**BACHELOR OF ENGINEERING (FOUR YEARS DEGREE COURSE)**
**FACULTY OF SCIENCE & TECHNOLOGY**
**TEACHING AND EXAMINATION SCHEME WITH CHOICE BASED CREDIT SYSTEM**

## Course and Examination Scheme of Bachelor of Engineering (Mechanical Engineering)

## III Semester B.E. (Mechanical Engineering)

| Course Code | Course Title | Teaching Scheme | | | | Examination Scheme | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Hours per week | | | No. of Credits | Theory | | | | | | Practical | | | |
| | | L | T | P | | Duration of Paper (Hrs.) | Max. Marks | Max. Marks Sessional | | Total | Min. Passing Marks | Max. Marks | Max. Marks | Total | Min. Passing Marks |
| | | | | | | | ESE | MSE | IE | | | TW | POE | | |
| **ME 301** | **Applied Mathematics-III** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| **ME 302** | **Fluid Mechanics** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| **ME 303** | **Theory of Machines-I** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| **ME 304** | **Manufacturing Process-I** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| **ME 305** | **Engineering Metallurgy** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| | | | | | | | | | | | | | | | |
| **ME 306** | **Machine Drawing and Computer Graphics** | - | | 2 | 1 | - | **-** | **-** | **-** | - | - | **50** | **50** | 100 | 50 |
| **ME 307** | **Manufacturing Process-I** | - | - | 2 | 1 | - | **-** | **-** | **-** | - | - | **25** | **25** | 50 | 25 |
| **ME 308** | **Engineering Metallurgy** | - | | 2 | 1 | - | **-** | **-** | **-** | - | - | **25** | **25** | 50 | 25 |
| **ME 309** | **Industrial Visit** | - | - | 2 | 1 | Audit Course | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| | | 15 | 5 | 8 | 4 | - | | | | | | | | | |
| | | **28** | | | **24** | **-** | **400** | **50** | **50** | **500** | **-** | **100** | **100** | **200** | **100** |
| | | | | | | **700** | | | | | | | | | |

**BACHELOR OF ENGINEERING (FOUR YEARS DEGREE COURSE)**
**FACULTY OF SCIENCE & TECHNOLOGY**
**TEACHING AND EXAMINATION SCHEME WITH CHOICE BASED CREDIT SYSTEM**

## Course and Examination Scheme of Bachelor of Engineering (Mechanical Engineering)

## IV Semester B.E. (Mechanical Engineering)

| Course Code | Course Title | Teaching Scheme | | | | Examination Scheme | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Hours per week | | | No. of Credits | Theory | | | | | | Practical | | | |
| | | L | T | P | | Duration of Paper (Hrs.) | Max. Marks | Max. Marks Sessional | | Total | Min. Passing Marks | Max. Marks | Max. Marks | Total | Min. Passing Marks |
| | | | | | | | ESE | MSE | IE | | | TW | POE | | |
| **ME 401** | **Applied Mathematics-IV** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| **ME 402** | **Engineering Thermodynamics** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| **ME 403** | **Strength of Materials** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| **ME 404** | **Manufacturing Processes-II** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| **ME 405** | **Hydraulic Machines** | 3 | 1 | - | 4 | 3 | **80** | **10** | **10** | 100 | 40 | **-** | **-** | - | - |
| | | | | | | | | | | | | | | | |
| **ME 406** | **Manufacturing Processes-II** | - | - | 2 | 1 | - | **-** | **-** | **-** | - | - | **25** | **25** | 50 | 25 |
| **ME 407** | **Hydraulic Machines** | - | - | 2 | 1 | - | **-** | **-** | **-** | - | - | **25** | **25** | 50 | 25 |
| **ME 408** | **Strength of Materials** | - | - | 2 | 1 | - | **-** | **-** | **-** | - | - | **25** | **25** | 50 | 25 |
| **ME 409** | **Seminar** | - | - | 2 | 1 | - | **-** | **-** | **-** | - | - | **50** | **-** | 50 | 25 |
| | | | | | | | | | | | | | | | |
| | | 15 | 5 | 8 | 4 | - | | | | | | | | | |
| | | **28** | | | **24** | **-** | **400** | **50** | **50** | **500** | **-** | **125** | **75** | **200** | **100** |
| | | | | | | **700** | | | | | | | | | |

**Gondwana University, Gadchiroli**

**FACULTY OF SCIENCE & TECHNOLOGY**

# B.E. (MECHANICAL ENGINEERING): THIRD SEMESTER

## ME 301: APPLIED MATHEMATICS – III (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: | 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: | 80 Marks |
| | College Assessment: | 20 Marks |

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**Unit - I Laplace Transform** **[ 09 Hrs. ]**

Definition, Properties (statements only)., Inverse Laplace transform by partial fractions and convolution theorem. Solution of ordinary linear differential equations with constant coefficients by Laplace transforms.

**UNIT – II Numerical Method** **[ 09 Hrs. ]**

Soltion of algebraic and transcendental equations by False position method, Newton-Raphson method. Non linear simultaneous equations by Newton-Raphson Method. Solution of system of simultaneous linear equations by Gauss Jordan method, Gauss Seidel method, Crouts method.

**UNIT – III Numerical Method** **[ 09 Hrs. ]**

Solution of ordinary first order first degree differential equation by Taylor's series method, Runge Kutta 4th order method, Euler's modified method, Milne's Predictor Corector method. Largest Eigen values and corresponding eigen vector by iteration method.

**UNIT – IV Partial differential equation** **[ 09 Hrs. ]**

Linear Partial Differential Equations first order and first degree i.e. Lagrange's form, Linear homogeneous equations of higher order with constant coefficients Method of separation of variables.

**UNIT – V Fourier series** **[ 09 Hrs. ]**

Periodic functions and their Fourier series expansion, Fourier Series for even and odd functions, Change of interval, Half range expansions.

**TEXT BOOKS:**


1. Higher Engineering Mathematics - B. S. Grewal, Khanna Publications
2. Probability and Statistics - Murray R Spiege 13th Edition, Schaum's Outline Series
3. Higher Engineering Mathematics - H.K.Dass S.Chand


**REFERENCE BOOK:**


1) A Text Book of Engineering Mathematics - N.P. Bali and Manish
2) Numerical Methods for Engineers - Steven C. chapra & Raymond P. Canale

## ME 302: FLUID MECHANICS (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: 80 Marks |
| | College Assessment: 20 Marks |

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**UNIT – I** **[9 Hrs.]**

Introduction, Types of fluids, Properties of fluids, Newton's law of viscosity.

Pascal's law, Hydrostatic law, Fluid pressure & its measurements (simple & Differential Manometers)

Hydrostatics: - Pressure variations in compressible & incompressible fluids, Forces on submerged bodies.

**UNIT – II** **[9 Hrs.]**

Buoyancy, centre of Buoyancy, Metacentre, Metacentric height, Stability of floating and submerged bodies,

Kinematics of fluid flow:- Types of flow, Pathline, stream line, stream tube streak line, Continuity equation, Velocity Potential function & Stream function.

Dynamics of fluid flow: - Euler's equation of motion, Derivation of Bernoulli's equation for incompressible flow.

**UNIT – III** **[9 Hrs.]**

Measurement of Fluid Flow: - Through ducts: Venturimeter, Through Reserviors: Large Orifice & through open channels: Discharge over triangular, Rectangular & Trapezoidal notch

Viscous Flow:- Flow of Viscous fluid through circular pipe, Flow of viscous fluid between two parallel plates, Kinetic energy Correction factor & Momentum Correction factor.

**UNIT – IV** **[9 Hrs.]**

Turbulent flow: - Reynolds experiment, frictional loss in pipe flow. Darcy Weibach equation

Flow through pipes:- Equations of pipe flow, Losses in pipes & fittings, Hydraulic Gradient Line & Total energy Line, Syphon, Flow through pipe in series and parallel, Flow through branched pipes, Power transmission through pipe, Flow through nozzle, Water Hammer.

**UNIT – V** **[9 Hrs.]**

Dimensional Analysis: Dimensional Homogeneity, Rayleigh's method, Buckingham's π-Theorem.

Boundary Layer flow:- Boundary Layer concepts, Boundary Layer thickness, Displacement thickness, Momentum thickness, energy thickness, Momentum Integral equation for boundary layer (Von Karman), Separation, Drag and Lift on immersed bodies.

**TEXT BOOKS:**


1. Fluid Mechanics & Fluid Power Engineering By Dr. V. M. Domkundwar, Dhanpat Rai & Co. Pvt. Ltd.
2. Fluid Mechanics & Fluid Power Engineering – Som & Biswas
3. Fluid Mechanics & hydraulic Machines - R. K. Bansal

REFERENCE BOOK


1. Fluid Mechanics & Fluid Power Engineering – Mc Donald Fox
2. Fluid Mechanics - White
3. Fluid Mechanics - Streder Wylie

## ME 303: THEORY OF MACHINES – I (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: 80 Marks |
| | College Assessment: 20 Marks |

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**UNIT - I** **[ 9 Hrs. ]**

Basic concept of mechanism , Kinematic link , kinematic pairs , kinematic chain , mechanism , machine, Inversions of slider crank chain, Quick return mechanism, Inversions of Double slider crank chain, Harding`s notation, classification of four bar chain ( class -I & class - II ), inversion of four-bar- chain. Degree of freedom , estimation of degree of freedom of mechanism by Grubbler`s criterion and other methods. Various types of mechanism such as Pantograph, Geneva wheel, Pawal and ratchet mechanism, Exact straight line mechanism, Approx. straight line mechanism, steering mechanism, Transport mechanism.

**UNIT - II** **[ 9 Hrs. ]**

Quantitative kinematic analysis of mechanism: - Displacement, Velocity, and Acceleration analysis of planner mechanism by graphical method, Coriolis component of acceleration, Instantaneous center method, Kennedy`s theorem.

**UNIT - III** **[ 9 Hrs. ]**

Concepts of cam mechanism. Types of cams and followers and applications. Synthesis of cam for different types of follower motion like constant velocity , parabolic , SHM , cycloidal etc.

Analysis of follower motion for cams with specified contours like, tangent cam and Pressure angle in cam.

**UNIT - IV** **[ 9 Hrs. ]**

Concepts of motion transmission by toothed wheels, comparison with cam and linkages, various tooth profiles, their advantages and limitations, gear tooth terminologies, concept of conjugate action, law of conjugate action, kinematics of involute gear tooth pairs during the contact duration, highlighting locus of the point of contact, arc of contact, numbers of pairs of teeth in contact, path of approach and path of recess, interference, undercutting for involute profile teeth.

**UNIT - V** **[ 9 Hrs. ]**

Kinematics of helical, bevel, spiral, worm gear, rack & pinion gears, kinematic analysis, & torque analysis of simple and Compound epicyclic gear trains.

**TEXT BOOKS:**


1. Theory of mechanisms & machines, - Shigley J. E.
2. Theory of Machine, - S.S.Ratan
3. Theory of Machines, - P.S.Ballani
4. Theory of Machines, - Thoman Beven, CBS publication

**REFERENCE BOOKS:-**


1. Theory of Machines - Sandor & Erdman.
2. Theory of mechanisms & machines - Ghosh & Mallik, West Press Private Ltd, New Delhi East
3. Mechanism and Machine Theory - J. S. Rao

## ME 304: MANUFACTURING PROCESSES – I (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: 80 Marks |
| | College Assessment: 20 Marks |

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**UNIT- I** **[ 9 Hrs. ]**

Lathe: Introduction , type , construction of simple lathe , mechanism & attachments for various operations , machine specifications , basis for selection of cutting speed , feed and depth of cut , time estimation for turning operations such as facing , step turning , taper turning , threading , knurling. Introduction and Operations of Capstan & Turret Lathe.

**UNIT- II** **[ 9 Hrs. ]**

Shaper: Introduction, type, specification, description of machines, hydraulic drives in shapers, cutting parameters. Mechanism of shaper: Quick return mechanism, Crank & slotted link mechanism, Table feed mechanism, attachments for shaper, work holding devices, shaper operations, time estimation for shaping operations.

Slotter: Introduction, specifications, description, type of drives for slotter, types of slotting machines - production slotter, puncher slotter, tool room slotter, slotter tools.

Planer: Mechanism for planner: Driving mechanism, feeding mechanism, planner cutting tools, cutting parameters.

**UNIT- III** **[ 9 Hrs. ]**

Milling : Introduction , specifications , types , column & knee type milling machine ,fixed bed type milling machine , production milling machine , special purpose milling machines such as thread milling machines , profile milling machine , Gear Milling / Hobbing machines. Mechanisms & Attachments for Milling, Cutting parameters, Types of milling operations, Types of milling cutters, Tool geometry & their specifications. Indexing - Simple, compound & differential.

Grinding operations , grinding wheel , specifications & selection , cylindrical & center less grinding operations , surface grinding , tool & cutter grinding , time estimation for grinding operations. Super finishing process, Honing, Lapping, Super finishing, Polishing, Buffing, Metal spraying, Galvanizing & electroplating.

**UNIT - IV** **[ 9 Hrs. ]**

Drilling : Introduction , tools for drilling , classification of drills , twist drill , drill size & specifications , carbide tipped drills , types of drilling machines - Portable drilling machine , bench drilling machine , upright drilling machine , radial drilling machine , universal drilling machine, multi spindle drilling machine. Drilling machines operations, time estimation for drilling.

Reaming: Introduction, description of reamers, types of reaming operations.

Boring: Introduction, types of boring machines, horizontal boring machine, vertical boring machine, jig boring machine, micro boring, boring operations.

Broaching: Introduction, types of broaches, nomenclature of broaches, types of broaching machines.

**UNIT – V** **[ 9 Hrs. ]**

Theory of metal cutting: Introduction, Orthogonal and oblique cutting. Mechanics of Metal Cutting, Metal Cutting, Shear plane, Stress, Strain & Cutting Forces, Merchant Circle, Chip Formation, Cutting Force Calculations, Determination of Torque and Power Required for Turning, Drilling and Milling, Influence of tool angle, Cutting Fluids, Cutting speed, Feed and depth of cut on power requirement, Estimation of tool life.

**TEXT BOOKS:**


1. Manufacturing Technology ( Metal Cutting & Machine Tools ), - P. N. Rao, McGraw Hills Education (India)Pvt. Ltd.
2. Manufacturing Science, - Ghosh & Mallik
3. Work shop Technology ( Volume - II ), - Hajra Choudhary


**REFERENCE BOOKS:**


1. Manufacturing Engineering & Technology, - S. Kalpakjian & S R Schmid
2. Technology of machine tools, - Krar & Oswald
3. Manufacturing Processes, - M. Begman
4. Processes & Materials of Manufactures, - R. Lindberg
5. Production Technology, - HMT
6. Work shop Technology ( Volume I & II ), - Bawa

## ME 305: ENGINEERING METALLURGY (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: 80 Marks |
| | College Assessment: 20 Marks |

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**UNIT – 1** **[ 9 Hrs. ]**

Introduction, Difference between metals & non metals, Mechanical properties of metals, Introduction to Polymers, Ceramics and Composite materials.

CRYSTAL STRUCTURE – Difference between Crystaline and Amorphus materials, Unit cell, Crystal systems, BCC, FCC, HCP, Rank (No. of atoms per unit cell) and packing density calculations.

Polymorphism & allotropy, Effect of crystal structure on the properties of metal, Imperfections in crystal - Point Defect, Line Defect, Surface Defect, Volume Defects; Effect of imperfection on the properties of metal, Miller indices - For Plain, For Direction.

Study of optical microscope, specimen preparation for observation under optical microscope, microscopic and macroscopic examination of specimen.

**UNIT - II** **[ 9 Hrs. ]**

SOLID SOLUTION:- Introduction, Alloy, Mechanical Mixture, Type of solid solution - Ordered solid solution, Disordered solid solution; Substitute solid solution, Hume Rothery Rule, Solidification of metal (For pure metal & alloys), Ingot structure, Dendritic solidification, Effect of grain size on the properties of metals.

PHASE DIAGRAMS:- Binary equilibrium diagram, Isomorphus system - Monotectic, Eutectic, Eutectoide, Peritectic, Peritectoid; Study of Fe Fe-C diagram – Introduction, α - Ferrite, Austenite, δ- Ferrite, Cementite, Pearlite, Ledeburite, Bainite, Martensite, Uses, Limitation;

**UNIT – III** **[ 9 Hrs. ]**

PLAIN CARBON STEEL:- Introduction, Classification: Based on Carbon Percent:- Hypo-Eutectoid Steel, Eutectoid Steel, Hyper-Eutectoid Steel; Based on Application:- Dead mild steel, Mild steel, Medium carbon steel, High carbon steel; Limitations of Plain Carbon Steel, Effect of impurities – S, P, Si, Mn.

HEAT TREATMENT:- Introduction, Mechanisms, Purpose; Annealing - Stress Relief Annealing, Process Annealing, Spheroidising, Full Annealing; Normalizing, Tempering,

Temper embrittlement, TTT Curve, Critical cooling rate CCT Curve, Uses, Limitations. Hardening by martensitic transformation, Quench cracks, Retained austenite and its elimination, Hardenability - Jomini End quench test, decarburising, Special heat treatment processes such as Austempering, Martempering Maraging, Patenting, Age hardening, Red hardness, Overheated Steel, Burnt Steel, Surface hardening - Carburising, Nitriding, Cyaniding, Flame hardening, Induction hardening, Precautions For Heat Treatment.

**UNIT – IV** **[ 9 Hrs. ]**

ALLOY STEEL :- Introduction, Effects of alloying elements - Chromium, Nickel, Vanadium, Carbon, Silicon, Titanium, Molybdenum, Tungsten, Manganese, Copper, Boron, Cobalt, Aluminium; Tool steel - Carbon Steel, Alloy Steel, Non-Ferrous Alloys, Cemented Carbide, Ceramic Tools, Diamond Tools; Red hardness, Stainless steel - Ferritic, Martensitic, Austenitic, Duplex, Precipitation hardening stainless steel; Hadfield Manganese steel, Spring steel, Maraging Steel, O.H.N.S. Steel; Selection of steel - Wood cutting saw, Hacksaw Blade (Ordinary), Drill & Reamer , Good hacksaw blade, Hot forging Die, Ball Bearing Balls, Steam Turbine Blades, Food processing Equipment, Leaf Spring, Gears.

**UNIT – V** **[ 9 Hrs. ]**

CAST IRON:- Introduction, Difference between steel and cast iron, Introduction, Composition, Production route, microstructure, properties and application of Grey cast iron, White cast iron, Nodular cast iron, Malleable cast iron, Mottled cast iron, Ni – hard cast iron, Ni – Resist cast iron, Meehanite Alloy; Maurer Diagram; Effects of alloying elements on the properties of cast iron; Heat treatment of cast iron.

STUDY OF NON FERROUS ALLOYS :- Brasses – Cap brass, Gliding brass, Cartridge Brass, Admiralty Brass, Muntz metal, naval brass, leaded brass, high tensile brass, brazing brass, Mechanical properties of brass, season cracking of brass; Bronzes - Aluminium bronze, Tin bronze, Beryllium Bronzes, Silicon Bronzes; Gun Metal, Muntz Metal, Babbits, Bearing Metals, Soldering & Brazing Metals.

**TEXT BOOKS:**


1. A Text Book of Engineering Metallurgy (First Course) – Dr. Vinod S. Gorantiwar, M/S. Harivansh Publications
2. Introduction to Physical Metallurgy, Sidney H. Avner, Tata McGraw-Hill Edition
3. Introduction to Engineering Materials, B.K.Agrawal, Tata McGraw-Hill Edition
4. Heat Treatment – Principles & Techniques, T.V.Rajan, C.P. Sharma, Ashok Sharma, Prentice – Hall India
5. Materials Science & Metallurgy, Dr. V.D.Kotgire, Everest Publishing House
6. Text Book of Materials Science & Metallurgy, O.P.Khanna , Dhanpat Rai Publication

## ME 306: MACHINE DRAWING AND COMPUTER GRAPHICS (Practical)

**CREDITS: 01**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Practical: 2 Hours/Week | University Assessment: 50 Marks |
| | College Assessment: 50 Marks |

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**UNIT – I**

Drawing Standards for following

Drawing Sheets, Name Blocks, Lines, Sections Dimensioning. Dimensioning of Tolerances, Standard Components, Standard Features, Machining Symbols, Welding Symbols, Surface Finish Symbols, Heat Treatment Manufacturing Instructions, Allowances, Materials

**UNIT – II**

Reading and interpretation of drawing of industrial components (Minimum Three) ,

Production Drawing Name Plates, Part List, Revisions etc, Essential Parts / Formats required for production drawing, Process Sheet.

**UNIT – IIII**

Study, qualitative selection of type / size (excluding design calculations) and standard practices for following elements Threads, Bolts, Nuts, Washers , Rivets, Welds, Keys & Keyways, Splines, Couplings

**UNIT – IV**

Assembly and Dismantling: Principles, Fits and Tolerances (Standards, types, application and selection) Tolerance Charting, Surfaces finish requirement for assembly, Geometries suitable for assembly, Assembly / Dismantling Tools, Bearing Assemblies, Assemblies by fastening
**Study of Some standard Assemblies,** Assembly Drawings, Principles, techniques and standards for preparing components drawings Subassembly, Drawings, Full assembly Drawing, Exploded Views

**UNIT – V**

Introduction to Computer Graphics, Software tools available for drawing (AutoCAD, CATIA, ANSYS), Generation of Drawing and elementary Mechanical elements in AutoCAD or other Software.

**LIST OF PRACTICALS (Based on above Syllabus):**

Minimum Eight Practical from the following list shall be performed:

1. Conventional representation of Symbols.
2. Pencil Drawings of sectional views of machine components.

3. Pencil Drawings of some standard components. ( e.g. Screw Fasteners)
4. Pencil Drawings of standard assemblies with components.( e.g. Couplings)
5. Pencil Drawing of a small assembly with components (e.g. Screw Jack)
6. Pencil Drawings of detailed drawings of Assembly
7. Pencil Drawings of a large assembly with component drawings, subassembly drawings and assembly drawing using all standard formats ( e.g. Spring Loaded Safety Valve)
8. Sheet on Blue Print Reading.
9. Sheet on Preparation and explanation on Production Drawing.
10. Process Sheets for one component having maximum five operations.
11. Computer Print out on Three Dimension Modeling using AutoCAD or Solid work software.

**Note:**

1. Pencil drawings shall be in Full Imperial Sheet. Computer Printouts shall be on a Laser printer in A3 size. All drawings shall be submitted in one folder.
2. During University practical examination of 50 marks, students are expected to solve TWO problems of 30 marks of two hours duration on,
   - Sectional View / Missing View
   - Assembly Drawing/ Sub assembly Drawing
   - production drawing

   Oral of 20 marks shall be conducted during University practical examination.

**TEXT BOOKS:**


1. Machine Drawing, - K. L. Narayana , New Age International Publishers
2. Machine Drawing, - N. D. Bhatt & V M Panchal, Charoter Publications
3. Engineering Graphics with AutoCAD, - D. M.Kulkarni, A.P.Rastogi, A.K.Sarkar, PHI Learning Pvt. Ltd
4. PSG Data book
5. CMTI Data Book
6. Jadaan Data Book, - I.K. International.
7. Relevant IS Codes.


**REFERENCE BOOKS:**


1. Machine Drawing - N.Sidheshwar, Shastry , Kanhaiah, Tata Mcgraw Hill

2. Fundamentals of Machine Drawing, - Sadhu Singh, P. L. Sah, PHI Learning Pvt. Ltd

## ME 307: MANUFACTURING PROCESSES –I (Practical)

**CREDITS: 01**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Practical: 2 Hours/Week | University Assessment: 25 Marks |
| | College Assessment: 25 Marks |

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**LIST OF PRACTICALS:**

Minimum Eight Practical from the following list shall be performed:

1. Study of Single Point Cutting Tool.
2. Study of multiple point cutting tools (milling, drilling)
3. Study of Lathe Machine.
4. Study of shaper mechanisms.
5. Study of Broaching machines.
6. One Job/operation on Milling.
7. One Job/operation on Drilling, Boring
8. One Job/operation on Thread Cutting, Taper Turning.
9. One Job/operation on Surface Grinding.
10. One Job/operation on Shaper.

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

## ME 308: ENGINEERING METALLURGY (Practical)

**CREDITS: 01**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Practical: 2 Hours/Week | University Assessment: 50 Marks |
| | College Assessment: 50 Marks |

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**LIST OF PRACTICALS:**

Minimum Eight Practical from the following list shall be performed:

1. Study of crystal structure
2. Study of metallurgical Microscope
3. Specimen Preparation
4. Metallography ( Study & drawing of microstructure ) of plain carbon steel
5. Metallography of cast iron
6. Metallography of non-ferrous metals.
7. Metallography of heat-treated specimen.
8. Effect of annealing & normalizing on microstructure & hardness of steel.
9. Hardenability Test
10. Hardness Test by i) Brinell ii) Rockwell test.

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

## ME 309: INDUSTRIAL VISIT

**CREDITS: 01**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Practical: 2 Hours/Week | Audit Course |

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Students should be taken for visit to Industries. Visit to minimum two different types of industries is expected. Student should submit a visit report in the format given below. Preferably they should also make a presentation.

**Report should consist of**

1. Name of Industry
2. Nature of ownership
3. Year of establishment
4. List of finished products
5. Annual turnover of company
6. Number of employees
7. List of departments / sections
8. Classification of Industry - a) Based on turnover
   b) Based on product / process
9. List of major machines / equipment
10. List of raw material used
11. Sequence of operation (with brief description of operations) of at least one product / Process.

**FACULTY OF SCIENCE & TECHNOLOGY**

## B.E. (MECHANICAL ENGINEERING): FOURTH SEMESTER

## ME 401: APPLIED MATHEMATICS - IV (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: | 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: | 80 Marks |
| | College Assessment: | 20 Marks |

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**UNIT - I Fourier Transform** **[ 09 Hrs. ]**

Fourier Integral, Fourier sine & Cosine integral with example. Fourier Transform, Fourier Sine & cosine transform, Inverse Fourier transform & use to solve integral equation

**UNIT - I Numerical Method** **[ 09 Hrs. ]**

Solution to first order simultaneous differential equation & second order differential equation by Taylor's series and Runge-kutta fourth order method. Numerical integration, fitting of regression plane.

**UNIT - III Matrices** **[ 09 Hrs. ]**

Inverse of matrix by adjoint and partitioning method, Rank of a matrix and consistency of system of linear simultaneous equations. , Linear dependence, Linear and orthogonal transformation, Eigen values and Eigen vectors, Reduction to diagonal form.

**UNIT - IV Matrices** **[ 09 Hrs. ]**

Cayley-Hamilton Theorem, Sylvester's Theorem (statements only) Solution of second order linear differential equation with constant coefficient by matrix method. Reduction of quadratic form to canonical form.

**UNIT - V Random Variables, and Probability Distribution** **[ 09 Hrs. ]**

Random variables Distribution functions of discrete and continuous random variables, Joint distributions, Mathematical Expectations, Moments, Moments generating function and Characteristic function. Coefficient of skewness and Kurtosis.

**TEXT BOOKS:**


4. Higher Engineering Mathematics, - B. S. Grewal

5. Theory & Problems of Probability & Statistics, - Schaum Series, M. R. Spiegal (McGraw Hil)

6. Introductory methods of numerical analysis, - S. S. Sastri

7. Higher Engineering Mathematics, - H.K.Dass

**REFERENCE BOOKS:**


4. Advanced Engineering Mathematics, - Kreyszig
5. Mathematics for Engineers, - Chandrika Prasad
6. Advanced Mathematics for Engineers, - Chandrika Prasad
7. Applied Mathematics for Engineering & Physics, - L. A. Pipes & Harvile.
8. Calculus of Variation, - Forrey

## ME 402: ENGINEERING THERMODYNAMICS (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: | 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: | 80 Marks |
| | College Assessment: | 20 Marks |

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**UNIT - I** **[ 9 Hrs. ]**

Introduction to Thermodynamics :- Basic concepts of Thermodynamics, Thermodynamics Systems, Properties of system, State & Equilibrium, Processes & Cycles, Quasi-static Process, Thermodynamic Equilibrium, Temperature & Zeroth Law of Thermodynamics. Work Transfer, Mechanical forms of work, Non-Mechanical forms work ( Electrical, Shaft, Magnetic etc.) Heat Transfer, The Ideal Gas equation of state, Difference between Gas & Vapor, Compressibility factor and charts, Avagadro's Hypothesis, Universal Gas Constant, Internal energy & specific heats of gases.

**UNIT- II** **[ 9 Hrs. ]**

First Law of Thermodynamics :- Closed Systems ( Control mass system ) undergoing a cycle and change of state, Energy, Different forms of Energy, PMM-I, Work done, Change in internal energy, Heat transferred during various thermodynamic processes, P-V diagrams. Application of First Law to Steady Flow, ( Control volume systems ), Thermodynamic analysis of control volumes, Conservation of energy principle, Flow work & enthalpy, The steady flow process applied to (i) Nozzles & Diffusers (ii) Turbine & Compressors (iii) Throttle Valves, (iv) Pump, Boiler, etc.

**UNIT - III** **[ 9 Hrs. ]**

Second Law of Thermodynamics :- Introduction ( Law of degradation of energy ), Thermal energy reservoirs, Heat engines, Refrigerator & Heat pump, Kelvin-Plank & Clausius statements, Perpetual motion machine-II, Reversible & Irreversible processes, Carnot cycle, Carnot Theorem, Thermodynamic temperature scale.

Entropy: - The Clausius inequality, Entropy, Principle of increase of entropy, Change in entropy for Closed & Steady flow open systems. T-S diagrams. .

**UNIT - IV** **[ 9 Hrs. ]**

PROPERTIES OF STEAM :- Formation of steam, Sensible heat, Latent heat, Super heat, Wet steam, Dryness fraction, Critical state, Internal energy of steam, External work done during evaporation, T-S diagram, Mollier chart, Work & Heat transfer during various thermodynamics processes with steam as working fluid. Determination of dryness fraction using various calorimeters.

**UNIT - V** **[ 9 Hrs. ]**

Air Standard Cycles :- Otto cycle, Diesel cycle, Dual cycle, Stirling & Ericsson cycle, Brayton cycle (Thermal efficiencies and mean effective pressure) Vapour cycles :- Rankine cycle (work done and efficiency, mean effective pressure, specific steam consumption).

**TEXT BOOKS:**


5. Engineering Thermodynamics, P.K.Nag
6. Thermodynamics - An engineering approach, Yunus Cengal, M.A.Boles, Tata Mc-Graw Hill Publication
7. Fundamentals of classical Thermodynamics, Gorden J.V.Wylen, Sonntag
8. Basic Engineering Thermodynamics, Reiner Joel.
9. Fundamentals of engineering Thermodynamics, E. Rathakrishan, PHI

## ME 403: STRENGTH OF MATERIALS (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: | 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: | 80 Marks |
| | College Assessment: | 20 Marks |

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**UNIT - I** **[ 9 Hrs. ]**

Concept of simple stresses & strains :- Introduction, stress, strain, types of stresses, stress-strain diagram for brittle & ductile material, elastic limit, Hooks law, modulus of elasticity, modulus of rigidity, factor of safety,

Definition of Longitudinal strain & stress, lateral stresses & strains, Poisson`s ratio, volumetric stresses & strains with bulk modulus, relation between Young`s modulus & modulus of rigidity, Poisson`s ratio.

Principle stresses & strains :- Definition of principle planes & principle stresses.

**UNIT - II** **[ 9 Hrs. ]**

Shear force & bending moment: - Types of beams (cantilever beam, simply supported beam, overhung beam etc.) Types of loads (Concentrated & UDL), Relation between load, shear force & bending moment.

Stresses in beams: - Pure bending, theory of simple bending, section modulus for various sections.

Shear stresses in beams: - Concept, shear stress distribution.

**UNIT - III** **[ 9 Hrs. ]**

Deflection of beams: - Deflection & slope of cantilever, simply supported, overhung beams subjected to concentrated load, UDL, Relation between slope, deflection & radius of curvature.

**UNIT - IV** **[ 9 Hrs. ]**

Torsion of circular shafts: - Derivation of torsion equation. Torsion, shear stress, Strength & rigidity. solid & hollow shaft. Principle stresses & maximum shear stress in shaft when it is subjected to bending moment, torque & axial load.

Column & struts:- Failure of long & short column, Euler`s column theory, End conditions for column. Limitations of Euler`s formula, Rankine formula, Johnson`s parabolic formula.

**UNIT - V** **[ 9 Hrs. ]**

Introduction to fracture mechanics: - Modes of fracture, stress intensity factors, crack propagation. Paris law, creep phenomenon, design of creep.

Strain energy & impact loading: - Definition of strain energy stored in a body when it is subjected to gradually applied load, suddenly applied loads & impact loads. Strain energy stored in bending & torsion. Castingliano`s theorem.

**TEXT BOOKS:**


4. Strength of Materials, - S. Ramamrutham
5. Strength of Materials, - R. K. Rajput, S. Chand and co.
6. Strength of Materials, - F. L. Singer
7. Mechanics of Materials, - Beer & Johnson, Tata McGraw Hills Publications ltd.
8. Design of machine elemental, - V. B. Bhandari, McGraw Hills Educations (India) Pvt. ltd.
9. Design data book for machine elements, - B.D. Shiwalkar, Duttatreya Publications Nagpur.
10. Strength of Materials, - Dr. R.K.Bansal


**REFERENCE BOOKS:**


7. Strength of materials, - Timoshenko
8. Machine Design, - Black & Adam
9. Machine Design, - J. E. Shigley, McGraw Hills Educations (India) Pvt. ltd.

## ME 404: MANUFACTURING PROCESSES – II (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: | 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: | 80 Marks |
| | College Assessment: | 20 Marks |

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**UNIT- I** **[ 9 Hrs. ]**

Casting Process: - Introduction. Pattern making: - Types, materials used, Pattern making allowances, color codes. Core making: - Types, core materials &its properties.

Moulding: - Types of sand moulds, moulding sand composition, moulding sand properties, moulding machines.

**UNIT- II** **[ 9 Hrs. ]**

Gating design: - Elements of gating systems, pouring time, riser design (Analytical treatment)
Melting furnaces: - Types, Electric furnace, Induction furnace, Cupola - construction & operation.
Cleaning, inspection & casting defects.

Foundry mechanism: - Special casting processes such as investment casting, centrifugal casting, shell moulding, CO moulding, Slush casting, Die casting.

**UNIT – III** **[ 9 Hrs. ]**

Rolling, Forging, Extrusion & Wire Drawing.

Press Working: Die cutting operation, classification, types of presses, press terminology, introduction to shaping operations, bending, forming & drawing.

**UNIT- IV** **[ 9 Hrs. ]**

Non-conventional Machining Processes: - Characteristics, Operation, Applications, Limitations and Selection of Process Parameters of the following Processes. Abrasive Jet Machining, Ultrasonic Machining, Water Jet Machining, EDM, ECM.

**UNIT - V** ` **[ 9 Hrs. ]**

Joining Processes: - Introduction to Welding, Soldering, Brazing Processes. Types of Welding, Arc Welding & Gas Welding Processes, Defects & Inspection of Welding Joints, Electrodes, Weldability of Metals, Welding equipments of Fixtures.

**TEXT BOOKS:**


1. Manufacturing Technology (Foundry Forming & Welding), - P. N. Rao, McGraw Hills Educations (India) Pvt. ltd.
2. Manufacturing Science, - Gosh & Mallik.
3. Work Shop Technology (Volume - I ), - Hajra Choudhary.
4. Manufacturing Engineering & technology, - S . Kalpakjian & S. R. Schmid.

**REFERENCE BOOKS:**


7. Work Shop Technology, Vol. I – III, WAJ Chapman.
8. Manufacturing Processes, - M. Begman
9. Processes & Materials of Manufacture, - R. Lindberg.
10. Work Shop Technology - ( Volume - I & II ), Bawa
11. Work Shop Technology - ( Volume - I & II ), B. S. Raghuvanshi, Dhanpat Rai & Co.

## ME 405: HYDRAULIC MACHINES (Theory)

**CREDITS: 04**

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Lectures: 3 Hours/Week | Duration of Paper: | 03 Hours |
| Tutorial: 1 Hour/Week | University Assessment: | 80 Marks |
| | College Assessment: | 20 Marks |

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**UNIT - I IMPACT OF JETS & IMPULSE TURBINE [ 9 Hrs. ]**

Impulse Momentum Principle, Dynamic Action of Jets on Fixed and Moving Flat Plates and Curved Vanes. Velocity Triangles, Introduction to Jet Propulsion of Ships. Theory of Turbo machinery, Euler's Equation, Classification of Hydraulic Machines. Elements of Hydroelectric Power Plant.

Pelton Turbines: Principle, Constructional Features, Velocity Diagrams and Analysis, Working Proportions, Design Parameters, Draft Tube Theory, Cavitation in Turbines. Performance Characteristics, Selection Criterion and Governing.

**UNIT – II REACTION TURBINE [ 9 Hrs. ]**

Principle of Operation, Comparison with Pelton Turbines.

Francis & Kaplan Turbines: Constructional Features, Velocity Diagrams and Analysis, Working Proportions, Design Parameters, Performance Characteristics, Selection Criterion and Governing.

**UNIT - III NON POSITIVE DISPLACEMENT PUMPS [ 9 Hrs. ]**

Classification of Hydraulic Pumps and their applications, Centrifugal Pumps Installation and Operation, Priming, Fundamental Equation, Various Heads, Velocity Triangles and Analysis, slip Factor, Vane Shape, Losses and Efficiencies, Multi staging of Pumps, Design Consideration, Working Proportion, N.P.S.H., Cavitation, Performance Characteristics , Pump and System Matching, Introduction to Mixed Flow and Axial Flow Pumps. Self Priming Pumps.

**UNIT - IV POSITIVE DISPLACEMENT PUMPS [ 9 Hrs. ]**

Reciprocating Pumps: Types, Main Components, Slip, Work done, Theoretical and Actual Indicator Diagrams. Air Vessels, Cavitations, Hand Pumps.

Rotary Pumps: Introduction to Gear Pumps, Sliding Vane Pumps, Screw Pumps.

**UNIT - V MODEL TESTING & WATER LIFTING DEVICES [ 9 Hrs. ]**

Model Testing: Types of Similarities, Unit and Specific Quantities. Model Testing of Hydraulic Turbines and Pumps.

Miscellaneous water lifting devices: Air Lift Pumps, Hydraulic Ram, Bore Hole Pump, Submersible Pumps, Jet Pumps, Regenerative Pumps.

**TEXT BOOKS:**


6. Theory & Design of Hydraulic Machines, - V. P. Vasandani (Khanna Publications.)
7. Fluid Mechanics, - A. K. Jain (Khanna Publications.)
8. Fluid Mechanics & Fluid Power Engineering, - D. S. Kumar (Kataria Publications.)
9. Fluid Mechanics & Machines, - R. K. Bansal (Laxmi Publications.)
10. Fluid Mechanics & Machines, - Banga & Sharma (Khanna Publications.)
11. Fluid Mechanics & Machines, - R.K. Rjput (S.Chand Publications..)


**REFERENCE BOOKS:**


12. Fluid Mechanics with Engineering Applications, - Daugherty & Franizini (Mc Graw Hill Publications.)
13. Theory of Turbo – Machines, - A. T. Sayers, (Mc Graw Hill (india) Pvt. Ltd.)
14. Fundamentals of Turbomachines, - B.K. Vekanna
15. Fluid Mechanics & Hydraulic Machines, - Som & Biswas (TMH Publications.)

## BEME 406: MANUFACTURING PROCESSES - II (Practical)

**CREDITS: 01**

| **Teaching Scheme** | **Examination Scheme** | |
|---|---|---|
| Practical: 3 Hours/Week | University Assessments | 25 Marks |
| | College Assessment: | 25 Marks |

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**LIST OF PRACTICALS:**

Minimum Eight practical from the following list shall be performed:

3. Study of Melting Furnaces
4. Study of Pattern Making and Moulding
5. Study of Special Casting Processes
6. One job on Gas Welding.
7. One job on Arc Welding
8. Study of various types of Presses
9. Study of Non-conventional machining processes (EDM, ECM and Ultrasonic Machining)
10. One job on Lathe (Threading and Taper turning)
11. One job on Milling Machine (Gear cutting, Key way Machining)
12. One Job on Shaper Machine

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

## ME 407: HYDRAULIC MACHINES (Practical)

**CREDITS: 01**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Practical: 3 Hours/Week | University Assessments 25 Marks |
| | College Assessment: 25 Marks |

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**LIST OF PRACTICALS:**

Minimum Eight practical from the following list shall be performed:

8. To run the centrifugal pump under various loading conditions and to draw the performance characteristic curves.
9. To conduct a test on Turbine/turbines wheel & plot the performance characteristic curves for constant load and head.
10. To study the performance of Reciprocating pump and draw the characteristic curves.
11. Determination of the Metacentric height of a floating body.
12. To study status of flow using Reynolds apparatus (Laminar and Turbulent).
13. Verification of Bernoulli's theorem.
14. Determination of the coefficient of discharge for a given Venturimeter.
15. Determination of the coefficient of discharge for a given Orificemeter.
16. Study and performance of Francis turbine at constant head.
17. To draw the characteristic curves of a Hydraulic Ram at constant valve lift and constant supply head.

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

## ME 408: STRENGTH OF MATERIALS (Practical)

**CREDITS: 01**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| Practical: 3 Hours/Week | University Assessments 25 Marks |
| | College Assessment: 25 Marks |

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**LIST OF PRACTICALS:**

Minimum Eight practical from the following list shall be performed:

3. Study of Universal Testing Machine
4. Tension Test on Mild Steel Bar
5. Compression Test on Concrete block and Cast Iron
6. Shear Test on M.S.Bar
7. Impact Test on M.S.Specimen
8. Determination Critical Buckling load capacity for Coloumn and Studs
9. Torsional Test for Circular M.S.Bar
10. Determination of stiffness of Helical Compression Spring
11. Deflection of Cantilever beam and simply supported beam
12. Fatigue test under completely reverse bending stress.

A Journal/Report on experiments conducted shall be submitted by each student. University Practical examination shall be on viva-voce of 10 marks and practical performance or objective test of 15 marks.

## ME 409: SEMINAR

**CREDITS: 01**

| **Teaching Scheme** | **Examination Scheme** |
|---|---|
| **Practical: 2 Hours/Week** | **College Assessment: 50 Marks** |

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This is an individual student activity. Seminar should be based on any relevant advanced technical topic. Report should be based on the information collected from Handbooks, Journals, Conference proceedings & reference books. Seminar report should be submitted & seminar should be delivered on reported work.