C. U. SHAH UNIVERSITY
Wadhwan City

FACULTY OF:- Technology and Engineering
DEPARTMENT OF: - Mechanical Engineering
SEMESTER: -III
CODE: - 4TE03EMT1
NAME: – Engineering Mathematics – 3 (EMT)

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			Total
							Sessional Exam		University Exam		Internal		University	
		Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE03EMT1	Engineering Mathematics - 3	4	0	0	4	4	30	1.5	70	3	---	---	---	**100**

Objectives:-

- To represent periodic functions in terms of infinite trigonometric series
- To solve higher order ordinary differential equations
- To solve linear partial differential equations of first and second order
- To learn Laplace transform technique
- To study the numerical methods to solve transcendental equations

Prerequisite:-

Students should have a firm grasp elementary engineering mathematics offered in first and second semesters. The basic concepts of calculus and algebra must be clear.

Course Outline:-

Sr. No.	Course Content	Hours
1	**Fourier Series :** Periodic functions, Dirichlet's conditions, Trigonometric series, Euler's formulae, Fourier expansion of periodic functions with period 2π, Fourier series of even and odd functions, Fourier series of periodic functions with arbitrary periods, half range Fourier series, Harmonic analysis.	**10**
2	**Laplace Transforms and Applications:** Definition of the Laplace transform, Inverse Laplace transform, Linearity property, First Shifting theorem, Laplace Transforms of derivatives and integrals, Differentiation and integration of Laplace transforms, Convolution theorem, Solution of Differential equations using Laplace Transform, Unit step function, Second shifting theorem, Dirac's delta function.	**15**

3	**Ordinary Differential Equations and Applications:** Linear differential equations of second and higher order: Higher order linear differential equations with constant coefficients, Complementary Function (C.F.), Short cut methods for finding Particular Integrals(P.I.), General method: [1/f(D)] r(x) method for finding particular integral, Wronskian, Solution by method of variation of parameters, Cauchy's Homogeneous linear differential equation, Legendre's Homogeneous linear differential equation, Modeling of Electric circuits.	**15**
4	**Partial Differential Equations and Applications:** Formation of PDEs, Solution of Partial Differential equations f(x,y,z,p,q) = 0, Solution of PDE by direct integration, Linear PDEs with constant coefficients, Classification of second order linear PDEs, Applications of PDE: Separation of variables, Solution of Wave equation, Heat equation and Laplace equation.	**15**
5	**Numerical solution of Algebraic & Transcendental equation** Solution of algebraic and transcendental equations: Bisection method, Regula falsi method, Secant method, Newton-Raphson method, rate of convergence	**05**

Learning Outcomes:

After the successful completion of the course, students will be able to

- express physical phenomenon in mathematical form
- represent periodic function as a series in terms of sine and cosine
- Solve differential equations by using tools like Laplace transform and Fourier series.
- To solve second order partial differential equations: wave equation, heat equation, laplace equation.

Teaching & Learning Methodology:

- Lecture method using standard teaching aids.
- Solving term assignments in tutorials.
- Quiz/Seminar/Expert lectures

Books Recommended:

1. Advanced Engineering Mathematics (8th Edition), **E. Kreyszig**, Wiley-India (2007).
2. Higher Engineering Mathematics – Vol. 2, **Dr. K. R. Kachot**, Mahajan Publ. house
3. Engineering Mathematics -Vol 2, by **Baburam**, Pearson.
4. Higher Engineering Mathematics, Thirty-fifth edition. **B. S. Grewal**, Khanna Publication.
5. Elementary Differential Equations (8th Edition), **W. E. Boyce and R. DiPrima**, John Wiley (2005).
6. Fourier series and boundary value problems, **R. V. Churchill and J. W. Brown**, McGraw-Hill (7th Edition - 2006).
7. Numerical Methods, by **B. S. Grewal**, Khanna Publ.

E-Resources:

1 http://www.wiley.com/college/mat/kreyszig154962/
2 http://en.wikipedia.org/wiki/Portal:Mathematics
3 http://www.online.math.uh.edu

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FACULTY OF:- Technology and Engineering
DEPARTMENT OF: -Mechanical Engineering
SEMESTER: -III
CODE: - 4TE03EMN1
NAME: – Electrical Machines and Electronics

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			
		Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE03EMN1	Electrical Machines and Electronics	3	0	2	5	4	30	1.5	70	3	30	20	---	**150**

Objectives

- To expose the students to the concepts of various types of electrical machines and applications of electrical machines.

Prerequisites

- Students should have knowledge of basic electrical engineering and fundamentals of physics.
- They should know the derivatives and integration.

Course Outline

Sr. No.	Course Contents	Hours
1	**D.C. Generator:** Generator Principle, Simple loop generator, Practical generator, Yoke-pole Cores and Poles Shoes-Pole Coils-Armature Winding-Brushes and Bearing, types of generators, E.M.F. equation, open circuit characteristic, external characteristic and internal characteristic of DC generator, Uses of DC Generators.	05
2	**D.C. Motors:** Construction, Types, Principle of operation, torque equation, losses and efficiency, speed torque characteristics of shunt, series and compound motor, D.C. shunt motor starter, speed control of D.C. shunt and series motors.	05
3	**Single Phase Transformer:** Working Principle of single-phase transformer, Transformer Construction, Core type and Shell type transformer, E.M.F. equation, operation at no load and on load, vector diagram, equivalent circuit, losses, efficiency and regulation, parallel operation, auto transformer, condition for maximum efficiency, all day efficiency.	06

4	**Three Phase Induction Motor** : Classification of a.c.motor, General Principle, Construction, Squirrel cage-Phase wound rotor, Production of rotating field, Relation between torque and rotor power factor, Synchronous Speed, speed of rotor field, slip, Various methods of measurement of slip,starting & running torque, torque-slip characteristics, losses and efficiency, starters for 3 phase induction motor, speed control.	06
5.	**Alternator:** Introduction, construction, details, exciters, alternator operation on load, voltage regulation, losses & efficiency, parallel operation of alternators, synchronizing procedure of alternators, cooling of alternators.	06
6.	**Supply systems:** Electric supply system, typical A.C. power supply system, comparison of D.C. and A.C. transmission, advantages of high transmission voltage, various systems of power transmission, comparison of conductor material in overhead system, economic choice of transmission voltage.	06
7.	**Tariffs and Power factor improvement:** Types of tariffs, energy bill calculations, disadvantages of low power factor, causes of low power factor, power factor improvement, calculation of power factor correction, importance of power factor improvement, most economical power factor.	06
8.	**Substation:** Classification of substations, comparison of indoor and outdoor sub stations, Transformer substation, pole mounted substations, underground substations.	03
9.	**Diode, Transistor and OPAMP Circuits:** Half wave rectifier circuits, Full wave rectifier, Full wave bridge rectifier, Three phase bridge rectifier, Common Emitter amplifier, Multistage amplifier, Symbol and pin diagram of IC 741 OPAMP, OPAMP circuits- inverting, non-inverting, differential, comparator.	06
10.	**Logic Gates and Boolean Algebra:** Basic logic circuits: Logic gates (AND, OR, NOT, NAND, Ex-OR, Ex-NOR and their truth tables), Laws of Boolean algebra, De-Morgan's theorem.	03

Learning Outcomes

To impart knowledge on

- Constructional details, principle of operation, Performance, starters and speed control of DC Machines
- Constructional details, principle of operation of Transformer.
- Constructional details, principle of operation of Induction Motor.
- Different types of tariffs and supply systems.
- Basics of diodes transistor and OPAMP circuits.

Books Recommended:-

1. Electrical Technology Vol II, **B. L. Theraja;** S .Chand Publications
2. Performance and Design of A.C. machines by **M. G. Say**
3. Electrical Machines by **P. S. Bhimbra**
4. Electrical Machines by **J. B. Gupta**, Kataria Publications
5. Electrical Machines by **Samarjit Singh** – Pearson Education
6. Electrical Machines. By **Nagarath & Kothari**, TMH Publications
7. Principles of Power system by **V.K. Mehta**
8. Fundamentals of Digital circuits by **A. Anand Kumar**

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FACULTY OF:- Technology and Engineering
DEPARTMENT OF: -Mechanical Engineering
SEMESTER: -III
CODE: - 4TE03KOM1
NAME: – Kinematics of Machines (KOM)

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			
							Sessional Exam		University Exam		Internal		University	Total
		Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE03KOM1	Kinematics of Machines	3	0	2	5	4	30	1.5	70	3	30	20	---	**150**

Objectives

- The course under Kinematics of Machines has been designed to cover the basic concepts of kinematic aspects of Mechanical machines and major parts used in running of the machines.
- The students should be able to understand various parts involved in kinematics of machines for different applications.
- To study the principles involved in assessing the displacement, velocity and acceleration at any point in a link of a Mechanism.

Prerequisites

- Basic knowledge of vector calculus and Applied physics.

Course Outline

Sr. No.	Course Contents	Hours
1	**Mechanism & Machines:** Terminology and Definitions, Mechanism & Machines. rigid and resistance body, link, Kinematic pair Types of motion, degrees of freedom, classification of Kinematic pairs, Kinematic Chain, Linkage, Mechanics, Kinematic Inversion of Single and Double slider crank Chain, Four bar Chain Mechanism with lower pairs, Straight line mechanism and approximate straight line mechanism such as Paucellier, Hart's mechanism, Watt, Modified Scott- Russel, Grasshoper, Robert's mechanism, Hooke's Joint it's analysis, condition for equal speed of driven and driver shafts, Double Hooks Joint, Quick return mechanisms, Steering gear mechanisms such as Davis and Ackermann Steering gear.	**10**

2	**Kinematics:** Displacement, velocity and acceleration and analysis in simple mechanisms, Graphical Method velocity and acceleration polygons, Instantaneous Centre of Velocity, Kennedy Theorem, Angular velocity ratio theorem, Kinematic analysis by Algebric methods, Vector Approach, Acceleration analysis, Klein's Construction, Coriolis Acceleration.	**09**
3	**Belts, Ropes, Chains:** Introduction, belt and ropes drives, selection of belt drive, types of belt drives, V-belts, materials used for belt and rope drives, wire rope, Slip and Creep of belt, tensions for flat belt drive, angle of contact, centrifugal tension, maximum tension of belt, Chains, Classification, length, angular speed ratio, classification of chains.	**06**
4	**Gears & Gear Trains:** Introduction, Classification of Gears, Gear Terminology, Law of Gearing, Velocity of Sliding, Forms of teeth, Cyclodial Profile Teeth, Both of Contact, Arc of the contact, Numbers of pairs teeth in contact, Interference in involutes gears, Minimum Number of teeth, Interference between Rack and Pinion, Under cutting, Comparison of Cyclodial and involutes tooth forms, Efficiency of Helical, Spiral, Worm, Worm Gear, and Bevel Gears. Simple, Compound, Reverted, Epicyclic gear train.	**06**
5	**Cam motions & profiles:** Introduction, Types of cams & followers, Cam Terminology, displacement, velocity and acceleration of followers, Construction of cam profiles with knife-edge with roller and with flat footed for reciprocating and oscillating followers.	**08**
6	**Friction:** Surface contacts, Types of friction, Friction in screws with square thread and V threads, Pivot and collar friction, Friction clutches-single, multi-plate, cone clutch, Friction aspects in Brakes, Film friction, greasy friction	**06**

Learning Outcomes

To impart knowledge on

- Understand the basic concepts of machines and mechanisms.
- Draw velocity and acceleration diagrams of various mechanisms.
- Build up critical thinking and problem solving capacity of various mechanical engineering problems related to kinematics of machines.
- Asses various concepts of mechanisms like straight line motion mechanisms, Steering gear mechanisms and working principles of power elements (Gears, gear trains, Cams, Belt and Chain drives) and design related problems effectively.

Books Recommended:-

1. **Shigley, J.E and Uicker, J.J:** Theory of Machines and Mechanisms, Oxford University Press
2. **Rattan S.S.:** Theory of Machines Tata McGraw-Hill Publishing Co. Ltd. New Delhi,
3. **Rao J.S. and Dukkipati R.V:** Mechanisms and theory Machines theory, Wiley Eastern Ltd.
4. **Mabie H.H and Ocvirk, F.W:** Kinematic and Dynamics of Machinery,3rd Edition ,John wiley and sons.
5. **Green, W.G:** Theory of Machines, 2nd Edition, Blackie, London, 1992.
6. **Hollowenko, A.R:** Dynamics of Machinery, John wiley and sons. Inc. New York, 1955.
7. **Wilson,** Kinematics and Dynamics of Machinery, 3rd Edition, Pearson Education.
8. **Bevan Thomas,** Theory of Machines
9. Theory of Machines by **R.S.Khurmi** S.Chand

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FACULTY OF:- Technology and Engineering
DEPARTMENT OF: -Mechanical Engineering
SEMESTER: -III
CODE: - 4TE03TDY1
NAME: –Thermodynamics (TDY)

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			
		Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	Total
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE03TDY1	Thermodynamics	4	0	0	4	4	30	1.5	70	3	---	---	---	**100**

Objectives:-

- The objective is to understand principles of thermodynamics and to be able to use it in accounting for the bulk behavior of the simple physical systems.
- To provide in-depth study of thermodynamic principles, thermodynamics of state, basic thermodynamic relations, and Properties of pure substances.
- To enlighten the basic concepts of vapour power cycles.

Prerequisites:-

- Basic knowledge of elements of mechanical engineering.

Course outline:-

Sr. No.	Course content	No. of Hours
1.	**Introduction:** Macroscopic & Microscopic viewpoint, Thermodynamic system & control volume, Thermodynamic properties, processes & cycle, homogenous & heterogeneous Systems, Thermodynamic Equilibrium, Quasistatic Processes, Zeroth Law of Thermodynamics.	**05**
2.	**First law of Thermodynamics**: First law for a closed system undergoing a cycle and change of state, Energy-A property of the system, Perpetual motion machine of the first kind, steady flow energy equation applied to nozzle, diffuser, boiler, turbine, compressor, pump, heat exchanger, throttling process and filling and emptying process.	**08**
3.	**Second law of thermodynamics & Entropy:** Limitations of First law of thermodynamics, Kelvin-Planck and Clausius statements and their equivalence, Perpetual motion machine of the second kind, carnot cycle, carnot's theorem, corollary of carnot theorem, thermodynamic temperature scale. Clausius theorem,	**10**

	the property of entropy, inequality of Clausius, entropy change in open system, reversible and irreversible process, principle of increase of entropy, Third law of thermodynamics, Entropy and disorder, concept of exergy.	
4.	**Availability:** High and Low grades of energy. Available and unavailable energy, Availability of closed system, Availability of steady flow systems, Availability of open system processes, Irreversibility, some idea of exergy.	**06**
5.	**Gas power cycles:** Introduction to Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, Brayton cycle, Ericssion Cycle.	**06**
6.	**Properties of pure substance and steam power cycle:** Properties of pure substances in solid, liquid and vapour phases, P-V, T-V, T-S, H-S diagrams, PVT surfaces, Vapour Carnot cycle, Rankine cycle, modified Rankine cycle, comparison of Rankine and Carnot, binary vapour cycle.	**08**
7.	**Combustion of fuels:** Combustion of air, combustion equations, minimum air requirement, excess air and air fuel ratio, wet and dry analysis of products of combustion, conversion of volumetric analysis by mass, determination of calorific value of fuel by Bomb calorimeter and Junkers gas calorimeter, Enthalpy of formation, Enthalpy of reaction, Adiabatic flame temperature.	**08**
8.	**Properties of gases and Mixtures:** Avogadro's law, equation of state, ideal gas equation, Vander Waal's equation, reduced properties, law of corresponding states, compressibility chart. Gibbs-Dalton law, volumetric analysis of gas mixture, apparent molecular weight and gas constant, specific heat of a gas mixture, adiabatic mixing of perfect gases, gas and vapour mixtures.	**09**

Learning Outcomes: -

- Students will gain thorough understanding of Thermodynamics principles.
- The subject helps the students to understand the latest developments in the field.
- The practical performance develops the team work spirit and accuracy in work of an individual student.

Books Recommended:-

1. Engineering Thermodynamics by **P. K. Nag**, Tata McGraw-Hill , New Delhi
2. Engineering Thermodynamics by **R. K. Rajput**, Laxmi Publications, New Delhi
3. Fundamentals of Engineering Thermodynamics by **R. Yadav**, Central Publishing House, Allahabad

Reference Books:

1. Thermodynamics – An Engineering Approach by **Yunus Cengel & Boles**, Tata Mc. Graw-Hill, New Delhi
2. Thermodynamics by **J.P. Holman**, Tata McGraw-Hill.
3. Thermal Engineering by **P. L. Balleny**, Khanna Publication.

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FACULTY OF:-Technology and Engineering
DEPARTMENT OF:-Mechanical Engineering
SEMESTER:- III
CODE :- 4TE03MDI1
NAME – Machine Design and Industrial Drafting (MDI)

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			Total
		Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE03MDI1	Machine Design and Industrial Drafting	4	0	2	6	5	30	1.5	70	3	30	20	---	**150**

Objectives:-

- The aim of this course is to design and development of machinery utilizing advances in the field of material & manufacturing technology.
- To learn systematic approach to Basic Fundamentals and Component Design of the simple machine elements.
- To teach students mechanical engineering design theory to identify and quantify machine elements in the design of commonly used mechanical systems.
- To develop analytical abilities for providing solutions to engineering design problems.
- To recognize those factors constituting a practical, functional, efficient, and safe mechanical design.

Prerequisites:-

- Basic Knowledge of Strength of materials,
- Basic Knowledge of Engineering Drawing
- Analytical knowledge.
- They must know the derivatives and integration.

Course outline:-

PART A (Machine Design)

Sr. No.	Course Contents	Number of Hours
1	**Introduction:** Design engineering, Design consideration of Machine Parts: Definition and understanding of various types of design, basic requirements and procedure of design, design synthesis, selection of preferred sizes, Selection of materials, Properties and I.S. factors of safety, Stress Concentration and methods of relieving stresses	5

2	**Design Against Static Load:** Modes of Failure, Factor of Safety, Types of Loads And Stresses, Design of Simple Parts Subjected to Tension, Compression, Shear, Bending, Torsion And Combined Loads	5
3	**Design of Operational Joints:** Introduction, Strength of joints, Cotter Joints, Sleeve type cotter joint, Cotter for foundation bolt, Tapered rod connection with cotter, Gib & Cotter Joint, Knuckle Joint, Threaded Fasteners, Design load for Fasteners, Turnbuckle, Bolt of Uniform strength.	7
4	a)**Design of Riveted Joints:** Types of riveted joints, Advantages and limitations of riveted joints, types of riveted joints, design of riveted joints, efficiency of riveted joints b) **Welded Joints :**Types of welded joints, stresses in welded joints, Design for various loading conditions in torsion, shear, or direct load, eccentrically loaded welded Joints, welding symbols	7
5	**Design of Shafts** Introduction, standard sizes, Design Consideration, Material Used for Shafts, Design of Solid Shaft based on strength and rigidity, A.S.M.E. code for shaft design, Shafts Subjected to Fluctuating Loads, Hollow Shafts.	8
6	**Keys and Coupling** Types of keys, Design of different types of keys, design of a muff and clamp coupling, Rigid coupling, Flange Coupling, Flexible coupling- Oldham, universal coupling.	5
7	**Power Screws:** Introduction, Types of power screw threads, design of screw with different types of threads used in practice, Design of nuts, Design of C clamp, Screw jack, toggle jack.	6
8	**Levers:** General Procedure for design of levers, Weight reduction of levers, Hand levers & Foot Levers, design of lever for safety valve, design of bell crank lever, design of rocker arm for exhaust valves.	5

PART: B (Industrial Drafting)

1	**Assembly Drawings:** Drawings of assembled view for the part drawings of the following using propionate dimensions. a) Engine parts – cylinder, liners, piston, connecting rod, crank shaft, stuffing boxes, cross heads, Eccentrics. b) Machine parts - Screws jacks, Machine Vices, Plummer block, Tailstock. c) Valves: Steam stop valve, spring loaded safety valve, feed check valve and air cock	**3**
2	**Production Drawing:** Elements of production drawing, Fits and tolerance, allocation of fits for various mating parts, Geometric tolerance, Hole basis system and shaft basis system.	**2**
3	**Surface Roughness:** Roughness and Machining symbols, indication on drawings.	**2**

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PART C (AutoCAD)

1	**Applications of CAD:** Starting with AutoCAD, AutoCAD dialog boxes, Co-ordinate Systems, drawing lines, circle, arcs, rectangle, ellipse, polygons, etc. **Editing sketched objects:** Editing sketches, moving, copying, pasting, offsetting, scaling, chamfering, trimming, mirroring. Filleting, sketched objects.	**2**
2	**Basic Dimensioning:** Geometric dimensioning and Tolerance: Dimensioning AutoCAD, Creating linear, rotated, angular aligned base line Dimensions, Modifying dimensions.	**2**
3	Creating and modifying 3D objects using AutoCAD. Plotting the drawings in AutoCAD, plotting drawing using the plot dialog box, adding plotters and using plot styles, plotting sheets.	**1**

Learning Outcomes:-

- Students will develop the ability to make proper assumptions & design specific mechanical components like shaft, keys, coupling, screw jack etc.
- Student can gain knowledge of assembly drawing of engine parts, machine parts etc. &
- The students appreciate that Auto CAD provide a valuable resource tool for the futuristic design.
- This course will give the student some insight, to the working behind readily available Auto CAD software.
- Able to use design data books and different codes of design.

Books Recommended:-

1 **P.C Sharma and D. K. Aggarwal** " Machine Design", S.K. Kataria & Sons 2009
2 **V. B. Bhandari** "Design of Machine Elements", Tata McGraw Hill Publishing Co.
3 **R.C.Patel** and **A.D.Pandya** "Machine Design" vol-1,C.Jamnadas & Co.
4 **S. G. Kulkarni**, "Machine Design - Solved Problems", Tata McGraw Hill Publishing Company Ltd., New Delhi
5 **N.D. Bhatt**, "Machine Drawing" –Charator Publication
6 Machine Design – An Integrated Approach **Robert L Norton**, Pearson Education.
7 **P.S. Gill**, Machine Drawing by S.K. Kataria & Sons New Delhi
8 Machine elements : life and design **Boris M. Klebanov, David M. Barlam, Frederic E. Nystrom.**
9 **Sham Tickoo**, AutoCAD 2009 CENGAGE learning Indian Edition
10 **Joseph Edward Shigley and Charles R. Mischke**, "Mechanical Engineering Design", McGraw Hill International Edition,
11 **P.J Shah**, "Machine Drawing", S.Chand Publication
12 PSG Design Data Book

Research Reference:-

1 ASME Journal of Mechanical Design (http://asmedl.aip.org/MechanicalDesign)
2 IEEE (http://ieeexplore.ieee.org)
3 E book- http://scribd.com
4 www.kettering.edu/academics/...use/machine-design
5 www.sciencedirect.com

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FACULTY OF:-Technology and Engineering
DEPARTMENT OF: -Mechanical Engineering
SEMESTER: -III
CODE: - 4TE03AES1
NAME: – Alternate Energy Sources (AES)

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			
							Sessional Exam		University Exam		Internal		University	Total
		Th	Tu	Pr	Total		Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE03AES1	Alternate Energy Sources	3	0	0	3	3	30	1.5	70	3	----	---	---	**100**

Objectives:-

- The objective is to understand the principles of energy conversion and to be able to use it in accounting for the bulk behaviour of the simple mechanical systems.
- To utilize non-conventional energy sources and develop its scope.

Prerequisites:-

- Basic knowledge of conventional energy resources.

Course outline:-

Sr. No.	Course content	No. of Hours
1.	**Introduction:** Man and energy, energy forms, World's and India's production and reserves of energy, Global and national energy scenarios, Need for alternate sources.	**06**
2.	**Solar Energy:** Solar radiation and measurement: Solar geometry, extraterrestrial radiation, spectral distribution, solar radiation at the earth's surface, earth-sun angles, derived solar angles, sunrise, sunset and day length. Effects of receiving surface location and orientation. Heat transfer considerations relevant to solar energy. Instruments for solar radiation measurements, estimation of average solar radiation, radiation on tilted surface Solar energy collectors: Characteristics of materials and surfaces used in solar energy absorption. Devices for thermal collection and storage. Design consideration and performance of different types of solar cells. Flat plate, focusing collectors, non-focusing type collectors, CPC, optical losses.	**07**
3.	**Solar Energy storage and its utilization:** Solar energy storage: Energy storage devices such as water storage systems, packed Bed storage systems, phase change storage systems. Solar water heaters, heating and cooling of buildings, solar pumping, solar cooker, solar still, solar drier, solar refrigeration and A/C, solar pond, solar power plant, heliostat, solar furnace, solar chimney power plant, photovoltaic system for power generation, solar cell modules and arrays, solar cell types, material,	**05**

	applications, advantages and disadvantages.	
4.	**Wind Energy:** Introduction, power in wind, power coefficient, Generation systems, Components of wind energy system, wind mills-types, design consideration, performance, site selection, advantages and disadvantages, applications, wind energy development in India.	**04**
5.	**Biogas Energy:** Introduction, types of biogas plants, biogas generation, factors affecting biogas, site selection, applications, scope of biogas energy in India, biomass energy, energy plantation, gasification, types and application of gasifiers, design of gasifiers.	**04**
6.	**Ocean Energy:** Introduction, OTEC principle, open cycle OTEC system, closed cycle, hybrid, Energy from tides, estimation of tidal power, tidal power plants, single basin, wave energy, wave energy conversion devices, advantages and disadvantages, small scale hydro power	**05**
7.	**Geothermal Energy:** Introduction, geothermal field, vapour dominated system, liquid dominated system, binary cycle, hot dry rock resources, magma resources, advantages and disadvantages, applications, geothermal energy in India: prospects	**05**
8.	**MHD Power Plants:** Introduction, Principle of MHD power generation, open cycle plant, closed cycle plant, liquid metal system, advantages of MHD plants	**06**
9.	**Energy Management and Audit:** Energy economics, energy audit, energy conservation, cogeneration, waste heat recovery, concept of total energy system, combined cycle plant, energy	**03**

Learning Outcomes: -

- Students will gain thorough understanding of Non-conventional Energy sources.
- The subject helps the students to understand the latest developments in the field of renewable energy.
- The practical performance develops the team work spirit and accuracy in work of an individual student.

Books Recommended:-

1. Non- Conventional Energy Source by **G. D. Rai** , Khanna Pub.
2. Solar Energy by **S. P. Sukhatme** , Tata Mc Graw Hill Pub
3. Non conventional energy resources by **B. H. Khan**; Tata Mcgraw Hill Pub
4. Principles of Solar Energy, **Frank Krieth & John F Kreider**; John Wiley & sons, New York.
5. Alternate Energy System by Books India Publication**.**

Reference Books:

1. Solar Energy:Fundamentals and Applications by **H.P.Garg & Jai Prakash**, TataMcGrawHill
2. Solar Engineering of Thermal Processes by **J. A. Duffic and W. A. Beckman**, John Wiley & sons, New York.
3. Alternate energy sources and application by **N.K .Giri**; Khanna Publications.
4. Non conventional energy sources by **Raja et.al.** SciTech Publications Chennai
5. Renewable energy sources and conversion technology, Tata Mc Graw Hill.

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FACULTY OF:-Technology and Engineering
DEPARTMENT OF: - Mechanical Engineering
SEMESTER: - III
CODE: - 4TE03MTE1
NAME – Material Technology (MTE)

Teaching and Evaluation Scheme:-

Subject Code	Name of the Subject	Teaching Scheme (Hours)				Credits	Evaluation Scheme							
							Theory				Practical (Marks)			Total
		Th	Tu	Pr	Total		Sessional Exam		University Exam		Internal		University	
							Marks	Hrs	Marks	Hrs	Pr/Viva	TW	Pr	
4TE03MTE1	Material Technology	3	0	2	5	4	30	1.5	70	3	30	20	---	**150**

Objectives:-

- The objective is to impart the basic knowledge about material in general as a prime element in design and manufacturing environment.
- It also clears the importance of engineering materials selection in various fields of mechanical applications.
- The availability of wide range of materials makes it essential to select most suitable material for the suitable application with most specific

Prerequisites:-

- Basic knowledge of Physics.

Course outline:-

Sr. No.	Course content	No. of Hours
1.	**Introduction of materials and crystallography:** Introduction to materials, basic properties, selection of engineering materials, crystal structure of metals, space lattice, No. of atoms per unit cell and atomic packing factors, Miller indices, growth of metal crystals.	**06**
2.	**Theory of Alloys and Phase diagrams:** Solid solutions], Significance of alloying, equilibrium diagrams for binary alloy systems and their limitations, allotropy forms of Iron, Influence of Carbon as alloying element, Iron-Carbon equilibrium diagram, and significance of IC diagram in heat treatments].	**07**
3.	**Defects in Crystals:** Types of defects, dislocation theories, geometry of dislocations, motion of dislocations, multiplication of dislocations, Frank-reed source of dislocation, dislocation Pile-up.	**06**
4.	**Ferrous and Non ferrous metals and alloys:** Types, properties, structure and applications of steels and Cast Irons ,Steel specifications as per IS, AISI/SAE, BS, Types,	**06**

	properties, structure and applications of Copper, Aluminum, Magnesium and Nickel alloys.	
5.	**Heat Treatment of Steels:** Time Temperature Transformation diagram (TTT), classification of heat treatment process, softening treatment: Annealing, normalizing, tempering etc, Hardening treatment, surface hardening treatments, heat treatment of Copper and Aluminium alloys, hardenability tests.	**07**
6.	**Testing of Materials:** Non-destructive testing, visual inspection, hammer test, radiography, X-ray radiography, Magnetic particle inspection, Liquid penetrant test, Ultrasonic inspection	**07**
7.	**Powder Metallurgy**: Definition and concept, history, primary and secondary processes, metal powder production, applications, drawbacks and advantages.	**06**

Learning Outcomes: -

- Students will be confident to select the material in their fields of interest.
- The subject helps the students to prove capability for testing and characterization of materials.
- The practical performance develops the team work spirit and accuracy in work of an individual student.

Books Recommended:-

1. " A Text book of Material Science and Metallurgy" By **O. P. Khanna**, Dhanpat Rai Publications.
2. :Engineering Material Technology", By **W. Bolton**, Butterworth Hrinemann Publications.
3. " Material Science and Engineering: An Introduction" By **W. D. Calister**, John Wiley & Sons, Inc.
4. "Introduction to Physical Metallurgy" By **S. H. Avner,** Tata McGraw Hill Publications.
5. "Physical Metallurgy", By **Vijendra Singh,** Standard Publishers Distributors**.**

Reference Books:

1. " Elements of Material Science and Engineering", **L. H. Vanblack**,
2. "Mechanical Metallurgy" By **George E. Dieter**, McGraw Hill Publications, NY.
3. "ASTM Hand Book" Volume 1,2,3,4,8,10,17
4. "Experiments in Material Technology", By **C. A. Higgersan**,