SEMESTER – IV

Metrology and Interchangeability (ME - 4001)

Course Code	**(ME - 4001)**	Credits : 4	L-3, T-1, P-0
Name of the Course	**Metrology and Interchangeability**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

Standards of Measurements : Line standards, imperial standard yard, standard meter, sub-standards and standards, end bars, slip gauges, angular slip gauges, wave length standard.

Measuring Principles : Principle for mechanical measuring instruments – Lever method, vernier method, screw & screw nut method. Compound gearing method, helical strip method. Principles of optical measuring instruments. Reflection, refraction interference, optical prism, lenses, optical systems. Principle of electrical measuring instruments. Transformation of energy, variation of electric parameters,- Principles of pneumatic measuring instruments. Construction details of measuring instruments. Abbe principle, graduation lines and scale division, pivot & bearings. Measuring accuracy – dimensional & geometrical accuracy. Types of error, systematic error, compound error, random error.

SECTION – B

Interchangeability : Concept and need of interchangeability. Systems of tolerances, system of fits. Limit gauges, Standardisation. Design standardisation. Manufacturing standardisation.

Linear and Angular Measurement : Use of slip gauges, dial indicators. Mechanical, optical and electrical comparators, pneumatic gauges, measuring machines, sinebars & angle, gauges, levels, clinometer, auto-collimator, tapper gauges.

SECTION – C

Straightness, Flatness and Squareness testing : Straight edges, surface plates straightness testing, straight edge methods, level or auto-collimator method. Flatness testing – level or auto – collimator method, optical flatness testing, squareness testing, indicator method, auto – collimator methods, engineer's squares.

Screw Thread Measurement : Errors in threads, screw thread gauges, measurement of element of the external and internal threads, thread caliper gauges.

SECTION – D

Spur Gear Measurement : Geometry of spur gear, measurement of spur gea parameters, ram out, pitch, profile, lead, backlash, tooth thickness, composite elements.

Surface Finish Measurement : Definition measurement of surface, finishtaly surf, profilometer, tomilson recorder, compariscope, microscope interference methods.

Miscellaneous : Acceptance tests for a lathe.

Alignment of bearings.

Text Books:-

1. Gupta, I.C., "Engineering Metrology", Dhanpat Rai & Sons, New Delhi, 1994.
2. Hume, K.J., "Engineering Metrology", Mac Donald & Co. 1963.

References Books:-

1. Kumar, D.S., "Mechanical Measurements and Control", Metropolitan, New Delhi.
2. Doeblein, E.O., "Measurement Systems, Application Design", Mc Graw Hill, 1990.
3. Beckwith Thomas G., "Mechanical Measurements", Narosa Publishing House, N.Delhi.

SEMESTER – IV

Manufacturing Technology – I (ME - 4002)

Course Code	**(ME - 4002)**	Credits : 4	L-3, T-1, P-0
Name of the Course	**Manufacturing Technology – I**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A
Unit – I

Metal Casting Processes: Advantage and limitations, sand mold making procedure, Patterns and Cores. Pattern materials, pattern allowances, types of pattern, colour coding, Molding material, Molding sand composition, and preparation, sand properties and testing type of sand molds.

Unit – II Cores: Types of cores, core prints, chaplets, chills, Gating systems, Gates and gaiting systems risers, Melting practice, Cupola, charge calculations. Casting cleaning and casting defects Fettling, defects in castings and their remedies, methods of testing of castings fore their soundness.

SECTION – B
Unit – III Special Casting Processes: Shell molding, precision investment casting, permanent mold casting, die casting, centrifugal casting, continuous casting.

Unit – IV Metal forming Processes: Nature of plastic deformation, hot working and cold working. Principles of rolling roll passes roll pass sequences. Forging: Forging operations, smith forging, drop forging, press forging, forging defects.

SECTION – C

Unit – V Extursion and other processes : Extrusion principle, hot extrusion, cold extrusion, wire drawing, swaging, tube making, Sheet metal operation, Press tolls operations, shearing action, drawing dies, spinning, bending, strech forming, embossing and coining.

Unit – VI Gas and Arc Welding: Classification: Oxy-acetylene welding equipment and techniques. Electric arc welding: Electrodes, manual metal arc welding, inert gas shielding arc welding, tungsten inert gas welding (TIG), metal inert gas wedling (MIG), submerged arc welding (SAW)

SECTION – D

Unit – VII Resistance Welding: Principles, resistance sopt welding, resistance seam welding, upset welding, flash welding.

Unit – VIII Other Welding Processes : Introduction thermit welding, electro slag welding, electron beam welding, forge welding, friction welding, diffusion welding, brazing and soldering.

Text Books:

1. Principles of Manufacturing Materials & Processes – Campbell J.S.Publisher – Mc Graw Hill.
2. Manufacturing Science – Ghosh A.Malik, A.K.Affiliated East-West Press Pvt. Ltd., New Delhi.

Reference Books :

1. Foundary Technology – K.P.Sinha, D.B.Goel, Roorkee Publishing House.
2. Welding and Welding Technology, Richard L.Little Tata McGraw Hill Ltd.
3. Principle of Metal casting- Rosenthal, Tata Mc Graw hill, New Delhi.
4. Production Technology – R.K.Jain, Khanna Publication Ltd., N D.
5. Manufacturing Processes and Systems : Ostwald Phillip F., Munoz Jairo, John Wiley & Sons (Asia) Pvt. Ltd.
6. Welding Technology – O.P.Khanna, Dhanpat Rai & Sons, Delhi.
7. Manufacturing Technology – Foundry, Forming and Welding – P.N.Rao, Tata Mc Graw Hill.

SEMESTER – IV

STRENGTH OF MATERIALS – II ME - 4003

Course Code	**ME - 4003**	Credits : 5	L-4, T-1, P-0
Name of the Course	**Strength of Materials – II**		
Lectures to be delivered	**65 (1 Hr Each) (L = 52, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section - A

Unsymmetrical Bending: Properties of beam cross section, product of inertia, ellipse of inertia, slope of the neutral axis, stresses & deflections, shear center and the flexural axis, Numerical problems.

Continuous Beams: Clapeyorn's Theorem, Wilson's method, Numerical problems.

Section - B

Thin Walled Vessels: Derivation of Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels under internal pressure. Change in volume of vessel under pressure, Numerical problems.

Thick Cylinders & Spheres: Derivation of equations for radial & hoop stresses and strains in thick cylinders and spherical shells. Compound cylinders and spherical shells subjected to internal fluid pressure only, hub shrunk on solid shaft. Wire - wound cylinders. Numerical problems.

Section - C

Rotating Rims, Discs & Cylinders: Stresses and strains in (i) rotating rims, neglecting the effect of spokes, (ii) rotating discs, including disc of uniform strength and disc shrunk on hub (iii) rotating cylinders (solid & hollow). Numerical problems.

Section - D

Bending of Curved Bars: Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature. Stresses in crane hooks, rings and chain links of circular & trapezoidal sections. Numerical Problems.

Springs: Stresses in closed and open coiled helical springs subjected to axial loads and twisting couples. Leaf springs, flat spiral springs. Numerical Problems.

Text Books:

1. Strengths of Materials – G.H. Ryder- Third Edition in S.I. units 1969 Macmillan India.
2. Mechanics of Materials- Dr. Kirpal Singh, Standard Publishers Distributors, New Delhi.

Reference Books:

1. Strengths of Materials-Popov , PHI, New Delhi
2. Strengths of Materials-Sadhu Singh, Khanna Publications
3. Strengths of Materials- A Rudimentary Apprach-M.A. Jayaram, Revised Ed. 2001, Sapna Book house, Bangalore.
4. Strengths of Materials- U.C. Jindal

SEMESTER – IV

COMPUTER BASED NUMERICAL ANALYSIS AS - 4004

Course Code	**AS – 4004**	Credits : 4	L-3, T-1, P-0
Name of the Course	**Computer based Numerical Analysis**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

SECTION – A

FINITE DIFFERENCES & INTERPOLATION : Various difference operators and relation between them. Newton's forward and backward interpolation formulae. Central difference Interpolation formula. Gauss's forward and backward interpolation formulae. Lagrenge's interpolation formula and Newton's divided difference formulae.

SECTION- B

SOLUTION OF ALGEBRAIC AND TRANSCENDENTAL EQUATIONS : Bisection method, method of false position, secant method, Iteration method, Newton-Raphson method, Generalized Newton-Raphson method.

SOLUTION OF SIMULTANEOUS ALGEBRAIC EQUATIONS : Jacobi's method, Gauss-seidal method, relaxation method.

SECTION – C

NUMERICAL DIFFERENTIATION AND INTEGRATION : Formulae for derivatives. Trapezoidal rule, Simpson's $1/3^{rd}$ and $3/8^{th}$ rules, Boole's and Weddle's rules, Romberg's integration.

SECTION – D

NUMERICAL SOLUTION OF P.D.E.: Finite difference approximations of partial derivatives, solution of Laplace equation (Standard 5-point formula only) One-dimensional heat equation (Schmidt method, Crank – Nicolson DuFort method and Frankel method) and wave equation.

TEXT BOOKS:

1. Numerical Methods in Engg. & Sciences : B.S.Grewal : Khanna
2. Numerical methods for Scientific & Engg. Computations : M.K.Jain, S.R.K.Iyengar & R.K.Jain; Wiley Eastern Ltd.

REFERENCE BOOKS:

1. Computer Oriented Numerical methods : U.Rajaramanm Orebtuce; Hall of India.
2. Introduction to Numerical Analysis : C.E.Froberg; Addison Wesley.

NOTE:

i) Students will be asked to write computer program of problems discussed. In c/c++.

SEMESTER – IV

Heat Power Engineering ME - 4005

Course Code	**ME - 4005**	Credits : 4	L-3, T-1, P-0
Name of the Course	**Heat Power Engineering**		
Lectures to be delivered	**52 (1 Hr Each) (L = 39, T = 13 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section –A

Unit I Fuels and Combustion: Combustion equations, stochiometric air fuel ratio, excess air, exhaust gas analysis, Orsat apparatus. Enthalpy and internal energy of combustion, enthalpy of formation, adiabatic flame temperature, Gibb,s and Helmholtz functions, calorific value of fuel and its determination.

Unit II Steam Boiler: Boilers and their classification, comparison between fire tube and water tube boilers, essentials of a good boiler. Constructional and operational details of Locomotive, Babcock-Wilcox, Lancashire Boiler, Benson, Lamont, Loeffler and Velox boilers. Boiler mountings and accessories. Natural draft from chimney, height of chimney, maximum draft and chimney efficiency, forced draft and induced draft, Boiler Heat Balance Sheet.

Section B

Unit III Vapour Power Cycles: Carnot and Rankine Vapour cycles, effect of operating conditions on thermal efficiency of Rankine cycle, Rankine cycle with superheat, reheat cycle and regenerative feed heating cycle, Binary vapour cycle.

Unit IV Flow Through Nozzles: Velocity and heat drop, mass discharge through a nozzle, critical pressure ratio and its significance, effect of friction and nozzle efficiency, supersaturated flow, nozzles off the design pressure ratio.

Section C & D

Unit V Steam Turbines: Classification, flow through impulse blades, velocity diagram, calculation of power output and efficiency, maximum blade efficiency of single stage impulse turbine, blade friction, compounding of impulse turbine. Flow through impulse reaction blades, degree of reaction, velocity diagram, calculations for power output, efficiency and blade height, comparison of impulse and impulse reaction turbines. Losses in steam turbines, stage efficiency overall efficiency and reheat factor. Governing of steam turbines, throttle governing, nozzle control governing and by pass governing. Steam for heating and process work, back pressure turbines and pass out turbines.

Unit VI Steam Condensers: Elements of a condensing plant, types of condensers, comparison of jet and surface condensers. Condenser vacuum, air leakage and loss of vacuum, vacuum efficiency and condenser efficiency, Dalton's law and air vapour mixture, air pumps.

Text Books:

1. Thermal Engineering – P L Ballaney, Khanna Publishers.
2. Thermodynamics and Heat Engines vol II - R Yadav, Central Publishing House.
3. Thermal Engineering – A.S.Sarao – S.K.Kataria and Sons.

Reference Books:

1. Applied Thermodynamics for Engineering Technologists – T D Eastop and A McConkey, Pearson Education.
2. Heat Engineering – V P Vasandani and D S Kumar, Metropolitan Book Co Pvt. Ltd.

SEMESTER – IV

MATERIAL SCIENCE & ENGINEERING ME - 4006

Course Code	**ME - 4006**	Credits : 3	L-3, T-0, P-0
Name of the Course	**Material Science & Engineering**		
Lectures to be delivered	**39 (1 Hr Each) (L = 39, T = 0 for each semester)**		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 100**	**Min. Pass Marks: 40**
Continuous Assessment (based on sessional tests (2) 50%, Tutorials/Assignments 30%, Quiz/Seminar 10%, Attendance 10%)		**Max. Marks: 50**	

Instructions

1. **For Paper Setters:** The question paper will consist of five sections A, B, C, D & E. Section E will be compulsory, it will consist of a single question with 10-20 subparts of short answer type, which will cover the entire syllabus and will carry 40% of the total marks of the semester end examination for the course. Section A, B, C & D will have two questions from the respective sections of the syllabus and each question will carry 15% of the total marks of the semester end examination for the course.

2. **For candidates:** Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C & D of the question paper and all the subparts of the questions in Section E. Use of non-programmable calculators is allowed.

Section A

Unit I Crystallography: Review of crystal structure, space lattice, crystal planes and crystal directions, co-ordination number, number of atoms per unit cell, atomic packing factor, numerical problems related to crystallography.

Unit II Imperfection in metal crystals: Crystal imperfection and their classifications, point defects, line defects, edge & screw dislocations, surface defects, volume defects, and effects of imperfections on metal properties.

Section B

Unit III Solid solutions and phase diagram: Introduction to single and multiphase solid solutions and types of solid solutions, Importance and objectives of phase diagram, systems, phase and structural constituents, cooling curves, unitary & binary phase diagrams, Gibb's phase rule, Lever rule, eutectic and eutectoid systems, peritectic and peritectoid systems, iron carbon equilibrium diagram and TTT diagram.

Unit IV Heat Treatment: Principles, purpose, classification of heat treatment processes, annealing normalizing, stress relieving, hardening, tempering, carburizing, nitriding, cyaniding, flame and induction hardening. Allotropic transformation of iron and steel, properties of austenite, ferrite, pearlite, martensite.

Section C

Unit V Deformation of Metals: Elastic and plastic deformation, mechanism of plastic deformation, twining; conventional and true stress strain curves for polycrystalline materials, yield point phenomena, strain hardening, age hardening work hardening, Bauschinger effect, season cracking. Recovery, re-crystallization and grain growth.

Unit VI Alloys and alloying elements. Effect of various alloying elements on the mechanical properties. Properties of important alloys used in mechanical engineering practice.

Section D

Unit VII Failures of metals: Failure analysis, fracture, process of fracture, types of fracture, fatigue, characteristics of fatigue, S-N curve, fatigue limit, mechanism of fatigue, factor affecting fatigue, Miner's law, simple numerical problems on fatigue.

Unit VIII Creep & Corrosion: Definition and concept, creep curve, mechanism of creep, impact of time and temperature on creep, creep fracture, creep testing and prevention against creep. Corrosion: Mechanism and effect of corrosion, prevention of corrosion.

Text Books :

1. Mechanical Metallurgy – George E. Dieter Jr. Mc. Graw Hill, International Students Edition.
2. Physical Metallurgy – Lakhtin – Mir Publishers, Moscow.
3. Physical Metallurgy – Bijender Singh – Standard Publishers Distributors, New Delhi.

Reference Books:

1. Material Science & Engineering - V.Raghavan, Prentice Hall of India Pvt. Ltd., New Delhi.
2. A Text Book of Material Science & Metallurgy – O.P.Khanna, Dhanpat Rai & Sons.
3. Material Science and Engineering – An Introduction – Callister, W.D.John Wiley & Sons. (ASIA) Pvt. Ltd., New Delhi.
4. Elements of Material Science and Engineering : Van Vlack, Wesley Pub. Comp.
5. Engineering Materials: Kenneth G.Budinski, Prentice Hall of India, New Delhi.
6. Mechanics of materials : Kirpal Singh, Standard Publishers Distributors, New Delhi.
7. Heat Treatment of Metals – Bijender Singh – Standard Publishers Distributors, New Delhi.

SEMESTER – IV

Manufacturing Practice - I ME - 4007

Course Code	**ME - 4007**	Credits : 2	L-0, T-0, P-2
Name of the Course	**Manufacturing Practice – I**		
Lectures to be delivered	26 hours of Lab sessions		
Semester End Examination	**Max. Time = 3 hrs.**	**Max. Marks: 50**	**Min. Pass Marks: 20**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva/Hands 25%, Attendance 20%**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To make a pattern for a given casting with all the necessary allowances, parting line, running system details. Prepare the mold and make the casting. Investigate the casting defects and suggest the remedial measures.
2. To make a component involving horizontal and vertical welding and study the welding defect and suggests their remedies.
3. To prepare a job on surface grinder/cylindrical grinder and measure the various parameters of the finished piece.
4. To cut external threads on a lathe.
5. Manufacture and assembly of a unit consisting of 2 to 3 components to have the concept of tolerances and fits (shaft and bush assembly or shaft, key and bush assembly or any suitable assembly).
6. Leveling of machine tools and testing their accuracy.
7. Disassembly and assembly of small assemblies such as tail stock, bench vice, screw jack etc.
8. Development and manufacture of complex sheet metal components such as funnel etc.
9. Multi slot cutting on milling machine by indexing.
10. Drilling and boring of a bush.

SEMESTER – IV

Computer based Numerical Analysis Lab AS - 4008

Course Code	**AS - 4008**	Credits : 2	L-0, T-0, P-2
Name of the Course	**Computer based Numerical Analysis**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination		**Max. Marks: 50**	**Min. Pass Marks: 20**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva/Hands 25%, Attendance 20%**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

WRITE DOWN AND EXECUTE FOLLOWING PROGRAMS USING C/C++ LANGUAGE

1. To find the roots of non-linear equation using Bisection method/Muller's method.
2. To find the roots of non-linear equation using Newton's method/Muller's method.
3. Curve fitting by least-squares approximations.
4. To solve the system of linear equations using Gauss-Elimination method.
5. To solve the system of linear equations using Gauss-Seidal iteration method.
6. To solve the system of linear equations using Gauss-Jordan method.
7. To solve integral equation numerically using Trapezoidal rule.
8. To solve integral equation numerically using Simpson's rule.
9. Find the largest Eigen value of a matrix by power – method.
10. To find numerical solution of ordinary differential equations by Euler's method.
11. To find numerical solution of ordinary differential equations by Runge-Kutta method.
12. To find numerical solution of partial differential equation/laplace equation/ wave equation/heat equation.
13. To find numerical solution of ordinary differential equations by Milne's method.
14. To solve a given problem using Newton's forward interpolation formula.
15. To solve a given problem using Lagrange's forward interpolation formula.

NOTE : Minimum 10 experiments are to be performed.

SEMESTER – IV

HEAT POWER ENGINEERING LAB ME – 4009

Course Code	**ME - 4009**	Credits : 2	L-0, T-0, P-2
Name of the Course	**HEAT POWER ENGINEERING LAB**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination		**Max. Marks: 50**	**Min. Pass Marks: 20**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva/Hands 25%, Attendance 20%**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To prepare heat balance sheet for given boiler

2. To study the working of impulse and reaction steam turbines.

3. To find dryness fraction of steam by separating and throttling calorimeter.

4. To find power out put & efficiency of a steam turbine.

5. To find the condenser efficiencies

6. To study and find volumetric efficiency of a reciprocating air compressor.

7. To study cooling tower and find its efficiency.

8. To find calorific value of sample of fuel using Bomb calorimeter.

SEMESTER – IV

MATERIAL SCIENCE LAB ME - 4010

Course Code	**ME – 4010**	Credits : 2	L-0, T-0, P-2
Name of the Course	**MATERIAL SCIENCE LAB**		
Lectures to be delivered	**26 hours of Lab sessions**		
Semester End Examination		**Max. Marks: 50**	**Min. Pass Marks: 20**
Continuous Assessment	**Lab work 30%, Lab record 25%, Viva/Hands 25%, Attendance 20%**	**Max. Marks: 50**	**Min. Pass Marks: 25**

Instructions for paper setter/Candidates

Laboratory examination will consist of two parts:

i) Performing a practical examination assigned by the examiner (25 marks).
ii) Viva-voce examination (25 marks).

Viva-voce examination will be related to the practicals performed/projects executed by the candidate related to the paper during the course of the semester.

List of Experiments:

1. To study crystal structures of a given specimen.
2. To study crystal imperfections in a given specimen.
3. To study micro - structures of metals/alloys.
4. To prepare solidification curve for a given specimen.
5. To study heat treatment processes (hardening and tempering) of steel specimen.
6. To study micro - structure of heat treated steel.
7. To study thermo-setting of plastics.
8. To study the creep behavior of a given specimen.
9. To study the mechanism of chemical corrosion and its protection.
10. To study the properties of various types of plastics.
11. To study Bravais lattices with the help of models.
12. To study crystal structures and crystals imperfections using ball models.