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

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

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

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

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

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

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

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

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

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.