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B.E - MECHANICAL ENGINEERING

S.No	Name of the course that include experiential learning through Project work/ Internship (2019 - 2020)
1	GE6253 - Engineering Mechanics
2	CE6306 - Strength of Materials
3	ME6301 - Engineering Thermodynamics
4	ME6302 - Manufacturing Technology - I
5	EE6351 - Electrical Drives and Controls
6	ME6401 - Kinematics of Machinery
7	ME6402 - Manufacturing Technology– II
8	ME6403 - Engineering Materials and Metallurgy
9	GE6351 - Environmental Science and Engineering
10	ME6404 - Thermal Engineering
11	ME6501 - Computer Aided Design
12	ME6502 - Heat and Mass Transfer
13	ME6503 - Design of Machine Elements
14	ME6504 - Metrology and Measurements
15	ME6505 - Dynamics of Machines
16	ME6601 - Design of Transmission Systems
17	ME6602 - Automobile Engineering
18	ME6603 - Finite Element Analysis
19	ME6701 - Power Plant Engineering
20	ME6702 - Mechatronics
21	ME6703 - Computer Integrated Manufacturing Systems
22	GE6757 - Total Quality Management
23	MG6863 - Engineering Economics
24	ME6001 - Quality Control and Reliability Engineering
25	ME6004 - Unconventional Machining Processes

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26	ME6005	-	Process Planning and Cost Estimation
27	ME6006	-	Design of Jigs, Fixtures and Press Tools
28	ME6007	-	Composite Materials and Mechanics
29	ME6008	-	Welding Technology
30	ME6009	-	Energy Conservation and Management
31	ME6011	-	Thermal Turbo Machines
32	IE6605	-	Production Planning and Control
33	ME6014	-	Computational Fluid Dynamics
34	ME6015	-	Operations Research
35	ME6016	-	Advanced I.C. Engines
36	ME6017	-	Design of Heat Exchangers
37	ME6019	-	Non Destructive Testing and Materials

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19-20.

ME6403 **ENGINEERING MATERIALS AND METALLURGY** **L T P C 3 0 0 3**

OBJECTIVES:

To impart knowledge on the structure, properties, treatment, testing and applications of metals and non-metallic materials so as to identify and select suitable materials for various engineering applications.

UNIT I ALLOYS AND PHASE DIAGRAMS **9**

Constitution of alloys – Solid solutions, substitutional and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.

UNIT II HEAT TREATMENT **10**

Definition – Full annealing, stress relief, recrystallisation and spheroidising – normalising, hardening and Tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T.diagram CCR – Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening. .

UNIT III FERROUS AND NON-FERROUS METALS **9**

Effect of alloying additions on steel- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron - Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel – Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.

UNIT IV NON-METALLIC MATERIALS **9**

Polymers – types of polymer, commodity and engineering polymers – Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al_2O_3, SiC, Si_3N_4, PSZ and SIALON –Composites-Classifications- Metal Matrix and FRP - Applications of Composites.

UNIT V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS **8**

Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test Izod and charpy, fatigue and creep failure mechanisms.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to apply the different materials, their processing, heat treatments in suitable application in mechanical engineering fields.

TEXT BOOKS:

1. Avner,, S.H., "Introduction to Physical Metallurgy", McGraw Hill Book Company,1994.
2. Williams D Callister, "Material Science and Engineering" Wiley India Pvt Ltd, Revised Indian Edition 2007

REFERENCES:

1. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 1999.
2. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint 2002.
3. Upadhyay. G.S. and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt. Ltd., New Delhi, 2006.
4. U.C.Jindal, "Material Science and Metallurgy, "Engineering Materials and Mettalurgy", First Edition, Dorling Kindersley, 2012

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GE6253 **ENGINEERING MECHANICS** L T P C
3 1 0 4

OBJECTIVES:

To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

UNIT I BASICS AND STATICS OF PARTICLES 12

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces — Vectorial representation of forces – Vector operations of forces -additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II EQUILIBRIUM OF RIGID BODIES 12

Free body diagram – Types of supports –Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 12

Centroids and centre of mass– Centroids of lines and areas - Rectangular, circular, triangular areas by integration – T section, I section, - Angle section, Hollow section by using standard formula – Theorems of Pappus - Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration – T section, I section, Angle section, Hollow section by using standard formula – Parallel axis theorem and perpendicular axis theorem –Principal moments of inertia of plane areas – Principal axes of inertia-Mass moment of inertia –mass moment of inertia for prismatic, cylindrical and spherical solids from first principle – Relation to area moments of inertia.

UNIT IV DYNAMICS OF PARTICLES 12

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion - Newton's laws of motion – Work Energy Equation– Impulse and Momentum – Impact of elastic bodies.

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 12

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction-. Rolling resistance -Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere.

TOTAL : 60 PERIODS

OUTCOMES:

ability to explain the differential principles applies to solve engineering problems dealing with force, displacement, velocity and acceleration.

ability to analyse the forces in any structures.

ability to solve rigid body subjected to dynamic forces.

TEXT BOOKS:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010)

REFERENCES:

1. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11th Edition, Pearson Education 2010.
2. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics", 4th Edition, Pearson Education 2006.
3. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2", Third Edition, John Wiley & Sons,1993.
4. Rajasekaran S and Sankarasubramanian G., "Engineering Mechanics Statics and Dynamics", 3rd Edition, Vikas Publishing House Pvt. Ltd., 2005.
5. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers, 1998.
6. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi 2008.

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ME6007 **COMPOSITE MATERIALS AND MECHANICS** **L T P C**
3 0 0 3

OBJECTIVES:

To understand the fundamentals of composite material strength and its mechanical behavior
Understanding the analysis of fiber reinforced Laminate design for different combinations of plies with different orientations of the fiber.
Thermo-mechanical behavior and study of residual stresses in Laminates during processing.
Implementation of Classical Laminate Theory (CLT) to study and analysis for residual stresses in an isotropic layered structure such as electronic chips.

UNIT I INTRODUCTION, LAMINA CONSTITUTIVE EQUATIONS & MANUFACTURING 12

Definition –Need – General Characteristics, Applications. Fibers – Glass, Carbon, Ceramic and Aramid fibers. Matrices – Polymer, Graphite, Ceramic and Metal Matrices – Characteristics of fibers and matrices. Lamina Constitutive Equations: Lamina Assumptions – Macroscopic Viewpoint. Generalized Hooke's Law. Reduction to Homogeneous Orthotropic Lamina – Isotropic limit case, Orthotropic Stiffness matrix (Qij), Typical Commercial material properties, Rule of Mixtures. Generally Orthotropic Lamina –Transformation Matrix, Transformed Stiffness. Manufacturing: Bag Moulding Compression Moulding – Pultrusion – Filament Winding – Other Manufacturing Processes

UNIT II FLAT PLATE LAMINATE CONSTITUTE EQUATIONS 10

Definition of stress and Moment Resultants. Strain Displacement relations. Basic Assumptions of Laminated anisotropic plates. Laminate Constitutive Equations – Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina Properties from Laminate Tests. Quasi-Isotropic Laminates. Determination of Lamina stresses within Laminates.

UNIT III LAMINA STRENGTH ANALYSIS 5

Introduction - Maximum Stress and Strain Criteria. Von-Misses Yield criterion for Isotropic Materials. Generalized Hill's Criterion for Anisotropic materials. Tsai-Hill's Failure Criterion for Composites. Tensor Polynomial (Tsai-Wu) Failure criterion. Prediction of laminate Failure

UNIT IV THERMAL ANALYSIS 8

Assumption of Constant C.T.E's. Modification of Hooke's Law. Modification of Laminate Constitutive Equations. Orthotropic Lamina C.T.E's. C.T.E's for special Laminate Configurations – Unidirectional, Off-axis, Symmetric Balanced Laminates, Zero C.T.E laminates, Thermally Quasi-Isotropic Laminates

UNIT V ANALYSIS OF LAMINATED FLAT PLATES 10

Equilibrium Equations of Motion. Energy Formulations. Static Bending Analysis. Buckling Analysis. Free Vibrations – Natural Frequencies.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to analyse the fiber reinforced Laminate for optimum design
Apply classical laminate theory to study and analyse the residual stresses in Laminate.

TEXT BOOKS:

1. Gibson, R.F., "Principles of Composite Material Mechanics", Second Edition, McGraw-Hill, CRC press in progress, 1994, -.
2. Hyer, M.W., "Stress Analysis of Fiber – Reinforced Composite Materials", McGraw Hill, 1998

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ME6702 **MECHATRONICS** L T P C
3 0 0 3

OBJECTIVES:

To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

UNIT I INTRODUCTION 12

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Sensors and Transducers: Static and dynamic Characteristics of Sensor, Potentiometers – LVDT – Capacitance sensors – Strain gauges – Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors

UNIT II 8085 MICROPROCESSOR AND 8051 MICROCONTROLLER 10

Introduction – Architecture of 8085 – Pin Configuration – Addressing Modes –Instruction set, Timing diagram of 8085 – Concepts of 8051 microcontroller – Block diagram,.

UNIT III PROGRAMMABLE PERIPHERAL INTERFACE 8

Introduction – Architecture of 8255, Keyboard interfacing, LED display –interfacing, ADC and DAC interface, Temperature Control – Stepper Motor Control – Traffic Control interface.

UNIT IV PROGRAMMABLE LOGIC CONTROLLER 7

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC.

UNIT V ACTUATORS AND MECHATRONIC SYSTEM DESIGN 8

Types of Stepper and Servo motors – Construction – Working Principle – Advantages and Disadvantages. Design process-stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to design mechatronics system with the help of Microprocessor, PLC and other electrical and Electronics Circuits.

TEXT BOOKS:

1. Bolton, "Mechatronics", Printice Hall, 2008
2. Ramesh S Gaonkar, "Microprocessor Architecture, Programming, and Applications with the 8085", 5th Edition, Prentice Hall, 2008.

REFERENCES:

1. Michael B.Histand and Davis G.Alciatore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International edition, 2007.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Smaili.A and Mrad.F , "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2007.
4. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
5. Krishna Kant, "Microprocessors & Microcontrollers", Prentice Hall of India, 2007.
6. Clarence W. de Silva, "Mechatronics" CRC Press, First Indian Re-print, 2013

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CE6306 **STRENGTH OF MATERIALS** L T P C
3 1 0 4

OBJECTIVES:

To understand the stresses developed in bars, compounds bars, beams, shafts, cylinders and spheres.

UNIT I STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.

UNIT II TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM 9

Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending–bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.

UNIT III TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts– Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT IV DEFLECTION OF BEAMS 9

Double Integration method – Macaulay's method – Area moment method for computation of slopes and deflections in beams - Conjugate beam and strain energy – Maxwell's reciprocal theorems.

UNIT V THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.

TOTAL (L:45+T:15): 60 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to apply mathematical knowledge to calculate the deformation behavior of simple structures.

Critically analyse problem and solve the problems related to mechanical elements and analyse the deformation behavior for different types of loads.

TEXT BOOKS:

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2007
2. Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2007

REFERENCES:

1. Egor. P.Popov "Engineering Mechanics of Solids" Prentice Hall of India, New Delhi, 2001
2. Subramanian R., "Strength of Materials", Oxford University Press, Oxford Higher Education Series, 2007.
3. Hibbeler, R.C., "Mechanics of Materials", Pearson Education, Low Price Edition, 2007
4. Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2005.

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ME6503 **DESIGN OF MACHINE ELEMENTS** L T P C 3 0 0 3

OBJECTIVES

- To familiarize the various steps involved in the Design Process
- To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
- To learn to use standard practices and standard data
- To learn to use catalogues and standard machine components

(Use of P S G Design Data Book is permitted)

UNIT I STEADY STRESSES AND VARIABLE STRESSES IN MACHINE MEMBERS 10

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties - Preferred numbers, fits and tolerances – Direct, Bending and torsional stress equations – Impact and shock loading – calculation of principle stresses for various load combinations, eccentric loading – curved beams – crane hook and 'C' frame- Factor of safety - theories of failure – Design based on strength and stiffness – stress concentration – Design for variable loading.

UNIT II SHAFTS AND COUPLINGS 8

Design of solid and hollow shafts based on strength, rigidity and critical speed – Keys, keyways and splines - Rigid and flexible couplings.

UNIT III TEMPORARY AND PERMANENT JOINTS 9

Threaded fastners - Bolted joints including eccentric loading, Knuckle joints, Cotter joints – Welded joints, riveted joints for structures - theory of bonded joints.

UNIT IV ENERGY STORING ELEMENTS AND ENGINE COMPONENTS 9

Various types of springs, optimization of helical springs - rubber springs - Flywheels considering stresses in rims and arms for engines and punching machines- Connecting Rods and crank shafts.

UNIT V BEARINGS 9

Sliding contact and rolling contact bearings - Hydrodynamic journal bearings, Sommerfeld Number, Raimondi and Boyd graphs, -- Selection of Rolling Contact bearings.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to successfully design machine components

TEXT BOOK:

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
3. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010
4. Bernard Hamrock, Steven Schmid,Bo Jacobson, "Fundamentals of Machine Elements",2nd Edition, Tata McGraw-Hill Book Co., 2006.
5. Orthwein W, "Machine Component Design", Jaico Publishing Co, 2003.
6. Ansel Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003
7. Merhyle F. Spotts, Terry E. Shoup and Lee E. Hornberger, "Design of Machine Elements" 8th Edition, Printice Hall, 2003

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ME6402 MANUFACTURING TECHNOLOGY – II L T P C
3 0 0 3

OBJECTIVES:

To understand the concept and basic mechanics of metal cutting, working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines, grinding and allied machines and broaching.

To understand the basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming

UNIT I THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools – nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II TURNING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi automatic – single spindle : Swiss type, automatic screw type – multi spindle:

UNIT III SHAPER, MILLING AND GEAR CUTTING MACHINES 9

Shaper - Types of operations. Drilling ,reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling ,hobbing and gear shaping processes –finishing of gears.

UNIT IV ABRASIVE PROCESS AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centreless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V CNC MACHINING 9

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining centre, part programming fundamentals CNC – manual part programming – micromachining – wafer machining.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to understand and compare the functions and applications of different metal cutting tools and also demonstrate the programming in CNC machining.

TEXT BOOKS:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters
2. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", Tata McGraw-Hill, New Delhi, 2003.

REFERENCES:

1. Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White "Machine Tool Practices", Prentice Hall of India, 1998
2. HMT, "Production Technology", Tata McGraw Hill, 1998.
3. Geofrey Boothroyd, "Fundamentals of Metal Machining and Machine Tools", Mc Graw Hill, 1984
4. Roy. A.Lindberg, "Process and Materials of Manufacture," Fourth Edition, PHI/Pearson Education 2006

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ME6302 **MANUFACTURING TECHNOLOGY – I** L T P C 3 0 0 3

OBJECTIVES:

To introduce the concepts of basic manufacturing processes and fabrication techniques, such as metal casting, metal joining, metal forming and manufacture of plastic components.

UNIT I METAL CASTING PROCESSES 9

Sand Casting : Sand Mould – Type of patterns - Pattern Materials – Pattern allowances –Moulding sand Properties and testing – Cores –Types and applications – Moulding machines– Types and applications; **Melting furnaces** : Blast and Cupola Furnaces; **Principle of special casting processes :** Shell - investment – Ceramic mould – Pressure die casting - Centrifugal Casting - CO_2 process – Stir casting; **Defects in Sand casting**

UNIT II JOINING PROCESSES 9

Operating principle, basic equipment, merits and applications of : Fusion welding processes : Gas welding - Types – Flame characteristics; Manual metal arc welding – Gas Tungsten arc welding - Gas metal arc welding – Submerged arc welding – Electro slag welding; **Operating principle and applications of** : Resistance welding - Plasma arc welding – Thermit welding – Electron beam welding – Friction welding and Friction Stir Welding; Brazing and soldering; **Weld defects:** types, causes and cure.

UNIT III METAL FORMING PROCESSES 9

Hot working and cold working of metals – Forging processes – Open, impression and closed die forging – forging operations. Rolling of metals– Types of Rolling – Flat strip rolling – shape rolling operations – Defects in rolled parts. Principle of rod and wire drawing – Tube drawing – Principles of Extrusion – Types – Hot and Cold extrusion.

UNIT IV SHEET METAL PROCESSES 9

Sheet metal characteristics – shearing, bending and drawing operations – Stretch forming operations – Formability of sheet metal – Test methods –special forming processes-Working principle and applications – Hydro forming – Rubber pad forming – Metal spinning– Introduction of Explosive forming, magnetic pulse forming, peen forming, Super plastic forming – Micro forming

UNIT V MANUFACTURE OF PLASTIC COMPONENTS 9

Types and characteristics of plastics – Moulding of thermoplastics – working principles and typical applications – injection moulding – Plunger and screw machines – Compression moulding, Transfer Moulding – Typical industrial applications – introduction to blow moulding –Rotational moulding – Film blowing – Extrusion – Thermoforming – Bonding of Thermoplastics.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to apply the different manufacturing process and use this in industry for component production

TEXT BOOKS:

1. Hajra Chouldhary S.K and Hajra Choudhury. AK., "Elements of workshop Technology", volume I and II, Media promoters and Publishers Private Limited, Mumbai, 1997
2. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 2006

REFERENCES:

1. Gowri P. Hariharan, A.Suresh Babu, "Manufacturing Technology I", Pearson Education, 2008
2. Roy. A. Lindberg, "Processes and Materials of Manufacture", PHI / Pearson education, 2006
3. Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Processes, in Manufacturing" Eight Edition, Prentice – Hall of India, 1997.
4. Sharma, P.C., "A Text book of production Technology", S.Chand and Co. Ltd., 2004.
5. Rao, P.N., "Manufacturing Technology Foundry, Forming and Welding", 2nd Edition, TMH-2003;

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CE6451 **FLUID MECHANICS AND MACHINERY** L T P C 3 0 0 3

OBJECTIVES:

The applications of the conservation laws to flow through pipes and hydraulic machines are studied

To understand the importance of dimensional analysis.

To understand the importance of various types of flow in pumps and turbines.

UNIT I FLUID PROPERTIES AND FLOW CHARACTERISTICS 8

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation.

UNIT II FLOW THROUGH CIRCULAR CONDUITS 8

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude - Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV PUMPS 10

Impact of jets - Euler's equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle - work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps –classification.

UNIT V TURBINES 10

Classification of turbines – heads and efficiencies – velocity triangles. Axial, radial and mixed flow turbines. Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to apply mathematical knowledge to predict the properties and characteristics of a fluid.

Can critically analyse the performance of pumps and turbines.

TEXT BOOK:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi 2004.

REFERENCES:

1. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2004
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011

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ME6301 **ENGINEERING THERMODYNAMICS** **L T P C**
3 0 0 3

OBJECTIVES:

To familiarize the students to understand the fundamentals of thermodynamics and to perform thermal analysis on their behavior and performance.

(Use of Standard and approved Steam Table, Mollier Chart, Compressibility Chart and Psychrometric Chart permitted)

UNIT I BASIC CONCEPTS AND FIRST LAW **9**

Basic concepts - concept of continuum, comparison of microscopic and macroscopic approach. Path and point functions. Intensive and extensive, total and specific quantities. System and their types. Thermodynamic Equilibrium State, path and process. Quasi-static, reversible and irreversible processes. Heat and work transfer, definition and comparison, sign convention. Displacement work and other modes of work .P-V diagram. Zeroth law of thermodynamics – concept of temperature and thermal equilibrium– relationship between temperature scales –new temperature scales. First law of thermodynamics –application to closed and open systems – steady and unsteady flow processes.

UNIT II SECOND LAW AND AVAILABILITY ANALYSIS **9**

Heat Reservoir, source and sink. Heat Engine, Refrigerator, Heat pump. Statements of second law and its corollaries. Carnot cycle Reversed Carnot cycle, Performance. Clausius inequality. Concept of entropy, T-s diagram, Tds Equations, entropy change for - pure substance, ideal gases - different processes, principle of increase in entropy. Applications of II Law. High and low grade energy. Available and non-available energy of a source and finite body. Energy and irreversibility. Expressions for the energy of a closed system and open systems. Energy balance and entropy generation. Irreversibility. I and II law Efficiency.

UNIT III PROPERTIES OF PURE SUBSTANCE AND STEAM POWER CYCLE **9**

Formation of steam and its thermodynamic properties, p-v, p-T, T-v, T-s, h-s diagrams. p-v-T surface. Use of Steam Table and Mollier Chart. Determination of dryness fraction. Application of I and II law for pure substances. Ideal and actual Rankine cycles, Cycle Improvement Methods - Reheat and Regenerative cycles, Economiser, preheater, Binary and Combined cycles.

UNIT IV IDEAL AND REAL GASES, THERMODYNAMIC RELATIONS **9**

Properties of Ideal gas- Ideal and real gas comparison- Equations of state for ideal and real gases- Reduced properties-.Compressibility factor-.Principle of Corresponding states. -Generalised Compressibility Chart and its use-. Maxwell relations, Tds Equations, Difference and ratio of heat capacities, Energy equation, Joule-Thomson Coefficient, Clausius Clapeyron equation, Phase Change Processes. Simple Calculations.

UNIT V GAS MIXTURES AND PSYCHROMETRY **9**

Mole and Mass fraction, Dalton's and Amagat's Law. Properties of gas mixture – Molar mass, gas constant, density, change in internal energy, enthalpy, entropy and Gibbs function. Psychrometric properties, Psychrometric charts. Property calculations of air vapour mixtures by using chart and expressions. Psychrometric process – adiabatic saturation, sensible heating and cooling, humidification, dehumidification, evaporative cooling and adiabatic mixing. Simple Applications

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to apply the Thermodynamic Principles to Mechanical Engineering Application.

Apply mathematical fundamentals to study the properties of steam, gas and gas mixtures.

TEXT BOOKS :

1. Nag.P.K., "Engineering Thermodynamics", 4th Edition, Tata McGraw-Hill, New Delhi, 2008.
2. Natarajan. E., "Engineering Thermodynamics: Fundamentals and Applications", Anuragam Publications, 2012.

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ME6505 **DYNAMICS OF MACHINES** **L T P C**
3 0 0 3

OBJECTIVES:

To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.

To understand the undesirable effects of unbalances resulting from prescribed motions in mechanism.

To understand the effect of Dynamics of undesirable vibrations.

To understand the principles in mechanisms used for speed control and stability control.

UNIT I FORCE ANALYSIS **9**

Dynamic force analysis – Inertia force and Inertia torque– D Alembert's principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams –Fly Wheels – Flywheels of punching presses- Dynamics of Cam-follower mechanism.

UNIT II BALANCING **9**

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing of Multi-cylinder inline, V-engines – Partial balancing in engines – Balancing of linkages – Balancing machines-Field balancing of discs and rotors.

UNIT III SINGLE DEGREE FREE VIBRATION **9**

Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration– Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

UNIT IV FORCED VIBRATION **9**

Response of one degree freedom systems to periodic forcing – Harmonic disturbances –Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

UNIT V MECHANISM FOR CONTROL **9**

Governors – Types – Centrifugal governors – Gravity controlled and spring controlled centrifugal governors – Characteristics – Effect of friction – Controlling force curves. Gyroscopes –Gyroscopic forces and torques – Gyroscopic stabilization – Gyroscopic effects in Automobiles, ships and airplanes.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the Students can able to predict the force analysis in mechanical system and related vibration issues and can able to solve the problem

TEXT BOOK:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms" ,3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Benson H. Tongue, "Principles of Vibrations", Oxford University Press, 2nd Edition, 2007
4. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
5. Allen S. Hall Jr. "Kinematics and Linkage Design", Prentice Hall, 1961
6. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
7. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.

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ME6601 **DESIGN OF TRANSMISSION SYSTEMS** **L T P C**
3 0 0 3

OBJECTIVES:

To gain knowledge on the principles and procedure for the design of Mechanical power Transmission components.

To understand the standard procedure available for Design of Transmission of Mechanical elements

To learn to use standard data and catalogues (Use of P S G Design Data Book permitted)

UNIT I DESIGN OF FLEXIBLE ELEMENTS **9**

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

UNIT II SPUR GEARS AND PARALLEL AXIS HELICAL GEARS **9**

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

UNIT III BEVEL, WORM AND CROSS HELICAL GEARS **9**

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits-terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

UNIT IV GEAR BOXES **9**

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

UNIT V CAMS, CLUTCHES AND BRAKES **9**

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches-Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to successfully design transmission components used in Engine and machines.

TEXT BOOKS:

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.

REFERENCES:

1. Sundararajamoorthy T. V, Shanmugam .N, "Machine Design", Anuradha Publications, Chennai, 2003.
2. Gitin Maitra, L. Prasad "Hand book of Mechanical Design", 2nd Edition, Tata McGraw-Hill, 2001.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. C.S.Sharma, Kamlesh Purohit, "Design of Machine Elements", Prentice Hall of India, Pvt. Ltd., 2003.
5. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", 2nd Edition, Tata McGraw-Hill Book Co., 2006.
6. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
7. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo (Schaum's Outline), 2010

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ME6502 **HEAT AND MASS TRANSFER** **L T P C**
3 0 0 3

OBJECTIVES:

To understand the mechanisms of heat transfer under steady and transient conditions.
To understand the concepts of heat transfer through extended surfaces.
To learn the thermal analysis and sizing of heat exchangers and to understand the basic concepts of mass transfer.

(Use of standard HMT data book permitted)

UNIT I CONDUCTION **9**

General Differential equation of Heat Conduction– Cartesian and Polar Coordinates – One Dimensional Steady State Heat Conduction — plane and Composite Systems – Conduction with Internal Heat Generation – Extended Surfaces – Unsteady Heat Conduction – Lumped Analysis – Semi Infinite and Infinite Solids –Use of Heisler's charts.

UNIT II CONVECTION **9**

Free and Forced Convection - Hydrodynamic and Thermal Boundary Layer. Free and Forced Convection during external flow over Plates and Cylinders and Internal flow through tubes .

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS **9**

Nusselt's theory of condensation - Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors - Analysis – LMTD method - NTU method.

UNIT IV RADIATION **9**

Black Body Radiation – Grey body radiation - Shape Factor – Electrical Analogy – Radiation Shields. Radiation through gases.

UNIT V MASS TRANSFER **9**

Basic Concepts – Diffusion Mass Transfer – Fick's Law of Diffusion – Steady state Molecular Diffusion – Convective Mass Transfer – Momentum, Heat and Mass Transfer Analogy –Convective Mass Transfer Correlations.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to understand and apply different heat and mass transfer principles of different applications.

TEXT BOOK:

1. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 2010

REFERENCE BOOKS:

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
2. Venkateshan. S.P., "Heat Transfer", Ane Books, New Delhi, 2004.
3. Ghoshdastidar, P.S, "Heat Transfer", Oxford, 2004,
4. Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
5. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000
6. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
7. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
8. Yadav, R., "Heat and Mass Transfer", Central Publishing House, 1995.
9. M.Thirumaleshwar , Fundamentals of Heat and Mass Transfer, "Heat and Mass Transfer", First Edition, Dorling Kindersley, 2009.

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ME6504 **METROLOGY AND MEASUREMENTS** **L T P C**
3 0 0 3

OBJECTIVES:

To provide knowledge on various Metrological equipments available to measure the dimension of the components.

To provide knowledge on the correct procedure to be adopted to measure the dimension of the components.

UNIT I .BASICS OF METROLOGY **5**

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

UNIT II LINEAR AND ANGULAR MEASUREMENTS **10**

Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.

UNIT III ADVANCES IN METROLOGY **12**

Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM – Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications.

UNIT IV FORM MEASUREMENT **10**

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

UNIT V MEASUREMENT OF POWER, FLOW AND TEMPERATURE **8**

Force, torque, power - mechanical , Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the Students can demonstrate different measurement technologies and use of them in Industrial Components

TEXT BOOKS:

1. Jain R.K. "Engineering Metrology", Khanna Publishers, 2005.
2. Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.

REFERENCES:

1. Charles Reginald Shotbolt, "Metrology for Engineers", 5th edition, Cengage Learning EMEA,1990.
2. Backwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education , 2006.

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ME6701 **POWER PLANT ENGINEERING** L T P C 3 0 0 3

OBJECTIVES:

Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

UNIT I COAL BASED THERMAL POWER PLANTS 10

Rankine cycle - improvisations, Layout of modern coal power plant, Super Critical Boilers, FBC Boilers, Turbines, Condensers, Steam & Heat rate, Subsystems of thermal power plants – Fuel and ash handling, Draught system, Feed water treatment. Binary Cycles and Cogeneration systems.

UNIT II DIESEL, GAS TURBINE AND COMBINED CYCLE POWER PLANTS 10

Otto, Diesel, Dual & Brayton Cycle - Analysis & Optimisation. Components of Diesel and Gas Turbine power plants. Combined Cycle Power Plants. Integrated Gasifier based Combined Cycle systems.

UNIT III NUCLEAR POWER PLANTS 7

Basics of Nuclear Engineering, Layout and subsystems of Nuclear Power Plants, Working of Nuclear Reactors : *Boiling Water Reactor* (BWR), *Pressurized Water Reactor* (PWR), CANada Deuterium-Uranium reactor (CANDU), Breeder, Gas Cooled and Liquid Metal Cooled Reactors. Safety measures for Nuclear Power plants.

UNIT IV POWER FROM RENEWABLE ENERGY 10

Hydro Electric Power Plants – Classification, Typical Layout and associated components including Turbines. Principle, Construction and working of Wind, Tidal, *Solar* Photo Voltaic (SPV), Solar Thermal, Geo Thermal, Biogas and Fuel Cell power systems.

UNIT V ENERGY, ECONOMIC AND ENVIRONMENTAL ISSUES OF POWER PLANTS 8

Power tariff types, Load distribution parameters, load curve, Comparison of site selection criteria, relative merits & demerits, Capital & Operating Cost of different power plants. Pollution control technologies including Waste Disposal Options for Coal and Nuclear Power Plants.

OUTCOMES: TOTAL : 45 **PERIODS**

Upon completion of this course, the students can able to understand different types of power plant, and its functions and their flow lines and issues related to them.
Analyse and solve energy and economic related issues in power sectors.

TEXT BOOK:

1. Nag. P.K., "Power Plant Engineering", Third Edition, Tata McGraw – Hill Publishing Company Ltd., 2008.

REFERENCES:

1. El-Wakil. M.M., "Power Plant Technology", Tata McGraw – Hill Publishing Company Ltd., 2010.
2. Black & Veatch, Springer, "Power Plant Engineering", 1996.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.
4. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.

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ME6604 **GAS DYNAMICS AND JET PROPULSION** **L T P C 3 0 0 3**

OBJECTIVES: To understand the basic difference between incompressible and compressible flow.

To understand the phenomenon of shock waves and its effect on flow. To gain some basic knowledge about jet propulsion and Rocket Propulsion.
(Use of Standard Gas Tables permitted)

UNIT I BASIC CONCEPTS AND ISENTROPIC FLOWS **6**

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers

UNIT II FLOW THROUGH DUCTS **9**

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.

UNIT III NORMAL AND OBLIQUE SHOCKS **10**

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications.

UNIT IV JET PROPULSION **10**

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

UNIT V SPACE PROPULSION **10**

Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to successfully apply gas dynamics principles in the Jet and Space Propulsion

TEXT BOOKS:

1. Anderson, J.D., "Modern Compressible flow", 3rd Edition, McGraw Hill, 2003.
2. Yahya, S.M. "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 1996.

REFERENCES:

1. Hill. P. and C. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison – Wesley Publishing company, 1992.
2. Zucrow. N.J., "Aircraft and Missile Propulsion", Vol.1 & II, John Wiley, 1975.
3. Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.
4. Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York,1986,.
5. Shapiro. A.H.," Dynamics and Thermodynamics of Compressible fluid Flow", John wiley, New York, 1953.
6. Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 1999.
7. Somasundaram. PR.S.L., "Gas Dynamics and Jet Propulsions", New Age International Publishers, 1996.
8. Babu. V., "Fundamentals of Gas Dynamics", ANE Books India, 2008.
9. Cohen. H., G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Longman Group Ltd., 1980.

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ME6603 **FINITE ELEMENT ANALYSIS** L T P C 3 0 0 3

OBJECTIVES:

To introduce the concepts of Mathematical Modeling of Engineering Problems.
To appreciate the use of FEM to a range of Engineering Problems.

UNIT I INTRODUCTION 9

Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – RitzTechnique – Basic concepts of the Finite Element Method.

UNIT II ONE-DIMENSIONAL PROBLEMS 9

One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation –Transverse deflections and Natural frequencies of beams.

UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS 9

Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts –Quadrilateral elements – Higher Order Elements.

UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS 9

Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.

UNIT V ISOPARAMETRIC FORMULATION 9

Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.

OUTCOMES: **TOTAL : 45 PERIODS**

Upon completion of this course, the students can able to understand different mathematical Techniques used in FEM analysis and use of them in Structural and thermal problem

TEXT BOOK:

1. Reddy. J.N., "An Introduction to the Finite Element Method", 3rd Edition, Tata McGraw-Hill, 2005
2. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

REFERENCES:

1. Rao, S.S., "The Finite Element Method in Engineering", 3rd Edition, Butterworth Heinemann, 2004
2. Logan, D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002
3. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, "Concepts and Applications of Finite Element Analysis", 4th Edition, Wiley Student Edition, 2002.
4. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", 3rd Edition, Prentice Hall College Div, 1990
5. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005 (Indian Reprint 2013)*

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ME6602 **AUTOMOBILE ENGINEERING** L T P C 3 0 0 3

OBJECTIVES:

To understand the construction and working principle of various parts of an automobile.

To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components - functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to identify the different components in automobile engineering.

Have clear understanding on different auxiliary and transmission systems usual.

TEXT BOOKS:

1. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.

REFERENCES:

1. Newton ,Steeds and Garet, "Motor Vehicles", Butterworth Publishers,1989.
2. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 1999.
3. Martin W, Stockel and Martin T Stockle , "Automotive Mechanics Fundamentals," The Good heart –Will Cox Company Inc, USA ,1978.
4. Heinz Heisler, "Advanced Engine Technology," SAE International Publications USA, 1998.
5. Ganesan V, "Internal Combustion Engines", Third Edition, Tata McGraw-Hill, 2007.

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MG6863 **ENGINEERING ECONOMICS** L T P C
3 0 0 3

OBJECTIVES:

To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating inflation factor in economic decision making.

UNIT I INTRODUCTION TO ECONOMICS 8

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis - V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning.

UNIT II VALUE ENGINEERING 10

Make or buy decision, Value engineering – Function, aims, Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

UNIT III CASH FLOW 9

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION

Depreciation- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset.

TOTAL: 45 PERIODS

OUTCOMES :

Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions.

TEXT BOOKS:

1. Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.

REFERENCES:

1. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011.
4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012

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ME6001 QUALITY CONTROL AND RELIABILITY ENGINEERING

L T P C
3 0 0 3

OBJECTIVES:

To introduce the concept of SQC
To understand process control and acceptance sampling procedure and their application.
To learn the concept of reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES 10

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation –Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and □chart - process capability – process capability studies and simple problems. Six sigma concepts

UNIT II PROCESS CONTROL FOR ATTRIBUTES 8

Control chart for attributes –control chart for non conformings– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING 9

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING – RELIABILITY 9

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABLITY 9

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

TOTAL: 45 PERIODS

Note: Use of approved statistical table permitted in the examination.

OUTCOMES:

- Upon successful completion of this course, the students can able to apply the concept of SQC in process control for reliable component production

TEXT BOOKS:

1. Douglas.C. Montgomery, " Introduction to Statistical quality control", 4th edition, John Wiley 2001.
2. Srinath. L.S., "Reliability Engineering", Affiliated East west press, 1991.

REFERENCES:

1. John.S. Oakland. "Statistical process control", 5th edition, Elsevier, 2005
2. Connor, P.D.T.O., "Practical Reliability Engineering", John Wiley, 1993
3. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
4. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
5. Gupta. R.C, "Statistical Quality control", Khanna Publishers, 1997.
6. Besterfield D.H., "Quality Control", Prentice Hall, 1993.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.

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GE6757 **TOTAL QUALITY MANAGEMENT** L T P C 3 0 0 3

OBJECTIVES :

To facilitate the understanding of Quality Management principles and process.

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Costs of quality.

UNIT II TQM PRINCIPLES 9

Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES II 9

Control Charts - Process Capability - Concepts of Six Sigma - Quality Function Development (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors..

TOTAL: 45 PERIODS

OUTCOMES:

The student would be able to apply the tools and techniques of quality management to manufacturing and services processes.

TEXT BOOK:

1. Dale H. Besterfiled, et at., "Total quality Management", Third Edition, Pearson Education Asia, Indian Reprint, 2006.

REFERENCES:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
2. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
3. Janakiraman. B and Gopal. R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.

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ME6703 **COMPUTER INTEGRATED MANUFACTURING SYSTEMS** **L T P C 3 0 0 3**

OBJECTIVES:

To understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Manufacturing cost, Layout & Material Handling system.

UNIT I INTRODUCTION **10**

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING **10**

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

UNIT III CELLULAR MANUFACTURING **9**

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

UNIT IV FLEXIBLE MANUFACTURING SYSTEM (FMS) AND AUTOMATED GUIDED VEHICLE SYSTEM (AGVS) **8**

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

UNIT V INDUSTRIAL ROBOTICS **8**

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the student can able to understand the use of computers in process planning and use of FMS and Robotics in CIM

TEXT BOOK:

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.
2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

REFERENCES:

1. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003.
2. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.
3. Rao. P, N Tewari &T.K. Kundra, "Computer Aided Manufacturing", Tata McGraw Hill Publishing Company, 2000.

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ME6004 **UNCONVENTIONAL MACHINING PROCESSES** **L T P C**
3 0 0 3

OBJECTIVES:

To learn about various unconventional machining processes, the various process parameters and their influence on performance and their applications

UNIT I INTRODUCTION **6**

Unconventional machining Process – Need – classification – Brief overview .

UNIT II MECHANICAL ENERGY BASED PROCESSES **9**

Abrasive Jet Machining – Water Jet Machining – Abrasive Water Jet Machining - Ultrasonic Machining.(AJM, WJM, AWJM and USM). Working Principles – equipment used – Process parameters – MRR- Applications.

UNIT III ELECTRICAL ENERGY BASED PROCESSES **9**

Electric Discharge Machining (EDM)- working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing – Wire cut EDM – Applications.

UNIT IV CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES **11**

Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants – Maskant - techniques of applying maskants - Process Parameters – Surface finish and MRR-Applications. Principles of ECM- equipments-Surface Roughness and MRR Electrical circuit-Process Parameters-ECG and ECH - Applications.

UNIT V THERMAL ENERGY BASED PROCESSES **10**

Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to demonstrate different unconventional machining processes and know the influence of difference process parameters on the performance and their applications.

TEXT BOOKS:

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 2007.

REFERENCES:

1. Benedict. G.F. "Nontraditional Manufacturing Processes", Marcel Dekker Inc., New York, 1987.
2. Mc Geough, "Advanced Methods of Machining", Chapman and Hall, London, 1998.
3. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, "Material and Processes in Manufacturing" Prentice-Hall of India Pvt. Ltd., 8thEdition, New Delhi , 2001.

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ME6005 **PROCESS PLANNING AND COST ESTIMATION** **L T P C**
3 0 0 3

OBJECTIVES:

To introduce the process planning concepts to make cost estimation for various products after process planning

UNIT I INTRODUCTION TO PROCESS PLANNING **10**

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES **10**

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION **8**

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION **8**

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

UNIT V MACHINING TIME CALCULATION **9**

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to use the concepts of process planning and cost estimation for various products.

TEXT BOOKS:

1. Peter scalon, "Process planning, Design/Manufacture Interface", Elsevier science technology Books, Dec 2002.

REFERENCES:

1. Ostwalal P.F. and Munez J., "Manufacturing Processes and systems", 9th Edition, John Wiley, 1998.
2. Russell R.S and Taylor B.W, "Operations Management", 4th Edition, PHI, 2003.
3. Chitale A.V. and Gupta R.C, "Product Design and Manufacturing", 2nd Edition, PHI, 2002.

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19-20

ME6006 **DESIGN OF JIGS, FIXTURES AND PRESS TOOLS**

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OBJECTIVES:

To understand the functions and design principles of Jigs, fixtures and press tools
To gain proficiency in the development of required views of the final design.

UNIT I LOCATING AND CLAMPING PRINCIPLES: 8

Objectives of tool design- Function and advantages of Jigs and fixtures – Basic elements – principles of location – Locating methods and devices – Redundant Location – Principles of clamping – Mechanical actuation – pneumatic and hydraulic actuation Standard parts – Drill bushes and Jig buttons – Tolerances and materials used.

UNIT II JIGS AND FIXTURES 10

Design and development of jigs and fixtures for given component- Types of Jigs – Post, Turnover, Channel, latch, box, pot, angular post jigs – Indexing jigs – General principles of milling, Lathe, boring, broaching and grinding fixtures – Assembly, Inspection and Welding fixtures – Modular fixturing systems- Quick change fixtures.

UNIT III PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES 10

Press Working Terminologies - operations – Types of presses – press accessories – Computation of press capacity – Strip layout – Material Utilization – Shearing action – Clearances – Press Work Materials – Center of pressure- Design of various elements of dies – Die Block – Punch holder, Die set, guide plates – Stops – Strippers – Pilots – Selection of Standard parts – Design and preparation of four standard views of simple blanking, piercing, compound and progressive dies.

UNIT IV BENDING AND DRAWING DIES 10

Difference between bending and drawing – Blank development for above operations – Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect – pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing, reverse redrawing and combination dies – Blank development for axisymmetric, rectangular and elliptic parts – Single and double action dies.

UNIT V OTHER FORMING TECHNIQUES 7

Bulging, Swaging, Embossing, coining, curling, hole flanging, shaving and sizing, assembly, fine Blanking dies – recent trends in tool design- computer Aids for sheet metal forming Analysis – basic introduction - tooling for numerically controlled machines- setup reduction for work holding – Single minute exchange of dies – Poka Yoke.

TOTAL: 45 PERIODS

Note: (Use of P S G Design Data Book is permitted in the University examination)

OUTCOMES:

Upon completion of this course, the students can able to design jigs, fixtures and press tools.

TEXT BOOKS:

1. Joshi, P.H. "Jigs and Fixtures", Second Edition, Tata McGraw Hill Publishing Co., Ltd., New Delhi, 2004.
2. Joshi P.H "Press tools - Design and Construction", wheels publishing, 1996

REFERENCES:

1. Venkataraman. K., "Design of Jigs Fixtures & Press Tools", Tata McGraw Hill, New Delhi, 2005.
2. Donaldson, Lecain and Goold "Tool Design", 3rd Edition, Tata McGraw Hill, 2000.
3. Kempster, "Jigs and Fixture Design", Third Edition, Hoddes and Stoughton, 1974.
4. Hoffman "Jigs and Fixture Design", Thomson Delmar Learning, Singapore, 2004.
5. ASTME Fundamentals of Tool Design Prentice Hall of India.
6. Design Data Hand Book, PSG College of Technology, Coimbatore.

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ME6008 **WELDING TECHNOLOGY** L T P C 3 0 0 3

OBJECTIVES

To understand the basics of welding and to know about the various types of welding processes

UNIT I GAS AND ARC WELDING PROCESSES: 9

Fundamental principles – Air Acetylene welding, Oxyacetylene welding, Carbon arc welding, Shielded metal arc welding, Submerged arc welding, TIG & MIG welding, Plasma arc welding and Electroslag welding processes - advantages, limitations and applications.

UNIT II RESISTANCE WELDING PROCESSES: 9

Spot welding, Seam welding, Projection welding, Resistance Butt welding, Flash Butt welding, Percussion welding and High frequency resistance welding processes - advantages, limitations and applications.

UNIT III SOLID STATE WELDING PROCESSES: 9

Cold welding, Diffusion bonding, Explosive welding, Ultrasonic welding, Friction welding, Forge welding, Roll welding and Hot pressure welding processes - advantages, limitations and applications.

UNIT IV OTHER WELDING PROCESSES: 9

Thermit welding, Atomic hydrogen welding, Electron beam welding, Laser Beam welding, Friction stir welding, Under Water welding, Welding automation in aerospace, nuclear and surface transport vehicles.

UNIT V DESIGN OF WELD JOINTS, WELDABILITY AND TESTING OF WELDMENTS 9

Various weld joint designs – Weldability of Aluminium, Copper, and Stainless steels. Destructive and non destructive testing of weldments.

TOTAL : 45 HOURS

OUTCOMES:

Upon completion of this course, the students can able to compare different types of Welding process for effective Welding of Structural components.

TEXT BOOKS:

1. Parmer R.S., "Welding Engineering and Technology", 1st edition, Khanna Publishers, New Delhi, 2008.
2. Parmer R.S., "Welding Processes and Technology", Khanna Publishers, New Delhi, 1992.
3. Little R.L., "Welding and welding Technology", Tata McGraw Hill Publishing Co., Ltd., New Delhi, 34th reprint, 2008.

REFERENCES:

1. Schwartz M.M. "Metals Joining Manual". McGraw Hill Books, 1979.
2. Tylecote R.F. "The Solid Phase Welding of Metals". Edward Arnold Publishers Ltd. London, 1968.
3. AWS- Welding Hand Book. 8th Edition. Vol- 2. "Welding Process"
4. Nadkarni S.V. "Modern Arc Welding Technology", 1st edition, Oxford IBH Publishers, 2005.
5. Christopher Davis. "Laser Welding- Practical Guide". Jaico Publishing House, 1994.
6. Davis A.C., "The Science and Practice of Welding", Cambridge University Press, Cambridge, 1993

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ME6009 ENERGY CONSERVATION AND MANAGEMENT L T P C 3 0 0 3

OBJECTIVES:

At the end of the course, the student is expected to

understand and analyse the energy data of industries
carryout energy accounting and balancing
conduct energy audit and suggest methodologies for energy savings and
utilise the available resources in optimal ways

UNIT I INTRODUCTION 8

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization –Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II ELECTRICAL SYSTEMS 12

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT III THERMAL SYSTEMS 12

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES 8

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems – Cooling Towers – D.G. sets

UNIT V ECONOMICS 5

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to analyse the energy data of industries.
Can carryout energy accounting and balancing
Can suggest methodologies for energy savings

TEXT BOOKS:

1. Energy Manager Training Manual (4 Volumes) available at www.energymanager training.com, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

REFERENCES:

1. Witte. L.C., P.S. Schmidt, D.R. Brown, "Industrial Energy Management and Utilisation" Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. "Design and Management for Energy Conservation", Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., "The Efficient Use of Energy" Butterworths, London, 1982
4. Turner. W.C., "Energy Management Hand book", Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY. "Energy Management", Butterworths, London 1987.

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ME6011 THERMAL TURBO MACHINES L T P C 3 0 0 3

OBJECTIVES:

To understand the various systems, principles, operations and applications of different types of turbo machinery components.

UNIT I PRINCIPLES 9

Energy transfer between fluid and rotor-classification of fluid machinery,-dimensionless parameters-specific speed-applications-stage velocity triangles-work and efficiency.

UNIT II CENTRIFUGAL FANS AND BLOWERS 9

Types- stage and design parameters-flow analysis in impeller blades-volute and diffusers, losses, characteristic curves and selection, fan drives and fan noise.

UNIT III CENTRIFUGAL COMPRESSOR 9

Construction details, impeller flow losses, slip factor, diffuser analysis, losses and performance curves.

UNIT IV AXIAL FLOW COMPRESSOR 9

Stage velocity diagrams, enthalpy-entropy diagrams, stage losses and efficiency, work done simple stage design problems and performance characteristics.

UNIT V AXIAL AND RADIAL FLOW TURBINES 9

Stage velocity diagrams, reaction stages, losses and coefficients, blade design principles, testing and performance characteristics.

OUTCOMES: **TOTAL: 45 PERIODS**

Upon completion of this course, the students can able to explain the various systems, principles and applications and different types of turbo machinery components.

TEXT BOOKS:

1. Yahya, S.H., Turbines, Compressor and Fans, Tata McGraw Hill Publishing Company, 1996.

REFERENCES:

1. Bruneck, Fans, Pergamom Press, 1973.
2. Earl Logan, Jr., Hand book of Turbomachinery, Marcel Dekker Inc., 1992.
3. Dixon, S.I., "Fluid Mechanics and Thermodynamics of Turbomachinery", Pergamon Press, 1990.
4. Shepherd, D.G., "Principles of Turbomachinery", Macmillan, 1969.
5. Ganesan, V., "Gas Turbines", Tata McGraw Hill Pub. Co., 1999.
6. Gopalakrishnan .G and Prithvi Raj .D, "A Treatise on Turbo machines", Scifech Publications (India) Pvt. Ltd., 2002.

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ME6014 **COMPUTATIONAL FLUID DYNAMICS** **L T P C**
3 0 0 3

OBJECTIVES:

To introduce Governing Equations of viscous fluid flows

To introduce numerical modeling and its role in the field of fluid flow and heat transfer

To enable the students to understand the various discretization methods, solution procedures and turbulence modeling.

To create confidence to solve complex problems in the field of fluid flow and heat transfer by using high speed computers.

UNIT I GOVERNING EQUATIONS AND BOUNDARY CONDITIONS 8

Basics of computational fluid dynamics – Governing equations of fluid dynamics – Continuity, Momentum and Energy equations – Chemical species transport – Physical boundary conditions – Time-averaged equations for Turbulent Flow – Turbulent–Kinetic Energy Equations – Mathematical behaviour of PDEs on CFD - Elliptic, Parabolic and Hyperbolic equations.

UNIT II FINITE DIFFERENCE AND FINITE VOLUME METHODS FOR DIFFUSION 9

Derivation of finite difference equations – Simple Methods – General Methods for first and second order accuracy – Finite volume formulation for steady state One, Two and Three -dimensional diffusion problems –Parabolic equations – Explicit and Implicit schemes – Example problems on elliptic and parabolic equations – Use of Finite Difference and Finite Volume methods.

UNIT III FINITE VOLUME METHOD FOR CONVECTION DIFFUSION 10

Steady one-dimensional convection and diffusion – Central, upwind differencing schemes properties of discretization schemes – Conservativeness, Boundedness, Transportiveness, Hybrid, Power-law, QUICK Schemes.

UNIT IV FLOW FIELD ANALYSIS 9

Finite volume methods -Representation of the pressure gradient term and continuity equation – Staggered grid – Momentum equations – Pressure and Velocity corrections – Pressure Correction equation, SIMPLE algorithm and its variants – PISO Algorithms.

UNIT V TURBULENCE MODELS AND MESH GENERATION 9

Turbulence models, mixing length model, Two equation (k-Є) models – High and low Reynolds number models – Structured Grid generation – Unstructured Grid generation – Mesh refinement – Adaptive mesh – Software tools.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able

To create numerical modeling and its role in the field of fluid flow and heat transfer

To use the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems.

TEXT BOOKS:

1. Versteeg, H.K., and Malalasekera, W., "An Introduction to Computational Fluid Dynamics: The finite volume Method", Pearson Education Ltd.Second Edition, 2007.
2. Ghoshdastidar, P.S., "Computer Simulation of flow and heat transfer", Tata McGraw Hill Publishing Company Ltd., 1998.

REFERENCES:

1. Patankar, S.V. "Numerical Heat Transfer and Fluid Flow", Hemisphere Publishing Corporation, 2004.
2. Chung, T.J. "Computational Fluid Dynamics", Cambridge University, Press, 2002.
3. Ghoshdastidar P.S., "Heat Transfer", Oxford University Press, 2005
4. Muralidhar, K., and Sundararajan, T., "Computational Fluid Flow and Heat Transfer", Narosa Publishing House, New Delhi, 1995.
5. ProdipNiyogi, Chakrabarty, S.K., Laha, M.K. "Introduction to Computational Fluid Dynamics", Pearson Education, 2005.
6. Anil W. Date "Introduction to Computational Fluid Dynamics" Cambridge University Press, 2005.

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IE6605 **PRODUCTION PLANNING AND CONTROL** L T P C 3 0 0 3

OBJECTIVES:

To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.

To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control-Functions of production control-Types of production-job- batch and continuous-Product development and design-Marketing aspect - Functional aspects-Operational aspect-Durability and dependability aspect aesthetic aspect. Profit consideration-Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II WORK STUDY 9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning-Steps in process planning-Quantity determination in batch production-Machine capacity, balancing-Analysis of process capabilities in a multi product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling-Batch production scheduling-Product sequencing – Production Control systems-Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size-ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems-elements of JUST IN TIME SYSTEMS-Fundamentals of MRP II and ERP.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.

They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

TEXT BOOKS:

1. Martand Telsang, "Industrial Engineering and Production Management", First edition, S. Chand and Company, 2000.
2. James.B.Dilworth,"Operations management – Design, Planning and Control for manufacturing and services" Mcgraw Hill International edition 1992.

REFERENCES:

1. Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
2. Elwood S.Buffa, and Rakesh K.Sarin, "Modern Production / Operations Management", 8th Edition, John Wiley and Sons, 2000.
3. Kanishka Bedi, " Production and Operations management", 2nd Edition, Oxford university press 2007.
4. Melynk, Denzler, " Operations management – A value driven approach" Irwin Mcgraw hill.
5. Norman Gaither, G. Frazier, "Operations Management", 9th edition, Thomson learning IE, 2007

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ME6016 ADVANCED I.C ENGINES L T P C 3 0 0 3

OBJECTIVES:

To understand the underlying principles of operation of different IC Engines and components.
To provide knowledge on pollutant formation, control, alternate fuel etc.

UNIT I SPARK IGNITION ENGINES 9

Mixture requirements – Fuel injection systems – Monopoint, Multipoint & Direct injection - Stages of combustion – Normal and Abnormal combustion – Knock - Factors affecting knock – Combustion chambers.

UNIT II COMPRESSION IGNITION ENGINES 9

Diesel Fuel Injection Systems - Stages of combustion – Knocking – Factors affecting knock – Direct and Indirect injection systems – Combustion chambers – Fuel Spray behaviour – Spray structure and spray penetration – Air motion - Introduction to Turbocharging.

UNIT III POLLUTANT FORMATION AND CONTROL 9

Pollutant – Sources – Formation of Carbon Monoxide, Unburnt hydrocarbon, Oxides of Nitrogen, Smoke and Particulate matter – Methods of controlling Emissions – Catalytic converters, Selective Catalytic Reduction and Particulate Traps – Methods of measurement – Emission norms and Driving cycles.

UNIT IV ALTERNATIVE FUELS 9

Alcohol, Hydrogen, Compressed Natural Gas, Liquefied Petroleum Gas and Bio Diesel - Properties, Suitability, Merits and Demerits - Engine Modifications.

UNIT V RECENT TRENDS 9

Air assisted Combustion, Homogeneous charge compression ignition engines – Variable Geometry turbochargers – Common Rail Direct Injection Systems - Hybrid Electric Vehicles – NOx Adsorbers - Onboard Diagnostics.

TOTAL : 45 PERIODS

OUTCOME:

- Upon completion of this course, the students can able to compare the operations of different IC Engine and components and can evaluate the pollutant formation, control, alternate fuel

TEXT BOOKS:

1. Ramalingam. K.K., "Internal Combustion Engine Fundamentals", Scitech Publications, 2002.
2. Ganesan, "Internal Combustion Engines", II Edition, TMH, 2002.

REFERENCES:

1. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., Dhanpat Rai & Sons 2007.
2. Duffy Smith, "Auto Fuel Systems", The Good Heart Willcox Company, Inc., 1987.
3. Eric Chowenitz, "Automobile Electronics", SAE Publications, 1995

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ME6015 **OPERATIONS RESEARCH** **L T P C**
3 0 0 3

OBJECTIVES:

To provide knowledge and training in using optimization techniques under limited resources for the engineering and business problems.

UNIT I LINEAR MODELS **15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS **8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS **6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS **6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS **10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life – Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use the optimization techniques for use engineering and Business problems

TEXT BOOK:

1. Taha H.A., "Operations Research", Sixth Edition, Prentice Hall of India, 2003.

REFERENCES:

1. Shennoy G.V. and Srivastava U.K., "Operation Research for Management", Wiley Eastern, 1994.
2. Bazara M.J., Jarvis and Sherali H., "Linear Programming and Network Flows", John Wiley, 1990.
3. Philip D.T. and Ravindran A., "Operations Research", John Wiley, 1992.
4. Hillier and Libeberman, "Operations Research", Holden Day, 1986
5. Budnick F.S., "Principles of Operations Research for Management", Richard D Irwin, 1990.
6. Tulsian and Pasdey V., "Quantitative Techniques", Pearson Asia, 2002.

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ME6017 **DESIGN OF HEAT EXCHANGERS** L T P C
3 0 0 3

OBJECTIVES:

To learn the thermal and stress analysis on various parts of the heat exchangers
To analyze the sizing and rating of the heat exchangers for various applications

UNIT I INTRODUCTION 9

Types of heat exchangers, shell and tube heat exchangers – regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA)

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS 9

Heat transfer correlations, Overall heat transfer coefficient, analysis of heat exchangers – LMTD and effectiveness method. Sizing of finned tube heat exchangers, U tube heat exchangers, Design of shell and tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III STRESS ANALYSIS 9

Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types of failures, buckling of tubes, flow induced vibration.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER 9

Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V CONDENSERS AND COOLING TOWERS 9

Design of surface and evaporative condensers – cooling tower – performance characteristics.

TOTAL: 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to apply the mathematical knowledge for thermal and stress analysis on various parts of the heat exchangers components.

TEXT BOOKS:

1. SadikKakac and Hongtan Liu, "Heat Exchangers Selection", Rating and Thermal Design, CRC Press, 2002.
2. Shah,R. K., Dušan P. Sekulić, "Fundamentals of heat exchanger design", John Wiley & Sons, 2003.

REFERENCES:

1. Robert W. Serth, "Process heat transfer principles and applications", Academic press, Elesevier, 2007.
2. Sarit Kumar Das, "Process heat transfer", Alpha Science International, 2005
3. John E. Hesselgreaves, "Compact heat exchangers: selection, design, and operation", Elsevier science Ltd, 2001.
4. Kuppan. T., "Heat exchanger design hand book", New York : Marcel Dekker, 2000.
5. Eric M. Smith, "Advances in thermal design of heat exchangers: a numerical approach: direct-sizing, step-wise rating, and transients", John Wiley & Sons, 1999.

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ME6019 NON DESTRUCTIVE TESTING AND MATERIALS L T P C
3 0 0 3

OBJECTIVES:

To study and understand the various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

UNIT I OVERVIEW OF NDT 7

NDT Versus Mechanical testing, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterisation. Relative merits and limitations, Various physical characteristics of materials and their applications in NDT., Visual inspection – Unaided and aided.

UNIT II SURFACE NDE METHODS 8

Liquid Penetrant Testing - Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Testing Procedure, Interpretation of results. Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetisation methods, Interpretation and evaluation of test indications, Principles and methods of demagnetization, Residual magnetism.

UNIT III THERMOGRAPHY AND EDDY CURRENT TESTING (ET) 10

Thermography- Principles, Contact and non contact inspection methods, Techniques for applying liquid crystals, Advantages and limitation - infrared radiation and infrared detectors, Instrumentations and methods, applications.Eddy Current Testing-Generation of eddy currents, Properties of eddy currents, Eddy current sensing elements, Probes, Instrumentation, Types of arrangement, Applications, advantages, Limitations, Interpretation/Evaluation.

UNIT IV ULTRASONIC TESTING (UT) AND ACOUSTIC EMISSION (AE) 10

Ultrasonic Testing-Principle, Transducers, transmission and pulse-echo method, straight beam and angle beam, instrumentation, data representation, A/Scan, B-scan, C-scan. Phased Array Ultrasound, Time of Flight Diffraction. Acoustic Emission Technique –Principle, AE parameters, Applications

UNIT V RADIOGRAPHY (RT) 10

Principle, interaction of X-Ray with matter, imaging, film and film less techniques, types and use of filters and screens, geometric factors, Inverse square, law, characteristics of films - graininess, density, speed, contrast, characteristic curves, Penetrameters, Exposure charts, Radiographic equivalence. Fluoroscopy- Xero-Radiography, Computed Radiography, Computed Tomography

TOTAL : 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to use the various Non Destructive Testing and Testing methods understand for defects and characterization of industrial components

TEXT BOOKS:

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu "Practical Non-Destructive Testing", Narosa Publishing House, 2009.
2. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010

REFERENCES:

1. ASM Metals Handbook,"Non-Destructive Evaluation and Quality Control", American Society of Metals, Metals Park, Ohio, USA, 200, Volume-17.
2. Paul E Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition New Jersey, 2005
3. Charles, J. Hellier," Handbook of Nondestructive evaluation", McGraw Hill, New York 2001.
4. ASNT, American Society for Non Destructive Testing, Columbus, Ohio, NDT Handbook,Vol. 1, Leak Testing, Vol. 2, Liquid Penetrant Testing, Vol. 3, Infrared and Thermal Testing Vol. 4, Radiographic Testing, Vol. 5, Electromagnetic Testing, Vol. 6, Acoustic Emission Testing, Vol. 7, Ultrasonic Testing

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ME6401 **KINEMATICS OF MACHINERY** L T P C
3 0 0 3

OBJECTIVES:

To understand the basic components and layout of linkages in the assembly of a system / machine.

To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.

To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.

To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

UNIT I BASICS OF MECHANISMS 9

Classification of mechanisms – Basic kinematic concepts and definitions – Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law – Kinematic inversions of four-bar chain and slider crank chains – Limit positions – Mechanical advantage – Transmission Angle – Description of some common mechanisms – Quick return mechanisms, Straight line generators, Universal Joint – rocker mechanisms.

UNIT II KINEMATICS OF LINKAGE MECHANISMS 9

Displacement, velocity and acceleration analysis of simple mechanisms – Graphical method– Velocity and acceleration polygons – Velocity analysis using instantaneous centres – kinematic analysis of simple mechanisms – Coincident points – Coriolis component of Acceleration – Introduction to linkage synthesis problem.

UNIT III KINEMATICS OF CAM MECHANISMS 9

Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions – Derivatives of follower motions – Layout of plate cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – sizing of cams.

UNIT IV GEARS AND GEAR TRAINS 9

Law of toothed gearing – Involutes and cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – contact ratio – Interference and undercutting. Helical, Bevel, Worm, Rack and Pinion gears [Basics only]. Gear trains – Speed ratio, train value – Parallel axis gear trains – Epicyclic Gear Trains.

UNIT V FRICTION IN MACHINE ELEMENTS 9

Surface contacts – Sliding and Rolling friction – Friction drives – Friction in screw threads –Bearings and lubrication – Friction clutches – Belt and rope drives – Friction in brakes- Band and Block brakes.

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to apply fundamentals of mechanism for the design of new mechanisms and analyse them for optimum design.

TEXT BOOKS:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009.

REFERENCES:

1. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
3. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
4. Allen S. Hall Jr., "Kinematics and Linkage Design", Prentice Hall, 1961
5. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi, 1988.
6. Rao.J.S. and Dukkipati.R.V. "Mechanisms and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
7. John Hannah and Stephens R.C., "Mechanics of Machines", Viva Low-Prices Student Edition, 1999.
8. Ramamurthi. V, "Mechanics of Machines", Narosa Publishing House, 2002.

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ME6501 **COMPUTER AIDED DESIGN** **L T P C 3 0 0 3**

OBJECTIVES:

- To provide an overview of how computers are being used in mechanical component design

UNIT I FUNDAMENTALS OF COMPUTER GRAPHICS **9**

Product cycle- Design process- sequential and concurrent engineering- Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - Line drawing -Clipping- viewing transformation

UNIT II GEOMETRIC MODELING **9**

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep

UNIT III VISUAL REALISM **9**

Hidden – Line-Surface-Solid removal algorithms – shading – colouring – computer animation.

UNIT IV ASSEMBLY OF PARTS **9**

Assembly modelling – interferences of positions and orientation – tolerance analysis-massproperty calculations – mechanism simulation and interference checking.

UNIT V CAD STANDARDS **9**

Standards for computer graphics- **Graphical Kernel System** (GKS) - standards for exchangeimages- **Open** Graphics Library **(OpenGL)** - Data exchange standards - IGES, STEP, CALSetc. - communication standards.

TOTAL : 45 PERIODS

OUTCOMES:

- Upon completion of this course, the students can able to use computer and CAD software's for modeling of mechanical components.

TEXT BOOKS:

1. Ibrahim Zeid "Mastering CAD CAM" Tata McGraw-Hill Publishing Co.2007

REFERENCES:

1. Chris McMahon and Jimmie Browne "CAD/CAM Principles", "Practice and Manufacturing management " Second Edition, Pearson Education, 1999.
2. William M Neumann and Robert F.Sproul "Principles of Computer Graphics", McGraw Hill Book Co. Singapore, 1989.
3. Donald Hearn and M. Pauline Baker "Computer Graphics"'. Prentice Hall, Inc, 1992.
4. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson Education - 2003.

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EE6351 **ELECTRICAL DRIVES AND CONTROL** L T P C
3 0 0 3

OBJECTIVES:

To understand the basic concepts of different types of electrical machines and their performance.
To study the different methods of starting D.C motors and induction motors.
To study the conventional and solid-state drives

UNIT I INTRODUCTION 8

Basic Elements – Types of Electric Drives – factors influencing the choice of electrical drives – heating and cooling curves – Loading conditions and classes of duty – Selection of power rating for drive motors with regard to thermal overloading and Load variation factors

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Mechanical characteristics – Speed-Torque characteristics of various types of load and drive motors – Braking of Electrical motors – DC motors: Shunt, series and compound - single phase and three phase induction motors.

UNIT III STARTING METHODS 8

Types of D.C Motor starters – Typical control circuits for shunt and series motors – Three phase squirrel cage and slip ring induction motors.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF D.C. DRIVES 10

Speed control of DC series and shunt motors – Armature and field control, Ward-Leonard control system - Using controlled rectifiers and DC choppers –applications.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF A.C. DRIVES 10

Speed control of three phase induction motor – Voltage control, voltage / frequency control, slip power recovery scheme – Using inverters and AC voltage regulators – applications.

TOTAL: 45 PERIODS

OUTCOMES:

Upon Completion of this subject, the students can able to explain different types of electrical machines and their performance

TEXT BOOKS:

1. Vedam Subrahmaniam, "Electric Drives (Concepts and Applications", Tata McGraw-Hill, 2001
2. Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, 1998

REFERENCES:

1. Pillai.S.K "A First Course on Electric Drives", Wiley Eastern Limited, 1998
2. Singh. M.D., K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 1998
3. Partab. H., "Art and Science and Utilisation of Electrical Energy", Dhanpat Rai and Sons, 1994

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GE6351 **ENVIRONMENTAL SCIENCE AND ENGINEERING** L T P C 3 0 0 3

OBJECTIVES:

To the study of nature and the facts about environment.

To finding and implementing scientific, technological, economic and political solutions to environmental problems.

To study the interrelationship between living organism and environment.

To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.

To study the dynamic processes and understand the features of the earth's interior and surface.

To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – biogeographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 10

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere - formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO_2, NO_X, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals - Water treatment processes. (c) Soil pollution - soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry- Proteins –Biochemical

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accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act – The Biomedical Waste (Management and Handling) Rules; 1998 and amendments- scheme of labeling of environmentally friendly products (Ecomark). enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

TOTAL : 45 PERIODS

OUTCOMES:

Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.

Public awareness of environmental is at infant stage.
Ignorance and incomplete knowledge has lead to misconceptions
Development and improvement in std. of living has lead to serious environmental disasters

TEXT BOOKS :

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

REFERENCES :

1. Trivedi.R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.
4. Rajagopalan, R, "Environmental Studies-From Crisis to Cure", Oxford University Press, 2005.

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FREE ENERGY GENERATION FOR USING PERPETUAL MOTION MECHANISM

A PROJECT REPORT

Submitted by

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K.DHANANCHEZIAN (311816114012)
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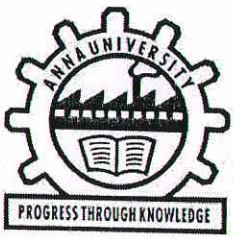
in partial fulfillment for the award of the degree

of

BACHELOR OF ENGINEERING

in

MECHANICAL ENGINEERING



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APRIL 2020

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BONAFIDE CERTIFICATE

Certified that this project report **"FREE ENERGY GENERATION FOR USING PERPETUAL MOTION MECHANISM"** is the bonafide work of **AZARUDEEN.MF (311816114009), DHANANCHEZIAN.K (311816114012), HARISUNDAR.V (311816114018)** who carried out the project work under my supervision.

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Project Viva-Voce held on 22/09/2020.

INTERNAL EXAMINER

EXTERNAL EXAMINER

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ABSTRACT

Renewable sources of energy is now a major concern worldwide as replacement to the high demand of fossil fuels. Majority of the electricity that is generated uses the Faraday's law, the electro-magnetic induction. This law led to new technologies that even brought up the misconception of free energy. Energy only becomes free if we don't have to pay for the generation of it; hence we resort to abundant sources of energy that we can convert into electricity. The researcher used wind to generate power. It will continuously pass the blades of the fan causing it to rotate. The generator is mounted into a vehicle exposing the blades into turbulent wind, rotating the shaft to generate power and, is extracted and stored into a battery. The process also demonstrates the conversion of kinetic energy from the wind into mechanical power. Results on different settings are compared to identify the best scenario that will generate usable amount of energy and adjustments on the design of the prototype to meet the needs of the end users. The energy generated can be used in numerous applications such as powering and charging mobile devices, powering small light emitting diodes and bulbs. This study focuses on the construction of the generator and evaluating the device to identify its possible applications and future enhancements. This prototype may impact and attract future researchers to work more on the research of free energy or renewable energy.

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CHAPTER - 9

CONCLUSIONS:

In this project, by integrating the concepts of a motor and a generator, the researcher has successfully ventured another concept of generating free electricity. The researcher has identified those sources as abundant as wind need not to be costly to use in generating electricity. It can be use easily. The force will be applied the material the free energy will be formed and also electricity produced.

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STUDY OF MECHANICAL BEHAVIOUR NATURAL COMPOSITE KIKAR WOOD FIBER REINFORCED WITH EPOXY RESIN

A PROJECT REPORT

Submitted by

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of

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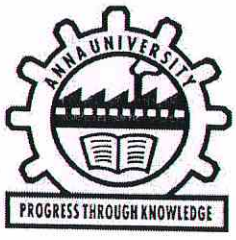

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Certified that this project report **"STUDY OF MECHANICAL BEHAVIOUR OF NATURAL COMPOSITE KIKAR WOOD FIBER REINFORCED WITH EPOXY RESIN"** is the bonafide work of **AKIL AHAMED . A (311816114007), IZSATH . A (311816114020), MOHAMED MUBARAK .S.S (311816114040)** who carried out the project work under my supervision.

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EXTERNAL EXAMINER

ABSTRACT

Now-a-days, the natural kikar wood from renewable natural resources offer the potential to act as a reinforcing material for polymer composites alternative to the use of glass, carbon and wood. Among various natural fibers, kikar wood is most widely used natural fiber due to its advantages like easy availability, low density, low production cost and satisfactory mechanical properties. For a composite material, its mechanical behavior depends on many factors such as fiber content, orientation, types, length etc. Attempts have been made in this research work to study the effect of loading on the physical and mechanical behavior of kikar wood reinforced epoxy based composites. In this research, natural fiber like kikarwood fiber (Prosopis juliflora) is fabricated with epoxy resin using hand-lay method. According to the ASTM D-3039 for Tensile test using the polyester resin as the matrix material. For hardness of kikarwood fiber was studied. micro structure of the specimens are scanned by the Scanning Electron Microscope(SEM). To this end, an attempt has been made to study the potential utilization of kikarwood fiber which is economically and effortlessly found in India for making value added products.

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CHAPTER 5

CONCLUSION

The material selection and properties of kikar wood fiber reinforced epoxy based hybrid composites has been obtained till now with the help of various journals. Reinforcement preparation and test results are yet to be obtained in future.

The present work showed the usefulness of kikar wood fiber as reinforcement to other natural fiber material. The tensile hardness and compression tests of kikar wood fiber will be conducted using UTM machine. The composites may become less ductile as coir fiber content is increased. Further work must be done related to fiber surface treatment and residue elimination in recycled HDPE to improve mechanical properties.

The greatest advantage of kikar wood composite material reinforced with epoxy resin is strength and stiffness combined with lightness. By choosing an combination of reinforcement and matrix material manufacturers can produce properties that exactly fit the requirements for a partical structure for a particular purpose.

Natural composite material of kikar wood fiber reinforced with epoxy resin is best to use for building, bridges and structures such as boat hulls, swimming pool panels, racing car bodies, shower stalls, bath tubs, storage tanks, imitation granite and cultured marble sinks and countertops.

However, as a class of materials, kikar wood fiber composites tent have the following characteristics: high strength; high modulus; low density; excellent resistance to fatigue, creep, creep rupture, corrosion and wear and low coefficient of thermal expansion (CTE).

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INFLUENCE OF INFILL PATTERN AND INFILL DENSITY ON MECHANICAL PROPERTIES OF POLYETHYLENE TEREPHTHALATE GLYCOL (PETG) BY FUSED DEPOSITION MODELING

A PROJECT REPORT

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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

Fused deposition modeling (FDM) is one of the Rapid Prototyping technique in which a plastic filament is melted in the extruder of the 3D printer and deposited on the build platform to form the object layer by layer. There is a wide array of different Additive Manufacturing technologies; Fused Deposition Modeling (FDM) is one of the most common techniques used for 3D printing. Part quality and mechanical properties of the FDM fabricated parts extensively depends on process variable parameters such as layer thickness, part orientation, speed, temperature etc. The present research is to investigate the influence of infill pattern as well as infill density on mechanical properties (Tensile, Impact & Flexural) of POLYETHYLENE TEREPHTHALATE GLYCOL (PETG) by fused deposition modeling. We had prepared PETG samples based on parameters such as Infill pattern (Line, Hexagon, Triangle) and Infill density (50%,75%,100%). Along with this combination, we had prepared 27 samples by Flash Forge Guider II 3D Printer. Mechanical properties of prepared PETG samples such as Tensile, Flexural & Impact tests were carried out to observe its behavior under various testing condition. The observation showed that the triangular pattern along with the maximum density produced better strength compared to other patterns and densities.

Keywords: Fused Deposition Modeling (FDM), Polyethylene Terephthalate Glycol (PETG), Infill Pattern, Infill Density.

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5. CONCLUSION

One of the advantages of 3D printing FDM technology is that the products can be manufactured with different infill density. With this benefit, time and amount of material can be reduced and also costs of finished product.

After analysing the results obtained, it can be concluded that:

1) Infill type and infill density have influence on destructive tests.
2) The quality and property of the printed part can be improved by reducing the printing speed.
3) The triangular pattern with various densities produced better strength compared to Line & Hexagonal pattern.
4) Varying the temperature also has the scope to give better property for the material.

In future work, the same PETG Material can be taken and tests can be performed by varying their build orientation, print speed and also choosing different patterns other than those specified above.

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INFLUENCE OF ADDITION OF BASALT FIBER AND KENAF FIBER POLYMER WITH POLYLACTIC ACID (PLA) TO FORM A COMPOSITE

A PROJECT REPORT

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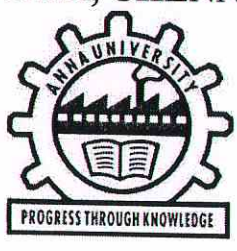

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INTERNAL EXAMINER

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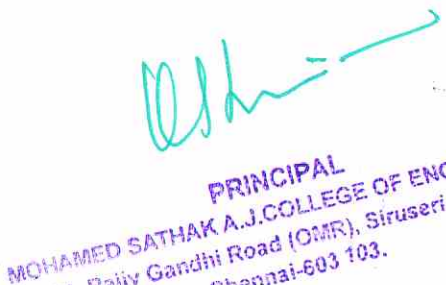
ABSTRACT

The major attractions about green composites are that they are environmentally friendly, fully degradable and sustainable in every way, at the end of their service life they can be easily disposed of or composted without harming the environment. In this work, fiber reinforced composites are investigated in order to enhance the thermal properties of PLA. Specifically, composite materials using natural fibers, such as kenaf are actively studied. In the utilization of natural fibers, such as kenaf, the treatment method for increasing the bonding force between the fiber and the matrix is very important. One of the mineral fibre such as basalt, it is separated from volconas rocks. In this study, the content of basalt fibre increase, changes in properties of PLA/Kenaf/Basalt composite is examined. The Glass Transition Temperature (Tg), Melting Temperature (Tm), degradation stages of composites, Storage Modulus, Loss Modulus is determined, Finally that was concluded that higher content of basalt fiber composite is more effective for improving the performance of thermal properties.



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CHAPTER 5
CONCLUSIONS

In this study, eco-friendly materials or green composites composed of Basalt with kenaf and PLA were prepared. Basalt fiber higher content was composed with PLA composites. Kenaf fibers was made less hydrophilic through acetylation. With respect to the higher basalt levels that were examined in this study, there was higher improvement in the mechanical properties as compared with the PLA composites.

In DSC results, the melting temperature of both PLA composite samples increased with an increase in basalt fiber content, and it was more evident in the annealed samples. The glass transition temperature of as prepared PLA samples increased with an increase in the basalt fiber content. The glass transition temperature of PLA composite sample II was higher than that of the as prepared samples I.

By using DMA, as prepared PLA composite the storage modulus increased with an increase in basalt fiber content. The modulus of PLA rapidly decreases after the glass transition temperature (Tg) region, and the modulus of elasticity changes abruptly, according to the degree of interaction with basalt.

By TGA results, the thermal stability of composites was altered depending on the degree of kenaf fiber. The PLA composite sample I is degraded earlier than PLA composites sample -II. The PLA composites contain acetylated kenaf that were more thermally stable, as discussed in the preceding paragraph.

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These results are directly related to changes in the thermal decomposition properties of the preceding kenaf. Since the initial thermal decomposition temperature of the acetylated kenaf greatly increases, the initial thermal decomposition temperature of the composite material also increases accordingly.

The presence of fiber increased the melting temperature, crystallisation temperature as well as the enthalpy of melting of the PLA composite sample II. The thermal stability of both PLA composite increased in the presence of kenaf fiber, and it was more significant for the sample II. The storage and Young"s modulus of the PLA samples increased as a result of presence of the stiffer kenaf fibers, with the Young"s modulus almost double. The PLA composites showed little or no biodegradation after 10 days of immersion in water at 80 °C.

The properties of the comparable PLA composites are compared, it is clear that the both PLA composite samples melt at very similar temperatures, although the PLA composite sample II has a higher glass transition temperature than PLA sample I. Although the PLA composites sample II seem to be thermally more stable than the PLA composite sample I, On a balance of properties it is possible that PLA composites containing small amounts of basalt fiber can replace equivalent PLA composites in a number of applications. The biodegradation of PLA is its biggest attribute, and it is attained more number of applications (automobile parts, products, electronic panels) especially where environmental concerns are important as almost all the properties are the same, with an additional property of environmental friendliness of PLA.

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INVESTIGATION OF THE MATERIAL CHARACTERIZATION OF THE GFRP WITH ALUMINIUM AND GRAPHITE POWDER COMPOSITES

A PROJECT REPORT

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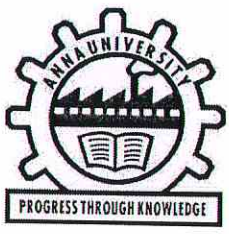

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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

The objective of this research is to produce GFRP with aluminium powder and graphite powder composite and investigates the material characterization of the composite. The different compositions of aluminium and graphite powder with GFRP are fabricated. The material characterizations find out through Tensile testing, Hardness testing, Impact analysis, micro structure analysis and flexural analysis in this combinations and results were compared.

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CHAPTER 6

CONCLUSION

This research is to produce GFRP with aluminium powder and graphite powder composite and investigates the material characterization of the composite. The different compositions of aluminium and graphite powder with GFRP are fabricated.

The material characterizations find out through Tensile testing, Hardness testing, Impact analysis, micro structure analysis and flexural analysis in this combinations and results were compared.

From the above graphs we can conclude that the specimen with the composition Aluminium powder 5% + Graphite powder 10% possess the better mechanical properties than other two compositions.

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EXPERIMENTAL ANALYSIS OF WOODEN SAW DUST AND PLASTIC WASTE WITH POLYMER AND EPOXY COMPOSITE MATERIAL

A PROJECT REPORT

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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

The objective of this research is to produce and investigates the material characterization of the composite material with wooden saw dust and plastic waste. The different compositions of wooden saw dust and plastic waste 25% and 30% are fabricated. Attempts have been made in this research work to study the physical and mechanical behavior of reinforced epoxy based composites in order to find out the material characterizations through Tensile testing, Hardness testing, Impact analysis, flexural analysis and water absorption testing in this combinations and results were compared.

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CHAPTER – 5

CONCLUSION

Thus for the investigation of material characterization of the composite material with wooden saw dust and plastic waste, the composites of different compositions of wooden saw dust and plastic waste i.e 25% and 30% are fabricated. Attempts have been made in this research work and the physical and mechanical behavior of reinforced epoxy based composites are found out through Tensile testing, Hardness testing, Impact analysis, Flexural analysis and Water Absorption testing in this combinations. Finally the results were analysed as the specimen with 30% composite composition which means 15 %of wooden saw dust and 15% of nylon plastic shows better results in its mechanical characteristics in comparison with the specimen with 25%composite composition which means 12.5% of wooden saw dust and 12.5% of nylon plastic. In other words increase in composite composition increase the physical and mechanical behavior of the fabricated material and leads to more better results since it shows an increased tensile strength of 1.47 mpa, 3.04 mpa of flexural strength, 4 mpa of hardness strength for an increase in 2.5% of composites. This assures that increase in composite composition increase the physical and mechanical behavior of the fabricated material and leads to increased strength.

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SYNTHESIS AND TESTING OF SINTERED COPPER – FERROUS POWDER COMPACT COMPONENT BY POWDER METALLURGY

A PROJECT REPORT

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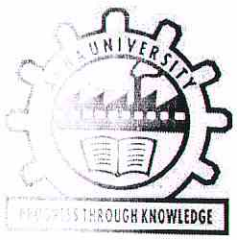

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INTERNAL EXAMINER

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ABSTRACT

Copper and ferrous powders constitute a huge majority of the raw materials used for the production of powder metallurgical parts. However when it comes to alloying, the Fe-Cu system is usually overlooked, since the solubility of copper in Fe is limited, especially at low temperatures, reducing its potential as a major alloying element. Through the powder metallurgical route, however, premixes of Cu and Fe might be used effectively to produce sintered parts. Since there is a gap in the melting points of the two elements, the pre-dominant sintering mechanism here will be liquid phase sintering. A potential downside is that in Fe-Cu compacts, a large diffusion time must be granted to obtain the maximum theoretical density. This can be overcome through the use of an infill metal (such as copper).Through experimental procedure we aim to find the properties of such a Fe-Cu compact infiltrated with excess of copper and identify any defects, if they are present. Our secondary objective is to determine if the density of the compact is altered as a result of infiltration.

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CHAPTER – 5
CONCLUSION

The experimental procedure and the analysis of test results have both lead to an understanding of the properties of Fe and Cu sintered parts. Further it was determined that the amount of porosity produced during sintering can be reduced by the use of an infill metal. The use of an infill metal also reduces the amount of time the component has to spend in a furnace in order to obtain maximum density.

So to conclude, the following points were established through this investigation:

- The properties of Fe20%Cu powder compact infiltrated with copper were found to slightly better than that of mild steel.
- The amount of porosity in the compact can be reduced by infiltration.
- Complete infiltration is possible only under vacuum conditions.
- Copper is not entirely soluble in iron leading to the formation of secondary phase copper networks.

From reference sources we were able to determine that for a compact consisting of Fe20%Cu, it takes about 20 hours to reach a density of 93% when sintered at about 1200 degrees. We were able to reach a similar density (92.35%) at a much shorter time of about 4 hours. This implies that through infiltration the holding time in order to reach a desired density can be substantially reduced.

No significant amount of porosity was identifiable from the analysis of the microstructure. Also through calculations we were able to determine that the void density was substantially low (7.65%, as deduced through density calculations)

We hypothesize that a better density value can be obtained by the use of a vacuum furnace since better infiltration can be achieved. As such it might be possible to obtain a density value close to maximum density.

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LOW VELOCITY IMPACT ANALYSIS OF KEVLAR - NiTi REINFORCED POLYMER COMPOSITE

A PROJECT REPORT

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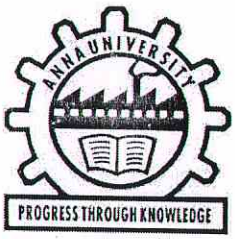

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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

The main aim of the project is to study the effects of the addition of a shape memory alloy sheet in between the layers of Kevlar in a Kevlar fiber reinforced polymer matrix composite. Kevlar is a heat-resistant and strong synthetic fiber, related to other aramids such as Nomex and Technora. Kevlar is the branded name of Poly-paraphenylene terephthalamide. Kevlar is a well-known component of personal armor such as combat helmets, ballistic face masks, and ballistic vests. A shape-memory alloy (SMA, smart metal, memory metal, memory alloy, muscle wire, smart alloy) is an alloy that "remembers" its original shape and that when deformed returns to its pre-deformed shape when heated. It gets its name because it exhibits the shape memory effect. But, the property of interest in this mechanical characterization is its toughness and vibration dampening capacity. The composite material will be manufactured with hand laid method with the SMA sheet between the layers of the Kevlar fabric(reinforcement) and epoxy resin as matrix. The resulting composite is then tested with various tests to identify its properties.

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CHAPTER 5

CONCLUSION

Based on the results of the tests, the following conclusions can be made:

- ✓ Addition of shape memory alloy in the form of sheet affects the impact properties and toughness of the resulted composite when compared to a composite solely made by using Kevlar and epoxy resin.
- ✓ The addition of shape memory alloy sheet increases the toughness of the resulted composite as it can be inferred from the visual inspection of the plain and SMA sheet specimens after the impact test.
- ✓ A large amount of elastic energy is stored in the specimen with the SMA sheet (in comparison with the plain specimen) which in turn is transferred to the tup after the impact which results in its rebound.
- ✓ The SMA sheet-Kevlar composite takes lesser damage after the impact when compared to the plain specimen, which indicates the increase in impact resistance.
- ✓ The addition of SMA sheet does not affect the tensile strength much as the outer fibers break off during the test while the SMA sheet withstands. It may be due to the bonding between the SMA sheet and the matrix being poor.
- ✓ The addition of SMA sheet does not affect the flexural strength much as the outer fibers break off during the test while the SMA sheet withstands. It may be due to the bonding between the SMA sheet and the matrix being poor.

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REAL TIME FIRE FIGHTING ROBOT USING ARDUINO

A PROJECT REPORT

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ABSTRACT

Nowadays, fire accidents are very common and sometimes it becomes very hard for a fireman to protect someone's life. It is not possible to appoint a person to continuously observe weather accidental fire has started where robot can do that. Robot will detect fire remotely. These robots are mostly useful in industries. The proposed vehicle is able to detect presence of fire and extinguishing it automatically. At the time of moving towards the source of fire it may happen that it will come across some obstacles, and then it has obstacle avoiding capability. It detects obstacles using ultrasonic sensors. Gas sensor used to detect the presence of gases in an area, often as part of a safety system. The condition about fire fighting robot monitored through IOT.

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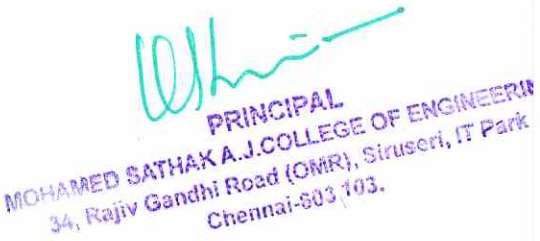
CHAPTER-6

CONCLUSION

In this work the system is designed and evaluated for its effectiveness as well as scalability due to the improvement of sensor technology. In this work, the latest technology can help to reduce caused due to fire. With the improvement of IoT sensor technology, the system is more efficient and useful. Thus observed that our Robot detect the presence of fire and obstacles. When the fire is detected water pump motor is automatically on for extinguish the fire. All these parameter are displayed on the LCD display and we getting alarm in hazardous condition, to alert the operator with the help of IOT and also based on command from IOT robot works.



INVESTIGATION ON MECHANICAL PROPERTIES OF THE AZ91 AND AZ61 MAGNESIUM ALLOYS BY TIG WELDING PROCESS

A PROJECT REPORT

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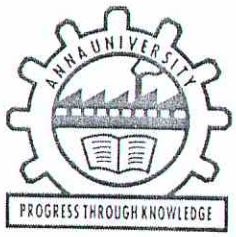

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ABSTRACT

Magnesium is the lightest structural alloy, which has been widely used in transportation industries mainly due to their low density and high strength to weight ratio. In addition, magnesium alloys have good castability and sound damping capabilities, electromagnetic interfere shielding properties, excellent machinability and recyclability. Welding of dissimilar magnesium alloy is an important issue because of their increasing application in industries. In this document, the research and progress of variety of welding parameters for joining dissimilar Mg alloys are reviewed from different perspectives.

This project deal with welding of two dissimilar Mg alloys and to investigate the welding parameters of TIG welding of AZ91 and AZ61 to provide a basic for further research. This project deals about parametric study of welding. The welding parameters, welding speed, current, voltage and temperature changed for 5 specimen and each specimen is tested to determine the quality of weld. From successfully welded samples the best parameters is detected. After that the values are tabulated and the sample images are captured and recorded.

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CHAPTER 6
SUMMARY AND CONCLUSIONS

6.1 SUMMARY

Magnesium and its alloys have attracted great attention in industry application 1 academic research due to their properties such as light weight, high specific strength, stiffness, machinability and recyclability. However, the development new alloy types, manufacturing techniques such as welding play an important Cole in exploiting the new fields of application. The extruded plates of AZ61 and AZ91 magnesium alloy were machined to the required dimensions (300 mm x 150 mm x 6 mm). The smooth (unnotched) tensile specimens were prepared to evaluate yield strength, tensile strength, elongan and reduction in cross sectional area. Microstructural examination was carried out using an optical microscope (OM).

6.2 CONCLUSIONS

With the reference with their tensile, hardness tests the parameters of the sample 3 is suggested for welding dissimilar Mg alloys Also the micro structure , macro structure, and SEM analysis also shows that the sample 3 has the best structure and fusion of nuddget and parent material, so the parameter for the sample 3 is suggested for further welding process of the dissimilar alloys.

6.3 SUGGESTIONS FOR FURTHER RESEARCH

the present investigation on TIG welding of AZ61 magnesium alloy alloys has given some important information related to the effect of on mechanical and metallurgical properties of the joints. However, there are few other aspects need to be investigated to understand the process effectively. In this regard, following suggestions are to be considered for further welding parameters search on this topic.

(1) TIG welding windows are to be developed by incorporating welding parameters

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EVALUATION OF COIR/BAMBOO EPOXY REINFORCED NATURAL COMPOSITE

A PROJECT REPORT

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INTERNAL EXAMINER

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ABSTRACT

Now-a-days, the natural coir/bamboos from renewable natural resources offer the potential to act as a reinforcing material for polymer composites alternative to the use of glass, carbon and wood. Among various natural fibers, coir or bamboo is most widely used natural fiber due to its advantages like easy availability, low density, low production cost and satisfactory mechanical properties. For a composite material, its mechanical behavior depends on many factors such as fiber content, orientation, types, length etc. Attempts have been made in this Project work to study the effect of loading on the physical and mechanical behavior of coir/bamboo reinforced epoxy based hybrid composites.

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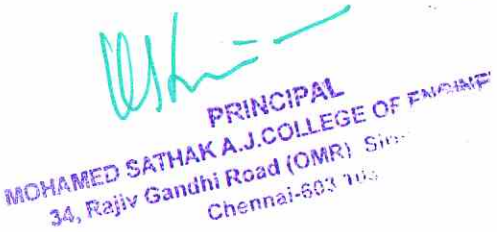
CHAPTER 5

CONCLUSION

The material selection and properties of coir/bamboo fiber reinforced epoxy based hybrid composites has been obtained till now with the help of reinforcement preparation and test results are yet to be obtained in future.

The advantages of coir\bamboo composite material is very strength and it is light in weight. We can reduce the useage of wood from trees eventually we can move ahead towards reducing global warming. The fibre reinforced plastics are best suited for any design that demands weight saving process.

The present work showed the usefulness of coir fiber as reinforcement to other natural fiber material. The tensile hardness and compression tests of coir/bamboo fiber will be conducted using UTM machine. The composites may become less ductile as coir fiber content is increased. Further work must be done related to fiber surface treatment and residue elimination in recycled (HDPE) to improve mechanical properties.



AUTOMATIC SEED SOWING ROBOT

A PROJECT REPORT

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ABSTRACT

In the farming process, often used conventional seeding operation takes more time and more labor. The seed feed rate is more but the time required for the total operation is more and the total cost is increased due to labor, hiring of equipment. The conventional seed sowing machine is less efficient, time consuming. Today's era is marching towards the rapid growth of all sectors including the agricultural sector. To meet the future food demands, the farmers have to implement the new techniques which will not affect the soil texture but will increase the overall crop production. In the farming process, often used conventional seeding operation takes more time and more labor. The seed feed rate is more but the time required for the total operation is also more and the total cost is increased due to labor, hiring of equipment. This machine reduces the efforts and total cost of sowing the seeds and fertilizer placement.

KEYWORDS:Seedsowing,farming,micro controller,automatic.

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PROCESSING AND CHARACTERIZATION OF AA6061 WITH TiO_2, SIC REINFORCED HYBRID COMPOSITE

A PROJECT REPORT

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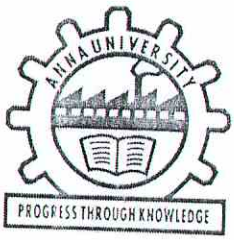

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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

The present requirement of the automobile industry is seeking lightweight material that satisfies the technical and technological requirements with better mechanical characteristics. This work aims to replace the conventional cast iron cylinder liner (CL) in diesel engine by introducing lightweight aluminium (AI) 60621 hybrid composite cylinder liner. The composite was fabricated by die casting technique with reinforcement materials Sic and TIO_2. The investigation was carried out to study the effect of wt% of Sic/TIO reinforcement on mechanical of hybrid metal matrix composites (HMMCs). HMMCs were characterized for its properties such as micro structure, compression, hardness and tensile strength. Hybrid composites showed improved mechanical properties suitable for engine cylinder liner applications.

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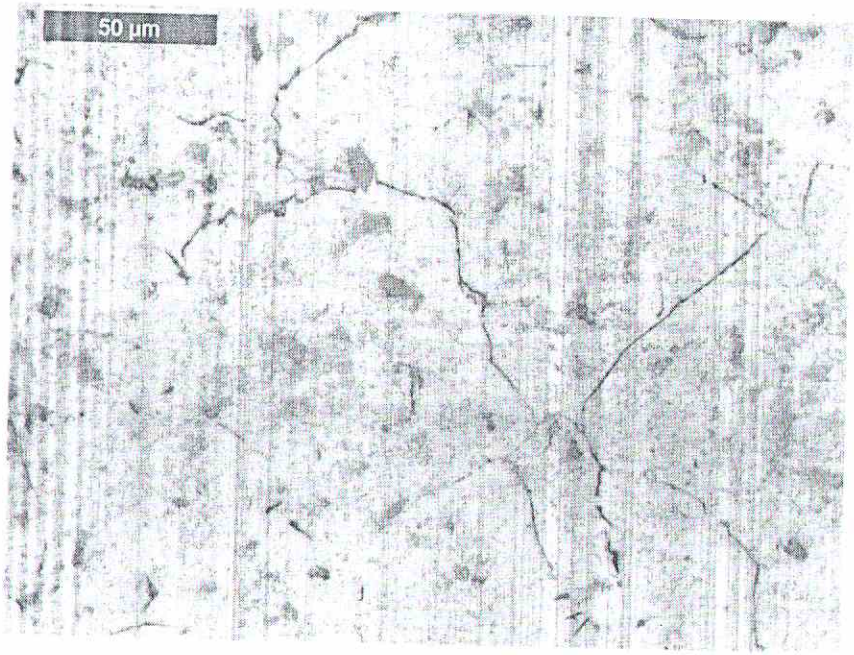

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From the Test results, it is clearly identified that the better uniform distribution of AA_{6061} with reinforce materials from the sample 3 that contains 5 % of SiC and TIO_2. is obtained.

5. CONCLUSION

Functionally graded metal matrix composites made of commercially pure aluminium reinforced with SiC and TIO_2. has been fabricated successfully through die casting technique. Different weight fractions (1%,2%, 3%) of BN and GR have been investigated.

This investigation analysed the effect of various weight percentages of SiC and TIO_2. with AA6061 alloy on the mechanical properties and metallurgical characterization and the results obtained from these studies are summarized as follows:

1. From the tensile test results, it is identified that the maximum tensile strength is found to be about 147 Mpa for 5 wt% reinforcement of SiC and TIO_2. on AA6061 alloy. Then the tensile tested samples are subjected to fractography investigation. The fractography results show that the increase in weight

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PARAMETRIC INFLUENCE ON FUNCTIONALLY GRADED AL-ALUMINA METAL MATRIX COMPOSITE MANUFACTURED BY CENTRIFUGAL CASTING

A PROJECT REPORT

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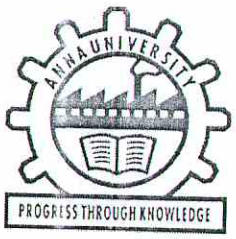

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INTERNAL EXAMINER

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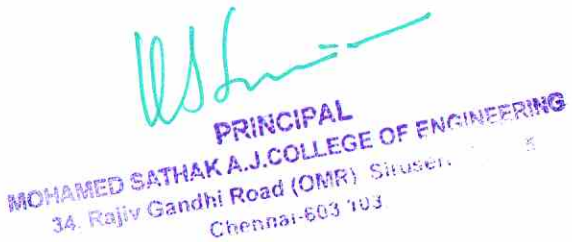
ABSTRACT

Functionally graded materials (FGMs) have been developed as ultrahigh temperature resistant materials for aircraft, space vehicles and other engineering applications. Most of FGMs are particle reinforced FGMs and their compositions depend on position. The present investigation focus on Study of functionally graded metal matrix composites (FGMMCs) based on aluminium matrix reinforced with Aluminium oxide (Al2O3). The newly developed FGMs have been produced by centrifugal casting processes under various conditions with different weight fractions. The mechanical and metallurgical characterizations were investigated in the newly developed cast tubes.



5. COLCLUSION

Functionally graded metal matrix composites made of commercially pure aluminium reinforced with Al_2O_3 has been fabricated successfully through horizontal centrifugal casting technique. Different weight fractions (2.5%, 5%) of Al_2O_3 have been investigated. Three rotational speeds of 800, 900 or 1000 rpm were used.

Investigation of microstructure reveals that the concentrations of the Al_2O_3 particles in the outer zone of the cast tubes reach its maximum value followed by a gradual decrease in the direction of inner diameter. In case of large particle sizes and higher rotational speeds, all fabricated tubes revealed high concentration of reinforcing particles in the outer zone due to higher centrifugal force and particle mass.

Brinell hardness measurements reveal that high hardness is obtained on the outer zone of all tested FGMs compared to that measured in inner, concentration transition and inner zones. It should be also noticed that the increase in Al_2O_3 weight fraction resulted in a proportional increase in outer zone hardness. The rate of increase decreases slightly with the wt.% Al_2O_3.

By increasing the weight fraction of Al_2O_3 an increase in tensile strength of FGMs samples cut through the whole tube thickness could be measured, while ductility has decreased.

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EXPERIMENTAL INVESTIGATION OF ENGINE PERFORMANCE AND EMISSION CHARACTERISTICS OF TiO_2 NANO ADDITIVE BIODIESEL BLEND WITH COATED CATALYTIC CONVERTER

A PROJECT REPORT

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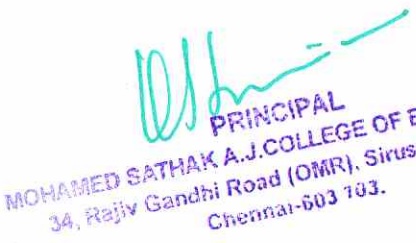
INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

Major research is focused on fuel consumption and emission reduction in the past few years. There is growing interest on alternative fuels due to volatile fossil fuel price and depletion. In many applications like Transportation, Power generation, Marine applications etc., diesel Engines are being used as a major source. During last century, the uses of fossil resources are increasing due to significant growth of population and change in life style. This causes crises of fossil fuel depletion for the diesel engines there is an urgent need for suitable alternative fuels. In this project we will examine the use of diesel-wheat germ oil in diesel four stroke engine. With diesel and different blends of germ oil, an attempt will be made to analyze the performance and emission characteristics of a diesel engine.



CHAPTER 6

SUMMARY AND CONCLUSION

The experimental investigation of combustion, performance and the emission characteristics of wheat germ oil and its blends have been performed on diesel engine and has been completed, the following conclusions have been drawn.

- The CO2 emissions are lower for all the diesel-biodiesel blends and the maximum reduction of CO2 emission is for B10+D90+30PPM TiO_2+Catalytic Converter. The percentage reduction is more than 35% compared to diesel.
- The NOx emissions with all the biodiesel blends shows less amount of NOx release when compared with diesel and the minimum amount of NOx emission is at B10+D90+30PPM TiO_2+Catalytic Converter.
- Brake thermal efficiency is increased with increasing load for diesel-biodiesel blends with addition of Nano additives at B30+D70+30PPM TiO_2+catalytic converter.
- Specific fuel consumption is less with diesel-biodiesel blends with Nano additives when compared to diesel and there is a little variation with increase in load But the samples (B10+D90+30PPMTio_2) is less at 75%, 100% load conditions when compared to the other samples and diesel.
- HC emission is less with B10+D90+30PPM TiO_2+Catalytic Converter 20% less when compared to diesel.
- CO emission is less with B10+D90+30PPM TiO_2+Catalytic Converter when compared to diesel.
- Out of all samples, the emission and performance characteristics are reduced for the blend B10+D90+30PPM TiO_2+Catalytic Converter.

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SYNTHESIS AND CHARACTERIZATION OF NEW ALUMINIUM HYBRID COMPOSITE MATERIAL FOR LINER APPLICATIONS

A PROJECT REPORT

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EXTERNAL EXAMINER

ABSTRACT

The present requirement of the automobile industry is seeking lightweight material that satisfies the technical and technological requirements with better mechanical characteristics. This work aims to replace the conventional cast iron cylinder liner (CL) in diesel engine by introducing light weight aluminum (AI) 6351 hybrid composite cylinder liner. The composite was fabricated by die casting technique with reinforcement materials BN and Gr. The investigation was carried out to study the effect of wt% of BN/Gr reinforcement on mechanical of hybrid metal matrix composites (HMMCs). HMMCs were characterized for its properties such as micro structure, compression, hardness and tensile strength. Hybrid composites showed improved mechanical properties suitable for engine cylinder liner applications.

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5. CONCLUSION

Functionally graded metal matrix composites made of commercially pure aluminium reinforced with BN and GR has been fabricated successfully through die casting technique. Different weight fractions (3%,4%, 5%) of BN and GR have been investigated.

This investigation analysed the effect of various weight percentages of BN and Gr with AA_{6351} alloy on the mechanical properties and metallurgical characterization and the results obtained from these studies are summarized as follows:

1. From the tensile test results, it is identified that the maximum tensile strength is found to be about 147 Mpa for 5 wt% reinforcement of BN and Gr on AA_{6351} alloy. Then the tensile tested samples are subjected to fractography investigation. The fractography results show that the increase in weight percentage of BN and Gr changes the mode of failure from ductile to brittle nature.

2. The compression test results reveal that the maximum compressive strength is about 105 Mpa for the sample containing 5wt% of BN and Gr.

3. The hardness test results reveal that the maximum hardness is about 48.6 BHN for the sample containing 3wt % of BN and Gr.

4. The microstructure results show that for higher weight percentage (5%) reinforcement of BN and Gr shows a good uniform distribution, interfacial bonding and non-occurrence of porosity.

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MECHANICAL CHARACTERISATION OF KEVLAR EPOXY POLYMER COMPOSITES REINFORCEDWITH CARBON NANOTUBES

A PROJECT REPORT

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INTERNAL EXAMINER

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ABSTRACT

The aim of the project is to study the effects of addition of carbon nanotubes in the layers of kevlar in a kevlar fibre reinforced polymer composite. Kevlar is a heat-resistant and strong synthetic fiber, related to other aramids such as Nomex and Technora. Poly-paraphenylene terephthalamide is the branded name of kevlar.Kevlar fibres properties are partly due to its internal structure and partly due to the way it is made into fibers that are knitted tightly together. kevlar has various applications ranging from bicycle tires to bulletproof vests due to its high tensile strength.

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CHAPTER 10

CONCLUSION

In this work, fibre composites are fabricated with matrix and carbon nanotubes. Their mechanical properties like impact strength, tensile strength and flexural strength are investigated and from the results obtained, the following conclusions weredrawn

- Impact strength of carbon nanotubes reinforced composite is is quite high when compared with the plain composite. It is obtained by using time vs energy, time vs force and time vs deformationgraphs.
- Flexural strength of carbon nanotubes reinforced composite is lower when compared with the plaincomposite.
- Tensile strength of carbon nanotubes reinforced composite is lower when compared with plaincomposite.
- From the above experimental data, it can be concluded that the impact strength of Carbon Nanotube Reinforced composites is stronger than the kevlar Fibre Reinforced composites.

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MULTI AXIS DRILLING MACHINE

A PROJECT REPORT

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ABSTRACT

In this project a lot of manufacturing processes, one of the most indispensable machining tools is the drilling machine. Drill machine have been the heart of every industry. Drilling process is one of the machining process which is used to drill micro holes not only in micro products but also in other work pieces like wood, sheets and plastics. In presence situation the drilling operations are performed by CNC machines where some of the process like undercut operations cannot be performed. So we introduce universal axis drilling machine where the work piece can be drilled in a flexible manner. A multi axis drilling machine can be mounted on a table or wall and can be used to drill holes horizontally, vertically and even upside down. So it is possible for easy drilling in every complicated parts and surfaces. The multi axis drilling machine produces efficient drilling and it is easy to use and it can reduce time. It is low in cost and reduces overall manufacturing cost. Thus we use rotating hinges and connectors with motor mount and supporting structure to design and fabricate for easy drilling operation. In future it will be used in every field where drilling is required.

KEYWORDS: Multiple axis, Low cost, Drilling, Machining process

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CHAPTER – 5

CONCLUSION

We did our project successfully by using the above reference and guidance. We have fabricated the "MULTI AXIS DRILLING MACHINE" and it is an impressing task in the field of small scale industries. In this project we had eliminated the human effort that is wasted.

Our product the "MULTI AXIS DRILLING MACHINE" is an economical and also useful small scale machine.

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EFFECT OF WELDING PARAMETERS ON 304L AND 410 STAINLESS STEEL USING GTAW BY DOE-(TAGUCHI METHOD)

A PROJECT REPORT

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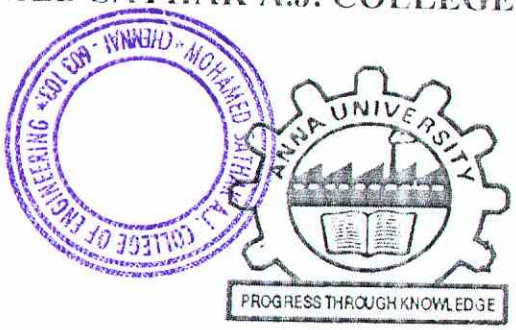

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INTERNAL EXAMINER

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ABSTRACT

The objective of any industry is production of high quality products at low cost and increase the production rate. Welding is most important operation in any industry. It is essential to optimize the various parameters viz; weldingcurrent,welding speed, voltage, gas flow rate, etc. of welding process so that we can achieve the reliability, productivity and quality of the products. TIG welding process is versatile and commonly used operation for joining of two materials with the application of heat and /or pressure or filler material to increase the production with less time and cost. The purpose of this study is to describe different methods to decide near optimal settings of the welding process parameters in TIG welding. The properties of the welded joints such as tensile strength, impact force, hardness etc. are affected by different welding parameters.

Key words: Weldment of SS 304 L & SS 410 by GTAW process.

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CHAPTER 6

CONCLUSION

6.1 Conclusion

- The best result is obtained for the sample no.6 (Corresponding to current (I) 161A, Welding Speed 200Mm/min, Filler Material 316L and nozzle to plate distance 4mm). The worst result in tensile testing has been obtained for the sample no. 4(corresponding to current 220 A, Welding Speed 200Mm/min,Filler Material 316L and nozzle to plate distance 4mm).

- And Dissimilar Weldments of Hardness values are also determined at the welded zone and the HAZ areas.

- Taguchi experimental design method is very useful to analyse the welding of Martensitic and Austenitic stainless steels in GTAW welding operation.

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MECHANICAL PROPERTIES OF BANANA FIBER REINFORCED COMPOSITES

A PROJECT REPORT

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ABSTRACT

World is as of now concentrating on alternate material sources that are environment agreeable and biodegradable in nature. Because of the expanding natural concerns, bio composite produced out of regular fiber and polymeric resin, is one of the late advancements in the business and constitutes the present extent of experimental work. The use of composite materials field is increasing gradually in engineering. The composite consists of mainly two phases i.e. matrix and fiber. The accessibility of characteristic fiber and simplicity of assembling have enticed scientists worldwide to attempt by regional standards accessible inexpensive fiber and to learning their achievability of fortification determinations and to what degree they fulfill the obliged particulars of great strengthened polymer composite aimed at structural requisition. Fiber reinforced polymer composites has numerous preferences, for example, generally minimal effort of creation, simple to create and better quality contrast than perfect polymer tars due with this reason fiber strengthened polymer composite utilized within an assortment of provision as class of structure material. This work describe the mechanical behavior of banana fiber reinforced polymer composite with the extraordinary references to the impact of fiber loading and length of fiber on the properties of composites.

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CHAPTER 5
CONCLUSION

The material selection and properties of banana sisal fiber reinforced epoxy based hybrid composites has been obtained till now with the help of various journals. Reinforcement preparation and test results are yet to be obtained in future.

The present work showed the usefulness of banana sisal fiber as reinforcement to other natural fiber material. The tensile hardness and compression tests of sisal&banana fiber will be conducted using UTM machine. The composites may become less ductile as sisal fiber content is increased. Further work must be done related to fiber surface treatment and residue elimination in recycled HDPE to improve mechanical properties.

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EVALUATION OF MACHINING BEHAVIOURS OF ALUMINIUM METAL MATRIX COMPOSITE (AL+ SiC)

A PROJECT REPORT

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ABSTRACT

The aim of this project is about a brief overview of the historical development of aerospace aluminum alloys. Aluminum matrix composites (AMCs) are potential materials for various applications due to their good physical and mechanical properties. They have the potential to replace the conventional materials because of obtaining superior properties such as high specific strength, high stiffness, high hardness, high wear resistance and low density. In the past three decades composite materials were playing a vital role in various sectors especially in aeronautical, avionics and automotive sectors. The problem is associated with the study of mechanical properties of aluminum- Silicon carbide metal matrix composites (MMCs) of aluminum alloy of grade 6061 with the addition of 10% 15% by weight composition of Silicon carbide (Sic) by stir casting technique.

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EXPERIMENTAL INVESTIGATION OF ALUMINIUM-ALLOY COMPOSITES PRODUCED BY CENTRIFUGAL CASTING

A PROJECT REPORT

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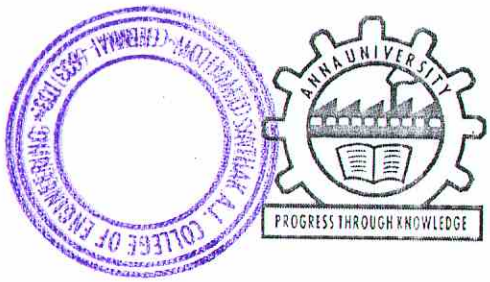

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INTERNAL EXAMINER

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ABSTRACT

Functionally graded materials (FGMs) have been developed as ultrahigh temperature resistant materials for aircraft, space vehicles and other engineering applications. Most of FGMs are particle reinforced FGMs and their compositions depend on position. The present investigation focus on Study of functionally graded metal matrix composites (FGMMCs) based on aluminium matrix reinforced with Aluminium oxide (Al2O3). The newly developed FGMs have been produced by centrifugal casting processes under various conditions with different weight fractions. The mechanical and metallurgical characterizations were investigated in the newly developed cast tubes.

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5. COLCLUSION

Functionally graded metal matrix composites made of commercially pure aluminium reinforced with Al_2O_3 has been fabricated successfully through horizontal centrifugal casting technique. Different weight fractions (7.5%, 10%) of Al_2O_3 have been investigated. Three rotational speeds of 800, 900 or 1000 rpm were used.

Investigation of microstructure reveals that the concentrations of the Al_2O_3 particles in the outer zone of the cast tubes reach its maximum value followed by a gradual decrease in the direction of inner diameter. In case of large particle sizes and higher rotational speeds, all fabricated tubes revealed high concentration of reinforcing particles in the outer zone due to higher centrifugal force and particle mass.

Brinell hardness measurements reveal that high hardness is obtained on the outer zone of all tested FGMs compared to that measured in inner, concentration transition and inner zones. It should be also noticed that the increase in Al_2O_3 weight fraction resulted in a proportional increase in outer zone hardness. The rate of increase decreases slightly with the wt.% Al_2O_3.

By increasing the weight fraction of Al_2O_3 an increase in tensile strength of FGMs samples cut through the whole tube thickness could be measured, while ductility has decreased.

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COMPARISION OF TENSILE TEST AND WEAR TEST USING GLASS AND BASALT FIBERS REINFORCED POLYMER MATRIX COMPOSITE.

A PROJECT REPORT

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ABSTRACT

Polymer matrix reinforced with glass fiber and basalt fiber by continuous fiber and discontinuous fiber using the hand layup method. Three samples are taken to optimize the mechanical properties. (i.e.: Tensile tests, wear tests etc.) of continuous fiber and discontinuous fiber of basalt fiber and glass fiber. The tests are taken in the Universal Testing machine. the results of the tensile strength of continuous and discontinuous fiber (basalt with glass), the discontinuous fiber (basalt with glass) has the highest tensile strength. the results of the wear test of continuous and discontinuous fiber (basalt with glass) the discontinuous fiber (basalt with glass) has the highest wear test. By comparing the results of both tensile strength and wear test of both continuous and discontinuous fibers (basalt with glass), discontinuous fiber has the highest value on both the tests and is most preferred.

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CONCLUSION

- The unidirectional basalt fabric reinforced polymer composites is successfully fabricated using hand layup techniques.
- When comparing the results of the tensile strength of continuous and discontinuous fiber (basalt with glass), the discontinuous fiber (basalt with glass) has the highest tensile strength
- When comparing the results of the wear test of continuous and discontinuous fiber (basalt with glass) the discontinuous fiber (basalt with glass) has the highest wear test.
- The flexural strength and impact test are tested only for the continuous fiber and the readings are presented on the above tables respectively.
- Thus, by comparing the results of both tensile strength and wear test of both continuous and discontinuous fibers (basalt with glass), discontinuous fiber has the highest value on both the tests and is most preferred.

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STUDY OF MECHANICAL BEHAVIOUR OF MANGO SHELL COMPOSITE

A PROJECT REPORT

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ABSTRACT

Natural fibres have been used to reinforce materials for over 3,000 years. Nowadays natural fibers form an interesting alternative for the most widely applied fiber in the composite technology. Fiber reinforced polymer (FRP) composites is an important class of structural material due to their numerous advantages. Reinforcement in polymer is either engineered or characteristic. In this research, natural fiber like Mango Shell Fiber(Mangifera indica) is fabricated with epoxy resin using hand-lay method and vacuum bag method. For hardness of Mango Shell Fiber was studied. micro structure of the specimens are scanned by the Scanning Electron Microscope(SEM). To this end, an attempt has been made to study the potential utilization of Mango Shell Fiber which is economically and effortlessly found in India for making value added products. The impact of fiber loading and length on mechanical properties like tensile strength, flexural strength, impact strength and hardness of composites is examined to utilize the advantages offered by renewable resources for the development of composite materials. Knowing that natural fibers are cheap and have a better stiffness per weight than glass, which results in lighter components. The environmental impact is smaller since the natural fiber can be thermally recycled and fibers come from a renewable resource.

Keywords: Mangifera Indica, SEM, Hand Lay-up Technique

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CHAPTER-5

CONCLUSION

The following conclusions were drawn from the results of this research work:

- Addition of Mango shell fibre as reinforcement to polyester composite significantly improved the physical and mechanical properties of the composites.
- Composite sample (IFC1) containing 10%wt of Mango shell fibre has the optimum hardness value and lowest moisture uptake.
- The hardness of the developed composite increased with decrease in moisture uptake of the samples produced.
- Composite sample (IFC5) containing 18%wt Mango shell fibre gave the optimum impact strength.
- The developed composite showed outstanding properties in the production of value-added composite panels in the conditions tested due to strong fibre-matrix interface bond created by the chemical treatment of the fibre.
- Based on the good properties, availability and cheaper cost of Mango shell fibre reinforced composites studied, the composite can certainly be considered as a very promising material for fabrication of lightweight materials used in automobile body building, office furniture, packaging industry and partition panels.

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EXPERIMENTAL INVESTIGATION OF ALUMINIUM METAL SCRAP RECYCLING AND STRENGTH IMPROVEMENT BY USING SIC FILLER MATERIAL

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ABSTRACT

Conventional simple method of producting metal marix composite with attained properties through the dispersion of silicon carbide in the matrix are investigate achieve these are objectives two step mixing method of stir casting technique was employed. Aluminum alloy (6% Si) and silicon carbide (320 and 1200 grits) were chosen as matrix and reinforcement materials respectively. Experiments were conducted by varying the weight fraction of silicon carbide for 2.5%, 5.0%,7.5% and 10%.The result indicate that the stir casting method was quite successful to obtain uniform dispersion of reinforcement in the matrix. This was evident by the improvement of properties of composites over the base metal. Reinforced Aluminum Silicon Carbide shows an increase in Young's modulus(E) and hardness above the unreinforced case and marginal reduction of electrical conductivity was recorded for the composites. The silicon carbide of 1200 grits (3 um) showed increased Young's modulus(E) and hardness of 1517.6 Mpa and 26.1 Hv values at 7.5%volume fraction of silicon carbide; when compared with the silicon carbide 320 grit (29 um).

Key words: Particulate-Aluminum composite matrix, silicon carbide.

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CONCLUSION

In the present work, an experimental investigation is carried out on the topic of fabrication and material characterization of composite material using industriawaste scraps for the waste management purpose.

The various specimens were prepared with the different composition such as Aluminium scraps, Aluminium scraps + SiC

The graphs were plotted for the values obtained from mechanical tests like,Tensile test, Yield test, Impact test, Hardness test, From the result tables and graphs we can able to conclude that Aluminium scraps + Silicon Carbide Strength can be increaseed good mechanical properties than other composition.

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PARAMETRIC INFLUENCE ON FUNCTIONALLY GRADED AL-ALUMINA METAL MATRIX COMPOSITE MANUFACTURED BY CENTRIFUGAL CASTING

A PROJECT REPORT

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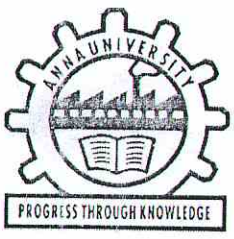

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INTERNAL EXAMINER

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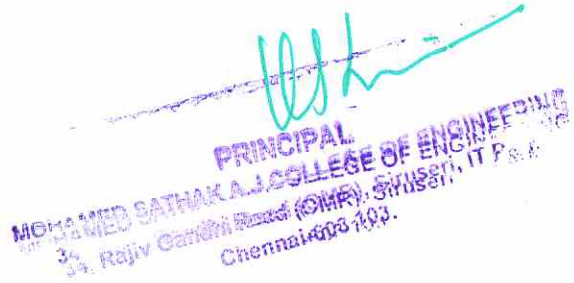
ABSTRACT

Functionally graded materials (FGMs) have been developed as ultrahigh temperature resistant materials for aircraft, space vehicles and other engineering applications. Most of FGMs are particle reinforced FGMs and their compositions depend on position. The present investigation focus on Study of functionally graded metal matrix composites (FGMMCs) based on aluminium matrix reinforced with Aluminium oxide (Al2O3). The newly developed FGMs have been produced by centrifugal casting processes under various conditions with different weight fractions. The mechanical and metallurgical characterizations were investigated in the newly developed cast tubes.



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Functionally graded metal matrix composites made of commercially pure aluminium reinforced with Al_2O_3 has been fabricated successfully through horizontal centrifugal casting technique. Different weight fractions (2.5%, 5%) of Al_2O_3 have been investigated. Three rotational speeds of 800, 900 or 1000 rpm were used.

Investigation of microstructure reveals that the concentrations of the Al_2O_3 particles in the outer zone of the cast tubes reach its maximum value followed by a gradual decrease in the direction of inner diameter. In case of large particle sizes and higher rotational speeds, all fabricated tubes revealed high concentration of reinforcing particles in the outer zone due to higher centrifugal force and particle mass.

Brinell hardness measurements reveal that high hardness is obtained on the outer zone of all tested FGMs compared to that measured in inner, concentration transition and inner zones. It should be also noticed that the increase in Al_2O_3 weight fraction resulted in a proportional increase in outer zone hardness. The rate of increase decreases slightly with the wt.% Al_2O_3.

By increasing the weight fraction of Al_2O_3 an increase in tensile strength of FGMs samples cut through the whole tube thickness could be measured, while ductility has decreased.

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EXPERIMENTAL INVESTIGATION OF ENGINE PERFORMANCE AND EMISSION CHARACTERISTICS OF TiO_2 NANO ADDITIVE BIODIESEL BLEND WITH COATED CATALYTIC CONVERTER

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ABSTRACT

Major research is focused on fuel consumption and emission reduction in the past few years. There is growing interest on alternative fuels due to volatile fossil fuel price and depletion. In many applications like Transportation, Power generation, Marine applications etc., diesel Engines are being used as a major source. During last century, the uses of fossil resources are increasing due to significant growth of population and change in life style. This causes crises of fossil fuel depletion for the diesel engines there is an urgent need for suitable alternative fuels. In this project we will examine the use of diesel-wheat germ oil in diesel four stroke engine. With diesel and different blends of germ oil, an attempt will be made to analyze the performance and emission characteristics of a diesel engine.

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CHAPTER 6

SUMMARY AND CONCLUSION

The experimental investigation of combustion, performance and the emission characteristics of wheat germ oil and its blends have been performed on diesel engine and has been completed, the following conclusions have been drawn.

- The CO2 emissions are lower for all the diesel-biodiesel blends and the maximum reduction of CO2 emission is for B10+D90+30PPM TiO_2+Catalytic Converter. The percentage reduction is more than 35% compared to diesel.
- The NOx emissions with all the biodiesel blends shows less amount of NOx release when compared with diesel and the minimum amount of NOx emission is at B10+D90+30PPM TiO_2+Catalytic Converter.
- Brake thermal efficiency is increased with increasing load for diesel-biodiesel blends with addition of Nano additives at B30+D70+30PPM TiO_2+catalytic converter.
- Specific fuel consumption is less with diesel-biodiesel blends with Nano additives when compared to diesel and there is a little variation with increase in load But the samples (B10+D90+30PPMTio_2) is less at 75%, 100% load conditions when compared to the other samples and diesel.
- HC emission is less with B10+D90+30PPM TiO_2+Catalytic Converter, 20% less when compared to diesel.
- CO emission is less with B10+D90+30PPM TiO_2+Catalytic Converter when compared to diesel.
- Out of all samples, the emission and performance characteristics are reduced for the blend B10+D90+30PPM TiO_2+Catalytic Converter.

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SYNTHESIS AND CHARACTERIZATION OF NEW ALUMINIUM HYBRID COMPOSITE MATERIAL FOR LINER APPLICATIONS

A PROJECT REPORT

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ABSTRACT

The present requirement of the automobile industry is seeking lightweight material that satisfies the technical and technological requirements with better mechanical characteristics. This work aims to replace the conventional cast iron cylinder liner (CL) in diesel engine by introducing light weight aluminum (AI) 6351 hybrid composite cylinder liner. The composite was fabricated by die casting technique with reinforcement materials BN and Gr. The investigation was carried out to study the effect of wt% of BN/Gr reinforcement on mechanical of hybrid metal matrix composites (HMMCs). HMMCs were characterized for its properties such as micro structure, compression, hardness and tensile strength. Hybrid composites showed improved mechanical properties suitable for engine cylinder liner applications.

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5. CONCLUSION

Functionally graded metal matrix composites made of commercially pure aluminium reinforced with BN and GR has been fabricated successfully through die casting technique. Different weight fractions (3%,4%, 5%) of BN and GR have been investigated.

This investigation analysed the effect of various weight percentages of BN and Gr with AA_{6351} alloy on the mechanical properties and metallurgical characterization and the results obtained from these studies are summarized as follows:

1. From the tensile test results, it is identified that the maximum tensile strength is found to be about 147 Mpa for 5 wt% reinforcement of BN and Gr on AA_{6351} alloy. Then the tensile tested samples are subjected to fractography investigation. The fractography results show that the increase in weight percentage of BN and Gr changes the mode of failure from ductile to brittle nature.

2. The compression test results reveal that the maximum compressive strength is about 105 Mpa for the sample containing 5wt% of BN and Gr.

3. The hardness test results reveal that the maximum hardness is about 48.6 BHN for the sample containing 3wt % of BN and Gr.

4. The microstructure results show that for higher weight percentage (5%) reinforcement of BN and Gr shows a good uniform distribution, interfacial bonding and non-occurrence of porosity.

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PROCESSING AND CHARACTERIZATION OF AA6061 WITH TiO_2, SIC REINFORCED HYBRID COMPOSITE

A PROJECT REPORT

Submitted by

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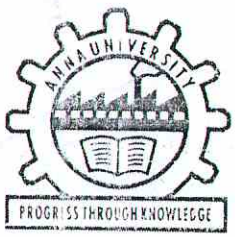
in partial fulfillment for the award of the degree of

BACHELOR OF ENGINEERING
IN
MECHANICAL ENGINEERING



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BONAFIDE CERTIFICATE

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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

The present requirement of the automobile industry is seeking lightweight material that satisfies the technical and technological requirements with better mechanical characteristics. This work aims to replace the conventional cast iron cylinder liner (CL) in diesel engine by introducing lightweight aluminium (AI) 60621 hybrid composite cylinder liner. The composite was fabricated by die casting technique with reinforcement materials Sic and TIO_2. The investigation was carried out to study the effect of wt% of Sic/TIO reinforcement on mechanical of hybrid metal matrix composites (HMMCs). HMMCs were characterized for its properties such as micro structure, compression, hardness and tensile strength. Hybrid composites showed improved mechanical properties suitable for engine cylinder liner applications.

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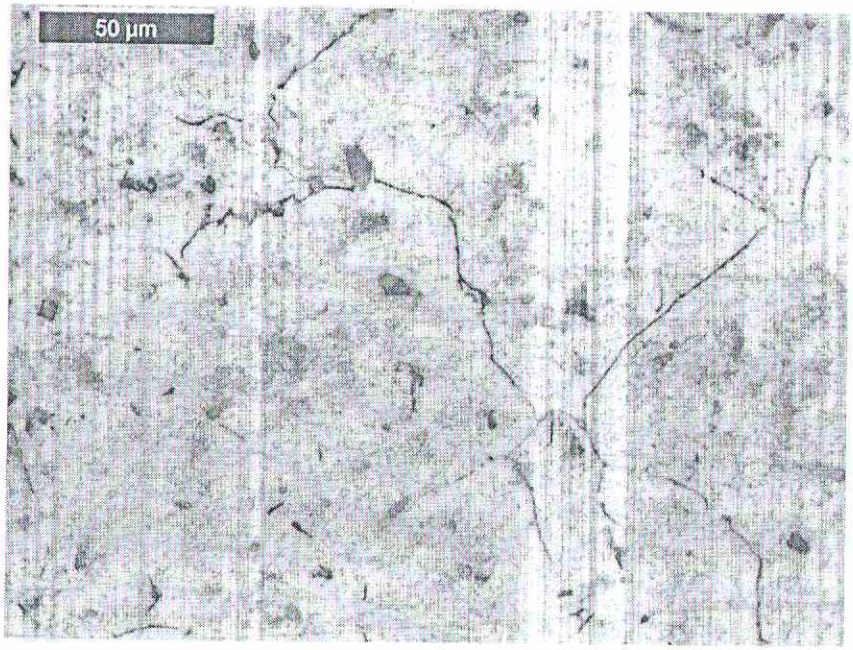

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From the Test results, it is clearly identified that the better uniform distribution of AA_{6061} with reinforce materials from the sample 3 that contains 5 % of SiC and TIO_2. is obtained.

5. CONCLUSION

Functionally graded metal matrix composites made of commercially pure aluminium reinforced with SiC and TIO_2. has been fabricated successfully through die casting technique. Different weight fractions (1%,2%, 3%) of BN and GR have been investigated.

This investigation analysed the effect of various weight percentages of SiC and TIO_2. with AA6061 alloy on the mechanical properties and metallurgical characterization and the results obtained from these studies are summarized as follows:

1. From the tensile test results, it is identified that the maximum tensile strength is found to be about 147 Mpa for 5 wt% reinforcement of SiC and TIO_2 on AA6061 alloy. Then the tensile tested samples are subjected to fractography investigation. The fractography results show that the increase in weight

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