inversions, Double slider crank chain and its inversions. Geneva Mechanisms, Ratchet and Paul Mechanisms		
Unit-IV	**Power Transmitting Devices**	**(08 Hrs.)**
Types of Belts and belt drives, Chain drive, rope drive, Types of gears, Types of Couplings, Types of friction clutch, Power transmission shafts, axles, keys, types of Keys, Sliding Contact and Rolling Contact Bearing, Bush and ball bearings, Types of brakes.		
Unit-V	**Introduction to Machine Tools**	**(08 Hrs.)**
Demonstration of: Lathe machine, Centre lathe, wood working lathe, Drilling machine, types of drilling machine, milling machine, Power saw. Grinding machine, cylindrical grinder, and surface grinder. NC machine, CNC machine.		

Unit-VI	Introduction to Robotics	(08 Hrs.)
History of robotics, Definition of robotics and robot, laws of robotics and classification of robot, application of robot, robot anatomy, Degree of freedom, Degree of mobility, Kinematics, joints, work envelope, pay load, reach, speed, acceleration, accuracy, precision, repeatability, Mounting, Footprint, cycle time, Components of robots such as sensor, power conversion unit, Actuators, Manipulators, Controllers, Base and user interface, Future of robotics.		

Term work: Term work shall consist following experiments

1. Study and demonstration of low-pressure boilers.
2. Study and demonstration of IC Engines.
3. Study and demonstration of Refrigeration and Air Conditioning.
4. Study and demonstration of Pumps and Compressors.
5. Study and demonstration of turbines.
6. Study and demonstration of Inversions of 4-bar, Single and Double Slider Crank Mechanisms.
7. Study and demonstration of power transmitting elements.
8. Study and demonstration of operations on center lathe.
9. Study and demonstration of operations on drilling machine.
10. Study and demonstration of robot anatomy.
11. Mini Project on Contents of Syllabus.

Assignment

1. Assignment on power producing and absorbing devices
2. Assignment on renewable and non-renewable energy
3. Assignment on mechanism of machines
4. Assignment on Power Transmitting Devices
5. Assignment on Machine Tools
6. Assignment on Robotics

Text Books

1. A Textbook of Production engineering" P.C. Sharma, S. Chand Publication, New Delhi, 2nd edition, 8th Edition (2014).
2. A Textbook of Manufacturing Technology: Manufacturing Processes, R. K. Rajput, Laxmi Publications (P) Ltd, 2nd Edition 2015
3. R S Khurmi and J K Gupta, Textbook of Thermal Engineering, S Chand publications.

Reference Books

1. V. Ganeshan, Internal Combustion Engine, Tata McGraw-Hill Publication, 4th Edition (2012).
2. R. K. Rajput, Thermal Engineering, Laxmi Publications
3. Ambekar A.G Mechanisms and Machine Theory,Prentice-Hall of India, Eastern Economy Edition (2007)
4. S.S. Ratan,Theory of Machines, , Tata McGraw Hill, 4th Edition
5. Introduction to robotics, S.K.Shah. McGraw Hill, 2nd Editi

Project Based Learning

Following is the list of topics for project based learning (Not Limited to) based on the syllabus contents:

1. To prepare chart of comparison among specification of various models of two wheeler available.
2. To develop demonstration model of low-cost household refrigerator
3. To develop demonstration model of low-cost air conditioner
4. To develop demonstration model of Biogas plant
5. To develop demonstration model of geothermal power plant

6. To develop demonstration model of wind power plant
7. To develop demonstration model of solar energy plant
8. To develop demonstration model of Whitworth quick return mechanism
9. To develop demonstration model of single slider crank chain mechanism with its inversion
10. To develop demonstration model of Ratchet and Paul mechanism
11. To develop demonstration model of mini conveyor using Geneva mechanism

Unit Test

Unit Test-I	Unit- I, II, III
Unit Test-II	Unit- IV, V, VI

Designation of Course	Electronics Engineering Systems		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory:- 04 Hours/ Week	End Semester Examination	60 Marks	04
Practical:- 02 Hours/ Week	Internal Assessment	40 Marks	
	Term Work	25 Marks	01
	Total	**125 Marks**	**05**

Course Prerequisites:-	Students should have the basic knowledge of ElectricalEngineering
Course Objectives:-	1. To provide overview of electronics engineering that serve the foundation of advanced studies in the area of mechanicalengineering. 2. Thiscourseprovidescomprehensive idea aboutworking principle 3. Operation and characteristics of electronic devices, transducers, digital electronics, and communication systems.
Course Outcomes:-	On completion of the course, students will be able to– 1. **Understand** the basic electronics devices and linearICs 2. **Understand and apply** the concepts of digitalelectronics. 3. **Understand** the methods of signal conditioning and itsapplications. 4. **Understand**conceptsofAnalog Communication&Digitalcommunication 5. **Understand** the concept of transducer and data acquisition system with its application. 6. **Understand**theconceptofMicroprocessor&Microcontrollerandits applications.

Course Contents

Unit-I	**Electronic Devices and Linear ICs**	**(08 Hrs.)**
Rectifiers: Half wave, Full wave and Bridge rectifiers - capacitor filter-wave forms-ripple factor regulation characteristics. Special semiconductor devices: FET, SCR. LED, MOSFET,DIAC, TRIAC,relays, VI characteristics – applications		
Unit-II	**Digital Electronics**	**(08 Hrs.)**
Number system – Binary, Decimal, Octal, Hela decimal, Digital Signal, Combinational and sequential logic circuits, clock signal, Boolean Algebra and Logic gates, Arithmetic Operations, Multiplexers, Demultiplexers, Encoders, Decoders, Flip-flop, Registers,Counters.Integrated circuits & logic families: – Logic levels, noise immunity, fan out, propagation delay, TTL logicfamily, CMOS logic family, comparison with TTL family		
Unit-III	**Signal Conditioning**	**(08 Hrs.)**
Operational amplifiers, Inverting, non-inverting, voltage follower, summing, subtractor,Instrumentation, 555 timer-operating modes: monostable, astablemultivibrator, Analog to Digital & Digital to AnalogConvertors		
Unit-IV	**Communication Systems**	**(08 Hrs.)**
Analog Communication & Digital communication: Block diagram of a basic communication system, Frequency spectrum, need for modulation, Methods of modulations- Principles of AM, FM, Pulse analog &pulsedigitalmodulation,AM/FMtransmitters&receivers,satellitecommunication–Radarsystem, data transmission and MODEM, Mobile communication systems: cellular concept, simple block diagram of GSM system		
Unit-V	**Transducers and Data Acquisition Systems**	**(08 Hrs.)**
Basic requirement of transducers, classification of transducers, passive transducers: Resistive, capacitive, inductive, LVDT, potentiometric strain gauge, thermistor, hall effect, proximity sensors. Active transducers:Piezoelectric,photoelectric&thermocouple.Staticcharacteristicsoftransducer,selectionoftransducer. Block diagram of data acquisition systems and its applications.		

Unit-VI	Microprocessor & Microcontroller	(08 Hrs.)
Overview of generic microprocessor, architecture & functional block diagram, comparison of Microprocessor& microcontroller. 8051 Architecture, ports, resisters, timers/counters. Serial communications interrupts. Interfacing of relay, stepper motor, LCD Display, Keyboard,ADC.		

Term Work:

Term work shall consist ofMinimum Eight **Experiments.**

1. To study and plot regulation characteristics of half wave and full waverectifier.
2. To study of characteristics ofSCR.
3. To study of characteristics ofTRIAC
4. To study basic logic gates: AND, OR, NOT, NAND, NOR, Ex-OR,Ex-NOR.
5. Implementation of Boolean functions using logicgates.
6. To study Operational Amplifiers(Op-amps).
7. Study of Amplitude Modulation and Demodulation
8. Study of Frequency Modulation and Demodulation
9. To study characteristics of LVDT for displacementmeasurement.
10. To study of Microprocessor &Microcontroller

Assignment:

Assignment based on each unit.

Text Books:

1. K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication,2008
2. W. Bolton, Mechatronics - A Multidisciplinary approach, 4th Edition, Prentice Hall,2009.
3. Dr. D.S.Kumar, Mechanical Measurement & Control, Metropolitan Book Co. Pvt.Ltd. New Delhi,2007
4. M.D. Singh and J.G.Joshi, Mechatronics, 3rd Edition, Prentice Hall, New Delhi,2009.
5. Mottershed Allen, Electronic Devices &Circuits,PHI
6. R. P. Jain, Modern Digital Electronics, M Graw

Reference Books

1. Thomas L. Floyd, Electronic Devices, Pearson Education (Sixthedition)
2. Millman&Halkis, Electronic Devices & Circuits,PHI
3. Malvino Leach, Digital Principles & Applications, Mc GrawHill
4. Millman&Halkis, Integrated Electronics,MGH

Project Based Learning:

Following is the list of topics for project based learning (Not Limited to) based on the syllabus contents:

To develop a demonstration model on;

1. Potential Divider and Variable DC bias circuit.
2. DC lighting circuit.
3. Automatic LED Emergency Light.
4. Flashing LED.
5. Dancing Light.
6. Voltage regulator using Zener diode.
7. Cascode amplifier using FET.
8. JFET as an analog switch.
9. FET used as a Multiplexer.
10. JFET acts as a current limiter.
11. LDR& Transistors based Light Detector.

12. LDR Based Smart Electronic Candle.
13. Smart Bulb Holder using LDR.
14. MOC3021 Opto-coupler as a solenoid/valve control.
15. Light controller switch using photo-transistor.

Unit Test -

Unit Test-I	Unit- I, II, III
Unit Test-II	Unit- IV, V, VI

Designation of Course	**Computer Aided Machine Drawing**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Theory: - 04 Hours/ Week	End Semester Examination	60 Marks	04
Practical: - 02 Hours/Week	Internal Assessment	40 Marks	
	Term Work and Practical	50 Marks	01
	Total	**150 Marks**	**05**

Course Prerequisites:-	1. Fundamentals of Mathematics 2. Mechanical Engineering systems 3. Computer Aided Drafting and Visualisation
Course Objectives:-	1. To make the students understand and interpret drawings of machine components 2. To prepare assembly drawings both manually and using standard CAD packages 3. To familiarize the students with Indian Standards on drawing practices and standard components
Course Outcomes:-	The students will be able to 1. **Understand** fundamentals of machine drawing and conventional representation of machine elements. 2. **Understand** concept of Geometric Dimensioning and Tolerancing; and apply in machine drawing. 3. **Understand and drawing** of component assemblies of given part drawings. 4. **Understand and drawing** of part details with the help of assembly drawings.

Course Contents

Unit-I	**Fundamental of Machine Drawing and Conventional Representation**	**(10 Hrs)**
Introduction to Machine Drawing and its importance, Code of practice for Engineering Drawing, BIS specifications – Materials, Welding Joint and symbols, riveted joints, pipe joints, keys, and screwed fasteners. Conventional Representation of dimensioning and sectioning, breaks in pipes and shafts, Screw Threads, springs, gears, foundation bolts, Common features and machine components.		
Unit-II	**Geometric Dimensioning and Tolerancing (GD&T)**	**(10 Hrs)**
Limits, Fits and Tolerances: Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, types of fits with symbols and applications, Geometrical Tolerances on drawings. Standards followed in industry, Interpretation of given symbols on drawing. **Characteristics of Surface Roughness**- Machining Symbols, Indications of surface roughness and its characteristics, Symbols for directions of lay.		
Unit-III	**Details to Assembly Drawing**	**(14 Hrs)**
Classification of Drawings- Machine drawing, Production Drawing, Part Drawing, Assembly drawing, Drawings for catalogues and instruction manuals, patent drawings, Drawing Standards, Introduction to unit assembly drawing, steps involved in preparing assembly drawing from details and vice-versa, Blueprint Readings. **Preparation of Assembly Drawings:** Universal and Oldham's Couplings, Foot-Step Bearings, Lathe Tool Post, Machine Vice, Pipe Vice, Screw Jack, Single Tool post, Square tool post, Clapper block, Revolving Centre, C-Clamp.		
Unit-IV	**Assembly to Details Drawing and Production Drawing**	**(14 Hrs)**
Types of Production Drawings- Detail or Part Drawings, Working Assembly Drawings, Detailed Drawings and Manufacturing Methods. **Preparation of Detail or Part Drawings:** Plummer Block or Pedestal Bearings, Lathe Tail Stock, Drilling Jig, Piston and Connecting Rod, Gland and Stuffing Box Assembly, Gate valve, Globe valve, Non-Return Valve and Steam Stop Valve.		

Term Work

1. Three A2 size sheets of **Details to assembly** drawing using AutoCAD.
2. Three A2 size sheets of **Assembly to details** drawings using AutoCAD.

Assignments

Minimum **Five** Questions based on each unit in A2 size Sheets

Textbook

1. R.K. Dhavan, "A Textbook of Machine Drawing", S Chand Publication, New Delhi.
2. Gopalakrishna K.R., "Machine Drawing", 22nd Edition, Subhas Stores Books Corner, Bangalore, 2013

References

1. N. D. Bhatt and V.M. Panchal, "Machine Drawing", 48th Edition, Charotar Publishers,2013
2. Junnarkar, N.D., "Machine Drawing", 1st Edition, Pearson Education, 2004
3. N. Siddeshwar, P. Kanniah, V.V.S. Sastri, "Machine Drawing", published by Tata McGrawHill, 2006
4. S. Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publishers, New Delhi, 2007

Project Based Learning:

Following is the list of topic for project based learning (Not Limited to) based on the syllabus contents:

1. To develop chart to represent different types of nuts and bolts conventionally along with industrial real life application.
2. To develop chart to represent different types of springs conventionally along with industrial real life application.
3. To develop chart to represent different types of welded and riveted joints conventionally along with industrial real life application.
4. To develop chart to represent different types of gears conventionally long with industrial real life
5. To develop chart to represent different types of bearings conventionally along with industrial real life application.
6. To develop chart to represent different types of foundation bolt conventionally along with industrial real life application.
7. To collect different types of nuts and bolts available in market, to identify their specifications and application.
8. To obtain industrial drawings to identify the limit, fits, tolerances.
9. To demonstrate geometrical tolerances for different industrial/real life application.
10. To prepare assembly and detail drawing of a given machine tool component.
11. To prepare assembly and detail drawing of a given IC engine component.

Unit Tests

Unit Test-I	Unit-I, II, III
Unit Test-II	Unit-IV, V, VI

Designation of Course	Sheet Metal Operations		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Practical:- 02 Hours/ Week	Term Work	50 Marks	01
	Total	**50 Marks**	**01**

Course Prerequisites:-	The student should have 1. Basic knowledge of workshop tools. 2. Basic knowledge of Materials
Course Objectives:-	1. The student should understand various tools, operations and use them for carrying out sheet metal operations.
Course Outcomes:-	The students should be able to– 1. **Understand** the knowledge of marking, cutting, holding tools and machines used in sheet metal industry. 2. **Understand** the types and use of rivets in sheet metal industry. 3. **Understand** the principle, construction of dies used in press working operations.

Course Contents

Unit-I	**First Aid, Sheet Metal Equipment's and Rivets**	**(12 Hrs.)**
General safety precautions and precautions for sheet metal industry. Measuring, marking, cutting and holding tools. Bench Work and Fitting Tools, Gauges, Introduction to machines in sheet metal Industry: shearing machine, bending machine, circular profile cutting machines. Different types of sheet metal folds. Rivets and its different parts, selection of rivet heads, types of rivets and its uses.		
Unit-II	**Introduction to Press Working**	**(12 Hrs.)**
Punching, blanking, shearing, bending and piercing. Punch & Die toleranceand clearance. **Introduction to Dies:** Simple Dies, Compound Dies, Progressive Dies. Types of presses.		

Term Work: List of Experiments

1. Cutting different types of shapes with hand snip.
2. Practical on bending machine
3. Practical on shearing machine
4. Practical on profile cutting machine.
5. Making hole with solid punch and round punch.
6. Practice for riveting.
7. Practical for making components from sheet metal.
8. Demonstrations of press working operations such as Punching, blanking operations.

Text Books:

1. Khanna O.P. and Lal. M., " Production Technology", Dhanpatrai Publications (P) Ltd., New Delhi.
2. Jain R.K., "Production Technology", Khanna Publishers, Delhi.
3. Choudhary Hajra S. k., Choudhary Hajra A. k. "Elements of Workshop Technology Vol 1 Manufacturing Processes, Publisher: Media Publishers & Promoters, India.
4. Choudhary Hajra S. k., Choudhary Hajra A. k. "Elements of Workshop Technology Vol 2 Machine Tools, Publisher: Media Publishers & Promoters, India.
5. Rajput R. K., "Manufacturing Technology", Laxmi Publications (P)Ltd, New Delhi.
6. Chapman W.A.J "Workshop Technology "volume I, II, III, ELBS.

Designation of Course	**Soft Computing- II**		
Teaching Scheme	**Examination Scheme**		**Credits Allotted**
Practical: -02 hours/Week	Term Work and Practical	75 Marks	01
	Total	**75 Marks**	**01**

Course Prerequisites: -	Basic Mathematics
Course Objective: -	The goal of the course is that students should develop techniques for problem solving using a programming language.
Course Outcomes	Students should 1. **Understand** the concept of pointers and **apply** them to locate variables in memory. **2. Apply** the concepts of pointers in functions **3. Understand** the concept of one-dimensional arrays and **apply** them in writing programs **4. Understand** the concept of multidimensional arrays and **apply** them in writing programs **5. Understand** the concept of classes and **apply** them in writing programs **6. Understand** the concept of objects and **apply** them in writing programs

Course Contents

Unit-I	**Pointers I**	**(04 Hrs.)**
Data Variables and memory; Address operator: &		
Unit-II	**Pointers II**	**(04 Hrs.)**
Pointers; Functions, pointers and Indirection Operators		
Unit-III	**Arrays**	**(04 Hrs.)**
Arrays Fundamentals; Arrays and Functions; Character Arrays		
Unit-IV	**Multidimensional Arrays**	**(04 Hrs.)**
Multidimensional Arrays; Multidimensional Arrays and Functions; Array filling from data files		
Unit-V	**Classes I**	**(04 Hrs.)**
Objects and classes; Class members; Class Destructors		
Unit-VI	**Classes II**	**(04 Hrs.)**
Array of objects; Overloaded operators and objects		

Term Work

Term work shall consist programs (not limited to)listed below based on syllabus.

1. C++ Program to Calculate Average of Numbers Using Arrays
2. C++ Program to Find Largest Element of an Array
3. C++ Program to Calculate Standard Deviation
4. C++ Program to Add Two Matrix Using Multi-dimensional Arrays
5. C++ Program to Multiply Two Matrix Using Multi-dimensional Arrays
6. C++ Program to Find Transpose of a Matrix
7. C++ Program to Multiply two Matrices by Passing Matrix to Function
8. C++ Program to Access Elements of an Array Using Pointer
9. C++ Program to Swap Numbers in Cyclic Order Using Call by Reference
10. C++ Program to Find the Frequency of Characters in a String
11. C++ Program to Find the Number of Vowels, Consonants, Digits and White Spaces in a String
12. C++ Program to Remove all Characters in a String Except Alphabets.

13. C++ Program to Find the Length of a String
14. C++ Program to Concatenate Two Strings
15. C++ Program to Copy Strings
16. C++ Program to Sort Elements in Lexicographical Order (Dictionary Order)
17. C++ Program to Store Information of a Student in a Structure
18. C++ Program to Add Two Distances (in inch-feet) System Using Structures
19. C++ Program to Add Complex Numbers by Passing Structure to a Function
20. C++ Program to Calculate Difference Between Two Time Period
21. C++ Program to Store and Display Information Using Structure
22. Increment ++ and Decrement -- Operator Overloading in C++ Programming
23. C++ Program to Subtract Complex Number Using Operator Overloading

TextBooks

1. "Let Us C++", KanetkarYashavant, BPB Publications

Reference Books

1. “C++ programming Today”, Barbara Johnston, Prentice Hall of India, New Delhi.
2. “C++ how to program”, Paul Deitel and Henry Deitel, Prentice Hall of India, New Delhi.
3. "Accelerated C++: Practical Programming by Example", Andrew Koenig and Barbara E. Moo, Addison-Wesley Publications
4. "C++: The Complete Reference", Herbert Schildt, McGraw Hill Publications.
5. "C++ Primer"; Barbara E. Moo, JoséeLajoie and Stanley B. Lippman; Addison-Wesley Professional
6. "Programming: Principles and Practice Using C++", BjarneStroustrup, Addison-Wesley Professional