NOTIFICATION

No. 89/2020 Date : 26/10//2020

Subject : Implementation of new Syllabi of Semester III & IV of B.E. (C.B.C.S.) as per A.I.C.T.E.Model Curriculum…

It is notified for general information of all concerned that the authorities of the University have accepted to implement new Syllabi of Semester III & IV of B.E./B.Text. E./B.Tech. (Chem.Tech.) (Food, Pulp & Paper, Oil & Paint and Petrochemical Tech.) (C.B.C.S.) as per A.I.C.T.E. Model Curriculum to be implemented from the academic session 2020-21 & onwards as per "**Appendix – A**" as given below:

Sd/-
(Dr.T.R.Deshmukh)
Registrar

"**Appendix – A**"

SYLLABUS OF B.E. [MECH.] SEM. III & IV {C.B.C.S.}

Semester-III
3ME01 MATHEMATICS-III

Course Learning Objectives :

1. To provide the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. To understand the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. To provide knowledge to apply False Position, Newton Raphson method to solve nonlinear & polynomial equations, Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. To understand the Gradient, divergent and curl of vector point functions. To find the directional derivatives of scalar point functions. To discuss the Irrotational and solenoidal vector fields. To define line surface andvolume integrals.

Course Outcomes :

Students will be able to -

1. Demonstrate the knowledge to solve ordinary Linear Differential equations with constant coefficient and its reducible equation using particular integral and complementary function and apply method of variation of parameter to solve ordinary Linear differential equations
2. Define the Laplace transform and its inverse transform for the basic functions. Locate the Laplace transform of periodic function. Apply the Laplace transform to solve differential equation
3. Apply False Position, Newton Raphson method to solve nonlinear & polynomial equations Apply Gauss Elimination method, Gauss Seidal iterative method, Relaxation method to solve system of linear equations, Apply Eulers method, Runge-Kutta method, Picards method to solve differential equations
4. Define Gradient, divergent and curl of vector point functions. Finds the directional derivatives of scalar point functions. Discuss the Irrotational and solenoidal vector fields. Define line surface and volume integrals

SECTION-A

UNIT-I : Ordinary differential equations:- Complete solution, Operator D, Rules for finding complementary function, the inverse operator, Rules for finding the particular integral, Method of variations of parameters, Cauchy's and Legendre's linear differential equations. (10 Hrs)

UNIT-II: Laplace transforms : Definition, standard forms, properties of Laplace transform, inverse Laplace transform, initial and final value theorem, convolution theorem, Laplace transform of impulse function, Unit step function, Laplace transforms of periodic function. Solution of Linear differential equations. (10 Hrs)

UNIT-III :a) Partial differential equation of first order of following form- (i) f (p,q)=0; (ii) f (p,q,z)=0; (iii)f (x,p)=g(y,q); (iv) Pp+Qq=R (Lagranges form); (v) z=px+qy+f (p,q) (Clairaut form)

b) Statistics : Curve fitting by method of least squares (Straight and parabola only), Correlation, Regression.

c) Probability Distribution:– Binomial distribution, Poisson and normal Distribution. (10 Hrs.)

SECTION-B

UNIT-IV: Complex Analysis :- Functions of complex variables, Analytic function, Cauchy-Reimann conditions, Harmonic function, Harmonic conjugate functions, Milne's method, conformal mappings (translation, rotation, magnification, inversion, bilinear transformation), singular points, expansion of function in Tayler's and Laurent's series. Cauchy's integral theorem and formula, Residue theorem. (12 Hrs.)

UNIT-V: Numerical Analysis : Solution of algebric and transcendental equations by Newton-Raphson method & method of false position. Solution of system of linear equations by Gauss-Seidal method, Relaxation method. Solution of first order ordinary differential equations by Picard's, modified Euler's, Runge-Kutta and Taylor's method. (10 Hrs.)

UNIT-VI: Vector Calculus :- Scalar and vector point functions, Differentiation of vectors, Gradient of a scalar point function, Directional derivatives, Divergence and curl of a vector point function and their physical meaning, line, surface, volume integrals, irrotational and solenoidal vector fields, Stoke's and Divergence theorem (without proof).

(10 Hrs.)

Books Recommended :-

Text Books:

1. Text book on Applied Engineering Mathematics, Vol. II, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
2. Higher Engineering Mathematics, B.S Grewal, Himalaya Publishing House.
3. Applied Mathematics, Vol. III, J.N. Wartikar and P.N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.

Reference Book : Advanced Engineering Mathematics, Erwin Kreyzig, John Wiley.

3ME02 MANUFACTURING PROCESSES

Course Learning Objectives :

1. To study the manufacturing processes in sand casting industries, tooling and equipment
2. To study the metal melting process, melting furnaces and defects in casting
3. To study the various types of casting processes
4. To study the mechanical working of metals and allied processes
5. To study the mechanical joining processes and fastenings
6. To study welding processes and surface treatment processes

Course Outcomes :

Students will understand the :

1. basic concept of foundry process and related activities
2. concept of complete sand casting process with advance casting methods
3. fundamentals of welding processes
4. various processes like electroplating, anodizing etc and their importance in industries

SECTION- A

Unit-I : Introduction to manufacturing processes & classification; Introduction to pattern making Pattern materials, pattern making tools, allowances, Types of patterns, functions of patterns, General properties of moulding sands, Mold hardness. Preparation of sand moulds of different types, Moulding processes, core making, core prints, core boxes. Sand casting Processes - Basic principle and Terminology of sand casting, design ofgating and riser system – by numerical approach. (9Hrs)

Unit-II : Technology of melting and casting - Melting furnaces, crucibles, pit, open hearth, gas fired cupola, cupola operation and electric hearth furnaces, Electric furnaces - Direct Arc, Indirect arc and electric induction furnace.

Defects in castings and its types, Causes and remedies of casting defects. Origin and classification of defects, shaping faults, Inclusion and sand defects, Gas defects, shrinkage defects, contraction defects, dimensional errors. Inspection and testing of castings:- Radiography, ultrasonic, Eddy current testing, fluorescent penetrant test.

(7 Hrs) **Unit III:** Casting processes and their principle of operation and applications permanent mold casting, slush casting, shell molding, Investment or lost wax casting, vacuum process, centrifugal casting,

continuouscasting, Die casting equipment and processes for Gravity, pressure and vacuum casting methods, cleaning ofcastings, Modernisation & Mechanisation of Foundries. (8 Hrs)

SECTION – B

Unit IV: Mechanical working of metals: Principle of hot and cold working process and its types, Extrusion, piercing, pipe and tube production, manufacture of seamless pipe and tubing. Shearing operations, tube drawing, wire drawing, spinning, embossing and coining, squeezing and bending operations, rotary swaging, load estimation for bulk forming (forging and drawing), rolling and types of rolling mills. (8 Hrs)

Unit V: Joining processes:- Mechanical joining processes, Mechanical fastening, riveting, soldering, brazing Welding, Types of welding processes-Arc welding: principle and working, Gas welding- principle and working Types and purpose of Electrodes, Electrode coatings(flux). TIG & MIG processes – Working principles and its applications, shielding gases, MIG-Spray transfer and dip transfer processes. (6 Hrs.)

Unit VI: Submerged arc welding & resistance welding :- Heat generation in resistance welding, operationalcharacteristics of resistance welding processes such as spot welding, projection welding, butt welding.
Principle of operation of friction welding, forge welding, plasma arc, thermit welding. Welding defects, Testingand Inspection of welds, Ultrasonic, Electroslag, Electron Beam, laser welding, weldability.
Surface Treatment-Electroplating, electroforming, and iodising, metal spraying, shot peening, polishing, mechanical cleaning. (9 Hrs)

Books Recommended :

Text Books:-

1. Workshop Technology Vol. I by Bawa, Tata Mc-Graw Hill Publication.
2. Workshop Technology Vol I by Hajra Chaudhary, Dhanpat Rai & Sons 2001.

References:-

1. Workshop Technology Vol I by Raghuwanshi.
2. Manufacturing Processes by J.P. Kaushish; PHI
3. Processes and Materials of Manufacture by R.A.Lindberg, PHI Pub 2001.
4. Manufacturing technology Vol. I, by P. N. Rao.

3ME07 MANUFACTURINGPROCESSES - LAB

Practices:-

1. Study of safety precautions in workshop practices.
2. Foundary:- Any two of the following jobs Sand preparation and practice in moulding of various types of patterns:- Pattern making - one job, Moulding - one job Casting - one job.
3. Joining Processes :Two composite jobs involving electric welding, gas welding and resistance welding process.
4. One job on Mechanical Working of Metals like piercing / drawing / bending/ embossing/ spinning/ upsetting, etc.

A journal should be prepared and submitted on above term work.

The practical examination shall consist of a job preparation and college assessment should be based upon thejobs, term work and viva examination.

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3ME03 MECHANICS OF MATERIALS

Course Learning Objectives :

1. To develop theoretical basis for stress, strain concept in various components under study
2. To study mechanical behavior of engineering material
3. To familiarize about finding shear force, bending moment, torsion, slope and deflection of various types ofbeams with different loading conditions
4. To build the necessary background to apply the knowledge of mechanics of materials on engineeringapplications

Course Outcomes :

Students will be able to -

1. Determine the stress & strain in the member subjected to axial, bending & torsional load
2. To observe different types of material behavior such as elastic, plastic, ductile and brittle
3. Apply SF and BM diagrams to analyse resistance offered by the beam and able to solve practical problemsin real world
4. Apply deflection criteria to check the stability of beam

SECTION-A

Unit-I: 1. Mechanical properties: Concept of direct, bending and shear stresses and strains, stress-strain relations, Biaxial and triaxial loading, elastic constants and their relationship, stress-strain diagrams and their characteristics formild steel, and other metals, factor of safety, stress and strain of bar due to self weight.

2. Uniaxial stresses and strains: Stresses and strains in compound bars in uniaxial tension and compression, temperature stresses in simple restrained bars and compound bars of two metals only, introduction to theory of elasticity and photoelasticity. (10 Hrs.)

Unit-II: 1. Axial force, shear force & bending moment diagrams : Beams, loading and support conditions, bending moment and shear force for all types of loadings for simply supported beams, cantilevers, relation between shear force, bending moment and loading intensity.

2. Simple or pure bending theory: Theory of simple bending, section modulus, moment of resistance, bending stresses in solid, hollow and built up section, leaf springs. (7 Hrs.)

Unit-III: 1.Torsion: Theory of torsion & assumptions, derivation of torsion equation, polar modulus, stresses insolid & hollow circular shaft, power transmitted by shaft, closed coiled helical spring with axial load.

2. Shear stress distribution on beam rectangular and circular cross sections. (7 Hrs.)

SECTION–B

Unit-IV: Thin and thick cylinders and thin spherical shells subjected to internal pressures. (4 Hrs.)

Unit–V: 1. Strain energy under uniaxial tension and compression impact loads and instantaneous stresses.

2. Principal Stresses : Biaxial stress system, principal stresses, principal planes, Mohr's circle of stresses.
3. Strain energy and resilience : proof resilience, shear resilience, strain energy due to self load (7 Hrs.)

Unit-VI: Deflection in simplysupported beam, cantilever beam subjected to point loads, uniformly distributed loads, moments by Macauley's method. (7 Hrs.)

Books Recommended:

Text Books :

1. Ramamruthm : Strength of Materials, Danpat Rai and Sons, New Delhi.
2. R. S. Khurmi: Strength of Material, S. Chand Publication, Delhi.

Reference Books :

1. E.P.Popov : Mechanics of Materials, Prentice Hall of India, New Delhi.
2. S. Timoshenko and O.H.Young : Elements of Strength of Materials, East West Press Private Ltd., New Delhi.
3. Shames, I. H. : Introduction to Solid Mechanics, Prentice Hall of India, New Delhi
4. Beer and Johston : Mechanics of Materials, McGraw Hill.
5. D. S. Prakash Rao : Strength of Material : APractical Approach, University Press, Hyderabad.

3ME08 MECHANICS OF MATERIALS - LAB

Practicals:

Minimum Six to Eight out of the following:

1. Tension test on metals.
2. Compression test on materials.
3. Shear test on metals.
4. Impact test on metals.
5. Hardness test on metals.
6. Torsion test on metals.
7. Deflection of beams.
8. Modulus of rupture test.
9. Deflection of springs.

Practical examination shall be viva-voce based on above practical and the syllabus of the course.

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3ME04 ENGINEERING THERMODYNAMICS

Course Learning Objectives :

1. To study the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. To study the laws of thermodynamics and their applications
3. To study the properties of steam, work done and concept of heat transfer
4. To study the air standard cycles

Course Outcomes :

Students will be able to

1. Understand the basic concepts of thermodynamics, thermodynamic systems, work and heat
2. Apply first law of thermodynamics and application of first law to flow and non-flow processes
3. Apply second law of thermodynamics and understand concept of entropy
4. Understand the properties of steam, work done and heat transfer during various thermodynamicsprocesses with steam as working fluid
5. Understand the concept of air standard cycles

SECTION–A

Unit-I: Introduction to basic concepts of thermodynamics, Macroscopic and microscopic approaches, properties of system, state, processes and cycle, thermodynamic equilibrium, types of thermodynamic systems, Temperatures and Zeroth law of thermodynamics, Quasi-static process, Gas Laws and Ideal gas equation of states, gas constant and universal gas constant.

Work and Heat: Definition of work, thermodynamic work, displacement work and other forms of work, Definition of Heat, Work and heat transfer as path function, comparison of work and heat, work done during various processes, P-V diagrams (10 hrs)

Unit-II: First law of thermodynamics: Energy of a system, classification of energy, law of conservation of energy law, Joules experiment. Energy a property of system, internal energy-a function of temperature, Enthalpy, specific heat at constant volume and constant pressure. Application of first law to non-flow processes, Change in internal energy, work done and Heat transfer during various non-flow processes.

(7 hrs)

Unit-III: First Law applied to flow processes: Steady state, steady flow process, equation for work done in steady flow process and its representation on P-V diagram, mass balance and energy balance in steady flow process, steady flow energy equation and its application to nozzles and diffusers, turbine and compressor pumps, heat exchangers, Throttle valve etc. work done and Heat transfer during steady flow processes. (9 hrs)

SECTION–B

Unit-IV: Second Law of thermodynamics: Limitations of First law, Thermal energy reservoir, heat engines refrigerator and heat pumps, COP and tonne of refrigeration, COP for heat pump and refrigerator, Kelvin-Plank and Clausious statements, their equivalence, reversible and irreversible processes, Carnot cycle, Carnot theorem and its corollary, The thermodynamic temperature scale, Reverse Carnot cycle, Inequality of Clausius.

Introduction to Entropy, availability and irreversibility. Principle of increase of entropy.

(8Hrs) **Unit-V:** Properties of Steam: Triple point and critical point, Sensible heat, latent heat, superheat and total heat of steam. Wet steam, dryness fraction, Internal energy of steam, External work of evaporation, internal latent hear, Specificvolume, enthalpy, internal energy and entropy of steam. T-S diagram Mollier chart, Steam tables and their use.Work done and heat transfer during various thermodynamics processes with steam as working fluid. Throttlingof steam, determination of dryness fraction using various calorimeters. (8 Hrs)

Unit VI : Air Standard Cycles: Ottto, diesel, semidiesel, Brayton, Sterling and joule cycles etc., their efficiencies and mean effective pressure, comparison of auto, diesel and duel cycles.

Vapour Cycles:- Rankine and Modified Rankine Cycle. Comparison of Rankine and Carnot cycle, representationon P-V, T-S and H-S diagram. (No numerical on this unit) (numerical on air standard cycle) (8 Hrs)

BOOKSRECOMMENDED:

Text Books :

1. Engineering Thermodynamic - by P. K. Nag.
2. Fundamentals of EngineeringThermodynamics; R. Yadav;
3. Thermodynamics Basics and Applied: by V. Ganeshan
4. Thermal Engineerirng: by Mahesh M. Rathore.

Reference Books :

1. Basic Engineering Thermodynamics - by Reyner Joel

2. Thermodynamics - by C.P. Arora.
3. Fundamentals of Classical Thermodynamics - by G. J. Vanwylen.
4. Engineering Thermodynamics; P. Chattopadhyay; Oxford
5. Engineering Thermodynamics; Gordon Rogers, Yon Mayhew; Pearson.

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3ME05 FLUID MECHANICS

Course Learning Objectives :

1. To introduce and explain the fundamentals of Fluid Mechanics used in applications of Hydraulics, Aerodynamics, Gas dynamics, etc.
2. To give fundamental knowledge of fluid, its properties and behavior under various conditions of internaland external flows.
3. To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body andapplication of mass, momentum and energy equation in fluid flow.
4. To imbibe basic laws and equations used for analysis of static and dynamic fluids.
5. To inculcate the importance of boundary layer flow and its applications
6. To determine the losses in a flow system, flow through pipes, impact of jet

Course Outcomes :

The student will be able to:

1. identify importance of various fluid properties at rest and in motion
2. derive and apply general governing equations for various fluid flows
3. understand the concept of boundary layer theory and flow separation.
4. calculate energy losses in pipe flow.
5. evaluate the performance characteristics of hydraulic jets

SECTION – A

UNIT-I : 1. Basic properties of fluid such as Density, Specific weight, Specific Volume, Specific gravity, Viscocityof fluid, Surface Tension, Capilarity, vapour pressure & cavitation.

2. pressure & its measurement: Pascals law, Hydrostatic law of pressure & pressure variation in fluid,measurement of pressure by Manometer. (10 Hours)

UNIT-II : 1. Hydrostatic pressure force on plane & curved surfaces. Measurment of total pressure & centre ofpressure.

2. Buoyancy & floatation: Concept of buoyancy, centre of buoyancy. Stability of floating body,Metacentre & metacentric height. Condition of equilibrium of floating & sub-merged body. (08 Hours)

UNIT III : 1. Kinematics of fluid flow, Methods of describing fluid motion, Types of flow, rate of flow, streamline, potential line, flow net, velocity & acceleration, continuity equation in three dimensional flow.

2. Dynamics of fluid flow : Eulers equation of motion, Bernoullis equation measurement of fluid flowwith venture meter. (08 Hours)

UNIT-IV : Flow through pipes: Losses in pipe, major losses, Darcy's Weisbach equation, monor losses due to sudden enlargement, contraction, entry, exit & pipe fitting. Hydraulic gradient & total energy line, flow through series & parallel pipes, concept of water hammer in pipes. (08 Hours)

UNIT-V : Motion of viscous fluid: Introduction to Laminar & Turbulent flow, Concept of Boundary layer & its type. Drag & Lift force on object. Boundary layer separation, Reynolds number & its significance. (08 Hours)

UNIT-VI : Principal of fluid machinery : Force exerted by fluid jet on plane, curved, stationary & moving vanes. Velocity diagrams, work done & efficiency. (08 Hours)

Books Recommended :-

Text Books:-

1. Fluid Mechanics & Machinery by Modi & Sheth.
2. Fluid Mechanics and Hydraulic Machines by R. K. Bansal.
3. Engineering fluid Mechanics by R. K. Rajput.
4. Fluid mechanics & Machinery by CRSP. Ojha, R. Berndtsson.
5. Fluid Mechanics by Strecter; Tata Macgraw Hill.

Reference Books:-

1. R.K.Rajput; Engineering Fluid Mechanics; S. Chand publications.
2. Dr. Mody & Seth; Hydraulics and Fluid Mechanics; Standard book house
3. S. Ramamrutham, Hydraulic, Fluid Mechanics & Fluid Machines, Dhanpatrai publishing company.
4. Strecter, Fluid Mechanics, Tata Mc-Graw Hill.

3ME09 FLUID MECHANICS - LAB

Practical Term Work:-

At least six (6) practicals (study/Trials) based on above syllabus, as given below shall be performed and a report there of submitted by the students :

1. Measurement of fluid pressure by manometer.
2. Determination of metacentric height.
3. Verification of Bernoulli's equation.
4. Determination of co-efficient discharge by Venturimeter.
5. Calculation of Reynolds number for Laminar & Turbulent flow.
6. Determination of co-efficient of friction (Major losses in Pipes) through pipe.
7. Determination of head loss due to sudden enlargement.
8. Determination of head loss due to sudden contraction.
9. Determination of loss of head in bends & in elbows.
10. Verification of momentum equation.

Note :- Practical examination shall consist of oral or Experimentation based on above term work.

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3ME10 Machine Drawing - Lab

Course Learning Objectives :

1. To study the techniques of sectioning and visualizing the objects
2. To imagine and develop the missing views of objects
3. To seek the knowledge of development of surfaces
4. To seek the knowledge of intersection of solid objects
5. To know the conventions for materials and parts used in industries
6. To prepare the drawings for machine assembly

Course Outcomes :

Student will be able to -

1. Demonstrate the techniques of sectioning and visualizing the objects
2. Imagine, understand and sketch the missing views
3. Develop surfaces of objects and apply knowledge during their fabrication
4. Understand the concept of intersection of solid objects
5. Understand and apply the conventions for materials and parts used in industries
6. Prepare detail machine assembly drawings

List of Practicals :

1. Conversion of pictorial view into Sectional Orthographic Projection
2. Missing Views
3. Development of surfaces of Cubes / Prisms / Cylinders / Pyramids / Cones & their cut sections
4. Intersections of Solids – Prism & Prism /Cylinder & Cylinder /Cylinder & Prism / Cone & Prism
5. Conventions for various materials & parts
6. Preparation of detail drawings of simple machine assembly
7. Preparation of assembly drawing of simple machines

Books recommended:

Text Books:

1. Engineering drawing by N.D. Bhatt; Charactor Publications.
2. Machine Drawing by A. M. Bisen; New Edge International publication.
3. Machine Drawing by R. K. Dhawan, S. Chand
4. Machine Drawing by Basant Agrawal, McGraw Hill.5.

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B.E. (MECHANICAL) SEMESTER

FOURTH

4ME01 MATERIAL SCIENCE

Course Learning Objectives:

1. To study the basic concepts of metallurgy and classification of materials
2. To study the process of formation of microstructures of metal materials and composites
3. To study the alloying elements, their effects and applications
4. To study the ferrous and non-ferrous metals and respective alloys
5. To study the various heat treatment processes and their industrial applications
6. To study the mechanical working of metals and process of powder metallurgy

Course Outcomes:

Students will understand the -

1. Basic concepts of metallurgy and types of materials.
2. Iron-Carbon Equilibrium Diagram, critical temperatures, formation of microstructures and they will get theknowledge of alloys.
3. Uses and practical applications of ferrous & non ferrous materials
4. Various heat treatment processes, powder metallurgy and industrial applications.

SECTION - A

UNIT-I: Introduction to metallurgy: Basic concept of process metallurgy, physical metallurgy, and mechanical metallurgy, Classification of materials & their application, Structure of metals and alloys, formation of Alloys, Solid solutions, types and their formation, lever rule for phase mixtures. Solidification of pure metals, nucleation and growth, ingot structure, dendritic solidification. (8 Hrs)

UNIT II: Study of binary equilibrium diagram and invariant reactions, Construction and study of Iron-carbon Equilibrium Diagram, Critical temperatures, Microstructure of slowly cooled steel, Estimation of carbon from microstructure, structure property relation, Introduction to composite materials, advantages and applications. (8

Hrs)

UNIT III: **Alloy Steels:** Purpose of alloying, Classification of alloy steels, classification of alloying elements, Effect of alloying elements on eutectoid composition, Eutectoid temperature, and on the S curve, , alloying elements and their effect on properties of steels, OHNS steels, Hadfield'S Manganese steels, High speed steels, their heat treatments and applications, Ferritic, Austenitic and Martensitic stainless steels, their properties and applications, weld decay in stainless steel. (8 Hrs)

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SECTION - B

UNIT IV: Cast irons **:** Factors governing condition of carbon in cast iron, Maurer's diagram, Solidification of grey and white cast iron, Malleabalizing, Constitution and properties of white, gray, Nodular and Malleable cast irons, their applications, Alloy cast irons.

Non Ferrous Metals and Alloys : Types, Properties and uses of Brasses and Bronzes. Important alloys of Aluminium, Lead, Tin and Zinc, their applications. Bearing materials, Season cracking, precipitation hardening. (8 Hrs) **UNIT V**: Principles of Heat Treatment: - Annealing, Normalizing, Tempering Iso-thermal transformation diagrams(S-curve), super imposition of continuous cooling curves on 's' Curve, pearlite, bainite and martenstetransformation, Quenching media, severity of quench, Austempering, Martempering and patenting, Retainedaustenite and sub-zero treatment. Hardenability. (8 Hrs)

UNIT VI: Methods of surface hardening: Carburizing, Nitriding, Cyaniding, Flame and Induction Hardening. Mechanical working of Metals: - Hot and cold working, Relative advantages and disadvantages, study of stress strain curve, Luder's bands, Work hardening, strain Ageing; Recovery, Recrystallization and grain growth. Metallurgical factors affecting various Mechanical working processes, preferred orientation, Deformation mechanisms-Slip& twining, critical resolved shear stress.

Powder Metallurgy: Concept, Methods of Manufacture of metal powders, compaction Process- Single die and double die, sintering, stages of sintering, Manufacture of porous bearings & cemented carbide tip tools by P.M.T. Advantages, limitations and applications of powder metallurgy. (8 Hrs)

BOOK RECOMMENDED :-

Text Books :-

1. Introduction to physical metallurgy ;Sidney H Avner, TATA Mc-Grawhill
2. Engineering materials & metallurgy R.K.Rajput, S chand publication.
3. Material nScience & Mettalurgy, by V.D. Kodgire. Everest Publication House.

Reference Books:

1. Mechanical Metallurgy, G. E. Dieter, Mc- Graw Hill International, London 3rd Edn. 1999
2. Physical metallurgy for engineers, Clarke and Varney, second Edn.,1987.
3. Power metallurgy, A.K Sinha First Edn. 1991.
4. Material Science and Metallurgy; V.D. Kodgire; Everest Publishing House
5. Engineering physical Metallugrgy, Y Lakhtin, Mir Publications. Second Ed. 1999
6. Material Science and Meallurgy- C Daniel Yesudian, Scitech Publication.

4ME07 MATERIAL SCIENCE - LAB

List of Practicals: - (At least eight (8) practicals out of the following list.)

1. Study of metallurgical microscope.
2. Preparation of specimen for micro-examination.
3. Moulding of specimen for micro-examination.
4. Study of micro structures of Annealed and normalized plain carbon steels.
5. Study of micro structures of alloy steels and H.S.S.
6. Study of micro structures of various cast irons.
7. Study of micro structures of non ferrous metals.(brasses, bronzes)
8. Study of micro structures of hardened and tempered steels.
9. Study of Iron carbon Equilibrium diagram & Allotropic forms of iron.
10. Study different Heat Treatment Process for steel.
11. Study of different surface Hardening processes for steels.
12. Study of effect of alloying elements on the properties of steels.
13. Measurement of hardenability by Jominy end quench test apparatus.
14. Study of hardness tester and conversion of Hardness number
15. Industrial visit to study heat treatment plant.
16. Measurement of particle size, grain size, nodularity, coating thickness etc. by using some software like Metzer Microcam 4.0

Practical Examination:

Note : Practical examination shall consist of viva voce/performance based on the above syllabus and practical work.

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4ME02 ENERGY CONVERSION - I

Course Learning Objectives:

1. To study the properties of steam and its behavior for different thermodynamic process.
2. To study different types of boilers, their mountings, accessories, performance of boilers and differentefficiencies.
3. To study the various fuel handling and ash handling system in power plant.
4. To study various types of condensers and cooling towers.
5. To study various thermodynamic aspects of flow of steam through nozzle and diffuser.
6. To study flow of steam through steam turbine and concept of compounding.

Course Outcomes:

1. Students will study the concept steam and steam power plant, mounting and accessories.
2. Students will demonstrate the calculation of various efficiency & related parameters.
3. Student will show the adequate knowledge of fuel & ash handling systems.
4. Students will demonstrate the knowledge of condenser & application.
5. Students will understand the concepts of steam nozzles & steam turbine.

SECTION – A

Unit I : Flow diagram for steam power plant with basic units such as steam generator, turbine, condenser and pump. Steam power plant layout, site selection. Boilers: Introduction to water tube and fire tube boilers used in thermal power plants, packaged Boilers, High pressure boilers; Loeffler, Benson, Lamont Boilers, Boiler mountings and accessories—devices for improving Boiler efficiency. Principle of fluidized bed combustion. Concept of co- generation. (7 Hrs.)

Unit II : Boiler draught; Types of draught, expression for diameter & height of chimney, condition for maximum discharge, efficiency of chimney, reasons for draught loss. Boiler performance:- Boiler rating, boiler

power, equivalent evaporation, efficiency. Effect of accessories on boiler efficiency and heat balance. (7 Hrs)

Unit III : CONDENSERS : Need, Types of condensers, quantity of cooling water required. Dalton's law of partial pressure, condenser and vacuum efficiency. Sources of air in condensers and its effect on performance. cooling towers: Natural and mechanical wet type cooling tower.

Steam nozzles : Flow of steam through nozzles & diffusers, Maximum discharge, critical pressure ratio, chocking in nozzles, Effect of friction. Determination of throat & exit areas, Nozzle efficiency, no numerical on concept of supersaturated flow & Wilson line. (7 Hrs.)

SECTION – B

UNIT IV : Steam Turbines:- Principle of working, Types of steam turbines such as impulse, reaction, axial & radial flow, back pressure & condensing turbines. Compounding. Reheat, regenerative cycles, bleeding. Analysis limited to two stages only. Analysis of steam Turbines : Flow of steam through impulse & impulse reaction turbine blades, Velocity diagrams. Graphical & analytical methods for work & power developed, axial thrust and efficiency. Height of turbine blades. losses in steam turbines:- blade friction, partial admission, disc friction, gland leakage losses and velocity losses. Governing of steam turbines. (7Hrs)

UNIT V : NUCLEAR POWER:- Fusion, fission, Chain reaction, conversion and breeding in nuclear fission. Components of Nuclear Power Plant such as Reactor, Steam generator, turbine, Moderator, Control Rods etc., Typesof nuclear reactors like BWR, PWR, CANDU and liquidized metal cooled thermal reactors. (7 Hrs.)

UNIT VI : Introduction to renewable energy, Wind Energy, solar, fuel cell, bio-gas, MHD, Geothermal, OTEC, tidal power plants, Applications of Non conventional energy. (7 Hours)

RECOMMENDED BOOKS:

Text books :

1. Thermal engineering; Mahesh M Rathore; Tata McGraw-Hill
2. Thermal Engineering R.Yadav; Central publication
3. Non-conventional Energy Sources B. H. Khan Tata McGraw-Hill
4. Non-conventional Energy Sources G. D. Rai.

Reference books:

1. Steam Turbine; Kearton; Oscar Publications.
2. Thermal Power Engineering; Mathur Mehta; Tata McGraw-Hill
3. Power Plant Engineeirng. P. K. Nag
4. Power Plant Engineeirng; R. K. Rajput ; Laxmi Publications
5. Thermal Engineering, P.L.Ballaney; Laxmi Publications.

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4ME03 MANUFACTURING TECHNOLOGY

Course Learning Objectives :

1. To study the mechanics of metal cutting, tool characteristics and cutting forces
2. To study the turning operations using lathe and CNC machines
3. To study the working of drilling and boring machines
4. To study the working of milling and gear cutting machines
5. To study the machining operations using grinding, shaper, planer and slotter machines
6. To study the unconventional machining processes

Course Outcomes :

Students will be able to -

1. Apply the knowledge of theory of metal cutting, tool selection & calculate cutting forces
2. Demonstrate the knowledge of basics of turning operations
3. Understand the drilling and boring operations and working of drilling & boring machines
4. Understand the milling and gear cutting operations and working of respective machines
5. Understand the working of grinding, shaper, planer and slotter machines
6. Understand the knowledge of unconventional machining processes

SECTION – A

UNIT I : Theory of Metal cutting: Mechanics of Metal cutting, Tool material, Tool Geometry, Cutting tool classification, Tool life, Tool wear, Calculation of Cutting forces, Machinability, Cutting fluids, Chip thickness ratio, Merchant circle. (8 Hrs)

UNIT II : Construction, Operations and accessories of centre lathe, introduction of capstan & turret lathe, indexing mechanism, bar feeding mechanism, Machine tool classification. Numerical approach. Taperturning & Screw cutting & basic concept of CNC. Introduction, working principal & CNC turning operation. (10 Hrs)

UNIT III : a) Drilling operation : Drilling M/cs general purpose, Mass production and special purpose drilling M/cs.
b) Introduction & types of Boring. Boring M/c :- Horizontal, Vertical and jig Boring M/c.
Introduction to Broaching and its types, broach terminologies, etc. (8 Hrs)

SECTION - B

UNIT IV : (a) Calculation of machining time for Milling.
(b)Milling M/c :- Types, Types of Milling Cutters, Dividing head, Compound and differential idexing.
c) Gear producing M/cs. (6 Hrs)

UNIT V : a)Grinding Machines: Bench grinders, surface grinders, centreles grinders, types of bonds & Abrasive modification of grinding wheels.
b) Study of various part & Operation of Shaper, Planer, Slotter. (6 Hrs)

UNIT VI : Unconventional Machining Processes:-

a) Mechanical Processes:- Ultrasonic Machining - principle and applications. process parameters; Abrasive and water parameters involved.
b) Thermal processes:- Election Beam Machining – Generation of beam, principle and applications : Laser Beam machining applications : Plasma-arc machining- Concept and generation of plasma, principle of PAM, applications.

c) Electric discharge Machining - Types die-sinking, wire cut EDM, Mechanism of material removal, process parameters, advantages and applications. (8 Hrs)

BOOKS RECOMMENDED :

Text Books:

1. Manufacturing Technology-Vol 1 & 2; R.L.Timings, S.P. Wilkinson; Pearson Publication.
2. Workshop Technology - By Hajra Choudhaury Vol II.
3. Manufacturing Technology Vol. II P. N. Rao, McGraw Hill Publication

References:-

1. Pandya & Shah, Modern Machining process, Tata McGraw Hill 1998.
2. Workshop Technology, O.P. Khanna, Dhanpatrai & Sons.
3. Workshop Technology - By Raghuwanshi. Vol II.

4ME08 MANUFACTURING TECHNOLOGY - LAB

Practicals:-

1. Demonstration of operations related to lathe, shaper, slotter, drilling & grinding m/cs.
2. One job on lathe covering taper turning and threading.
3. One job on shaping covering plane and inclined surfaces.

The above jobs should include drilling, grinding, tapping etc. Term work should be submitted in the form of journal.

N.B. :- The practical examination shall consists of preparation of practical jobs and assessment by externaland internal examiner.

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4ME04 BASIC ELECTRICAL DRIVES AND CONTROL

Course Learning Objectives :

1. To study the working of electrical drives and their components
2. To study the basics of DC motors and their characteristics
3. To study the working of AC motors, Induction motors and concept of braking
4. To study the different speed control methods of A.C. and D.C. motors
5. To study and design of transducers and their applications
6. To study the industrial applications of different drives

Course Outcomes :

Students will be able to -

1. Understand the working of electrical drives and their components
2. Understand the basics of DC motors and their characteristics
3. Understand the working of AC motors, induction motors and concept of braking
4. Understand the different speed control methods of A.C. and D.C. motors
5. Understand the design of transducers and their applications
6. Understand the industrial applications of different drives

SECTION-A

Unit I : Concept of general electric drives, classification and comparison of electrical drive system, Cooling and heating of electric motors. Introduction to mechatronics, Theory and principle of Power Transistor, SCR. **(**8 Hrs**)**

Unit II : Basic characteristics of D.C. motor, Torque equation, Modified speed – Torque characteristics. Starting and braking of Electrical D.C. motors, comparison of mechanical and electrical braking methods. Introduction, Principle, construction and working of Servo motors, stepper motors, Brushless D.C. motors. **(**8 Hrs**)**

Unit III : Classification of A.C. motors, construction, types, principle of working and characteristics of 3 phase Induction motors, applications. Starting and braking of 3 phase induction motors. Classification of single phase induction motors. construction, principle and working and applications. Principle and working of universal motor. **(**8 Hours**)**

SECTION-B

Unit IV : Conventional methods of speed control of A.C. and D.C. motors. Thyristorized stator voltage control of 3 phase induction motor, (v/f) control method, slip-power recovery scheme. Thyristorized armature voltage control of D.C. motors using phase control & Thyristorized chopper. **(**8 Hours**)**

Unit V : Basic principle, construction & applications of sensors and transducers, contact - non- contact type, optical proximity sensors. Switches, contact type, magnet type, electromagnetic type, sound, light, pressure, vibration transducers, Hall effect-sensors A.C./D.C. Tachogenerators. **(**8 Hours**)**

Unit VI: Industrial applications - classes of duty selection of an electric drive for particular applications such as steel mill, paper mill, cement mill, textile mill, sugar mill, electric traction, coal mining, etc. Induction heating, surface hardening& Dielectric heating. **(8 Hours)**

BOOKS RECOMMENDED :

Text Books:

1. A First Course on Electrical Drives - S.K. Pillai.
2. Basic Electrical Technology (Vol. 11) - B.L. Theraja

Reference Books :

1. Drives and Control - N. Dutta
2. Mechatronics - W. Bolton, Addison Wesley, Longman Ltd.
3. A Course in Electrical, Electronics Measurement and Instrumentation, By A.K.Sawhney, Dhanpat Rai & Sons,

4ME09 BASIC ELECTRICAL DRIVES AND CONTROL - LAB

List of Experiments :

Any EIGHT practicals from the following list :

1. To study the Specification of Various Electrical Machines.
2. To study the D.C. Motor Starters.
3. To study the Running and Reversing of D.C. Motor.
4. Speed Measurements using Magnetic Pick-up.
5. To study the Speed reversal of counter Current Breaking of 3-phase Induction Motor.
6. To control the speed of D.C. Motor by a) Armature Control b) Field Control.
7. To perform Load Test on Induction Motor.
8. To study Dynamic/Rheostatic Breaking of D.C. Motor.
9. To study Characteristics of Thyristor.
10. To study the speed -Torque Characteristic of Servo Motor.

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4ME05 HYDRAULIC AND PNEUMATIC SYSTEMS

Course Learning Objectives:

1. To get fundamental background about the hydroelectric power plants
2. To study operation, working principle & performance characteristics of hydraulic turbines
3. To study operation, working principle & performance characteristics of centrifugal pump,reciprocating pump and other hydraulic pumps
4. To study the behavior of compressible fluid flow
5. To study different hydrostatic & hydro kinematics industrial applications

Course Outcomes:

Students will be able to -

1. Demonstrate basic concepts of prime movers and turbines
2. Utilize the knowledge of centrifugal and reciprocating pumps for applications
3. Reveal the importance of other water lifting devices
4. Solve the elementary treatment on compressible fluid flow
5. Understand the concept of hydrostatic and hydrokinetic systems
6. Use the knowledge of hydraulics & pneumatics in developing project work.

SECTION - A

Unit I : Hydraulic Turbines - Theory of impulse and reaction turbines. Pelton, Francis and Kaplan turbines, theirconstruction, classification, analysis, characteristics and governing, draft tube. (10 Hours)

Unit II : Centrifugal pumps :- Basic Theory, classification, construction, operation, characteristics, multistage,NPSH and cavitations in pumps. (7 Hours)

Unit III:

1. Axial flow pump :- Basic theory, construction, & operation.
2. Other water lifting devices :- (a) Air lift pump. (b) Jet Pump. (c) Hydraulic Ram.
3. Computational Fluid Dynamics (CFD)
4. Introduction to CFD: Necessity, limitations, philosophy behind CFD, applications (6 Hours)

SECTION - B

Unit IV : Positive Displacement and other Pumps: Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels. Comparison of centrifugal and reciprocating pumps, performance characteristics. (9 Hours)

Unit V : Compressible fluid flow :- Perfect gas relationship, speed of sound wave, mach number, Isothermal andisotropic flows, shock waves. (8 Hours)

Unit VI : Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydrauliccoupling, hydraulic torque converter. (8 Hours)

BOOKS RECOMMENDED :-

Text Books:-

1. CSP Ojha, R. Berndtsson, Fluid mechanics and machinery; Oxford University.
2. Bansal R.K., Fluid mechanics and fluid machines; Laxmi publications.

Reference Books:-

1. Jagdish Lal, Hydraulic machines; Metropolitan Book Co. Pvt. Ltd.

2. Dr. Modi & Seth, Hydraulics and Fluid Mechanics; Standard house book.
3. Sen gupta, Computational fluid dynamics; Pearson Publishers.
4. Sameer sheikh, Iliyas Khan, Treaties on Hydraulics; Pneumatics, R.K. Publication.

4ME10 HYDRAULIC & PNEUMATIC SYSTEMS - LAB

List of Practicals:- At least **SIX** (6) practicals based on following :

1) Trial/Study of Pelton wheel
2) Trial/Study of Francis Turbine
3) Trial/Study of Kaplan Turbine
4) Trial/Study of centrifugal pump
5) Trial/Study of reciprocating pump
6) Trial/Study of axial flow pump
7) Trial/Study of hydraulic ram
8) Trial/Study of multistage pump
9) Trial/Study of special pumps (air lift pump/ jet pump)
10) Trial/Study of Gear pump
10) Any one practical based on CFD software

Note : Practical Examination : Practical examination shall consist of Viva Voce/performance based on abovesyllabus & practical work.

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