PROPOSED SYLLABUS FOR

S.E. (MECHANICAL ENGINEERING)

w.e.f. 2009-2010
Part -I

<table>
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<tr>
<th>Sr. No.</th>
<th>Subject</th>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
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<td>Engineering Math-III</td>
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<td>Manufacturing Technology-I Lab.</td>
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Part -II

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<td>03</td>
<td>Manufacturing Technology-II</td>
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<td>Machine Drawing And CAD</td>
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<td>Fluid Mechanics &amp; Hydraulics Machines</td>
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<td>Electrical Technology</td>
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<td>07</td>
<td>Theory of Machines Lab.</td>
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Note:- L-Lectures, P-Practical, Th-Theory, TW-Term-work, Pr-Practical exam.

Minimum two tests should be conducted for each theory subject and average of best two tests should be considered.
UNIT - I  Linear Differential equations of Higher order – I  8 Hrs
1.1 Introduction to L.D.E. with constant coefficients
1.2 General solution of f(D)y = X, shortcut methods
1.3 Non-Homogeneous linear equations: i) Solution by Method of variation of parameters
   ii) Solution by Method of undetermined coefficients
1.4 Equations Reducible to L.D.E. with constant coefficients i.e.
   i) Cauchy’s Homogeneous linear equation
   ii) Legendre’ Linear equations

UNIT – II  Linear Differential equations of Higher order - II  6 Hrs
2.1 Simultaneous L.D.E. with constant coefficient
2.2 Symmetrical simultaneous equations
\[ \frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R} \] by i) Method of Grouping ii) Method of Multipliers.
2.3 Applications of L.D.E. : Free Oscillations, Damping free vibrations, Forced Oscillations with resistance and without resistance, beams and columns, whirling of shafts.

UNIT – III  Vector Differential Calculus  7 Hrs
3.1 Vector and Scalar functions, fields, derivatives
3.2 Gradient of Scalar field, Directional derivative and Geometrical meaning of gradient (Gradd\( \phi \) )
3.3 Divergence and curl of a vector fields
3.4 Solenoidal and Irrotational vectors
3.5 Second order diff operator and vector identifies

UNIT – IV  Vector Integral Calculus  7 Hrs
4.1 Line integral, Line integral independent of path, Line Integral in parametric form
4.2 Circulation of a vector [Work done]
4.3 Green’s Theorem [without proof] its verification and applications
4.4 Surface Integral, Stoke’s Theorem [without proof] and its applications
4.5 Gauss Divergence Theorem [without proof] and its applications to Engineering problems

UNIT – V  Statistics  6 Hrs
5.1 Corelation: Scatter diagram,Types of correlations
5.2 Karl Pearsson’s coefficient of correlation
5.3 Regression: Lines of regressions, Lines of regression of Bivariate data
5.4 Curve fitting: Fitting of curves by Least Square Method

UNIT – VI  Probability  6 Hrs
6.1 Introduction, Random variable
6.2 Discrete and continuous Probability Distributions
6.3 Bionomical Distribution
6.4 Poisson Distribution
6.5 Normal Distribution
Text Books

1. Advanced Engineering Mathematics by Erwin Kreyszing (Wiley Eastern Ltd.)

Reference Books:

1. Applied Mathematics (Volumes I & II) by P. N. Wartikar and J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
1) **Simple Stress and Strain** :- Concept of stress and strain (linear, lateral, shear & volumetric), Hookes Law, Elastic constants & their relationship, Stresses of varying section in step, circular and rectangular. Temperature stresses. [05hrs]

2) **S.F. and B.M. Diagram** :- Concept and definition of S.F. and B.M., S.F. and B.M. diagram for beams due to - Concentrated load, Uniformly distributed loads & Couple in determinate beams, Cantilever, Simply supported and Overhanging beams. [05hrs]

3) **Bending Stresses** :- Theory of simple bending, Concept and assumptions, Derivation of flexure formula, Bending stresses distribution diagram, Different IS steel section, Flitched beams, Design of a section. [04hrs]

4) **Shear Stress in Beams** :- Concept and derivation of shear stress distribution formula, Shear stress distribution diagram for symmetrical and unsymmetrical section. [04hrs]

5) **Torsion of Circular Shaft** :- Theory of torsion of shaft of circular cross section, Assumptions, Derivation of torsion formulae, Stress in shaft of hollow, solid, composite circular cross section subjected to twisting moments, Stresses due to combined torsion, bending and axial force on shaft, Flanged coupling. [05hrs]

6) **Principal Stresses and Strains** :- Normal & shear stress on any oblique plane & concept of principal plane, principal planes by analytical methods & graphical method. [05hrs]

7) **Thin Pressure Vessels** :- Stress, Strain and deformation in thin walled seamless cylindrical and spherical vessels due to fluid pressure. [03hrs]

8) **Strain Energy** :- Strain energy due to axial loads, impact loads. [03hrs]

9) **Deflection of Beams** :- Concept of deflection, Slope and deflection by double integration method (Macauley’s method). Slope and deflection for simply supported, cantilever and statically determinate beam. [04hrs]

10) **Axially Loaded Columns** :- Concept of critical load and buckling, Derivation of Euler’s formula for buckling load with various end conditions, limitations of Euler’s formula, Rankine buckling load, Safe load on column. [05hrs]

**Text Books:**
1) Strength of Material - S. Ramamurthum.
3) Strength of Material - Bhavikatti.

**Reference Books:**
3) Strength of Material - Timoshenko and Young.
## S. E. (Mechanical) Part-I

### 03 - Engineering Thermodynamics

#### Teaching Scheme

| Theory | 4 Hrs/Week |

#### Examination Scheme

| Test (I&II) | 20 Marks |
| Theory | 80 Marks |

#### Objectives:

- To understand concept of quantity and quality of energy
- To understand use of steam for power generation and process heating
- To apply fundamentals of engineering thermodynamics to compressors
- To analyze combustion products

### UNIT – I

**Fundamentals of Thermodynamics**: Introduction to variable specific heat, First Law and its limitations, SFEE on Mass & Time basis and its applications.

### UNIT – II


### UNIT – III


**Properties of steam**: Introduction Steam Generation Thermodynamic properties of steam & steam table, properties of wet & super heated steam, Mesurement of dryness fraction of steam (Numerical Treatment).

### UNIT – IV

**Thermodynamic Cycles**: Thermodynamic Cycles such as Carnot, Rankine, Otto, Diesel, Brayton & Vapour Compression Cycles (Analysis of above Cycles).

### UNIT – V


### UNIT – VI


### Reference Books:

2. Sonntag, Borgnakke & Von Wylen - Fundamental of Thermodynamics Wiley Publishing
S. E. (Mechanical) Part-I

04 - Manufacturing Technology – I

Teaching Scheme
Theory : 4 Hrs/Week

Examination Scheme
Test (I&II): 20 Marks
Theory : 80 Marks

Objectives:
- To understand the basic manufacturing process classification and use in mechanical engineering
- To acquire the knowledge of casting, metal forming and metal joining processes from the point of view of tools and equipments required, materials processed, process parameters
To get the practical exposure of utilization of manufacturing techniques for product making through practical and industry visit

Unit – I
Introduction:
Concept of manufacturing Process, its importance, Classification of manufacturing process, Types of production and layout.

Metal Casting Processes:
Introduction to casting process and steps involved. Verities of component produced by casting process. Advantages and limitations of casting process.

Pattern Making, Molding and Casting:
Sand casting, pattern types, materials, pattern making allowances, molding sand types, properties and testing, hand and machine molding process and equipments, core type and manufacturing.

Unit – II
Special molding and casting processes – Lost Foam Process, Shell Molding, Investment casting, die casting, Centrifugal casting, Continuous casting

Melting, Pouring and Feeding: Furnaces – Types – Cupola - Construction, operation, zones, chemistry, etc. Gating system,

Cleaning and Inspection of casting: Fettling, defects in casting. Inspection and Testing, NDT methods.

Unit – III
Design of casting:
Solidification and Cooling, Riser and Gating design, design consideration in casting.

Processing of Plastics:
Introduction of plastic molding – Various plastics molding processes and materials.

Unit – IV
Hot and Cold Working Processes:

Cold rolling, Swaging, Forging, Extrusion – forward, backward, impact, Roll Forming, Tube drawing, Wire drawing, Spinning, Shot peening, HERF.

Unit – V
Introduction to sheet metal working:
Joining Processes:
Weldability, fusion and pressure welding, gas welding, Arc welding – theory, SMAW, GTAW, GMAW, FCAW, Submerged arc welding, Stud welding.
Resistance welding – Theory, Spot, Seam, Projection welding process.
Unit – V
[06 Hrs]

Other welding Processes:
Friction welding, Ultrasonic welding, Thermit welding, Electron Beam and Laser welding,
Explosive and Plasma welding,
Soldering, Brazing, Brazed welding.
Physics of welding, Design consideration in welding

Text Books:
   (TMH)
   Processes”

Reference Books:
1. Heine R.W. – “Principles of Metal Casting”
3. R. Little - “Welding Technology”
S. E. (Mechanical) Part-I
05 - Mechanical Measurement And Metrology

Teaching Scheme
Theory : 4 Hrs/Week

Examination Scheme
Test (I&II): 20 Marks
Theory : 80 Marks

Objectives:-
- To understand the basic principles, construction and working of engineering mechanical measurement science.
- To acquire proficiency in using, calibrating various measurement systems.
- To understand the problems in measurement system and develop the competency to resolve the problems.
- To know all the measuring instruments and to measure different parameters in day-to-day work.

Mechanical Measurement

UNIT-I [08 Hrs]
1.1 Mechanical Measurement:
Need of mechanical measurement, Instruments, Measurement methods, Generalized measurement system, Static performance characteristics, Errors and their classification.
1.2 Transducers:
Classification and various types of transducers
1.3 Measurement of Strain:
Introduction, Classification of strain gauges, Gauge factor, Temperature compensation, Quarter, Half and Full Bridge circuit, Application to measurement of load/force, Torque.

UNIT-II [08 Hrs]
2.1 Measurement of Pressure:
Importance of pressure and vacuum measurement, Range of high pressure and vacuum, Bourdon tubes, Dead weight pressure gauge testers, Diaphragm gauge, LVDT, Piezoelectrical pressure gauge, McLeod gauge, Thermal conductivity gauge.
2.2 Measurement of Flow:
Importance of flow measurement, Water meter, Turbine meter, Rotameter, Air/Gas flow meter, Hot wire anemometer, Electromagnetic flow meter, Venturimeter, Pitot tube.
2.3 Temperature Measurement:
Importance of temperature measurement, Thermometers, Thermisters, Thermocouples and its laws, Pyrometers.

UNIT-III [04 Hrs]
3.1 Speed Measurement:
Importance of angular speed measurement, Tachometer-Mechanical and Eddy current type, Mechanical counter, Stroboscope, Non-contact type counters-Inductive pickup, capacitive pickup and photoelectric pickup.
3.2 Measurement of Force/Torque:
Spring balance, Proving ring, Multi-lever system, Dynamometer and its various types.
Metrology

UNIT-I [07 Hrs]

1.1 Introduction:
Definition, Linear measurement – Standards, Classification of standards, Vernier caliper, Height gauge, Depth gauge, Feeler gauge, Slip gauge, Micrometer.

1.2 Limits, Fits and Gauges:
Terminology, Definitions, Hole basis and Shaft basis system, Limit, Fits, Tolerances, Taylor’s principle of gauge design, Principles of gauge design (Simple numerical problems on limits of size, tolerances etc.), Types of gauges, Interchangeability, Selective assembly.

UNIT-II [07 Hrs]

2.1 Comparators:
Types and working principles of mechanical, pneumatic, electronic, optical, electrical comparators and their applications.

2.2 Interferometry:
Principles of interferometry, Sources of light, Optical flat, Fringe patterns, Toolmakers microscope, Profile projector.

2.3 Surface Finish Measurement:
Definitions, Surface texture terminology, Measurement of surface roughness, Symbols and values of surface roughness.

UNIT-III [06 Hrs]

3.1 Angular Measurement:
Bevel protractor, Sine bar, Sine center and table, Angle gauge, Clinometer, Autocollimator, Angle dekkor.

3.2 Metrology of Screw Threads / Gear Metrology:
Screw thread terminology, Screw thread micrometer, Floating carriage micrometer. Gear terminology, Measurement of tooth thickness by gear tooth vernier caliper.

3.3 Advances in Metrology:
Universal Measuring, Applications of LASER in measurement, Metroscope, Automatic inspection system.

Recommended Books:
5) Mechanical Measurement and control by D.S. Kumar
6) Mechanical Measurement by Beckwith & Buck - McGraw Hill publication
7) Mechanical Measurement by R.K Jain - Khanna publication, New delhi
8) Industrial Instrumentation – Donald P. Eckman – Wiley eastern Ltd.
9) Mechanical Measurement by Sorih &Dr. Radnakrishnan.
11) Engineering Metrology by Hume K. J.
UNIT-I Basics of Communication: [03 Hrs]
Definition, Elements of Communication, Cycle of Communication and Feedback; Types of Communication: Verbal and Nonverbal (Oral, Written, Graphic Language and Body Language), Upward and Downward, Formal and Informal; Media of communication: verbal, non-verbal and audio-visual, Principles of Effective Communication, Barriers of Communication.

UNIT-II Listening Skills: [03 Hrs]
Active Listening: Basic Principles, Listening and Note Making, Listening to Conversations from IELTS (Book 1)

UNIT-III Reading Skills: [02 Hrs]
Active Reading: Types: Skimming, Browsing, etc. Reading and Note Making, Comprehension.

UNIT-IV Speaking Skills: [04 Hrs]

UNIT-V Writing Skills: [04 Hrs]
Business Correspondence: Business Letters, Job Application Resume Paragraph (Technical, Business or General current issues) Reports.

UNIT-VI English Grammar and Vocabulary: [04 Hrs]
Tenses, Common Errors in English, Synonyms, Antonyms, One Word Substitution.

Reference Books:
01. Developing Communication Skills by Mohan and Krishna.Meera Banerji (New Delhi Macmillan)
02. Communication Skills for Effective Management by DR. Anjali Ghanekar (Everest Publishing House)
03. Communication Skills for Engineers by Sunita Mishra and C. Muralikrishna, (Pearson  Education)
04. Technical Communication by Meenakshi Raman and Sangeeta Sharma (Oxford University Press)
05. Basic Communication Skills by Rutherford A. (Person Education, New Delhi)
06. Communication Skills by B.V. Pathak (Nirali Publication)
08. English in situation by R.O. Neill (Oxford University Press)
09. Organizational Behavior by Fred Luthans (McGraw Hill)
10. Spoken English for India by R.K, Bansal.
11. English Grammar and Composition by Pal and Suri, (Sultan Chand & Son, Educational Publishers)
List of Experiments:-
The term work shall consist of following lab test on mechanical properties of material :
1) Tension test on M.S. and TOR bar (ductile and brittle material).
2) Bending test.
3) Shear test.
4) Torsion test.
5) Hardness test.
6) Impact test.
7) Fatigue test.

Practical Examination:-
It will consist of conduct of any one test mentioned above and subsequent oral.
### S. E. (Mechanical) Part-I

**08 - Engineering Thermodynamics Laboratory**

**Teaching Scheme**
- Practical: 2 hrs/week

**Examination Scheme**
- Term work: 25 marks
- Practical: 25 marks

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**List of Experiments:**
1. Trial on Petrol/Diesel Engine
2. Study of steam calorimeter
3. Trial on Air Compressor
4. Experimental Determination of Flash & Fire Point of Liquid Lubricant
5. Study of Simple Carburetor
6. Study of Fuel Pump & Fuel Injector
7. Study of Zenith Carburetor
8. Study of Bomb calorimeter

**Practical Examination:**
- It shall consist of Actual Experiment / Trial and Oral based on experiment assigned to the candidate.
**S. E. (Mechanical) Part-I**  
**09 – Manufacturing Technology-I Laboratory**

### Teaching Scheme

Practical: 4 hrs/week

### Examination Scheme

Term work: 25 marks  
Practical: 25 marks

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**Term work:**  
The term work should consists of Practical Jobs Mentioned in (A) and a journal consisting of contents in (B)

(A) Jobs  
1. Pattern making  
2. Mould and Core Making  
3. Arc Welding  
4. Gas Welding

(B)  
1. Study of Sand Testing Equipments  
2. Study of Cupola  
3. Study of Casting Defects  
4. Study of NDT methods  
5. Study of processing of Plastics (Any Four Methods)  
6. Study of Metal working processes: Hot, Cold and Sheet metal  
   (Two processes in each Category)  
   (While writing study assignments it is desirable to visit laboratory/industrial set up in addition to referring the text and reference books.)

**Practical Exam:**  
Any one job of 4 hours duration.
Mechanical Measurement (Any five)
8) Study of Generalized Measurement System with typical instrument.
9) Temperature measurement using Thermocouple, Thermister and Pyrometers.
10) Experiment on pressure measurement: U-tube manometer, Bourdon tube, Dead weight tester.
11) Flow measurement using Rotameter / Watermeter.
12) Angular speed measurement using stroboscope, pickups and tachometers.
14) Study of LVDT.

Metrology (Any five)
1) Study of precision measuring instruments for linear measurement.
2) Study of comparator of different types.
3) Experiment on sine bar for measurement of taper angle.
4) Study of autocollimator/angle dekkor
5) Study and applications profile projector and Tool maker’s microscope.
6) Measurement of screw thread using floating carriage micrometer.
7) Measurement of gear tooth thickness by gear tooth vernier caliper.
8) Assignment on design of gauges.
S. E. (Mechanical) Part-I
11 – Communication Skills Laboratory

Teaching Scheme
Practical: 2 hrs/week

Examination Scheme
Term work: 25 marks
Practical: 25 marks

List of Practicals:
1. Draw a communication cycle showing all the elements.
2. Convert the verbal and numerical data into the suitable nonverbal form.
3. Listen to the presentation by the faculty or student and make running notes.
4. Listen to the pre-recorded conversation and answer the questions based on it.
   (Ref. IELTS: Book 1: CD: 1 and 2.)
5. Read the given passage and answer the questions following it.
   (Ref. Books for CAT or IELTS)
6. Introducing Yourself (3 to 5 minutes)
7. Presentation for minimum 5 minutes on the given topic.
   (Current Issues or Technical Topics)
8. Situational English (Dialogues and Role-plays)
10. Mock-interview: Demo by expert panel.

Note: minimum 8 out of 11 should be conducted.
UNIT - I Laplace Transforms [08 Hrs]
1.1 Definition, Existence of L.T.
1.2 Properties with proof: Linearity, Change of scale, First shifting, Second shifting, Multiplication by t, Division by t, L.T. of derivative and integral
1.3 Inverse L.T., Methods of obtaining inverse L.T., Convolution Theorem
1.4 L.T. of special functions
   i) Unit (Heaviside) step function
   ii) Unit Impulse function (Dirac delta function)
   iii) Periodic functions

UNIT – II Application of L.T. [05 Hrs]
Applications of L.T. to
i) Initial value problems
ii) Simultaneous Linear equations
iii) L.T. Method for the solution of partial differential equations

UNIT – III Series solutions of differential equations & Special functions [09 Hrs]
2.1 Power Series Method, Theory of Power Series Method
2.2 Legendre’s Equations, Legendre’s Polynomials $P_n(x)$
2.3 Bessel’s Equation. Bessel Functions $J_\nu(x)$, Bessel Functions of the
   Second Kind $Y_\nu(x)$
2.4 Sturm-Liouville problems.

UNIT – IV Fourier Series [06 Hrs]
3.1 Fourier series: Definition, Dirichlet’s conditions, Euler’s formulae
3.2 Fourier series over $(0, 2\pi)$ Functions having points of discontinuity
3.3 Change of interval
3.4 Expansions of Even and Odd functions, Half range series

UNIT – V Partial Differential Equations [06 Hrs]
4.1 Solution of first order Linear equations (Lagrange’s equation)
4.2 Non-Linear first order equations
4.3 Method separation of variables

UNIT – VI Applications of P.D.E [06 Hrs]
Applications of P.D.E. to
i) Wave equation
ii) One dimensional heat flow equation
iii) Two dimensional heat flow equation(Laplace’s Equation)

Text Books
1. Advanced Engineering Mathematics by Erwin Kreyszing (Wiley Eastern Ltd.)
Reference Books:
1. Applied Mathematics (Volumes I & II) by P. N. Wartikar and J. N. Wartikar (Pune Vidyarthi Griha Prakashan, Pune).
Objective

- To make students conversant with commonly used mechanisms for industrial applications.
- To develop competency in drawing velocity and acceleration diagrams for simple and complex mechanisms.
- To develop analytical competency in solving kinematics problems using complex algebra methods.
- To develop competency in graphical and analytical methods for solving problems in static and dynamic force analysis.
- To develop competency in conducting laboratory experiment for finding moment of inertia of rigid bodies, verification of displacement relation for Hooke’s joint and kinematic analysis of planar mechanisms.

UNIT – I
Basic concept: Links, Kinematics pairs, Kinematics pairs giving one, two & three degrees of freedom, Kinematics chains, Degree of freedom & move ability criteria. Constrained kinematics chains as mechanisms. Inversions of four bar chains. Inversions of single & double slider crank chain & their applications.

UNIT – II
Motion Characteristics of Mechanisms: Velocity & Acceleration analysis of mechanisms with single degree of freedom system using graphical method. Instantaneous Center, Kennedy’s theorem, analysis of velocity of mechanisms using instantaneous centre method. Short cut methods- Klien’s, Bennetts & Ritterheu’s construction. Inertia force diagrams- dynamical equivalent systems.

UNIT – III
Gears: Classification, Gear Terminology, Law of Gearing, profiles used in gears, Length of path of contact, Arc of contact, contact ratio, Interference of involutes teeth, methods of preventing interference & under cutting.

UNIT – IV

UNIT – V
Gyroscope: Gyroscope couple and precision stabilization of ships & Air crafts only.
Governors: Introduction, types of governors- Porter, Proell & Hartnell governor. (Mathematical derivations & Analytical problems are not to be covered in Governors)

UNIT – VI
CAMS: Introduction, Types of Cams, Types of followers, Follower motions, viz. Simple Harmonic Motion, Constant Velocity, Uniform Acceleration & Retardation, Cycloidal motion, layout of Cam profile for specified displacement characteristics. Cams with Oscillating follower system.
Text Books.

Reference Books.
S. E. (Mechanical) Part-II
03 - Manufacturing Technology – II

Teaching Scheme
Theory : 4 Hrs/Week

Examination Scheme
Test (I&II): 20 Marks
Theory : 80 Marks

Objectives:
- To understand process of cutting shaping.
- To understand working principles for various machining processes.
- To understand construction, working and applications of various machine tools.
- To learn basic set up, working and applications of a few important non conventional machining processes.
- To get hand on experience on various machine tools.

Unit I [06 Hrs]

Metal Cutting: Types of cutting tools, Orthogonal & Oblique cutting, Mechanism of chip formation, Types of chips, Cutting forces in orthogonal cutting, Cutting tool nomenclature.

Unit II [06 Hrs]
Lathe: Types of Lathe, Constructional features of centre Lathe, Accessories & Attachments, Cutting tools, Operations performed on Lathe. Cutting Speed, Feed, Depth of Cut & Machining time calculations for lathe.
Limitations of Centre Lathe, Construction and working of Capstan & Turret Lathes.

Unit III [09 Hrs]
Shaping, Planing & Slotting Machines: Types, Parts, Construction & Working, Operations of Shaper & Planer, Cutting Speed, Feed, Depth of Cut & machining time calculations for shaper and planer.
Types of slotting machines, Operations.

Unit IV [05 Hrs]
Boring Machines: Horizontal, Vertical & Jig Boring Machines – Parts, tools & operations.

Unit V [10 Hrs]
Grinding: Introduction, Kinds of grinding, Types of grinding machines, Grinding wheel abrasives; Grit, grade & structure of wheels, Marking system, Selection of grinding wheels, Mounting the grinding wheels, Dressing & truing of grinding wheels, Principal operations.
Surface finishing processes like Lapping, Honing, Super finishing, Polishing, Buffing etc.

Gear Manufacturing: Gear cutting processes- Gear hobbing, gear shaping, gear milling, gear shaving & gear grinding, Construction & working of the machines.
Unit VI
[06 Hrs]
Non-Conventional Machining Processes: Need for NCMP's, Constructional features, Working & Applications of USM, EDM, ECM, LBM, CHM.

Text Books
2. P. N. Rao - Manufacturing Technology Metal Cutting & Machine Tools

Reference Books
1. P. C. Sharma - Production Engineering (Khanna Publishers)
2. R. K. Jain - Production Technology (Khanna Publishers)
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<tr>
<td>Unit -1</td>
<td>06 Hrs</td>
<td><strong>SECTIONS OF SOLIDS:</strong> Projection of solids in simple positions or having their axes inclined to one of the reference planes and cut by a section plane inclined to one of the reference planes, true shape of section.</td>
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<tr>
<td>Unit -2</td>
<td>06 Hrs</td>
<td><strong>DEVELOPMENT OF SURFACES:</strong> The development of lateral surface of solids or cut solids and composite parts.</td>
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<td>Unit -3</td>
<td>08 Hrs</td>
<td><strong>INTERSECTION OF SOLIDS:</strong> Line of intersection, intersection of Prism and Prism, Cylinder and Cylinder, Cylinder and Prism, Cone and Cylinder, Cone and Prism, Cone and Cone, Application of intersection of surfaces.</td>
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| Unit -4    | 06 Hrs   | **CONVENTIONS:** Conventional representations of standard machine parts along with their actual drawing: Conventional representation for surface finish, welded Joints; conventional representation of spur, helical, bevel and worm and worm wheel.  
**MACHINE PARTS:**  
a) Screwed fastening: Thread profiles, Locking arrangement of nuts, Foundation bolts.  
b) Pipe Joints Flanged, socket and spigot joints, hydraulic, Union joints, expansion joints and stuffing box.  
c) Riveted Joints: Single and Double Riveted Butt and Lap Joints.  
d) Keys, Cotter Joints, Pin Joints; Type of Keys, Cotter and Cotter Joints; Pin or Knuckle Joint.  
| Unit -5    | 10 Hrs   | **ASSEMBLY AND DETAIL DRAWING:** Assembly and Detail drawing with Complete Dimensioning, Tolerance, Materials and Surface finish Specification as per SP 46-1988.(To be dealt partially in practical) |
| Unit – 6   | 04 Hrs   | **INTRODUCTION TO SOLID MODELLING:** (To be dealt partially in practical)  
1. Types of modeling.  
2. Limitation of 2D modeling  
3. Limitation of wire frame modeling  
4. Need of Solid modeling  
5. Benefits of Solid modeling |
6. Representation of Schemes of Solid modeling
   a) CSG or C-rep
   b) B-rep
   c) Sweep
   d) Parametric Modeling
   e) Feature based Modeling

Text Books:
1. N.D. Bhat, V.M. Panchal  :-  Elementary Engineering Drawing
2. N.D. Bhat, V.M. Panchal  :-  Machine Drawing
4. VenuGopal, Narayana  :-  Production Drawing
S. E. (Mechanical) Part-II
05 – Fluid Mechanics & Hydraulics Machines

Teaching Scheme
Theory : 4 Hrs/Week

Examination Scheme
Test (I&II): 20 Marks
Theory : 80 Marks

OBJECTIVES:
- To understand the properties of fluids and their variation with respect to temperature and pressure which are useful in understanding mechanism of lubrication and design of bearings
- To calculate forces on different types of gates
- To know the details about metacentre & metacentric height in design of various floating bodies.
- To know the losses in flowing fluids in pipes & to design pipeline systems.
- To understand the basics of model and to test the prototypes with the help of model testing and similitude.
- To understand the momentum principles & its applications to various fluid machinery.

UNIT - I
FUNDAMENTALS OF FLUID MECHANICS: Properties of fluids, viscosity, Units of Viscosity, Measurement of Viscosity (Liquids only). Ideal & real fluids, compressible and incompressible fluids, compressibility and Elasticity, Surface Tension and capillarity.

UNIT - II
FLUID STATICS: Study of variation of pressure with respect to head forces acting on immersed plane surfaces. Centre of pressure and resultant force. Buoyancy force and centre of Buoyancy. Metacentric height and equilibrium conditions of floating bodies.
KINEMATICS OF FLUIDS: Visualization of flow patterns, Types of flow, Streamline and path line, Rotational and Irrigational flows.

UNIT - III
FLUID DYNAMICS: Euler’s equation of motion, Bernoulli’s equation, application of Bernoulli’s equation for orifice meter, Venturimeter and pitot tube. Vortex motion, Laminar and Turbulent flows concept of hydrodynamic boundary layer, flow through pipes, friction factor, Smooth and rough pipes. Loss in pipe due to fluid friction, other different losses. Design of single pipeline considering all losses.
DIMENSIONAL ANALYSIS: Dimensions of physical quantities in fluid mechanics, dimensionally homogeneous equations. Buckingham’s theorem and its use in finding dimensional parameters. Model analysis and testing.

UNIT - IV

UNIT - V
HYDRAULIC TURBINES: Classification of water turbines, the pelton wheel, velocity triangles, Turbine efficiencies, working properties of pelton wheel. Francis and Deriaz turbines, velocity triangles and efficiencies, the draft tube for turbine, principle of similarity applied to turbines, governing of turbines, cavitation in turbines.
UNIT - VI [06 Hrs]
PUMPS: Centrifugal pumps- construction and working. Classification, energy increase in fluids due to pump action. Fundamental principle, increasing pumping action, variation of head with discharge, energy losses in a pump, efficiency, principle of similarity and specific speed, characteristic of prisms, net positive suction head (NPSH), cavitation in pumps, self priming pumps, multistage pumps, propeller or axial flow pumps.

TEXT BOOKS:
1. FLUID MECHANICS AND HYDRAULIC MACHINES – Dr. R. K. BANSAL
2. HYDRAULITIES & FLUID MACHINES – Dr. P. N. MODI & SETH

REFERENCE BOOKS:
1. FLUID MECHANICS AND HYDRAULIC MACHINES – K. R. ARORA
2. FLUID MECHANICS AND HYDRAULIC MACHINES – Dr. D. S. KUMAR
3. FLUID MECHANICS AND HYDRAULIC MACHINES – R. K. RAJPUT
4. FLUID FLOW MACHINES – N. S. GOVINDA RAO
5. TURBOMACHINES – SHAMES
6. CENTRIFUGAL AND AXIAL FLOW PUMP – STEP ANOFF
7. HUDRAULIC MACHINES – JAGDISH LAL
8. HUDRAULIC MACHINES – V. P. VASAMDANI
S. E. (Mechanical) Part-II
06 – Electrical Technology

Teaching Scheme
Theory : 4 Hrs/Week

Examination Scheme
Test (I&II): 10 Marks
Theory : 40 Marks

Objectives:
- To give basic knowledge about electrical machines.
- To get an overall idea about controlling of electrical equipments and their applications.

UNIT – I  D. C. Machines : [10hrs]
    Constructional features, Operating principles Operation of D. C. Machine as generator, Different types as per excitation systems, EMF equation, Operation characteristics and applications.
    Operation of D. C. Machine as Motor, Classification, Importance of back e.m.f., Torque equation, Speed control, Operating characteristics of all type of motor applications, Types of starter, Starting and Reversing.

UNIT – II  Induction Motor : [08 Hrs]
Three Phase Induction Motor:- Operating principle, Constructional features and application., Slip, Power factor, Torque at starting & running, Maximum torque condition, Maximum torque, Losses, Efficiency, Torque-Slip characteristics.

UNIT – III  Miscellaneous : [06 Hrs]
Electrical Heating:- Advantages and disadvantages, Resistance heating, Arc heating, Induction heating, Dielectric heating, Practical set up for such methods and operating circuits, Types of furnaces.
Safety Consideration:- Grounding methods and maintenance, Probable faults, Available safety protective devices, Principle of relays and fuses.

Recommended Books:
3) Electrical Technology - B. L. Theraja.
List of Experiments:
1. Compound pendulum.
2. Study of at least Four inversions of each single slider & Double slider crank mechanisms.
3. To generate gear tooth profile and to study the effect of under cutting and rack shift using model.
4. To draw cam profile for various types of follower motion.
5. Experimental study of Governors.

List of Drawing Sheets.
1. Graphical solution to problems on velocity acceleration in mechanism by relative velocity and acceleration method including problem with Corioli’s component of acceleration at least 4 sheets on velocity & Acceleration diagram.
2. Velocity by instantaneous center method.
3. Klein’s construction for slider cranks mechanisms.
4. Inertia forces analysis with graphical method.
5. At least Two sheets consisting of 4 problems on Cams.
S. E. (Mechanical) Part-II
08 – Manufacturing Technology-II Laboratory

<table>
<thead>
<tr>
<th>Teaching Scheme</th>
<th>Examination Scheme</th>
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<tr>
<td>Practical: 2 hrs/week</td>
<td>Term work: 25 marks</td>
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<tr>
<td></td>
<td>Practical: 25 marks</td>
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**Term work**
1. Demonstration of various machine tools like lathe, drilling machine, milling machine, shaper, grinding machine etc.
2. Preparing jobs involving turning, taper turning, eccentric turning, drilling, thread cutting, milling, shaping operations. (Three jobs)

**Practical examination**
Machining a composite job requiring operations like turning, drilling, boring, threading, milling / shaping. [06 Hrs]
ASSIGNMENT ON DRAWING:
1. One sheet on Sections of solids (Minimum 4 problems)
2. One sheet on Development of surfaces. (Minimum 4 problems)
3. One sheet on Intersection of solids (Minimum 4 problems)
4. One sheet on Assembly Drawing
5. One sheet on Detail Drawing
   Assembly and detail drawings can be given from the following
   a) Tool head of a shaping machine
   b) Tail stock of Lathe
   c) Vices
   d) Boiler Valves
   e) Engine Parts
6. A sketchbook consisting of the drawings/sketches of the conventions and machine parts as mentioned in Unit-4 above.

ASSIGNMENT ON CAD:
1. To draw simple 2D sketches using any CAD software such as AutoCAD/ UniGraphics/ Catia/ ProE etc.
2. To draw a 2D sketch using advanced sketching tools using any CAD software such as AutoCAD/ UniGraphics/ Catia/ ProE etc.
3. To make a 3D model of simple machine component such as Bracket, Bearing Housing, Cast components like connecting rod, piston, etc. using any CAD software such as AutoCAD/ UniGraphics/ Catia/ ProE etc.
4. To make a 3D model of a machine component using advanced 3d tools in any CAD software such as AutoCAD/ UniGraphics/ Catia/ ProE etc.

PRACTICAL EXAMINATION:
It shall consist of oral and practical based on the syllabus prescribed above
TERM WORK:
The term work shall consist of a journal based on laboratory work, which will consist of at least 08 experiments out of the following:
(Minimum four from fluid mechanics and four from Hydraulic Machines)

FLUID MECHANICS:
1. Reynolds apparatus.
2. Verification of Bernoulli’s theorem – apparatus.
3. Orifice meter experiment.
4. Venturimeter experiment.
5. Flow through notches experiment.
7. Major & Minor losses on pipe.
8. Orifice, mouth piece.

HYDRAULIC MACHINES:
1. Pelton wheel.
2. Francis turbine.
4. Centrifugal pump.
5. Gear pump.
6. Torque converter.
7. Cavitation test.
8. Reciprocating pump.

PRACTICAL EXAMINATION:
It shall consist of oral and practical based on the syllabus prescribed above
List of Experiments (any seven) :-
1) Study of D. C. Machines.
3) Load test on D. C. Shunt generator.
4) Load test on D. C. Shunt motor.
5) Speed control of D. C. Shunt motor.
6) Load test on Induction motor.
7) Starting and Reversing of Induction Motor, D. C. Motor.

PRACTICAL EXAMINATION
The practical examination (inclusive of an oral) shall be based on laboratory experiments performed during the course.
The examination shall be of 3 hours duration