BEA- 301 Mathematics-III

UNIT-I

Numerical Methods – Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT-II

Numerical Methods - Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.

UNIT-III

Numerical Methods – Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank- Nicholson methods), Finite difference explicit method for wave equation.

UNIT-IV

Transform Calculus - Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

UNIT-V

Concept of Probability - Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.

References:
1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
8. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
9. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. Statistics

MEA- 302 Thermodynamics

UNIT-I
Basic Concepts & Laws of Thermodynamics : Basic concepts: Property, Equilibrium, State, Process, Cycle, Zeroth law of thermodynamics, Heat and work transfer. First law of thermodynamics- first law applied to various systems steady flow process, limitations of first law of thermodynamics.

UNIT-II
Second law of thermodynamics, heat engine, heat reservoir, Refrigerator, heat pump, Carnot's cycle, statements of second law Reversible and irreversible processes, consequence of second law, Clausious Inequality , Entropy, T-S diagrams, Available & Unavailable energy Availability Concept .

UNIT-III
Properties of Steam : Pure Substance, Phase, Phase-transformations, formation of steam, properties of steam, PVT surface, HS,TS,PV,PH,TV diagram, processes of vapor measurement of dryness fraction, Use of steam tables and Mollier chart.

UNIT-IV
Air standard cycles: Carnot, Otto, Diesel, Dual cycles and their comparison, Brayton cycle, Non reactive gas mixture, PVT relationship, mixture of ideal gases, properties of mixture of ideal gases, internal energy, Enthalpy and specific heat of gas mixtures.

UNIT-V
Fuels & combustion : Actual & theoretical Combustion processes , Enthalpy of formation & enthalpy of reaction, first law analysis of reacting systems, Adiabatic flame temperature , Basic concept of Third Law of thermodynamics .
Steam Tables Mollier Charts & tables connected to reactive systems are allowed in Examination hall

References:
1. P.K.Nag; Engineering Thermodynamics; Mc Graw Hills Fifth Edition
2. Cengel Y; Thermodynamics; MC Graw Hills ,Eight Edition
3. Kross & Potter Thermodynamics for Engineers CENGAGE Learning
4. Moran, Shapiro ,Boettner Principles of Engineering Thermodynamics Wiley student edition
5. P Chattopadhya , Engineering Thermodynamics Second Edition,OXFORD University Press 6 Zemansky Heat & Thermodynamics , Eight Edition , Mc Graw Hills India Education
6. Achuthan M; Engineering Thermodynamics by, PHI India.
7. R Yadav Applied Thermodynamics, Central Publishing house Allahaba

MEA- 303 Materials Technology

UNIT-I

Solidification of metals , Crystallization , Crystal and amorphous , different types of bonds in different metals, Crystallography. Stability and meta stability of metals. Different mechanical properties of metals and other engineering materials like strength, hardness, elasticity, plasticity, Malleability, Ductility, Creep, Fatigue etc .Introduction to industrial metals, steels and prevailing manufacturing methods by manufacturers.

UNIT-II

Cooling curves, Isomorphous, Utectic, Eutectoid , Eutectoid solid solution, Peritectic and other phase diagrams, Alloying , Characteristics of alloying elements, Iron – Carbon phase diagram, T-T-T diagrams, Types of Cast Iron. Types of Stainless Steels, Elastic, anelastic and Viscoelastic behaviour.

UNIT-III

Heat treatment of metals, Based on phase diagram and T-T-T-Diagram the heat treatment of various metals, Bulk heat treatments, surface heat treatments, Case carburizing, Types of Annealing, Normalising, Spherodising, Phase Transformations like Pearlite, Cementite, Austenite, Troostite, Bainite, Hard and soft Martensite etc. Laser hardening, Cyniding, Boriding, Nitriding, Flame hardening, Ion implantation, Etc. Heat treatment cycles. Metallographic studies, Optical Microscope, Electron Microscope.

UNIT-IV

Destructive and non-destructive testing methods, Tensile test, Compression test, shear test, bend test, Different types of Hardness tests, Impact tests, Fatigue tests, Hardenability test. Fracture analysis, NDT Methods. Different properties of Steels, Aluminium and it's alloys, Copper and it's alloys, Manganese and it's alloys, Chromium and it's alloys, Nickel and it's alloys.

UNIT-V

Chemical Analysis of different alloying elements in commercial metals, C, Fe, Cr, Ni, Mn, Mg, S, P, Co, Mo, Etc. Different chemical reagents, Equipments , Volumetric and Gravimetric analysis, Spot test, Colorimetric methods, Optical and spectrophotometric analysis.

References:
1. V. Raghwan, Material Science
2. G.E.Dieter, MechanicalMetallurgy
3. P Chalmers, Physical Metallurgy
4. R. C.Rollason, Metallurgy for mechanical engineers

List of Experiments:
1. Metallographic studies – Study of Optical microscope, Optically flat surface preparation, etching reagents, Grain size- ASME no., micro structures, Image analysis, Standard specimen,

2. Carbon, sulphur, Phosphorus determination, Strauhlin's apparatus, Eggert's Method in different samples.
3. Hardness and Hardenability test, Jeremy Cony test. Soft and hard Martensite.
4. Different heat treatment cycles using electric furnace [Programmable preferred], Annealing, Case carburising, Normalising, etc.
5. Gravimetric / Volumetric - chemical analysis of alloying elements like, Cr, Ni, Mn, Si etc.
6. Study of different instrumental method of analysis, spectrophotometers, Differential Scanning calorimeter,
7. Spot test for quick assessment of alloying elements like Mn, Cr, Ni, etc.
8. Experiments / study of Non Destructive Methods, Ultrasonic test, Magnetic particle inspection, Dye penetration test, Eddy current test, Radiography test. Cupping test / formability test for sheet metal

MEA- 304 Manufacturing Process

UNIT-I
Casting : Types of casting process .Molding and Foundry core sands and their properties, gating, runners, risers, solidification, defects and elimination, molding machines, centrifugal casting, dye casting, shell molding; Lost wax molding; continuous casting; cupola description and operation.

UNIT-II
Welding: Types of welding ,Gas welding method, flames, gas cutting, Electric arc welding, AC and DC welding machines and their characteristics, flux, electrodes, submerged arc welding, TIG & MIG welding; pressure welding; electric resistance welding spot, seam and butt welding; Thermit chemical welding; brazing and soldering, welding defects & remedies .safety precautions .

UNIT-III
Pattern Making: Types of patters, Pattern and pattern making, pattern allowances; pattern design considerations, core, core boxes . Forging: types of forging operations Theory and application of forging processes description; , drop and horizontal forging machines .

UNIT-IV
Press working: Description and operation of processes, process of shearing, punching, piercing, blanking, trimming, perfecting, notching, lancing, embossing, coining, bending, forging and drawing; press, tool dies, auxiliary equipment, safety devices, stock feeders, scrap cutters, forces, pressure and power requirements . Rolling: Types of Rolling operations ,General description of machines and process; rolling of structural section plates and sheets; hot and cold rolling techniques

UNIT-V
Metal Machining : Basics of Lathe machines , operations & components ,working principle of Shaper & planner ,Introduction to milling ,grinding and drilling machines .

References:
1. Anderson and Tetro; Shop Theory; Mc Graw Hills
2. Kaushish JP; Manufacturing Processes; PHI Learning.
3. Kalpakjian Producting Engineering PEARSON Education
4. Chapman; Workshop Technology
5. Philip F Ostwald ; Manufacturing Process & systems : John Wiley
6. Raghuvanshi; Workshop Technology ; Dhanpat Rai.
7. Hajra Choudhary; Workshop Technology:, Vol I

List of Experiments:
1. To study of tools used for various manufacturing processes, study includes application & live demonstration of hand and machine tools .
2. To study of the Pattern Making
3. To study of Metal Casting of Simple component
4. To study of gas welding
5. To study of different welding process
6. To study of the die Casting
7. To study and perform various operation of forging machine .
8. To study of Hydraulic ,Pneumatic presses & demonstration of piercing, slitting, deep drawing operations on press machine.

MEA- 305 Strength of Material

UNIT-I
Stress and strain: stresses in members of a structure, axial loading, normal stress, shear stress, analysis of simple structures, stepped rods, members in series and parallel: stress strain diagram, Hooke's law, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain, relation among elastic constants, residual stress, fiber reinforced composite materials, strain energy under axial loads and stresses due to impact of falling weights. Transformation of stress and strain, principal stresses, normal and shear stress, Mohr's circle and its application to two and three dimensional analysis.

UNIT-II
Bending: pure bending, symmetric member, deformation and stress, bending of composite sections, eccentric axial loading, shear force and BM diagram, relationship among load, shear and BM, shear stresses in beams, strain energy in bending, deflection of beams, equation of elastic curve, Macaulay's method and Area moment method for deflection of beams.

UNIT-III
Torsion in shafts: Tensional stresses in a shafts, deformation in circular shaft, angle of twist, stepped and hollow transmission shafts.

UNIT-IV
Theories of failures: maximum normal stress & shear stress theory; maximum normal and shear strain energy theory; maximum distortion energy theory; application of theories to different materials and loading conditions.

UNIT-V
Columns & struts : stability of structures, Euler's formula for columns with different end conditions, Rankine's formula.

References:
1. Beer FP, Johnson Mechanics of Materials ,Sixth Edition ;Mc Graw Hills
2   Debabrata Nag & Abhijet Chanda :Strength of Materials : Wiley
3 Rattan; Strength of materials;Second Edition , Mc Graw Hills
4. Nash William; Schaum's Outline Series; forth Edition Strength of Materials;Mc Graw Hills
5. Singh Arbind K; Mechanics of Solids; PHI
6. Sadhu Singh; Strength of Materials; Khanna Pub.
7. R Subramannian , Strength of materials OXFORD University Press ,Third Edition.
8. 8 S Ramamurthum , Strength of materials , Dhanpat Rai

List of Experiments :
1. To perform standard tensile test on MS and CI test specimen with the help of UTM
2. To perform direct/ cross Shear test on MS and CI specimen
3. To perform transverse bending test on wooden beams to obtain modulus of rupture
4. To perform fatigue test
5. To perform brinell Hardness tests
6. To perform vicker hardness test
7. To perform izod/Charpy test
8. To perform rockwell Hardness test

MEA-306 Thermal Engineering Lab

1. To determine volumetric and isothermal efficiencies of a single stage compressor.
2. Study of two stage air compressor with intercooler.
3. Todetermine volumetric and isothermal efficiencies of a two stage compressor.
4. Study of different types of boilers and their classifications.
5. Study of different types of high pressure boilers.
6. To determine the performance of boiler.
7. Temperature measurements, Pyrometers and thermography.
8. Thermocouples, Temperature sensors,study and calibration.
9. Study and experiments on ORSAT apparatus.
10. Experiments on calorific value of different fuels and analysis of exhaust gases.

]

MEA– 307 Self study/GD Seminar

Objective of GD and seminar- is to improve the MASS COMMUNICATION and CONVINCING / under standing skills of students and it is to give student an opportunity to exercise their rights to express themselves. Evaluation will be done by assigned faculty base don group discussion and power point presentation.