SOLAPUR UNIVERSITY, SOLAPUR

FACULTY OF ENGINEERING & TECHNOLOGY

MECHANICAL ENGINEERING

Syllabus Structure for

S.E. (Mechanical Engineering) w.e.f. Academic Year 2013-14

T.E. (Mechanical Engineering) w.e.f. Academic Year 2014-15

B.E. (Mechanical Engineering) w.e.f. Academic Year 2015-16

SOLAPUR UNIVERSITY, SOLAPUR
FACULTY OF ENGINEERING & TECHNOLOGY
Mechanical Engineering

Structure of S.E. (Mechanical Engineering) w.e.f. from2013-14

Semester-I

Sr. No.	Subject	Teaching / Week					Examination Scheme				
		L	T	P	Dr	Total	TP	TW	OE	POE	Total
1	Analysis of Mechanical Elements	3	1			4	100	25			125
2	Applied Thermodynamics	3		2		5	100	25	25		150
3	Engineering Mathematics-III	3	1			4	100	25			125
4	Machine Tools and Processes	3		2		5	100	25			125
5	Machine Drawing	3			4	7	100	50			150
6	Computer Programming in C++	1		2		3		25		50	75
7	Workshop Practice- II			2		2		25		#25	50
Total		**16**	**2**	**8**	**4**	**30**	**500**	**200**	**25**	**75**	**800**
8	Environmental Science	1				1					

Semester-II

Sr. No.	Subject	Teaching / Week					Examination Scheme				
		L	T	P	Dr	Total	TP	TW	OE	POE	Total
1	Theory of Machine – I	3		2		5	100	25			125
2	Manufacturing Processes	3		2		5	100	25			125
3	Fluid Mechanics	3		2		5	100	25	25		150
4	Numerical Methods	3		2		5	100	25			125
5	Electrical and Electronics Technology	3		2		5	100	25			125
6	Computer Aided Machine Drawing	1		2		3		50		50	100
7	Workshop Practice – III			2		2		50			50
Total		**16**		**14**		**30**	**500**	**225**	**25**	**50**	**800**
8	Environmental Science	1				1					

'#' indicates practical examination only

Notes:

1. The Practical batch shall be of 20 students. After formation of batches, if the number of students remaining is more than 9, a new batch shall be formed.
2. Practical / Tutorial load indicates the load per batch.
3. TW: Term work assessment shall be a continuous process based on the performance of student in assignment, class test, quizzes, homework, interaction during theory and laboratory session, hand written lab book/ hand written journal, sheet drawing, subject seminar presentation etc. as applicable.
4. Industrial Training (B.E. Part 1) of minimum 30 days in one/two slot shall be completed in any vacation after SE Part-II but before BE Part-I & the report shall be submitted in BE Part-I.
5. For the subject '**Electrical and Electronics Technology'**, answer to the two sections must be written in separate answer books.

S.E.Mechanical Part-I

1. ANALYSIS OF MECHANICAL ELEMENTS

Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs/week	**Theory:** 100 Marks (3 Hrs.)
Tutorial: 1 Hr/week	**Term Work:** 25 Marks

Course Objectives:

1) To understand the properties of different materials and their application in different machine components.
2) To understand behavior of machine elements such as beams, columns and shafts under various types of loads including impact loads.
3) To understand & calculate the types of stresses and strains and their distribution in various machine elements and the concept of strain energy.

Course Outcomes:

At the end of this course, Students will be

1) able to calculate the stresses, strains of machine elements under different loading conditions such axial, transverse and torsion.
2) able to determine the strain energy stored in the machine element and calculate the associated deflection.

Section-I

Unit 1: Simple Stresses and Strains (06 Hrs)

Concept of stress and strain (tensile, compressive & shear), linear & lateral strains, Volumetric strain, Hooke's law, complementary shear stress, Elastic constants and their relationships, stresses and strains in three dimensions, Stress-Strain diagram for ductile and brittle materials, determination of stresses, strains and deformation in determinate homogeneous and composite bars under concentrated loads, self weight and temperature changes, factor of safety & working stress.

Unit 2: Torsion of Circular Shafts (04 Hrs)

Theory of torsion of circular shafts, assumptions, derivation of torsion formulae for solid and hollow circular shafts, determination of torsional shear stress and angular twist for solid, hollow, homogeneous and composite circular shafts in power transmission applications, shafts in series and parallel under torsion.

Unit 3: Shear Force and Bending Moment Diagrams for Beams (05 Hrs)

Concept and definition of shear force and bending moment in determinate beams due to concentrated loads, UDL, UVL and couples (analytical method only for cantilevers, simply supported and overhanging beams), relation between shear force & bending moment diagrams and determination of points of contraflexure and point of maximum bending moment.

Unit 4: Principal Stresses and Strains (05 Hrs)

Normal and shear stresses on any oblique planes, concept of principal planes, principal stresses and maximum shear stress (2-D cases only), planes of maximum shear, derivation of expressions to determine principal stresses, maximum shear stress, positions of principal planes and planes of maximum shear for various cases of loading (2-D only), graphical method of Mohr's circle of stresses, stresses due to combined torsion, bending and axial force on shafts.

Section-II

Unit 5: Bending and Shear Stresses in Beams (07Hrs)

a) Bending Stresses in Beams : Symmetric pure bending of beams, assumptions and sign conventions. Derivation of flexure's formula, moment of resistance and section modulus for commonly used cross sections (solid & hollow circular, rectangular, symmetrical and unsymmetrical I-sections, T-sections etc.), determination of bending stresses and bending stress distribution diagram for the beams.

b) Shear Stresses in Beams: Concept of shear stress in beams subjected to bending, derivation of shear stress distribution formula, maximum and average shear stress, determination of shear stresses and shear stress distribution diagram for beams with commonly used sections like circular, symmetrical and unsymmetrical I-section, T section, L-section etc.

Unit 6: Slope and Deflection of Beams (05 Hrs)

Concept and definitions of slope and deflection, slope and deflection relations by double integration method for cantilevers and simply supported beams subjected to point loads and UDL for standard cases only. Use of moment area method to determine slope and deflection for cantilevers and simply supported beams carrying point loads and UDL only.

Unit 7: Axially Loaded Columns (05 Hrs)

Concept of critical load and buckling, crippling and crushing stress, Euler's theory, assumption made & sign conventions. Derivation of Euler's formulae for buckling load for columns having various end connections, concept of equivalent length, limitations of Euler's formula, Slenderness ratio, safe load on a column, Rankine's formula for critical load of any column, determination of crippling load using Euler's and Rankine's formulae.

Unit 8: Strain Energy and Impact Load (03 Hrs)

Concept of strain energy or resilience, strain energy in tension and compression for axially loaded members due to gradual, sudden and impact loads, strain energy due to shear stress, strain energy due to torsion, proof stress and modulus of resilience.

TERM WORK

Term work shall consist of **eight assignments** on the units given below. Assignment must include a few theory questions along with different varieties of problems and objective questions.

List of Assignments:

1. Simple stresses and strains
2. Torsion of circular shafts
3. Shear force and bending moment diagrams for beams
4. Principal stresses and strains
5. Bending and shear stresses in beams
6. Slope and deflection of beams
7. Axially loaded columns
8. Strain energy

Text Books:

1. Rajput R. K., Strength of materials, S. Chand & Co.Ltd., New Delhi
2. Bansal R.K., Strength of materials, Laxmi publications (P) Ltd., New Delhi

Reference Books:

1. Basu A. R., Strength of materials, Dhanpat Rai & Co. (P) Ltd., Delhi
2. Khurmi R. S. & Gupta J. K., Strength of materials, S. Chand & Co.Ltd., New Delhi
3. Ramamrutham S., Strength of materials, Dhanpat Rai & Co. (P) Ltd., Delhi
4. Beer and Johnson, Strength of materials, Mc-Graw Hill International student series
5. Timoshenko & Young, Strength of materials, CSB Publishers

S.E.Mechanical Part-I

2. APPLIED THERMODYNAMICS

Teaching Scheme
Theory: 3 Hrs/week
Practical: 2 Hr/week

Examination Scheme
Theory: 100 Marks (3 Hrs.)
Term Work: 25 Marks
Oral Exam: 25 Marks

Course Objectives:

1. To study fundamental laws of Thermodynamics and its real life applications.
2. To study and analyze power producing devices used in practice such as boilers and turbines.
3. To study Power consuming devices used in practice such as compressor and their analysis.

Course Outcomes:

At the end of this course, the student will be able to

1. apply fundamental concepts of Thermodynamics to solve real life problems.
2. identify problems & analyse power producing and consuming devices.

Section-I

Unit 1: First Law of Thermodynamics – Analysis **(04Hrs)**

Review of basic concepts

Applications of throttling process:

1. Throttling calorimeter 2. Refrigeration 3. Liquefaction of gases.

Transient flow processes:

1. Charging of a cylinder 2. Discharging of a cylinder.

Chemically reacting system:

1. Fuels & combustion
2. The standard enthalpy (heat) of reaction, the standard enthalpy of formation.
3. Standard enthalpy of combustion.
4. Effect of temperature on standard heat of reaction.
5. Adiabatic flame temperature.

(Numerical treatment)

Unit 2: Second Law of Thermodynamics – Analysis. **(06 Hrs)**

Limitation of first law of thermodynamics, cycle heat engine, refrigerator and heat pump, Kelvin- Plank and Clausius statements and their equivalence, Reversibility and Irreversibility, Carnot cycle, Carnot theorem, Absolute thermodynamic temperature scale, Clausius inequality, calculation of entropy change for:

i) Absorption of energy by a constant temperature bath
ii) Heating OR cooling of matter.
iii) Phase change
iv) Adiabatic mixing
v) Change of state of an ideal gas.
vi) Mixing of non – identical gases.

Principle of entropy increase, T – S diagram, Second law analysis of a control volume, available energy, availability.

(Numerical treatment)

Unit 3: Performance of Boilers **(05 Hrs)**

Classification, constructional details of high pressure boilers, Evaporation,equivalent evaporation, Boiler efficiency, heat losses in boiler plant & heat balance
(Numerical treatment)

Unit 4: Vapour Power Cycles: **(05 Hrs)**

Classification of cycles, vapour power cycles, carnot vapour power cycles, simple Rankine cycle, actual Rankine cycle, Effect of operating conditions on Rankine cycle efficiency, Ideal reheat cycle, Ideal regenerative cycle, supercritical Rankine cycle (Numerical treatment).

Section-II

Unit 5: Steam Nozzles **(05 Hrs)**

Types of Nozzles, flow of steam through nozzles, condition for maximum discharge, expansion of steam considering friction, super saturated flow through nozzles, General relationship between area, velocity and pressure.

Unit 6: Steam Condensers **(05 Hrs)**

Condensers and Cooling Towers:- Elements of steam condensing plants, advantages of using condensers, types of condensers, thermodynamic analysis of condensers, efficiencies, cooling towers.

Unit7:Steam Turbines **(05 Hrs)**

Steam Turbines:- Advantages and classification of steam turbines, simple impulse turbine, compounding of steam turbines, parson's reaction turbine, velocity diagrams, work one done and efficiencies, losses in turbines.

Unit 8: Reciprocating Air Compressors **(05 Hrs)**

Uses of compressed air, classification of compressor, constructional detail of single & multistage compressor, types of compressor valves, computation of work, isothermal work done, isothermal efficiency, effect of clearance, volumetric efficiency FAD, theoretical & actual indicator diagram, method of improving volumetric efficiency, need of multistage, work done, volumetric efficiency, condition for maximum efficiency, inter cooling & after cooling, (Numerical treatment).

TERM WORK

Group – I

Any Three Assignments on following topics

1) Study of process boilers (Cochran, Babcock & Wilcox, Lancashire)
2) Boiler mountings & accessories
3) Study of various types of steam calorimeters
4) Lubrication – Necessity, types of lubricants, properties of
Lubricants
(oil & Greases), Selection of lubricants

Group – II

Any Six Experiments of following:

1) Cloud & Pour point of a lubricant
2) Flash & Fire point
3) Test on carbon residue
4) Trial on Redwood viscometer
5) Trial / Study of Bomb calorimeter
6) Test on grease penetrometer & dropping point apparatus
7) Trial on reciprocating air compressor.
8) Trial on steam calorimeter
9) Industrial visit to any process / power industry

Text Books:

1. An introduction to Thermodynamics – Y.V.C. Rao – Universities Presss,
2. A Course in Thermal Engineering – Domukundwar Kothandraman Dhanpat Rai & Co. Delhi.
3. Thermal Engineering R . K. Rajput – Laxmit Publication – New Delhi (Sixth Edition)
4. Basic & Applied Thermodynamics" by P.K. Nag Tata Mcgraw Hill Publication

Reference Books:

1. Thermodynamics by C.P. Arora TMH New Delhi 1998 edition
2. Thermodynamics & Heat Engine – Vol 1 & Vol 2 – R. Yadav Central Book Depat.
3. Thermodynamics Cengel Boles Tata McGraw Hill New Delhi.
4. R. Yadav, Steam & Gas Turbines CPH Allahabad.

S.E. Mechanical Part-I

3. ENGINEERING MATHEMATICS-III

Teaching Scheme	Examination Scheme
Theory: 3 Hrs/week	**Theory:** 100 Marks (3 Hrs.)
Tutorial: 1 Hr/week	**Term Work:** 25 Marks

Course Objectives:

1. To introduce the concepts of differential calculus, vector calculus and complex variables.
2. To apply the knowledge of these methods to solve practical engineering problems. To introduce statistical techniques for data analysis and decision making.

Course Outcomes:

At the end of the course the students will be able to-

1. Formulate and solve ordinary, partial differential equations and vector calculus for engineering problems.
2. Perform data analysis using statistical tools.

Section-I

Unit 1: Linear Differential equations (05 Hrs)

Linear Differential equations with constant coefficients (without method of variation of parameters).

Unit 2: Cauchy's Homogeneous and Legendre's Linear Differential equations (05 Hrs)

Applications to Mechanical Engineering problems related to Thermodynamics, Heat transfer and fluid mechanics.

Unit 3: Partial Differential equations (05 Hrs)

Four standard forms of Partial Differential equations of first order. Solution of partial differential equations by method of separation of variables.

Unit 4: Vector Calculus (05 Hrs)

Differentiation of vectors, tangent line to the curve, velocity and acceleration, Gradient, Divergence and Curl of vector field, Solenoid, irrotational and conservative vector field.

Section-II

Unit 5:Functions of Complex variables (06 Hrs)

Analytic functions , Cauchy's Riemann equations, Harmonic functions, Line integral, Cauchy's integral theorem, Cauchy's integral formula.

Unit 6: Probability distribution functions
(04Hrs)

Discrete and continuous random variables, probability distribution of random variables, Binomial distribution, Poisson distribution, Normal distribution.

Unit 7: Sampling Theory-I (05 Hrs)

Sample & population, Parameter of statistics & Standard error .Sampling Distribution, Critical region, Level of significance, Test of significance and confidence interval, one tailed and two tailed test. Test of significance of large samples - (1) Test of significance for single proportion, (2) Test of significance for difference proportion, (3) Test of significance for single and double means.

Unit 8: Sampling Theory-II **(05 Hrs)**

t-distribution & its properties, test of significance of small samples: 1) t-test of significance for single mean and (2) t-test of significance for difference mean. Chi-square distribution, Probability distribution function of Chi- square. Chi- square test of goodness of fit. Chi-square test for independence of attributes, 2x2 contingency table and Yates correction for continuity for 2x2 tables.

TERM WORK

At least eight assignments on the above mentioned syllabus.

Text Books:

1. J.N. and P.N. Wartikar, "A textbook of Applied Mathematics Vol. I and Vol. II", Vidyarthi Grah Prakashan, Pune.
2. B.S.Grewal, "Higher Engineering Mathematics", Khanna Publications, Delhi..
3. Jaggi and Mathur, "Advanced Engineering Mathematics", Dhapatrai and Sons, Bhopal.
4. N.P. Bali, Ashok Saxena and N.Ch. S.N Iyengar, "A textbook of Applied Mathematics", Laxmi Publications, Delhi.

Reference Books

1. Kreyzig, "Advanced Engineering Mathematics", John Wiley, New York.
2. S.G Gupta, "Fundamental of statistics", Himalaya publishing House.
3. Peter O Neil, "Engineering Mathematics", CRC Press.

S.E.Mechanical Part-I

4. MACHINE TOOLS & PROCESSES

Teaching Scheme	Examination Scheme
Theory: 3 Hrs/week	**Theory:** 100 Marks (3 Hrs.)
Practical: 2 Hr/week	**Term Work:** 25 Marks

Course Objectives:

1. To study the conventional machining processes such as drilling, milling, shaping, planning carried out on typical machine tools for different applications.
2. To study unconventional machining processes such as EDM, ECM and USM carried out on special purpose machine tools for typical applications.
3. To compare and select a suitable manufacturing process.

Course Outcomes:

At the end of this course, the student will

1. exhibit a knowledge of conventional, unconventional & modern machining processes and machine tools.
2. be able to select proper manufacturing process for the typical application.

Section-I

UNIT – 1 Introduction to Manufacturing processes: **(02Hrs)**

- Classification of manufacturing processes.
- Metal removal processes, principle, cutting motions, basics of metal cutting

UNIT – 2A Centre lathe: **(06 Hrs)**

- Main parts and their functions, specifications, accessories and attachments.
- Lathe operations, processing of simple component on lathe.

UNIT – 2B Capstan and Turret lathes: **(04 Hrs)**

- Principle parts, working, comparison with center lathe
- Capstan lathe vs. Turret lathe, mechanisms, tool holders.
- Introduction to Automats

UNIT – 2C Drilling machine: **(03 Hrs)**

- Classification, construction and working of Pillar type and radial drilling machines.
- Job holding devices and accessories, various operations.

UNIT – 3 Shaper, Plainer and slotting machine: **(03 Hrs)**

- Principle, types, specifications, operations on shaper.
- Types of planers, standard double housing plainer, construction, and operations.
- Introduction to construction and working of slotting machine.

UNIT -4 Unconventional Machining **(04 Hrs)**

- Introduction, classification, significance of Unconventional machining.
- Electrical discharge machining (EDM), Electrochemical Machining (ECM), Ultrasonic machining (USM)
- Principle, working, applications, advantages, limitations.

Section-II

UNIT – 5A Milling machines: **(07Hrs)**

- Classification of Milling machines, construction and working column and knee type milling machines.
- Milling methods – Up milling and down milling,
- Gear cutting on milling machines, indexing methods.

UNIT – 5B Boring machine: **(02 Hrs)**

- Horizontal and vertical boring machines, construction and working.
- Boring tools and bars, Jig boring machines.

UNIT – 6 Grinding machines: **(04 Hrs)**

- Classifications – Cylindrical, Center less, Surface grinder etc.
- Selection mounting, glazing, loading, truing, balancing.

UNIT –7 Gear manufacturing processes: **(02 Hrs)**

- Gear Hobbing, gear rolling.
- Gear finishing processes – gear shaving, gear burnishing.

UNIT – 8A Broaching machine: **(02 Hrs)**

- Classification, various operations, advantages and limitations.
- Study of Pull and Push type broach.

UNIT – 8B Introduction to CNC machines: **(01 Hrs)**

- Construction and working of CNC machine tools, types.

TERM WORK

1. Setting the lathe machine for taper turning by swiveling compound rest.
2. Setting the lathe machine for taper turning by set over of tail stock and taper turning attachment.
3. Setting the lathe machine for thread cutting operation.
4. Tool layout and processing of one simple component on capstan lathe.
5. Study and demonstration of attachments on milling machine.
6. Study and demonstration of various types of milling cutters.
7. Setting the milling machine for gear cutting operation.
8. Setting the Hobbing machine for gear cutting operation.
9. Study and demonstration of various types of grinding wheels and their specifications
10. Visit to at least one machine shop and one CNC shop

Note: Any Eight of the above exercises are expected. Journal based on above exercises shall be prepared by the Students.

Text Books:

1. Workshop Technology (Volume II) by Hajra Chowdhary.
2. Workshop Technology (Volume II) by Raghuvanshi
3. Production Technology (Volume II) by Gupte-Patel.
4. Workshop Technology (Volume II) by W.A.J.Chapman.
5. Manufacturing Technology-P.N.Rao Vol. II

Reference Books

1. Machining and Machine tools-A.B.Chatopaddhyay – Wiley India
2. Production Technology by P.C.Sharma. Production Technology – HMT Handbook.
3. Manufacturing Process and System-Phillip Ostwald and Jairo Munoj-Wiley India
4. Production Technology – HMT Handbook

- Question paper shall cover all the topics mentioned under section I and section II, as well under the heading ***TERM WORK***.

S.E. (Mechanical) Part-I

5. MACHINE DRAWING

Teaching Scheme:
Lectures: 3 hrs/week
Drawing: 4 hrs/week

Examination Scheme:
Theory Paper: 100 marks (4 hrs. duration)
Term work : 50 marks

Course Objectives

1 To understand & use the principles and requirements of drawing practices as per BIS standards
2 To interpret and apply technique for making assembly from the detail/components
3 To interpret and apply, limits, fits and tolerances to the various machine elements
4 To introduce drafting software

Course Outcomes:

At the end of this course, the student will be
1. able to create drawings as per BIS standards
2 . enabled to apply technique for assembly drawing from the detail/components
3 .able to incorporate limits, fits and tolerances for components on the working/engineering drawings.
4 . familiar in using drafting software

Note: 1.The first angle method of projection should be followed.
2. Practicals to be completed using suitable drafting package.
3. The practical & oral examination should be based on the syllabus of both the Semesters SE Part-I & II

UNIT-1 Basics of Machine Drawing & B.I.S. Conventions - (02Hrs)

Basics of Machine Drawing

Types of drawing, Dimensioning **:-** Placing of dimensions, Functional and Non-functional dimensions, Dimensioning common features like: Circular Arcs, Diameters, Holes, Angles, Chamfers, Tapers, Undercut, Repetitive features, Countersunk, Square, Sphere, Across flat, Threads, etc.

UNIT-2. Study of B.I.S. (Bureau of Indian Standards) Conventions- (04Hrs)

Significance and importance of BIS Conventions, Drawings sheet sizes and layout recommended by BIS. Conventional representation of engineering *Materials,* spur helical and bevel gears, worm and worm wheel, rack and pinion, gear assemblies, type of helical, disc and leaf springs. Internal and external threads, square head, spline shaft, diamond knurling BIS conventions for sectioning, type of sections, exceptional cases. BIS methods of linear- and angular dimensioning. Symbolic representation of welds as per BIS. Surface finish symbol.

UNIT-3. Free Hand Sketching of machine component (08Hrs)

Importance of sketching and entering proportionate dimensions on sketches. Free hand sketches of various types of threads, nut, bolts (square and hexagonal flanged nuts, lock nuts, dome nut, capstan nut, wing nut, castle nut, split pin, square headed bolt, cup headed bolt, T-headed bolt, Rag foundation bolt, stud, washer. Various types of rivets and riveted joints, Various types of keys, Socket and spigot (Cotter joint) , Knuckle (pin) joint, Muff coupling, Protected and unprotected Flanged, coupling, universal coupling, solid and bush bearing. Plummer block (pedestal bearing), foot step bearing. Flat and V-belt pulleys, Fast and loose pulleys, speed cone pulleys, Pipe joint for C.I. Flanged, socket and spigot type pipe joint. Union pipe joint and standard pipe-fitting. The applications of above machine components.

UNIT-4.Auxiliary Projections **(04Hrs)**

Projection on auxiliary vertical and horizontal plane, Auxiliary projection of simple machine components. Combination with missing view.

UNIT-5. Production Drawing: Limits, Fits, & Tolerances- **(06Hrs)**

Dimensional Tolerances : Introduction to system of limits and fits. Basic concepts. Terminology**,** Tolerances, various types. Necessity of Limit system, Unilateral and Bilateral Tolerances, Relation between Tolerances and Manufacturing Processes, Methods of indicating tolerances on drawings, IT grades, Types of fits, Grades of tolerances, types of Holes & shafts based on fundamental deviations, designation of fit, Systems of fits, Selection of fits, Selection of tolerances based on fits

.**Geometrical Tolerances:-** Need of Geometrical Tolerances, Terminology, Tolerances for Single Features such as Straightness, Flatness, Circularity, Cylindricity. Tolerances for Related Features such as Parallelism, Perpendicularity, Angularity, Concentricity, Tolerance Symbol and Value, Indicating Geometrical Tolerances on drawings.

Surface Finish:- Surface Texture, Surface Roughness Number, Roughness Symbols, Range of Roughness obtainable with different manufacturing processes.

(Numericales /calculations/problems/tasks/examples/theoretical questions on UNIT NO. 4)

UNIT-6. Details and Assembly Drawing **(07Hrs)**

To prepare detail drawings from given assembly drawing. To prepare assembly drawing from given drawing of details. Preparation of detailed drawing from the given details such as: Tools post of center lathe, Tail stock, Cross head Assembly, Jigs and fixtures, connecting rod and piston of I.C. Engines, Gland and stuffing box and many more suitable/considerations with moderate difficulty level, etc.

Selection and showing of all the symbols & surface finish symbols, fits, tolerances for dimensions to details and assembly drawings.

UNIT-7. Introduction to Computer Aided Drafting
(to be completed using suitable drafting package) **(06Hrs)**

There with elementary treatment on 2D Drawing .

1. Basic commands to draw 2-D objects like line, circle, arc, ellipse, polygon etc.
2. Edit & Modify commands : Erase, extension, break, fillet, chamfer, trim, scale, hatching etc.
3. Dimensioning & text commands
4. Viewing and other : Zoom , pan, block etc.
5. 2D–mechanical elemental drawing

UNIT-8. Computer Aided Drafting(to be completed using suitable drafting package) **(03Hrs)**

Modify commands and additional commands like snap, otrack, etc.

Isometric Drawing and Plotting of drawing using various viewports, layout etc.

TERM WORK

Sheet no. 1. Based on Basic of drawing & dimensioning along with BIS conventions mentioned in Unit No.1

Sheet no. 2: Based on Free hand sketches, drawing of various machine components mentioned in Unit No. 2

Sheet no. 3. Based on Auxiliary Projection Drawing.

Sheet no. 4. Based on Production Drawing.(Dimensional and Geometrical Tolerances)

Sheet no.5 : To draw details drawing from given assembly (With limits, fits, tolerances)

Sheet no. 6 .To draw assembly drawing from the given details drawing (limits, fits, tolerances)

Sheet no. 7. Computer aided drafting (2D) of two simple components and print out.

Sheet no. 8 Computer aided drafting (2D) of isometric drawing and print out.

BOOKS

Text Books:

1. P.S. Gill, Machine Drawing., S.K. Kataria and Sons , Delhi.
2. N. D. Bhatt,. Machine Drawing. Charotor Publication House, Bombay.
3. N. Sidheshwsr . P. Kannaiah and V.V. S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.
4. George Omura.,Mastering Auto CAD, BPB Publications.
5. K.L.Narayana, P.Kanniah, & K.V. Reddy , " Machine Drawing ".SciTech Publications (India Pvt. Ltd.) Chennai

Reference Books:

1. IS: SP46- Engineering drawing practice for schools and colleges, B.I.S. Publications.
2. IS: 696- Code of practice for general engineering drawings B.I.S. Publications.
3. IS : 2709-Guide for selection of fits, B.I.S. Publications.
4. IS:919- Recommendation for limits and fits for Engineering, B.I.S. Publications
5. IS: 8000- Part I, II. III. TV, geometrical tolerencing of technical drawings -- B.I.S. Publications.
6. Ajeet Singh, "Working with AutoCAD 2000", Tata McGraw Hill.

Exam. Scheme :

Question paper will contain one compulsory question – objective question for 20 Marks.

Question paper will contain one compulsory question on Unit No. 6 for 30-35 Marks.

Question paper will NOT contain any question on Unit No. 7 & 8

6. COMPUTER PROGRAMMING IN C++

Teaching Scheme
Theory: 1 Hrs/week
Practical: 2 Hr/week (2hrs.)

Examination Scheme
Term Work: 25 Marks
***Practical & Oral:** 50 Marks

Course Objectives:

1. To develop and enhance the programming skills amongst the students in general as well as application of it in the field of mechanical engineering.
2. To introduce an object oriented programming language.

Course Outcomes:

At the end of this course, the student will be able to

1. Develop algorithms for solving problems using object oriented language.
2. apply their knowledge and programming skills to solve various computing problems in the field of mechanical engineering.

UNIT-1 **(02Hrs)**

Introduction: Basic concepts, Benefits, object-oriented languages, Applications.

UNIT-2 **(03Hrs)**

C++ Programming basics: Operators, I / O statements, Control statements

UNIT-3 **(03Hrs)**

Classes & Objects: Introduction, Difference between structures & classes, Declaration of class, defining the object of a class, Data members, Member functions, accessing a member of a class.

UNIT-4 **(02Hrs)**

Constructor & Destructor: Default constructor, Parameterized constructor, constructor with default parameter, Copy constructor, Dynamic constructor, Destructor.

UNIT-5 **(02Hrs)**

Functions: Reference arguments, Overloaded functions, Inline functions, Function with default arguments, Returning by reference, Friend functions, Static variable & static member functions.

UNIT-6 **(02Hrs)**

Inheritance: Derived class & base class, Over riding member functions, Public & Private inheritance, Types of inheritances.

TERM WORK

1) Minimum 2 programs on Input/Output & arithmetic expressions, hierarchy of operators, Branching and loop control statements

2) Minimum 2 programs using inline function & function overloading.

3) Minimum 1 program on structures.

4) Minimum 1 programs on Class & Objects

5) Minimum 2 programs on Constructor – Destructor.

7) Minimum 2 programs on Inheritance

(***Practical & Oral:** Compilation and execution of any one program on above syllabus)

Text Books:

1) Let us C++ - Yashwant Kanitkar (BPB Publication).

Reference Books:

1) Object Oriented Programming - E. Balguruswami (Tata McGraw hill Publication)

2) Object oriented programming in C++ by Rajesh Shukla (Wiley India Publications)

S. E. (Mechanical) Part – I

7. WORKSHOP PRACTICE – II

Teaching Scheme:
Practical: 2 Hours / week

Examination Scheme:
Term Work: 25 marks
Practical Exam: 6 Hours

Course Objectives:

1. To get hands on experience of machining techniques such as grinding, drilling, shaping, turning etc. studied in theory subjects.
2. To develop skills to operate different machine tools.

Course Outcomes:

At the end of this course, the student will be able

1. to operate different machine tools such as grinders, lathes, drilling machines etc.
2. to machine the component as per specified dimensions.

1. Tool Grinding – Demonstration and actual grinding to understand the tool geometry **(02 turns)**

2. One composite job in M.S. consisting of 2 components and inclusive of following operation shall be performed by students:
   Turning, Step turning, taper turning, Chamfering, Grooving, and Threadcutting, Knurling, drilling, Boring.
   At least one dimension of the job shall carry close tolerance **(06 turns)**

3. Inspection of the job performed (by the student) **(01 turns)**

4. Preparation of process sheet for the above job **(02 turns)**

Note:

- Practical examination of 6 hours duration at the end of term.
- Students shall perform one composite job consisting of two pieces, having minimum
  six operations on lathe.
- Students shall prepare a work book involving brief write up regarding machine/machines employed for job, calculation related to taper turning, calculations related to change gear train required for threading shall be part of work book. Along with this work book shall contain drawing and process sheet of the job and inspection report of the job.
- Based on the job performed, attendance record, work book, internal viva, faculty members may evaluate the term work.

Books:

1. Workshop Technology (Volume II) by Raghuvanshi.
2. Workshop Technology (Volume II) by Hajra Chowdhary.
3. Workshop Technology (Volume II) by W.A.J.Chapman.
4. Production Technology by P.C.Sharma.
5. Production Technology – HMT Handbook.
6. Production Technology (Volume II) by Gupte-Patel.

S.E. Mechanical Part-II

1. THEORY OF MACHINES - I

Teaching Scheme	Examination Scheme
Theory: 3 Hrs/week	**Theory:** 100 Marks (3 Hrs.)
Practical: 2 Hrs/week	**Term Work:** 25 Marks

Course Objectives:

1. To Understand Kinematics and Dynamics of different mechanisms and machines.
2. To Select Suitable Mechanisms for a particular application.

Course Outcomes:

At the end of this course, the student will be

1. able to understand the basic concepts of machines and able to understand constructional and working features of important machine elements.
2. able to design and incorporate various mechanisms in developing machines.

Section-I

Unit 1 : Simple Mechanisms **(03 Hrs)**

Kinematic links, kinematic pairs, classification, kinematic chain, Types of constrained motion, structure, mechanism & machine, Inversion, Inversions of Four bar chain, Single slider crank chain and double slider crank chain, degrees of freedom, Kutzbach's and Grubler's criteria for plane mechanisms, Grashoff's law for four bar mechanism.

Unit 2 : Velocity and acceleration in mechanisms **(07 Hrs)**

Velocity and acceleration analysis in mechanisms by following graphical methods.

i) Instantaneous centre method.

ii)Relative velocity and relative acceleration method, Corioli's component of acceleration.

iii) Klein's construction method for slider crank mechanism.

Unit 3 : Mechanisms with lower pairs **(05 Hrs)**

Pantograph, Exact straight mechanisms, derivations for Scott-Russel's, Peaucellier, Hart's mechanisms. Approximate straight line mechanisms – Derivations for Watt's, Grashopper, Tchebicheff mechanisms, Steering mechanisms- Davis & Ackerman steering mechanisms, condition for correct steering, Hooke's joints (Single & Double).

Unit 4 : Kinetic analysis of mechanisms **(05 Hrs)**

Analytical method for velocity & acceleration in slider crank mechanism, inertia force & torque, D'Alembert's principle, dynamically equivalent system, force analysis of reciprocating engine mechanism.

Section-II

Unit 5 : Cams **(05 Hrs)**

Types of cams and followers, cam nomenclature, follower motions, displacement, velocity and acceleration diagrams for following motions of the follower

i) Uniform velocity ii) Simple harmonic motion iii) Uniform acceleration & retardation.

iv) Cycloidal motion v) Oscillatory follower

Construction of cam profile for radial cams with different types of followers, spring load on follower, jumping of follower.

Unit 6 : Friction **(06 Hrs)**

Types of friction, laws of friction, friction between screw and nut, screw jack, torque required to lift or lower the load, efficiency of screw jack, Overhauling & self locking screws, Square

threads & V-threads, friction in journal bearing, friction circle, friction in pivot & collar bearings, friction clutches – single disc, multiple disc clutches, cone clutch, centrifugal clutch, design considerations of clutch.

Unit 7 : Brakes **(04 Hrs)**

Classification of brakes, band brake, band & block brake, internal & external shoe brakes, design considerations of brakes.

Unit 8 : Governors **(05 Hrs)**

Types of governors – Watt, Porter & Hartnell governors, sensitivity, stability & isochronism, hunting of governor, governor effort, power and controlling force diagram of governors.

TERM WORK

Term work shall consist of any Six assignments of the following.

1. Velocity & acceleration problems by relative velocity & acceleration method on drawing sheet.
2. Problems on instantaneous centre method and Klein's construction on drawing sheet.
3. Verification of ratio of angular velocities of shafts connected by Hooke's joint.
4. Drawing the cam profile by plotting displacement, velocity & acceleration diagrams on drawing sheet.
5. Experiment on Watt, Porter & Hartnell governors to study governor characteristics.
6. Study of friction clutches.
7. Study of brakes

Text Books:

1. Ballaney P. L., Theory of Machines, Khanna Publications, New Delhi
2. Khurmi R. S. & Gupta J. K., Theory of Machines, S. Chand publications, New Delhi.
3. Bansal R. K., Theory of Machines, Laxmi publications, New Delhi.
4. Phakatkar H. G., Theory of Machines –I & II, Nirali publication, Pune
5. V.P. Singh, Theory of Machines, Dhanpat Rai & Sons Co. Pvt. Ltd., Delhi.

Reference Books:

1. Rattan S. S., Theory of Machines, Tata Mc Graw Hill publication,New Delhi.
2. Shigley J., Theory of Machines & Mechanisms, Mc Graw Hill International students edition.
3. Thomas Bevan, Theory of Machines, CBS publication, New Delhi

S.E.Mechanical Part-II

2. MANUFACTURING PROCESSES

Teaching Scheme	Examination Scheme
Theory: 3 Hrs/week	**Theory:** 100 Marks (3 Hrs.)
Practical: 2 Hrs/week	**Term Work:** 25 Marks

Course Objectives:

1. To study the fundamentals of conventional manufacturing processes such as casting, forming and joining processes and their applications.
2. To develop the ability to select a process from the recent manufacturing practices.

Course Outcomes:

At the end of this course

1. The student will develop a sound knowledge & use the various manufacturing processes.
2. The student will have the ability to choose the appropriate processes for manufacturing a product.

Section-I

UNIT-1 Casting Processes: (06Hrs)

Basic steps in casting processes, Importance and uniqueness of casting as a manufacturing process, advantages and limitations of casting process. General introduction to patterns, Core boxes and Gating systems. Types of patterns, Cores, Core boxes, materials used, Allowances, selection criteria. Components of gating system, functions of each part, function of riser, types of risers, method to improve efficiency of risers.

UNIT- 2A Moulding and core making processes: (07Hrs)

Green Moulding sand, its ingredients and properties, facing sand, backing sand, shell sand, CO_2 sand, Oil sand cores, and core making, CO_2 core making, shell core making, cold box process of core making. Green sand moulding (hand and machine moulding), shell moulding, CO_2 process.

Introduction to special casting techniques, such as Investment casting, centrifugal casting, continuous casting, gravity and pressure die casting processes.

UNIT –2B Melting and pouring: (03 Hrs)

Melting furnaces used in C.I. foundries, i.e. Cupola, Induction furnace construction and working in brief, metallurgical control, Arc furnaces used in steel foundries, Crucible, oil and gas fired furnaces, Pouring equipments.

UNIT – 2C Fettling, Cleaning and Inspection of Castings: (01 Hrs)

Need for fettling, stages in fettling, equipments used in fettling and cleaning of castings. Common important defects in castings. Inspection procedure.

UNIT – 3 Computer applications in foundry processes, foundry Mechanization. (01 Hrs)

UNIT- 4 Processes for Plastics (03 Hrs)

Injection moulding, Extrusion, Blow moulding, Compression moulding (Preliminary treatment only)

Section-II

UNIT – 5A Introduction to forming process, classification of forming processes **(01Hrs)**

UNIT – 5B Rolling process: **(03 Hrs)**

Rolling mills, classification, hot rolling, rolling of billets, rods, sections, sheet, and tube rolling, cold rolling of sheets.

UNIT – 6 Forging processes: **(03 Hrs)**

Advantages of forging processes over other processes, basic forging equipments.
Open die forging, closed die forging, drop forging, cold heading etc.

UNIT – 7A Extrusion: **(02Hrs)**

Types – direct extrusion, indirect extrusion, impact extrusion, hydrostatic extrusion.

UNIT – 7B Wire rod and tube drawing: **(02 Hrs)**

Wire drawing process, single pass and multi pass wire drawing, wire drawing bench. Methods of rod and tube drawing.

UNIT – 8 Introduction to Joining processes: **(08 Hrs)**

Welding processes, such as gas welding, arc welding, submerged arc welding, TIG welding, MIG welding, resistance welding. Gas cutting, Plasma arc cutting etc. Brazing and soldering.

TERM WORK

1. Exercise on pattern and core box design, & drawing, for a simple component
   (Drawing on sheet expected)
2. Testing of silica sand for grain fineness and clay content.
3. Testing of green sand for green compression strength, permeability, moisture content.
4. Study of mould and core hardness tester.
5. Study of manufacturing sequence of any one forged product.
6. Study of manufacturing sequence of any one rolled product.
7. Visit to Foundry unit.
8. Visit to Forging shop
   (Journal based on above term work)

Text Books:

1. Heine, Lopar, Rosenthall, Principles of Metal Casting
2. N.D.Titov ,Foundry Practice
3. P.L.Jain, Principles of Foundry Technology
4. P.N.Rao, Manufacturing Technology: Foundry, Forming and Welding
5. Production Technology by P.C.Sharma

Reference Books:

1. Manufacturing Processes and systems by Phillip F.Ostwald, Jairo Munoz –Wiley India
2. Fundamentals of modern Manufacturing by Mikel P.Groover-Wiley India

- Question paper shall cover all the topics mentioned under section I and section II, as well under the heading ***TERM WORK***.

S.E. Mechanical Part-II

3. FLUID MECHANICS

Teaching Scheme
Theory: 3 Hrs/week
Practical: 2 Hrs/week

Examination Scheme
Theory: 100 Marks (3 Hrs.)
Term Work: 25 Marks
Oral Exam: 25 Marks

Course Objectives:

1) To understand principles of Fluid Mechanics governing the behavior of fluid at rest and in motion.
2) To provide the student the necessary analytical skills to solve and analyze a variety of fluid mechanics related problems.

Course Outcomes:
At the end of this course, the student will have

1. An ability to identify, formulate and solve problems related to fluid at rest and fluid in motion.
2. Knowledge of contemporary issues in the area of fluid mechanics.

Section-I

Unit – 1 : Fluid statics **(04 Hrs)**

Center of pressure, Total pressure on immersed surfaces – horizontal, vertical, inclined & curved surfaces. The principle of buoyancy, Archimedes principle, conditions of equilibrium for submerged & floating bodies, discussions on stability, Meta-center & meta centric height.

Unit – 2 : Fluid kinematics **(06 Hrs)**

Langrangian & Eulerian method of description of fluid flow, Types of flow – steady & unsteady flow, uniform & non-uniform, laminar & turbulent, one, two and three dimensional, rotational & irrotational, compressible & incompressible. Streamlines, path lines & streak lines, velocity components, local & convective acceleration, velocity potential function, equipotential lines, Laplace equation governing potential flow, stream function, continuity equation in Cartesian co-ordinates.

Unit – 3 : Fluid dynamics **(07 Hrs)**

Euler equation along a stream line & Bernoulli's equation, applications of Bernoulli's Theorem : Pitot tube, venturi meter, orifice meter. Flow through sharp edged small circular orifices,
Determination of hydraulic coefficients of an orifice. trajectory of liquid jets

Unit – 4 : Laminar flow **(03 Hrs)**

Laminar flow between parallel plates, laminar flow through circular pipes, relation between pressure & shear forces.

Section-II

Unit – 5 : Flow through pipes **(08 Hrs)**

Major & minor Energy losses, Darcy-Weisbach & Chezy's equation, Moody's diagram, loss of head in pipe connections & fittings, equivalent pipe, hydraulic gradient & total energy line, flow through pipes in series & parallel. Siphon pipe, efficiency of power transmission, maximum transmission of fluid power through a given pipe.

Unit – 6 : Dimensional analysis & similitude, boundary layer theory (05 Hrs)
Buckingham's Π theorem, similitude, modeling. Introduction to boundary layer theory, displacement & momentum thickness, boundary layer separation & control.

Unit – 7 : Drag & lift on immersed bodies (05 Hrs)
Drag on bodies, effect of viscosity on drag, development of lift on thin flat plate, airfoil shapes, lift & drag on airfoil, stall on airfoil.

Unit – 8 : Introduction to Computational Fluid Dynamics (02 Hrs)
Introduction, governing equation, discretisation of equations, Grid generation, method of solution & an example case, CFD models & softwares

TERM WORK

Compulsory:

1) Numerical & theoretical assignment on basics of fluid mechanics (Properties of fluids & related laws)
2) Study of Manometers.

Candidates should conduct at least seven practical among the following in the laboratory and submit the report of their work as term work.

1. Flow visualization by plotting streamlines (Halleshaw apparatus)
2. Determination of metacentric height
3. Drawing flow net using electrical analogy method
4. Steady flow through orifice.
5. Verification of Bernoulli's theorem.
6. Calibration of venturimeter.
7. Calibration of orifice meter.
8. Determination of hydraulic coefficients of orifice
9. Reynold's experiments.
10. Determination of coefficient of friction for G.I. pipe, P.V.C. pipe, M.S.pipe.
11. Pipes in series & parallel.
12. Determination of velocity profile for laminar flow through circular pipe.
13. To plot the pressure and velocity distributaries over an air foil and cylindrical & rectangular shape model.

Text Books:

1. Dr. P.N. Modi and Dr. S.M. Seth - Hydraulics and Fluid Mechanics including Hydraulic Machines, Standard Book House.
2. Dr. R.K. Bansal - Fluid Mechanics and Hydraulic Machines - , Laxmi Publication Pvt. Ltd., New Delhi.
3. Streeter, Wylie, Bedford - Fluid Mechanics, McGraw Hill Publication.
4. R.K. Rajput - A Text Book of Fluid Mechanics – S Chand Publications.

Reference Books:

1. Robert Fox, Philip Pritchard, Alan McDonald Introduction to Fluid Mechanics, Wiley India Publication
2. Merle Potter, David Wiggert, Bassem Ramadan ,Mechanics of Fluids, Cengage Learning Publications
3. Munson Young, Okiishi, Huebsch, Fundamentals of Fluid Mechanics, Wiley India

Publications
4. White - Fluid Mechanics, McGraw Hill Publication
5. Irving Shames - Mechanics of Fluid, McGraw Hill Publication
6. Murlidhar - Advanced Fluid Engineering, Narosa Publication.
7. Narayan Pillai, C Ramakrishanan, Principles of Fluid Mechanics & Fluid Machinery
8. John Anderson, Computational Fluid Dynamics, Mc Graw Hill

S.E (Mechanical)-Part-II

4. NUMERICAL METHODS

Teaching Scheme: 3 lectures/week
Practical : 2hour / week

Examination Scheme:
Theory -100 marks
Term work : 25 marks.

Course Objectives

1. To introduce numerical methods for solving linear and non-linear equations.
2. To apply the knowledge of these methods to solve practical problems with suitable software.
3. To introduce numerical methods for evaluating definite integrals.

Course Outcome

At the end of the course the students are able to-

1. Identify, classify and choose the most appropriate numerical method for solving a problem.
2. Solve the Mechanical Engineering problems using software's.

SECTION-I

Unit1: Solution of Algebraic and Transcendental Equations: **(6Hrs)**

Introduction, Basic properties of equations. Bisection Method, False position Method, Newton-Raphson Method, Multiple Roots, Newton's iterative formula for obtaining square root, Muller's Method.System of non linear equations by Newton Raphson Method.

Unit 2: Solution of linear simultaneous Equations: **(7Hrs)**

Direct Methods- Gauss Elimination Method, Gauss Jordan Method, Method of Factorization. Iterative Methods- Jacob's Method, Gauss-Seidal Method.
Eigen values and Eigen vectors (complex Eigen values), Power Method.

Unit 3: Statistics **(2Hrs)**

Coefficient of correlation and lines of Regression of bivariate data

Unit 4: Curve Fitting: **(5Hrs)**

Least squares curve fitting- Fitting a straight line, Non linear curves. Interpolation- Lagrange's interpolating polynomials, Newton's divided difference Interpolating polynomials.

SECTION-II

Unit 5: Numerical Integration **(6Hrs)**

Numerical Integration using Newton's Cote's formulae- Trapezoidal rule, Simpson's $1/3^{rd}$ rule, Simpson's $3/8^{th}$ rule, Weddels rule, Gaussian Quadrature, Romberg Integration, and Double Integration.

Unit 6: Numerical solutions of ordinary differential equations: **(6Hrs)**

Simultaneous first order differential equation by Picards method and Runge-Kutta Method (fourth order).
Boundary value problems-Finite difference method and Shooting method

Unit 7: Numerical Solutions to Partial Differential Equations:-I (4Hrs)

Elliptic Equations, Laplace Equations, Liebmen Methods, Secondary Variables, Boundary Conditions.

Unit 8: Numerical solutions to Partial Differential Equations:-II (4Hrs)

Parabolic Equations, Explicit Method, Implicit Method, Crank Nicolson Method.

Term Work

- Minimum eight Assignments based on above mentioned syllabus. The students are expected to solve the given problem by using the appropriate program given to them by C programming/ Matlab/ Scilab or any suitable software in practical session.
- The theory paper shall contain only the numerical based on syllabus. No computer program will be asked in the theory examination.

TEXT BOOKS

1. Dr.B.S Grewal, "Numerical Methods", Khanna Publications - New Delhi.
2. S.S.Shastry, "Introductory mothods of Numerical Analysis" - PHI Learning Publication
3. S. Arumugam, A Somasundaram and A Thangapandi Issac, "Numerical Methods" – SCITECH Publication.
4. P Kandasamy , K Thilagavathy, K Gunavathi, Numerical Methods- S Chand Publication.

REFERENCE BOOKs

1. M. K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Methods for scientific and engineering computations - New Age International Ltd.
2. Robert J. Schilling, Sandra L. Harris, Applied Numerical Methods for Engineers (using MATLAB and C) - Cengage Publications.

S.E. Mechanical Part-II
5. ELECTRICAL AND ELECTRONICS TECHNOLOGY

Teaching Scheme	**Examination Scheme**
Theory: 3 Hrs/week	**Theory:** 100 Marks (3 Hrs.)
Practical: 2 Hrs/week	**Term Work:** 25 Marks

Course Objectives:

1) To understand essential concepts and applications of electrical drives.
2) To understand concept of electrical heating and welding.
3) To understand and analyze digital circuits.
4) To understand working of signal conditioner and operational amplifiers.
5) To understand concept of microprocessor and microcontroller.
6) To simulate some of above systems using suitable simulation tools.

Course Outcomes:

1) Students are able to select the electrical drives for different mechanical processes.
2) Students understands concept of electrical heating and welding.
3) Students are able to analyze digital circuits.
4) Student understands the concepts and working of microprocessor and microcontroller.
5) Student can simulate above circuits using simulation software and can interpret results.

Section-I

Unit 1: Direct Current Motors: (05 Hrs)

Principal of motor action, significance of back emf, comparison of generator and motor action, types, characteristics, torque equation of direct current motors, speed control methods and their comparison, necessity and types of starters.
(Numerical exercises on torque and speed control.)

Unit 2: Three Phase Induction Motors: (06 Hrs.)

Concept of rotating magnetic field, working principle and construction and types of three phase induction motor , concept of slip , torque equation , starting torque , condition for maximum starting torque , torque under running condition , condition for maximum running torque , torque slip characteristics , starting of three phase induction motors ,types of starters-direct online , resistance starter, auto transformer starter, star delta starter.
(Numerical exercises on torque and slip.)

Unit 3: Special Motors and Selection of Motors: (04 Hrs.)

Working, construction, types and characteristics of single phase induction, universal, shaded pole, brushless dc, linear induction, stepper and servo motor. Group and individual drive, selection of motors.

Unit 4: Electrical Heating and Welding: (05 Hrs.)

Introduction to electrical heating, advantages, modes of heat transfer, types of electrical heating equipment-direct resistance heating, indirect resistance heating, direct induction heating, indirect induction heating, dielectric heating, electrical arc heating, infrared heating, properties of heating element, design of heating element. Electrical welding, resistance and arc welding.(Numerical exercises on design of heating element.)

Section - II

Unit 5: Digital circuits: (05 Hrs.)
Combinational and Sequential logic, Flip flops, shift registers, memory and counters.

Unit 6: Signal Conditioning Fundamentals: (05 Hrs.)
Need for signal conditioning, definition & symbol of operational amplifier, ideal characteristic, block diagram representation of operational amplifier ,electrical amplification (gain) operational amplifier as an adder, substractor, integrator, differentiator, comparator, instrumentation amplifier, analog to digital converter, digital to analog converter.

Unit 7: Microprocessor 8085: (03 Hrs.)
Elements of a microprocessor based system, the Intel 8085 architecture, types of memory. Evolution of the microprocessor from 8085 till today, difference between microprocessor and microcontroller.

Unit 8: Microcontroller 8051: (07 Hrs.)
Architecture and features, addressing modes, instruction set, interrupts, Microcontroller based process controller (ON-OFF Controller).

TERM WORK

- Term work shall consist of minimum four experiments from each section based upon-

Section-1

1. Speed control of dc shunt motors by flux control method.
2. Speed control of dc shunt motors by armature voltage control method.
3. Load test on dc shunt motor.
4. Break load test on dc motor.
5. Study of starters used for dc shunt motors.
6. Load test on three phase induction motor.
7. Study of starters used for three phase induction motor.

Section-2

1. Operational Amplifier as adder and subtractor.
2. Operational Amplifier as differentiator and Integrator.
3. Operational Amplifier as level detector (Comparator).
4. Implementation of Flip flops using basic gates using simulation software.
5. Implementation of counters in using simulation software.
6. Implementation of registers in using simulation software.
7. Implementation of simple arithmetic and logical operations using using simulation software / 8051 / Atmel AVR microcontroller

Text Books:

1. Text book of Electrical technology Volume II , 21st revised edition, B.L. Theraja, S. Chand publications.
2. Digital Design, 3/E, by M. Morris Mano (PHI).
3. Modern Digital Electronics, 3/E, by R. P. Jain (TMH).

Reference Books:

1. Electrical Power, S.L. Uppal, 13th edition, Khanna Publishers, Delhi.
2. Fractional and sub-fractional horse power electric motors, Veinott and Martin 4th Edition McGraw-Hill Publications Electrical and Mechanical Engineering Series.
3. Op-amps and Integrated circuits, 4th edition By Ramakant Gaikwad (PHI).
4. Digital Principles & Applications, 6/E, by Leach, Malvino.
5. Ramesh Gaokar,Microprocessor,Architecture,Programming and applications,Penram International Publications Ltd.
6. Kenith J Ayala , 8051 Microcontroller Architecture Programming & Applications.

S.E. (Mechanical) Part-II

6. COMPUTER AIDED MACHINE DRAWING

Teaching Scheme:
Lectures: 1 hrs/week
Practical: 2 hrs/week

Examination Scheme:
Practical & Oral Exam : 50 marks
Term work : 50 marks

Course Objectives

1. To develop the ability to use drafting software
2. To provide brief introduction to computer graphics techniques/tools of 2D and 3D modeling

Course Outcomes:

At the end of this course, the student will be able to

1. Use drafting software
2. apply computer graphics techniques/tools of 2D and 3D modeling for communicating effectively.
3. to carry out applications using modern engg. tools.

Note: 1.The first angle method of projection should be followed.
2. Practicals to be completed using suitable drafting package.
3. The practical & oral examination should be based on the syllabus of both the Semesters SE Part-I & II

1. **Details and assembly drawing (2D)** **(02Hrs)**
   To prepare detail drawings from given assembly drawing.
   To prepare assembly drawing from given drawing of details. The no. of parts is twelve to fourteen.
2. **Interpenetration of Solids (3D)** **(02Hrs)**
   Introduction of box, prism, cylinder, cone, pyramid, sphere etc. Slice/sections of 3D solid entities. Interpenetration of solids with each other with possible combinations.
   Auxiliary Projections : Projection on auxiliary vertical and horizontal plane, Auxiliary projection of solid/solid sections/3D entity/simple machine components.
3. **Computer aided drafting (3D)** **(03Hrs)**
   Three dimensional drawing, UCS & three dimensional co-ordinates. Viewing in three dimensions, Three dimensional modelling.- Wire drawing, Surface modeling & Solid modeling, Editing of solids, Three dimensional Booleans operations.
4. **Details and assembly drawing (3D)** **(02Hrs)**
   To prepare detail drawings from given assembly drawing.
   To prepare assembly drawing from given drawing of details. The no. of parts is twelve to fourteen.
5. **Introduction to lisp programming :** **(02Hrs)**
   Concept of parametric programming, Need and importance of lisp programming. Data types in lisp: Integers, Real numbers, Strings, Symbols, Lists and File Descriptors. Data types conversions: Integer to real, string list, real to integer, string lists. Reading and writing to the screen by using visual lisp consoles.
6. **Inputs in lisp Programming:** **(03Hrs)**
   Get functions for user input. Use of lists and the entities: Filtering from lists, editing/ modifying the lists, entity managing and modifying the entities. Arithmetic and Logical Functions: Additions, Subtraction, Multiplication, Division, sorting the data for deciding maximum and minimum numbers, remainders, exponential operation, trigonometric functions, AND, OR etc. Decision-making and looping in Autolisp, File handling

functions (changing the properties of AutoCAD entities). Block attributes and extracting the attribute data.

7. Application of lisp programming : (01Hrs)

Study of innovative program to draw an animated mechanism by using lisp programming

8. Introduction and Study of Visual lisp programming : (01Hrs)

Basics and application programs on the same.

TERM WORK

Following assignment sheets should be completed with Computer aided drafting & printouts / plots should be taken :

Assignments based on computer aided drafting (Using suitable software):

Sheet no. 1 Computer Aided Drafting (2D)- To draw details drawing & assembly drawing (Assembly of ten to twelve components with use of layers, in drawing fit, tolerances, machining symbol etc. and plotting the same)

Sheet no. 2. Sheet based on interpenetration of solids (3D)

Sheet no. 3: Sheet based on sections/slice of solids and auxiliary view (3D)

Sheet no. 4 :.Computer Aided Drafting (3D)- To draw details drawing & assembly drawing (Assembly of ten to twelve components with use of layers, fit, tolerances, machining symbol etc. and plotting the same)

Assignments based on lisp programming:

Print outs of the programs & output results should be attached

1) a)Introductory programs such as programs to draw geometric figure or their combinations with changes in the type of input. Such programs should have use of arithmetic functions, data conversions, filtering from lists.
   b)Parametric Programming such as- Program to draw a profile, generated after getting the data from user such as profile of cam, profile of gear tooth, profile of points present on moving links mechanisms etc.
2) a) Programs for Decision making
   b) Programs with logical functions
3) Study of innovative program to draw an animated mechanism by using lisp programming (mechanisms such as slider crank, four bar, cam- follower etc.)
4) Introduction and Study of Visual lisp, application program on the same.

Text Books:

1 Ajeet Singh, "Working with AutoCAD 2000", Tata McGraw Hill.
2 George Omura , "ABC of Autolisp " BPB Publications, New DelP.S. Gill, Machine Drawing., S.K. Kataria and Sons , Delhi.
3. George Omura.,Mastering Auto CAD, BPB Publications.
4. N. D. Bhatt,. Machine Drawing. Charotor Publication House, Bombay.
5 .N.Sidheshwsr .P.Kannaiah & V.V.S. Sastry. Machine Drawing, Tata McGraw Hill, New Delhi.
6 K.L.Narayana, P.Kanniah, & K.V. Reddy , " Machine Drawing ".SciTech Publications (India Pvt. Ltd.) Chennai

Reference Books:

1. IS: SP46- Engineering drawing practice for schools and colleges, B.I.S. Publications.
2. IS: 696- Code of practice for general engineering drawings B.I.S. Publications.
3. IS : 2709-Guide for selection of fits, B.I.S. Publications.
4. IS:919- Recommendation for limits and fits for Engineering, B.I.S. Publications
5. IS: 8000- Part I, II. III. TV, geometrical tolerencing of technical drawings -- B.I.S. Publications.
6. R.K. Dhavan, Machine Drawing., S. Chand and Company.

Examination Scheme: Practical & Oral Exam : 50 marks

Practical examination will be with suitable computer aided drafting software, where student will be asked to draw and print the output of any of the following –

1. Computer Aided Drafting (2D)- drawing details drawing (components with use of layers, fit, tolerances, machining symbol etc. and plotting the same)
2. Computer Aided Drafting (2D)- assembly drawing (Assembly of components with use of layers, in drawing fit, tolerances, machining symbol etc. and plotting the same)
3. Task based on isometric drawing.
4. Task based on interpenetration of solids (3D)
5. Task based on sections/slice of solids and auxiliary view (3D)
6. Computer Aided Drafting (3D)- drawing details drawing (components with use of layers, fit, tolerances, machining symbol etc. and plotting the same)
7. Computer Aided Drafting (3D)- assembly drawing (Assembly of components with use of layers, in drawing fit, tolerances, machining symbol etc. and plotting the same)
8. Task based on various lisp programming.

Oral examination will be based on term work and syllabus content of - MACHINE DRAWING of S.E. (MECHANICAL) PART-I and COMPUTER AIDED MACHINE DRAWING of S.E. (MECHANICAL) PART-II.

S. E. (Mechanical) Part – II
7. WORKSHOP PRACTICE – III

Teaching Scheme:
Practical: 2 Hours / week

Examination Scheme:
Term Work: 50 marks

Course Objectives:
1. To get hands on experience in pattern making, joining processes and forming processes.
2. To develop skills in pattern making and sheet metal work

Course Outcomes:
At the end of this course, the student will be able
1. To develop the skills necessary for engineering practices like joining and forming processes.
2. To Choose and apply the appropriate methods for pattern making & sheet metal working.

1) Preparation of Wooden pattern (single piece) for a simple component:

Part A –
This shall cover –
Study of component drawing, preparing casting drawing, Allowance table, Pattern drawing, Deciding parting line & Deciding pattern making process.

Part B –
Actual manufacturing of pattern **(4 Turns)**

2) Study of gas welding & gas cutting equipments, Study of arc welding equipment, Study & demonstration of resistance welding, Study of various types of welding joints & demonstration of gas & arc welding,
Manufacturing of one job each of gas and arc welding **(4 Turns)**

3) Study of sheet metal operations like bending, shearing, lancing, perforating, punching etc...
One sheet metal job consisting of at least 3 operations. **(3 Turns)**
(Either performed manually or on press)

Demonstration:

4) Study of various hand forging operations like upsetting, drawing dawn, piercing, swaging etc…One job involving 3 operations. (Either performed manually or on press) **(4 Turns)**

5) Students should prepare a work book involves a process sheet for each job.

Text Books:
1. Heine, Lopar, Rosenthall, Principles of Metal Casting
2. N.D.Titov ,Foundry Practice
3. P.L.Jain, Principles of Foundry Technology
4. P.N.Rao, Manufacturing Technology: Foundry, Forming and Welding
5. Workshop Technology (Volume II) by W.A.J.Chapman.
6. Production Technology – HMT Handbook.

Reference Books:
1. Manufacturing Processes & systems by Phillip F.Ostwald, Jairo Munoz –Wiley India
2. Fundamentals of modern Manufacturing by Mikel P.Groover-Wiley India