B.E - MECHANICAL ENGINEERING

S.No	Name of the course that include experiential learning through Project work/ Internship (2020 - 2021)
1	PH8251 - Materials Science
2	GE8291 - Environmental Science and Engineering
3	GE8292 - Engineering Mechanics
4	ME8391 - Engineering Thermodynamics
5	CE8394 - Fluid Mechanics and Machinery
6	ME8351 - Manufacturing Technology - I
7	EE8353 - Electrical Drives and Controls
8	ME8492 - Kinematics of Machinery
9	ME8451 - Manufacturing Technology – II
10	ME8491 - Engineering Metallurgy
11	CE8395 - Strength of Materials for Mechanical Engineers
12	ME8493 - Thermal Engineering- I
13	ME8595 - Thermal Engineering- II
14	ME8593 - Design of Machine Elements
15	ME8501 - Metrology and Measurements
16	ME8594 - Dynamics of Machines
17	ME8651 - Design of Transmission Systems
18	ME8691 - Computer Aided Design and Manufacturing
19	ME8693 - Heat and Mass Transfer
20	ME8692 - Finite Element Analysis
21	ME8694 - Hydraulics and Pneumatics
22	ME8792 - Power Plant Engineering
23	ME8791 - Mechatronics
24	ME8072 - Renewable Sources of Energy
25	ME8073 - Unconventional Machining Processes

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26	ME8099 - Robotics
27	ME8097 - Non Destructive Testing and Evaluation
28	ME8091 - Automobile Engimneering

| | MATERIALS SCIENCE | | L | T | P | C |

MATERIALS SCIENCE
(Common to courses offered in Faculty of Mechanical
Engineering
Except B.E. Materials Science and Engineering)

PH8251

L	T	P	C
3	0	0	3

OBJECTIVES:
   To introduce the essential principles of materials science for mechanical and related engineering applications.

UNIT I   PHASE DIAGRAMS   **9**
Solid solutions - Hume Rothery's rules – the phase rule - single component system - one-component system of iron - binary phase diagrams - isomorphous systems - the tie-line rule - the lever rule - application to isomorphous system - eutectic phase diagram - peritectic phase diagram - other invariant reactions – free energy composition curves for binary systems - microstructural change during cooling.

UNIT II   FERROUS ALLOYS   **9**
The iron-carbon equilibrium diagram - phases, invariant reactions - microstructure of slowly cooled steels - eutectoid steel, hypo and hypereutectoid steels - effect of alloying elements on the Fe-C system - diffusion in solids - Fick's laws - phase transformations - T-T-T-diagram for eutectoid steel – pearlitic, baintic and martensitic transformations - tempering of martensite – steels – stainless steels – cast irons.

UNIT III   MECHANICAL PROPERTIES   **9**
Tensile test - plastic deformation mechanisms - slip and twinning - role of dislocations in slip - strengthening methods - strain hardening - refinement of the grain size - solid solution strengthening - precipitation hardening - creep resistance - creep curves - mechanisms of creep - creep-resistant materials - fracture - the Griffith criterion - critical stress intensity factor and its determination - fatigue failure - fatigue tests - methods of increasing fatigue life - hardness - Rockwell and Brinell hardness - Knoop and Vickers microhardness.

UNIT IV   MAGNETIC, DIELECTRIC AND SUPERCONDUCTING MATERIALS   **9**
Ferromagnetism – domain theory – types of energy – hysteresis – hard and soft magnetic materials – ferrites - dielectric materials – types of polarization – Langevin-Debye equation – frequency effects on polarization - dielectric breakdown – insulating materials – Ferroelectric materials - superconducting materials and their properties.

UNIT V   NEW MATERIALS   **9**
Ceramics – types and applications – composites: classification, role of matrix and reinforcement, processing of fiber reinforced plastics -- metallic glasses: types , glass forming ability of alloys, melt spinning process, applications - shape memory alloys: phases, shape memory effect, pseudoelastic effect, NiTi alloy, applications – nanomaterials: preparation (bottom up and top down approaches), properties   and   applications   –   carbon   nanotubes: types.

OUTCOMES:
Upon completion of this course,
      the students will have knowledge on the various phase diagrams and their applications
          the students will acquire knowledge on Fe-Fe$_3$C phase diagram, various microstructures and
          alloys
      the students will get knowledge on mechanical properties of materials and their measurement
      the students will gain knowledge on magnetic, dielectric and superconducting properties of
      materials
      the students will understand the basics of ceramics, composites and nanomaterials.

TEXT BOOKS:
   1.   Balasubramaniam, R. "Callister's Materials Science and Engineering". Wiley India Pvt. Ltd.,
         2014.
   2.   Raghavan, V. "Physical Metallurgy: Principles and Practice". PHI Learning, 2015.
   3.   Raghavan, V. "Materials Science and Engineering : A First course". PHI Learning, 2015.

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OBJECTIVES:
- To study the nature and 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   14

Definition, scope and importance of environment – need for public awareness - concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – 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   8

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – pollution case studies – disaster management: floods, earthquake, cyclone and landslides. 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 over- utilization of surface and ground water, floods, drought, conflicts over 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. 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. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

GE8292   **ENGINEERING MECHANICS**   **L T P C**
                                                                        3 2 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   STATICS OF PARTICLES   9+6
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   9+6
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   9+6
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   9+6
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 RIGID BODY DYNAMICS   9+6
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 : 45+30=75 PERIODS

OUTCOMES:
On successful completion of this course, the student will be able to
- illustrate the vectorial and scalar representation of forces and moments
- analyse the rigid body in equilibrium
- evaluate the properties of surfaces and solids
- calculate dynamic forces exerted in rigid body
- determine the friction and the effects by the laws of friction

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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)

ME8391   ENGINEERING THERMODYNAMICS   **L T P C**
                                                                            3 2 0 4

OBJECTIVE:
   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 + 6
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 + 6
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 + 6
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 + 6
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 + 6
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 : 75 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
   CO1   Apply the first law of thermodynamics for simple open and closed systems under steady and unsteady conditions.
   CO2   Apply second law of thermodynamics to open and closed systems and calculate entropy and availability.
   CO3   Apply Rankine cycle to steam power plant and compare few cycle improvement methods
   CO4   Derive simple thermodynamic relations of ideal and real gases

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CE8394   FLUID MECHANICS AND MACHINERY   L T P C
                                                                              4 0 0 4

OBJECTIVES

The properties of fluids and concept of control volume are studied
The applications of the conservation laws to flow through pipes are studied.
To understand the importance of dimensional analysis
To understand the importance of various types of flow in pumps.
To understand the importance of various types of flow in turbines.

UNIT I   FLUID PROPERTIES AND FLOW CHARACTERISTICS   12

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   12

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   12

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

UNIT IV   PUMPS   12

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   12

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: 60 PERIODS

OUTCOMES:

Upon completion of this course, the students will be able to

Apply mathematical knowledge to predict the properties and characteristics of a fluid.
Can analyse and calculate major and minor losses associated with pipe flow in piping networks.
Can mathematically predict the nature of physical quantities
Can critically analyse the performance of pumps
Can critically analyse the performance of turbines.

TEXT BOOK:

1. Modi P.N. and Seth, S.M. "Hydraulics and Fluid Mechanics", Standard Book House, New Delhi, 2013.

REFERENCES:

1. Graebel. W.P, "Engineering Fluid Mechanics", Taylor & Francis, Indian Reprint, 2011
2. Kumar K. L., "Engineering Fluid Mechanics", Eurasia Publishing House(p) Ltd., New Delhi 2016
3. Robert W.Fox, Alan T. McDonald, Philip J.Pritchard, "Fluid Mechanics and Machinery", 2011.
4. Streeter, V. L. and Wylie E. B., "Fluid Mechanics", McGraw Hill Publishing Co. 2010

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EE8353　　　　　ELECTRICAL DRIVES AND CONTROLS　　　　　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
OUTCOME:
　　Upon Completion of this subject, the students can able to explain different types
　　of electrical machines and their performance

TEXT BOOKS:
1. Nagrath .I.J. & Kothari .D.P, "Electrical Machines", Tata McGraw-Hill, 2006
2. Vedam Subrahmaniam, "Electric Drives (Concepts and Applications)", Tata McGraw-Hill, 2010

REFERENCES:
1. Partab. H., "Art and Science and Utilisation of Electrical Energy", Dhanpat Rai and Sons, 2017
2. Pillai.S.K "A First Course on Electric Drives", Wiley Eastern Limited, 2012
3. Singh. M.D., K.B.Khanchandani, "Power Electronics", Tata McGraw-Hill, 2006.

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ME8451   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 the completion of this course the students will be able to

CO1   Explain the mechanism of material removal processes.

CO2   Describe the constructional and operational features of centre lathe and other special purpose lathes.

CO3   Describe the constructional and operational features of shaper, planner, milling, drilling, sawing and broaching machines.

CO4   Explain the types of grinding and other super finishing processes apart from gear manufacturing processes.

CO5   Summarize numerical control of machine tools and write a part program.

TEXT BOOKS:

1. Hajra Choudhury, "Elements of Workshop Technology", Vol.II., Media Promoters 2014
2. Rao. P.N "Manufacturing Technology - Metal Cutting and Machine Tools", 3rd Edition, Tata McGraw-Hill, New Delhi, 2013

REFERENCES:

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

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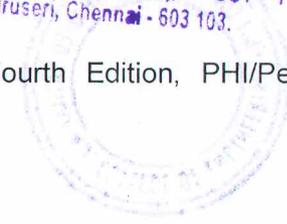
ME8493　　　　　　　　**THERMAL ENGINEERING - I**　　　　　**L　T　P　C**

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OBJECTIVES:

- To integrate the concepts, laws and methodologies from the first course in thermodynamics into analysis of cyclic processes
- To apply the thermodynamic concepts into various thermal application like IC engines, Steam.
- Turbines, Compressors and Refrigeration and Air conditioning systems
  (Use of standard refrigerant property data book, Steam Tables, Mollier diagram and Psychrometric chart permitted)

UNIT I　　　GAS AND STEAM POWER CYCLES　　　　　　　　　　　　　9

Air Standard Cycles - Otto, Diesel, Dual, Brayton – Cycle Analysis, Performance and Comparison – Rankine, reheat and regenerative cycle.

UNIT II　　　RECIPROCATING AIR COMPRESSOR　　　　　　　　　　9

Classification and comparison, working principle, work of compression - with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency. Multistage air compressor with Intercooling. Working principle and comparison of Rotary compressors with reciprocating air compressors.

UNIT III　　　INTERNAL COMBUSTION ENGINES AND COMBUSTION　　　9

IC engine – Classification, working, components and their functions. Ideal and actual : Valve and port timing diagrams, p-v diagrams- two stroke & four stroke, and SI & CI engines – comparison. Geometric, operating, and performance comparison of SI and CI engines. Desirable properties and qualities of fuels. Air-fuel ratio calculation – lean and rich mixtures. Combustion in SI & CI Engines – Knocking – phenomena and control.

UNIT IV　　　INTERNAL COMBUSTION ENGINE PERFORMANCE AND SYSTEMS　　9

Performance parameters and calculations. Morse and Heat Balance tests. Multipoint Fuel Injection system and Common Rail Direct Injection systems. Ignition systems – Magneto, Battery and Electronic. Lubrication and Cooling systems. Concepts of Supercharging and Turbocharging – Emission Norms.

UNIT V　　　GAS TURBINES　　　　　　　　　　　　　　　　　9

Gas turbine cycle analysis – open and closed cycle. Performance and its improvement - Regenerative, Intercooled, Reheated cycles and their combinations. Materials for Turbines.

　　　　　　　　　　　　　　　　　　　　　　　　TOTAL:45 PERIODS

OUTCOMES:

　Upon the completion of this course the students will be able to
　CO1　Apply thermodynamic concepts to different air standard cycles and solve problems.
　CO2　Solve problems in single stage and multistage air compressors
　CO3　Explain the functioning and features of IC engines, components and auxiliaries.
　CO4　Calculate performance parameters of IC Engines.
　CO5　Explain the flow in Gas turbines and solve problems.

TEXT BOOKS:

1. Kothandaraman.C.P., Domkundwar. S, Domkundwar. A.V., "A course in thermal Engineering" Fifth Edition, "Dhanpat Rai & sons , 2016
2. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, 2017

REFERENCES:

1. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 2008
2. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata Mcgraw-Hill 2012
3. Ramalingam. K.K., "Thermal Engineering", SCITECH Publications (India) Pvt. Ltd., 2009.
4. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003
5. Sarkar, B.K."Thermal Engineering" Tata McGraw-Hill Publishers, 2007

ME8595	THERMAL ENGINEERING – II	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To apply the thermodynamic concepts for Nozzles, Boilers, Turbines, and Refrigeration & Air Conditioning Systems.
- To understand the concept of utilising residual heat in thermal systems.

UNIT I STEAM NOZZLE 9

Types and Shapes of nozzles, Flow of steam through nozzles, Critical pressure ratio, Variation of mass flow rate with pressure ratio. Effect of friction. Metastable flow.

UNIT II BOILERS 9

Types and comparison. Mountings and Accessories. Fuels - Solid, Liquid and Gas. Performance calculations, Boiler trial.

UNIT III STEAM TURBINES 9

Types, Impulse and reaction principles, Velocity diagrams, Work done and efficiency – optimal operating conditions. Multi-staging, compounding and governing.

UNIT IV COGENERATION AND RESIDUAL HEAT RECOVERY 9

Cogeneration Principles, Cycle Analysis, Applications, Source and utilisation of residual heat. Heat pipes, Heat pumps, Recuperative and Regenerative heat exchangers. Economic Aspects.

UNIT V REFRIGERATION AND AIR – CONDITIONING 9

Vapour compression refrigeration cycle, Effect of Superheat and Sub-cooling, Performance calculations, Working principle of air cycle, vapour absorption system, and Thermoelectric refrigeration. Air conditioning systems, concept of RSHF, GSHF and ESHF, Cooling load calculations. Cooling towers – concept and types.

TOTAL:45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1   Solve problems in Steam Nozzle
CO2   Explain the functioning and features of different types of Boilers and auxiliaries and calculate performance parameters.
CO3   Explain the flow in steam turbines, draw velocity diagrams for steam turbines and solve problems.
CO4   Summarize the concept of Cogeneration, Working features of Heat pumps and Heat exchangers
CO5   Solve problems using refrigerant table / charts and psychrometric charts

TEXT BOOKS:

1. Kothandaraman, C.P., Domkundwar. S and Domkundwar A.V.,"A course in Thermal Engineering", Dhanpat Rai & Sons, 2016.
2. Mahesh. M. Rathore, "Thermal Engineering", 1st Edition, Tata Mc Graw Hill Publications, 2010.

REFERENCES:

1. Arora .C.P., "Refrigeration and Air Conditioning" Tata Mc Graw Hill, 2008 **PRINCIPAL**
2. Ballaney. P.L ." Thermal Engineering", Khanna publishers, 24th Edition 2012 **DHAAK AL COLLEGE OF ENGINEERING**
3. Charles H Butler : Cogeneration" McGraw Hill, 1984. No.34.Rajiv Gandhi Salai (OMR), SIPCOT - IT Park
4. Donald Q. Kern, " Process Heat Transfer", Tata Mc Graw Hill, 2001. Siruseri, Chennai - 603 103.
5. Sydney Reiter "Industrial and Commercial Heat Recovery Systems" Van Nostrand Reinhols, 1985.

ME8593 **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**   9
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**   9
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 fasteners - 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 the completion of this course the students will be able to
CO1   Explain the influence of steady and variable stresses in machine component design. CO2 Apply the concepts of design to shafts, keys and couplings.
CO3   Apply the concepts of design to temporary and permanent joints.
CO4   Apply the concepts of design to energy absorbing members, connecting rod and crank shaft.
CO5   Apply the concepts of design to bearings.

TEXT BOOKS:
1. Bhandari V, "Design of Machine Elements", 4th Edition, Tata McGraw-Hill Book Co 2016
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 9th Edition, Tata McGraw-Hill, 2011.

REFERENCES:
1. Alfred Hall, Halowenko, A and Laughlin, H., "Machine Design", Tata McGraw-Hill BookCo.(Schaum's Outline), 2010
2. Ansel Ugural, "Mechanical Design – An Integral Approach", 1st Edition, Tata McGraw-Hill Book Co, 2003.
3. P.C. Gope, "Machine Design – Fundamental and Application", PHI learning private ltd, New Delhi, 2012.
4. R.B. Patel, "Design of Machine Elements", MacMillan Publishers India P Ltd., Tech-Max Educational resources, 2011.
5. Robert C. Juvinall and Kurt M. Marshek, "Fundamentals of Machine Design", 4th Edition, Wiley, 2005
6. Sundararajamoorthy T. V. Shanmugam .N, "Machine Design", Anuradha Publications,

ME8594   DYNAMICS OF MACHINES

	L	T	P	C
	4	0	0	4

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   12

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   12

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   FREE VIBRATION   12

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   12

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   12

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 : 60 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1   Calculate static and dynamic forces of mechanisms.

CO2   Calculate the balancing masses and their locations of reciprocating and rotating masses.

CO3   Compute the frequency of free vibration.

CO4   Compute the frequency of forced vibration and damping coefficient.

CO5   Calculate the speed and lift of the governor and estimate the gyroscopic effect on automobiles, ships and airplanes.

TEXT BOOKS:

1. F. B. Sayyad, "Dynamics of Machinery", McMillan Publishers India Ltd., Tech-Max Educational resources, 2011.
2. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, 2014.
3. Uicker, J.J., Pennock, G.R. and Shigley, J.E., "Theory of Machines and Mechanisms", 4th Edition, Oxford University Press, 2014.

REFERENCES:

1. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2014.
2. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", 3rd Edition, Affiliated East-West Pvt. Ltd., New Delhi, 2006.
3. Khurmi, R.S.,"Theory of Machines", 14th Edition, S Chand Publications, 2005.
4. Rao.J.S. and Dukkipati.R.V., "Mechanism and Machine Theory", Wiley-Eastern Ltd., New Delhi, 1992.
5. Robert L. Norton, "Kinematics and Dynamics of Machinery", Tata McGraw-Hill, 2009.
6. V.Ramamurthi, "Mechanics of Machines", Narosa Publishing House, 2002

		L	T	P	C
ME8693	HEAT AND MASS TRANSFER	3	2	0	4

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+6

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+6

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+6

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+6

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

UNIT V   MASS TRANSFER   9+6

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 : 75 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1   Apply heat conduction equations to different surface configurations under steady state and transient conditions and solve problems

CO2   Apply free and forced convective heat transfer correlations to internal and external flows through/over various surface configurations and solve problems

CO3   Explain the phenomena of boiling and condensation, apply LMTD and NTU methods of thermal analysis to different types of heat exchanger configurations and solve problems

CO4   Explain basic laws for Radiation and apply these principles to radiative heat transfer between different types of surfaces to solve problems

CO5   Apply diffusive and convective mass transfer equations and correlations to solve problems for different applications

TEXT BOOKS:

1. Holman, J.P., "Heat and Mass Transfer", Tata McGraw Hill, 2000
2. Yunus A. Cengel, "Heat Transfer A Practical Approach", Tata McGraw Hill, 5th Editions2015

REFERENCES:

1. Frank P. Incropera and David P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 1998.
2. Kothandaraman, C.P., "Fundamentals of Heat and Mass Transfer", New Age International, New Delhi, 1998.
3. Nag, P.K., "Heat Transfer", Tata McGraw Hill, New Delhi, 2002
4. Ozisik, M.N., "Heat Transfer", McGraw Hill Book Co., 1994.
5. R.C. Sachdeva, "Fundamentals of Engineering Heat & Mass transfer", New Age International

ME8692 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 – Ritz Technique – 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.

TOTAL : 45 PERIODS

OUTCOMES
- CO1   Summarize the basics of finite element formulation.
- CO2   Apply finite element formulations to solve one dimensional Problems.
- CO3   Apply finite element formulations to solve two dimensional scalar Problems.
- CO4   Apply finite element method to solve two dimensional Vector problems.
- CO5   Apply finite element method to solve problems on iso parametric element and dynamic Problems.

TEXT BOOKS:
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.

ME8694	HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

OBJECTIVE:

To provide student with knowledge on the application of fluid power in process, construction and manufacturing Industries.

To provide students with an understanding of the fluids and components utilized in modern industrial fluid power system.

To develop a measurable degree of competence in the design, construction and operation of fluid power circuits.

UNIT I   FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS   9

Introduction to Fluid power – Advantages and Applications – Fluid power systems – Types of fluids - Properties of fluids and selection – Basics of Hydraulics – Pascal's Law – Principles of flow - Friction loss – Work, Power and Torque Problems, Sources of Hydraulic power : Pumping Theory –   Pump   Classification   –   Construction,   Working,   Design,   Advantages, Disadvantages, Performance, Selection criteria of Linear and   Rotary – Fixed and Variable displacement pumps – Problems.

UNIT II   HYDRAULIC ACTUATORS AND CONTROL COMPONENTS   9

Hydraulic Actuators: Cylinders – Types and construction, Application, Hydraulic cushioning – Hydraulic motors -   Control Components : Direction Control, Flow control and pressure control valves – Types, Construction and Operation – Servo and Proportional valves – Applications – Accessories : Reservoirs, Pressure Switches – Applications – Fluid Power ANSI Symbols – Problems.

UNIT III   HYDRAULIC CIRCUITS AND SYSTEMS   9

Accumulators, Intensifiers, Industrial hydraulic circuits – Regenerative, Pump Unloading, Double-Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems.

UNIT IV   PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS   9

Properties of air – Perfect Gas Laws – Compressor – Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit – Cascade method – Electro Pneumatic System – Elements – Ladder diagram – Problems, Introduction to fluidics and pneumatic logic circuits.

UNIT V   TROUBLE SHOOTING AND APPLICATIONS   9

Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools – Low cost Automation – Hydraulic and Pneumatic power packs.

TOTAL:45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1   Explain the Fluid power and operation of different types of pumps.

CO2   Summarize the features and functions of Hydraulic motors, actuators and Flow control valves

CO3   Explain the different types of Hydraulic circuits and systems

CO4   Explain the working of different pneumatic circuits and systems

CO5   Summarize the various trouble shooting methods and applications of hydraulic and pneumatic systems.

TEXT BOOKS:

1. Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.
2. Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGraw-Hill, 2001.

REFERENCES:

1. Anthony Lal, "Oil hydraulics in the service of Industry", Allied publishers, 1982.
2. Dudelyt. A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.
3. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
4. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.

ME8792	POWER PLANT ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVE:
- 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   9

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   9

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   9

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   9

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   9**

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.

TOTAL : 45 PERIODS

OUTCOMES:

Upon the completion of this course the students will be able to

CO1 Explain the layout, construction and working of the components inside a thermal power plant.

CO2 Explain the layout, construction and working of the components inside a Diesel, Gas and Combined cycle power plants.

CO3 Explain the layout, construction and working of the components inside nuclear power plants.

CO4 Explain the layout, construction and working of the components inside Renewable energy power plants.

CO5 Explain the applications of power plants while extend their knowledge to power plant economics and environmental hazards and estimate the costs of electrical energy production.

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. Godfrey Boyle, "Renewable energy", Open University, Oxford University Press in association with the Open University, 2004.
3. Thomas C. Elliott, Kao Chen and Robert C. Swanekamp, "Power Plant Engineering", Second Edition, Standard Handbook of McGraw – Hill, 1998.
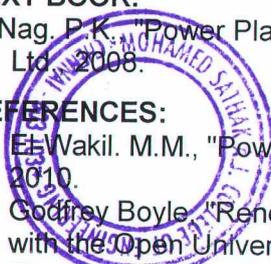
OIE751   ROBOTICS

L T P C
3 0 0 3

OBJECTIVES:

To understand the functions of the basic components of a Robot.
To study the use of various types of End of Effectors and Sensors
To impart knowledge in Robot Kinematics and Programming
To learn Robot safety issues and economics.

UNIT I   FUNDAMENTALS OF ROBOT   6

Robot - Definition - Robot Anatomy - Co ordinate Systems, Work Envelope Types and Classification- Specifications-Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load- Robot Parts and their Functions-Need for Robots-Different Applications.

UNIT II   ROBOT DRIVE SYSTEMS AND END EFFECTORS   9

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives, End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT III   SENSORS AND MACHINE VISION   12

Requirements of a sensor, Principles and Applications of the following types of sensors- Position sensors - Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, pneumatic Position Sensors, Range Sensors Triangulations Principles, Structured, Lighting Approach, Time of Flight, Range Finders, Laser Range Meters, Touch Sensors ,binary Sensors., Analog Sensors, Wrist Sensors, Compliance Sensors, Slip Sensors, Camera, Frame Grabber, Sensing and Digitizing Image Data- Signal Conversion, Image Storage, Lighting Techniques, Image Processing and Analysis-Data Reduction, Segmentation, Feature Extraction, Object Recognition, Other Algorithms, Applications- Inspection, Identification, Visual Serving and Navigation.

UNIT IV   ROBOT KINEMATICS AND ROBOT PROGRAMMING   13

Forward Kinematics, Inverse Kinematics and Difference; Forward Kinematics and Reverse Kinematics of manipulators with Two, Three Degrees of Freedom (in 2 Dimension), Four Degrees of freedom (in 3 Dimension) Jacobians, Velocity and Forces-Manipulator Dynamics, Trajectory Generator, Manipulator Mechanism Design-Derivations and problems. Lead through Programming, Robot programming Languages-VAL Programming-Motion Commands, Sensor Commands, End Effector commands and simple Programs.

UNIT V   IMPLEMENTATION AND ROBOT ECONOMICS   5

RGV, AGV; Implementation of Robots in Industries-Various Steps; Safety Considerations for Robot Operations - Economic Analysis of Robots.

OUTCOME: **TOTAL: 45 PERIODS**

Upon completion of this course, the students can able to apply the basic engineering knowledge for the design of robotics

TEXT BOOKS:

1. Klafter R.D., Chmielewski, T.A and Negin M., "Robotic Engineering - An Integrated Approach", Prentice Hall, 2003.
2. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.

REFERENCES:

1. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.
2. Deb S.R., "Robotics Technology and Flexible Automation" Tata McGraw Hill Book Co., 1994.
3. Koren Y., "Robotics for Engineers", Mc Graw Hill Book Co., 1992.
4. Fu.K.S.,Gonzalz R.C. and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw Hill Book Co., 1987.
5. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill, 1995.
6. Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008.
7. Surender Kumar, "Industrial Robots and Computer Integrated Manufacturing", Oxford and IBH Publishing Co. Pvt. Ltd., 1991.

ME8073	UNCONVENTIONAL MACHINING PROCESSES	L	T	P	C
		3	0	0	3

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

UNIT I   INTRODUCTION AND MECHANICAL ENERGY BASED PROCESSES   9
Unconventional machining Process – Need – classification – merits, demerits and applications. 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 II   THERMAL AND ELECTRICAL ENERGY BASED PROCESSES   9
Electric Discharge Machining (EDM) – Wire cut EDM – Working Principle-equipments-Process Parameters-Surface Finish and MRR- electrode / Tool – Power and control Circuits-Tool Wear – Dielectric – Flushing –– Applications. Laser Beam machining and drilling, (LBM), plasma, Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment –Types - Beam control techniques – Applications.

UNIT III   CHEMICAL AND ELECTRO-CHEMICAL ENERGY BASED PROCESSES   9
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 IV   ADVANCED NANO FINISHING PROCESSES   9
Abrasive flow machining, chemo-mechanical polishing, magnetic abrasive finishing, magneto rheological finishing, magneto rheological abrasive flow finishing their working principles, equipments, effect of process parameters, applications, advantages and limitations.

UNIT V   RECENT TRENDS IN NON-TRADITIONAL MACHINING PROCESSES   9
Recent developments in non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Comparison of non-traditional machining   processes.

TOTAL: 45 PERIODS

OUTCOMES:
Upon the completion of this course the students will be able to
CO1   Explain the need for unconventional machining processes and its classification
CO2   Compare various thermal energy and electrical energy based unconventional machining processes.
CO3   Summarize various chemical and electro-chemical energy based unconventional machining processes.
CO4   Explain various nano abrasives based unconventional machining processes.
CO5   Distinguish various recent trends based unconventional machining processes.

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.
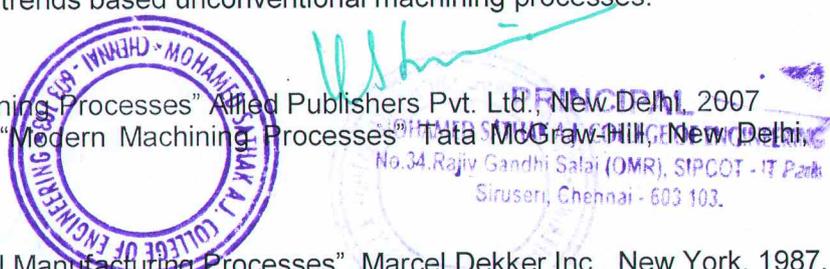
ME8097   NON DESTRUCTIVE TESTING AND EVALUATION   **L   T   P   C**
                                                          3   0   0   3

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

UNIT I   OVERVIEW OF NDT   9
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   9
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)   9
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)   9
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)   9
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 the completion of this course the students will be able to
   CO1   Explain the fundamental concepts of NDT
   CO2   Discuss the different methods of NDE
   CO3   Explain the concept of Thermography and Eddy current testing
   CO4   Explain the concept of Ultrasonic Testing and Acoustic Emission
   CO5   Explain the concept of Radiography
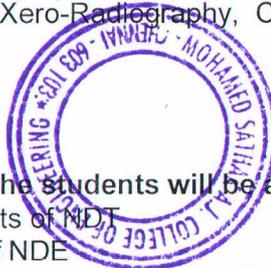
PRINCIPAL
.OF MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING
No.34 Rajiv Gandhi Salai (OMR), SIPCOT - IT Park
Siruseri, Chennai - 603 103.

PREPARATION AND EMISSION ANALYSIS OF NEEM OIL BIODIESEL

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

PRINCIPAL
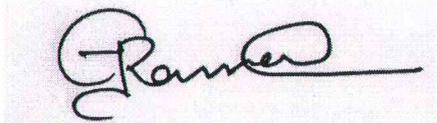MOHAMED SATHAK A.J. COLLEGE OF ENGINEERING
No.34.Rajiv Gandhi Salai (OMR), SIPCOT - IT Park
Siruseri, Chennai - 603 103.

MOHAMED SATHAK A J COLLEGE OF ENGINEERING, SIRUSERI IT PARK, OMR, CHENNAI – 603 103

ANNA UNIVERSITY, CHENNAI 600 025

MARCH 2021

ANNA UNIVERSITY: CHENNAI 600 025

BONAFIDE CERTIFICATE
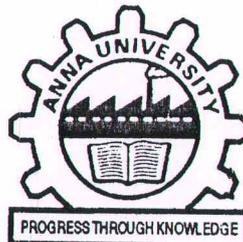
Certified that this project report **"PREPARATION AND EMISSION ANALYSIS OF NEEM OIL BIODIESEL"** is the bonafide work of **GOKUL L (311817114301) ABDUL BASIT (311816114002) MANOJ KUMAR (311817114028) KARTHICK KUMAR (311817114025)** who carried out the project work under my supervision.
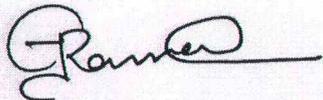
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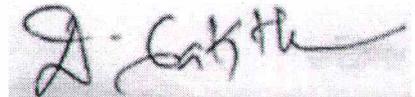
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ABSTRACT

In the current energy scene of fossil fuel, renewable energy sources such as biodiesel, bioethanol, biomethane, and biomass from wastes or hydrogen have become the subjects of great interest. These fuels contribute to the reduction of dependence on fossil fuels. In addition, energy sources such as these could partially replace the use of those fuels which are responsible for environmental pollution and may be scarce in the future. For these reasons they are known as "alternative fuels". Vegetable oil cannot be directly used in the diesel engine for its high viscosity, high density, high flash point and lower calorific value. So it needs to be converted into biodiesel to make it consistent with fuel properties of diesel. Biodiesel production is a valuable process which needs a continued study and optimization process. This present study will focus on the preparation of the biodiesel using Neem oil from its seed by two step method, analyzing the property of the prepared neem fatty acid and analayzing the combustion and emission properties like NOX, Hydrocarbon, carbon dioxide and Oxygen for different blend.

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Chapter 8

Conclusion

- The two-step transesterification process determines the maximum biodiesel yield. A maximum biodiesel yield of 90% was obtained by this method.

- The value of Density, Kinematic viscosity, Acid value and FFA of biodiesel properties are reduced by this double stage transesterification method and well within the requirement range.

- The Emission values of Hydrocarbon & Oxides of Nitrogen of B10 blend is lower than diesel.

- When compared with B20 blend the percentage of CO_2 is lower than other blends.

- B40 Oxygen emission values are lower than other blends.

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FABRICATION OF BOREWELL RESCUE SYSTEM

A PROJECT REPORT

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ABSTRACT

Deep well accidents are common due to uncovered openings of Deep well. It is very difficult and risky to rescue the trapped children. A small delay in the rescue can cost the child his or her life. Lifting the child out of the narrow hole of the bore well is not easy. The child who has suffered the trauma of the fall is confined to a small area where with the passage of time, the supply of oxygen reduces. The main objective of this project is to design and construct a portable robot which is cost effective, quick in action and accurate. The Bore well Rescue Robot is capable of moving inside the well and performs operations according to the user commands. The proposed model is designed to provide the child with two level of safety achieved by using robotic arms at the top which operate by pneumatic power transmission. This arrangement ensures that the child does not slip further deep during the rescue operation. Deepwell rescue Robot is a human controlled computerized Robotic system embedded with additional safety devices.

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CHAPTER 5

CONCLUSION

The proposed prototype performs the rescuing actions more precisely in very limited time. Usage of robotic arms ensures the rescuing action in both conditions such as when the child has been struck in between or at the bottom of the well. The inclusion of metallic plates has been proposed to provide an additional support and ensure the complete safety of the child. The robot is also capable of performing lifesaving actions like supplying oxygen.

Human life is precious. Our bore well child rescue system is a significant attempt to save the life of the victim of bore well accidents. Besides this, the unique capability of climbing through vertical and inclined pipes makes wide scope of application for this machine in manufacturing industries and other relevant fields. In the current design of bore well child saver machine it has been made to suit every possible situation that may occur during a rescue operation. We would like to conclude that with our project, we were able to carry out a rescue operation successfully .With the utilization of advanced robot technology we can overcome the existing limitations to save many lives.

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FABRICATION OF BRAKE FAILURE INDICATOR ALARM

A PROJECT REPORT

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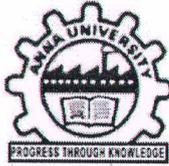
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i

ABSTRACT

The aim is to design and develop a control system based an electronically controlled automatic break failure indicator by using IR Sensor and engine over heating alarm by using heat sensor is called "AUTOMATIC BREAK FAILURE INDICATOR ALARM" Now a day, Machines are widely controlled by control system. To meet the need of exploding population economic and effective control of machines is necessary. The main theme of our project is to monitor the brake system at every moment

Today accidents are occur due to lot of reasons , the one of the main reason is brake failure, it caused to due to poor maintenance as well as product defect, in order to safe guard the valuable human for accident the accident monitoring of brake is very important thing in automobile

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CHAPTER 6

CONCLUSION

The **Fabrication of Brake Failure Indicator Alarm** is working with satisfactory conditions and able to understand the difficulties in maintaining the tolerances and also quality. The indication of brake failure is sensed with the temperature sensor and the alarm is made to switched on to indicate the buzzer . Thus the life of the brake shoe is monitored and the failure system is activated which helps to know how to achieve low cost automation. The application produces smooth operation. By using more techniques, they can be modified and developed according to the applications.

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STUDY OF MECHANICAL AND METALLURGICAL PROPERTIES OF MAGNESIUM (AZ31D)/SIC COMPOSITE FABRICATED THROUGH POWDER METALLURGY TECHNIQUE

A PROJECT REPORT

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CHAPTER 6
CONCLUSION

In the present investigation, Mg and Mg-SiC composites are fabricated through powder metallurgy with different SiC Content, the characterization was executed with Optical microscope, density with Archimedes' principle, hardness on micro-Vickers hardness tester and compression behaviour on UTM. Based on conducted experiments, the following conclusions are drawn.,

1. The effect of tubular sintering displayed a better densification response due to volumetric uniform heating. Density increases with increases in addition of SiC as showed better densification than base matrix.

2. The optical microscope revealed the presence of SiC particles with uniform distribution on base matrix with defect free composites.

3. The hardness of 4 wt.% SiC composite shows higher hardness than another fabricated samples, the hard SiC resist the deformation during indentation.

4. The maximum compressive strength is 10.635 KN on AZ31D+4 wt.% SiC composite are responsible preventing plastic deformation and also higher strain hardening. In addition, the difference in density among Mg and SiC particles as results improves internal stress and higher density of dislocations.

EXPERIMENTAL ANALYSIS OF MICROCHANNEL HEATSINKS FOR ELECTRONICS COOLING

A PROJECT REPORT

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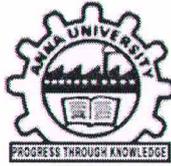
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INTERNAL EXAMINER

EXTERNAL EXAMINER

v

ABSTRACT

In this modern world, it is a complicated task to eliminate the heat produced by IC in the computers; better heat transfer is required for the optimum operation of the device. Numerous problems arises due to this improper heat dissipation. Adequate damages also occur in the main system in computers, as well as in automotive electronics and causes unwanted crisis to the user, so here it is an important issue we have is the elimination of heat from the IC computers in an efficient way. Heat sink is one of the prominent devices used for better thermal transport and better operation. In this work the study of heat transfer characteristics in a micro channel heat sink (MCHS) is done, the heat is liberated by using fluid and temperature distribution in solid section (fin) designed in heat sink. By the help of MCHS we able to study the factors which affect the heat transfer in automotive electronics. By using MCHS temperature distribution, velocity and Nusselt number can be obtained and reliable solution for the thermal management problems associated with data centers could be resolved.

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CHAPTER 7

CONCLUSION AND FUTURE SCOPE

7.1 CONCLUSION:

It can be seen that there is up to 50% increase in the thermal conductivity of fluids as compared to those of base fluids. It has been observed with change in temperature the fluids show more enhancement of conductivity containing smaller CuO particles. It is also observed that over a temperature range of 21°C to 51°C, there is two to four times increase in thermal conductivity enhancement of fluids that takes place. This makes fluids even more attractive cooling fluids for devices that have high energy density where the cooling fluid can work at a temperature higher than the room temperature. The heat transfer coefficient of split channel has comparatively greater of the order of 7000 W/m^{2}K in one side. Moreover, the high heat-transfer coefficient of the order of 14000 W/m^{2}K can be achieved by heat transfer in two directions. Also the leakage and evaporation problems could be avoided much better by using liquid metal as the coolant of micro channel cooling devices.

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EXPERIMENTAL INVESTIGATION ON AA5083 REINFORCED WITH Al_2O_3 & SiC PARTICULATES COMPOSITES PRODUCED BY POWDER METALLURGY ROUTE

A PROJECT REPORT

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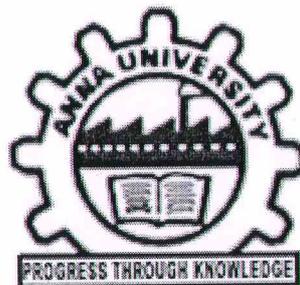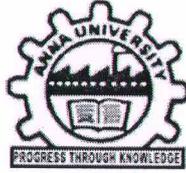
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INTERNAL EXAMINER

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ABSTRACT

The expectations over novel composite materials have been increased especially in automotive and aerospace applications due to its superior weight to strength ratio and tailored mechanical properties. In this frame work, aluminum alloy AA5083 alloy matrix reinforced with (8% wt –2% wt) of Al2O3 and Sic-particles.

The composite samples were fabricated through powder metallurgy route.

Optimum amount of reinforcement were determined by evaluating mechanical properties like micro-hardness and compressive strength of composites. The characterizations were probed by Microstructure.

The results reveal that the composites containing 6% wt of Al_2O_3 and 4% SiC reinforcement witnessed superior mechanical properties due to its combined effect of concentration and particulate scale and the great isotropic behavior was achieved by homogenous dispersion of reinforcement in the matrix phase.
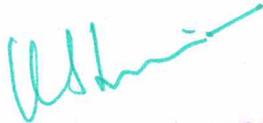
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CHAPTER 5

CONCLUSION

- The present review has been undertaken with an objective to compare the composite materials with pariculates Al_2O_3 & SiC as reinforcements and AA5083 as the matrix material.

- It shows different values of mechanical properties by varying the % of weight concentration.

- The combination of AA5083- Al_2O_3 (90-10%) shows best result in both the compression test and hardness.

- The microstructure images shows that the consolidation of SiC is poor with AA5083 in comparison of Al_2O_3 with AA5083.So the porosity is more in AA5083-SIC than the AA5083- Al_2O_3 and the porosity increases with increase of reinforcements.

- The hardness of the composites increases with increase of Al_2O_3 and decreases with the increase of SIC. The hardness of Al_2O_3 is more than the AA5083 when Al_2O_3 is added , so the hardness increases with increase of Al_2O_3.

- The hardness of SiC is less than the AA5083, so the hardness decreases with increase of SiC. In the upcoming years the researchers may focus on hybrid composites and fully biodegradable composites.

- The future of the hybrid composites appears to be bright.

INVESTIGATION OF MICROSTRUCTURAL AND MECHANICAL BEHAVIOR OF AA6351/B$_4$C COMPOSITES THROUGH POWDER METALLURGY

A PROJECT REPORT

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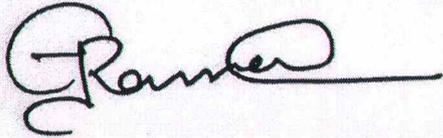
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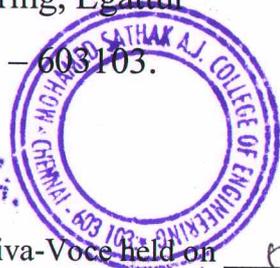
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INTERNAL EXAMINER

EXTERNAL EXAMINER

ii

ABSTRACT

The tribological behaviour of AA6351/ Boron Carbide (0-5.0 wt.%B4C) composites were processed through Powder Metallurgy (PM) routine. The varying wt. % of Al/ B4C composites were compacted with help of uniaxial press in a pressure range of 400 MPa and sintered in tubular furnace at 600 °C with argon gas environment. The investigation on theoretical density of alloy and composites of sintered composites increased up to 95%. The optical micrograph of composites reveals fine distribution of B4C particles over the matrix material. The hardness of fabricated samples was characterized with micro-Vickers hardness tester its shows increase in hardness up to 62.5 % on (AA6351+5.0 wt.% B4C) as compare to base matrix (AA6351+0wt.% B4C). The improvement in compression properties as effect of decreased grain size of α-Al with fine distribution of reinforcement particles with effect heat transfer during sintering process.

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CHAPTER 6

CONCLUSION

The AA6351/B4C composites have been successfully fabricated through powder metallurgy technique. The density, hardness, microstructure, and Compression behaviour of alloy and composites were assessed.

The experimental results as follows.

- The improved density in fabricated composites and its increases with increasing wt.% of B4C, it improves the strength of composites.

- The hardness of AA6351+5.0 wt.% B4C composite shows improved hardness as compared to base matrix, as effect of hard ceramic particles.

- The optical microstructures reveal the uniform distribution of reinforcement particles with a minimal amount of porosity.

- The incorporation of B4C particles to AA6351 alloy increases the compressive strength as due to reduction in grain size and precipitation hardening effect because the precipitated particles act as obstacles to dislocation movement.

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STUDY OF HEAT TRANSFER PERFORMANCE AND ORIENTATION ANALYSIS OF FLAT HEAT PIPE

A PROJECT REPORT

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In partial fulfillment for the award of the degree of

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MARCH 2021

iv

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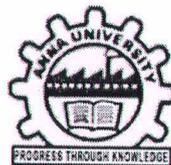
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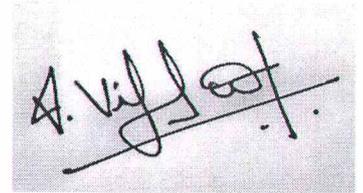
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INTERNAL EXAMINER

EXTERNAL EXAMINER

v

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ABSTRACT

In this 21st century, Humans are living in a era of miniaturization of electronic devices such as laptops, Smart phones etc., Every electronic devices emits heat energy at great rate. Miniaturization increases the damage for efficiency in cooling technology which is used to reduce the heat dissipation in those electronic devices. The cooling technology includes the heat pipe, heat sink, heat exchangers etc. Very few cooling methods finds efficient application in heat dissipation of miniaturized electronic devices. This is where Heat pipe plays a vital role in miniaturized device cooling technology. Heat pipes can be a viable and promising solution for this heat reduction issue. There are several types of heat pipes in cooling electronic devices, out of which flat heat pipe is most commonly used. A flat heat pipe has been developed to assist in meeting the high thermal design requirements in high power microelectronics, power converting systems, laptop computers and spacecraft thermal control system. Both experimental and analytical investigations were to be conducted to examine the maximum heat transport capacity and optimize the design parameters of this design. The performance analysis and fabrication of a flat heat pipe is done in this paper.

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CHAPTER 7

CONCLUSION

The results from the experiment shows that the Water as Cooling liquid in Copper Flat heat pipe provides very effective heat reduction or dissipation than the acetone as cooling liquid. So this project provide the evidences that water is the best cooling liquid in flat heat pipe which is used to reduce the temperature generated in Electronic devices than any other cooling liquid.

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AUTOMATIC PNEUMATIC RAMMING MACHINE

A PROJECT REPORT

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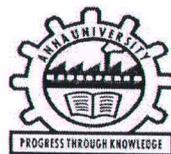
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INTERNAL EXAMINER

EXTERNAL EXAMINER

ABSTRACT

Sand casting is relatively cheap and sufficiently refractory even for steel foundry use. In addition to the sand, a suitable bonding agent (usually clay) is mixed or occurs with the sand. The mixture is moistened, typically with water, but sometimes with other substances, to develop strength and plasticity of the clay and to make the aggregate suitable for molding. The sand is typically contained in a system of frames or mould known as a flask. The mould cavities and gate system are created by compacting the sand around models, or patterns, or carved directly into the sand.

We use rammer in sand moulding. Moulding is one of the important metals forming process in manufacturing components for various applications in industry. Casting of any size and shape can be made accurately. Automation in this field helps to improve the foundry environment and accuracy of the cast parts. Efficiency of moulding is affected by various parameters like permeability, collapsibility, adhesiveness etc. So it is a must to avoid defects in casting. The defects occur in sand castings post a great problem in foundry. On account of defects more than 10% castings are rejected. Even though skilled labor is employed for ramming operation, the packing of molding sand will not be even throughout the molding box. So we have selected the idea of fabricating "PNEUMATIC RAMMER". This rammer is operated pneumatically. By using this rammer moulding sand will be packed evenly throughout the box

Keywords: Moulding, Casting, permeability, collapsibility, adhesiveness, pneumatically
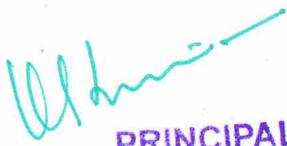
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CHAPTER 8

COCLUSION AND REFERENCE

8.1 CONCLUSION

This study proposes that Pneumatic ramming machine is very cheap as compared to hydraulic ramming machine. The range of the ramming sand can be increased by arranging a high pressure compressor and installing more hardened blades. This machine is advantageous to sand ramming process industries as they cannot afford the expensive hydraulic ramming machine, Electromagnetic ramming machine, rack and pinion, and spring ramming machine. Thus our concept complying with the demand of the customer whose use the product as well as those who our new. The latent needs of the customer which they were not able to reciprocate properly is the estimated successfully the individual functions were study and thoroughly and were evaluated further study will involve more analysis about the product and comparison of the similar product available in the market this process has cheaper than other ramming process.

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32

FABRICATION OF AUTOMATIC PNUEMATIC CONTROLLED THREE SIDE TILTING TRAILER.

A PROJECT REPORT

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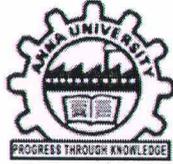
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Project Viva-Voce held on <u>05-08-2021</u>

INTERNAL EXAMINER

EXTERNAL EXAMINER

2

ABSTRACT

To deliver the material from the storing point to the particular place.To develop the automation in material handling system.To promote the convenient method of discharging the materials on three directional side in for sand ,stone, wood etc .

In the present situation , the transportation with discharging of materials like sand through the automotive system is on one side only i.e rear side of vehicle. In order to discharge the material on three sides for our convenient in order to store the materials to required side..

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CHAPTER 8

CONCLUSION

We make this project entirely different from other projects. Since concepts involved in our project is entirely different that a single unit is used to various purposes which is not developed by any of other team members.

By doing this project we gained the knowledge of controller programming ,pneumatic system and how automation can be effectively done with the help of pneumatic system.

It is concluded that any automated material handling system can be done with the help of controller & pneumatic system.

We have successfully completed the project work on using controller and pneumatic components at our Institute.

By doing this project work, we understood the working principle and uses of various sensors, switches, relays etc. as more and more industries are automating their material handling process.

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FABRICATION OF QUADCOPTER WITH AGRICULTURAL PESTICIDE SPRAYER

Project Work

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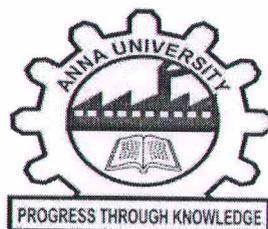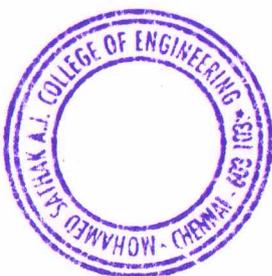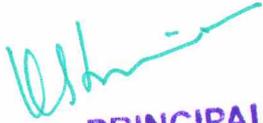
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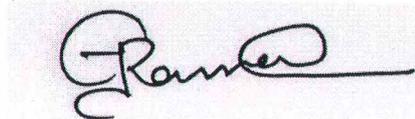
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ABSTRACT

One of the main sources of income in of India is agriculture. The production rate of crops in agriculture is based on various parameters like temperature, humidity, rain, soil, etc. Which are natural factors and not in farmers control. The field of Agriculture is also depends on some of factors like pests, disease, fertilizers, etc which can be control by giving proper treatment to crops. Pesticides may increase the productivity of crops but it also affects on human health. So the main aim of this work is to design agriculture drone for spraying pesticides. In this project, we are going to discus different architecture based on unmanned aerial vehicles (UAVs). The use of pesticides in agriculture is very important to agriculture and it will be so easy if will use intelligent machines such as robots using new technologies. This project gives the idea about various technologies used to reduce human efforts in various operations of agriculture like detection of presence of pests, spraying of UREA, spraying of fertilizers, etc. and describes the development of quad copter UAV and the spraying mechanism further also discuss about the integration of sprayer module to quad copter system. The discussed system involves designing a prototype which uses simple cost effective equipment like BLDC motor, Arduino, ESC wires, etc

Keywords: Unmanned Arial vehicles, Brushless motors, remote sensing, ESC wires, Li Pro wireless charger

9 CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our limited knowledge. Regarding, planning, purchasing, assembling and add application while doing this project work . we feel that the project work is a good solution to bridge the gates between institution and industries . we are proud that we have completed the work with the limited time successfully. The **"FABRICATION OF QUADCOPTER WITH AGRICULTURAL PESICIDE SPRAYER"** is working with satisfactory condition . we are able to understand the difficulties in maintaining the tolerance and also quality. We have done to our ability and skill making maximum use of availability facilities.
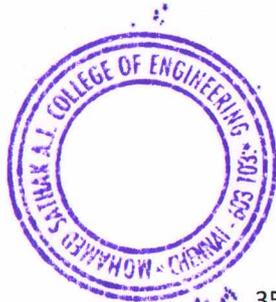
EVALUTATION OF MECHANICAL BEHAVOIUR OF
ALUMINIUM E-GLASS COMPOSITE

Project Work

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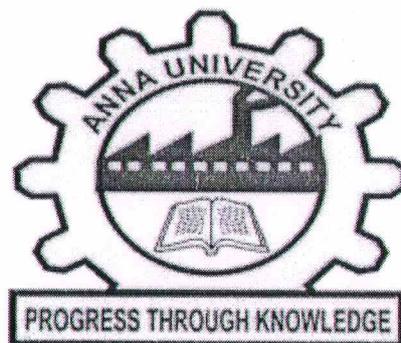
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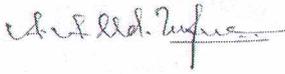
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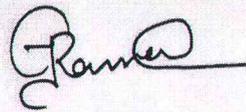
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ABSTRACT

The main problem in wood based products is mainly deforestation. Various steps and measures are in process for reducing global warming by saving trees. Very soon a demand for wood will arise in India. Hence to implement a better solution in advance we came up with Aluminium and steel based composite material by replacing existing E-glass. The core idea of our project is to reduce the risk of shortage of wood in future as well as to save more tress for our environment. There are many drawbacks in using wood as furniture for houses. The present Work concentrates on the properties and Aluminium composition of steel and E-glass. It is challenge to the creation of better materials for the improvement of quality of life with better mechanical properties. And also focuses on the physical properties, mechanical properties, and steel aluminium composition of E-glass. The objective of the present study is to utilize the advantages offered by renewable resources for the development of composite materials based on aluminium.

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CHAPTER 6
CONCLUSION

- Aluminum alloy (Al6061) with a specific composition along with the E-Glass fiber is selected as a matrix material and reinforcement material respectively in this project work

- The E-Glass fiber was effectively reinforced with Al6061 alloy matrix by the Sand casting method to prepare the composite specimens as per ASTM standards to carry out tensile test.

- The results of this test indicated that there is an increase in tensile strength of the composite specimens was better than the base metal (Al6061 alloy).

- When Al6061 is reinforced with 5% of E-Glass fiber, tensile strength of composite specimens was found to be increased

- Tensile Strength & compression survey of Al6061 significantly improved with the addition of E-Glass fiber, when it was compared with the results of unreinforced matrix material i.e. Al6061 alloy.

- From this analysis the fibre metal laminates are have high energy absorption properties by combining the properties of low strength materials like aluminium improved ductility. Here we attain the properties of FML is nearly equal to dual phase steel plate

- We can also use the FML for automobile body panels instead of steel plate which gives the better result at compared with monolithic aluminium plates.

FABRICATION OF PNEUMATIC REVERSE LOCKING TESTING RIG

A PROJECT WORK
SUBMITTED BY

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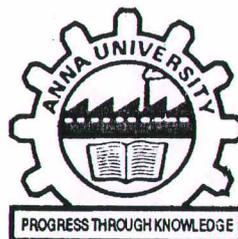In Partial Fulfillment for the Award of the Degree

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APRIL - 2021

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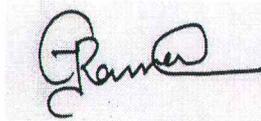
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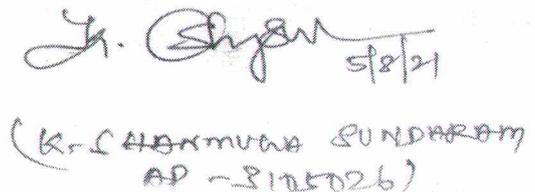
DESIGN AND FABRICATION OF PNEUMATIC REVERSE LOCKING TESTING RIG

ABSTRACT

Road transport safety is an important issue in the land transport sector all over the world due to the increment in the usage of automobiles in few decades. In this project, we are designed to develop a locking system of reverse motion using Pneumatic system for light motor vehicles. Its outline system requirements to successfully develop and deploy a less complicated, safe and secure mechanism for the uncontrolled reverse motion of the vehicle on hilly terrains. The mechanism consists of a vehicle and ratchet & pawl connected to the rear drive shaft of the vehicle and an actuator along with the help of an inclination sensor which will control the movement of the pawl while engaging or disengaging the mechanism. The engaging mechanism will represent the reverse motion is undesirable or to be restricted and disengaging mechanism when the reverse motion is desirable.

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CHAPTER 7

7. CONCLUSION

Our project "Pneumatic Reverse Locking Testing Rig" would help in avoiding the rearward motion of the vehicle on the hilly terrains and Ghats. Since a less complex structure is been used in our design, it can be easily used by new drivers. Thus the mechanism can stop the vehicle from rolling back in hill roads. This would be more helpful for the drivers to drive their cars and park them comfortably in hilly road. Here we conclude that with the use of this system, the unwanted reverse motion of the vehicles can be prevented It provides working vehicle with differential locking system to be capable of reliable straight running and excellent working performance.

INVESTIGATE THE EFFECT OF COPPER AND SiC ASSISTED DISSIMILAR WELDMENT OF SS304 AND SS316L WITH 308L ON TIG WELDING.

Project Work

Submitted by

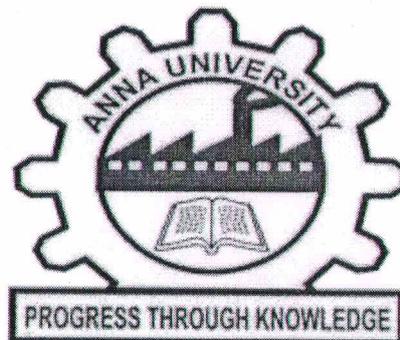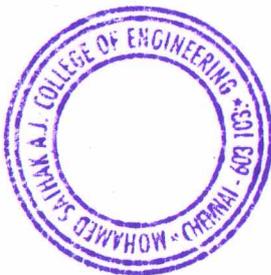|	
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In partial fulfillment for the award of the

degree of

BACHELOR OF ENGINEERING

In

MECHANICAL ENGINEERING

MOHAMED SATHAK A.J COLLEGE OF ENGINEERING

ANNA UNIVERSITY,

CHENNAI – 600025   APRIL 2021

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BONAFIDE CERTIFICATE

It is certified that this project report titled **"Investigate The Effect Of Copper And Sic Assisted Dissimilar Weldment Of Stainless Steel Grade 304 And 316L With 308L On Tungsten Inert Gas(TIG) Welding"** is bonafide work of **K. MOHAMED REEFDEEN (311817114041), J.MUHAMMED SUFYAN (311817114048), M.MOHAMMED FAYAAS (311817114045)**, who carried out the research under my supervision.

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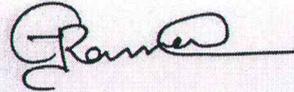
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SYNOPSIS

Tungsten Inert Gas welding is one of the widely used welding techniques mainly in stainless steel applications. The major objective of this project is to weld two dissimilar stainless steel plates SS304 and SS316L by activated TIG welding along with analyzing the mechanical property (Hardness) of the welded joints. Two dissimilar metals of 6mm thick AISI 304 and SS 316L stainless steel plate are welded by activated Tungsten Inert Gas welding. The activated flux used in this welding such as SiC, copper which increases the weld penetration of the joint and also to done the welding in two pass. The life span of many food processing machines has been reduced over the years due to low quality welded joints in the machine or has not fulfilled the estimated life span of the machine due to their poor quality of joints and the materials of the machine could not adopt the working condition of the machine.
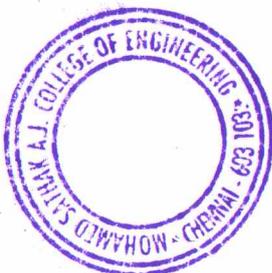
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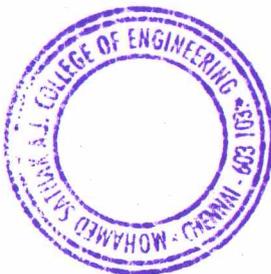
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CHAPTER 6
CONCLUSION

In this investigation, the copper powder and SiC powder fluxes where used to compare the effect of fluxes in the TIG welding of dissimilar metal and to evaluate the hardness(mechanical) of TIG welding with stainless steel 304 and stainless steel 316l. The following conclusions are observed from this investigation.

- Higher hardness were found at the sample 3 of 58 HRC found at the weld zone.

- Lower Hardness of 44.5 HRC found on the weld zone of Sample 1 which has a combination of copper powder coating on both weld passes.

- Combination of copper Powder and SiC powder fluxes which does not meet the hardness achieved by sample 3.

- Hence the recommendation for Hardness while using Dissimilar weld is SiC powder as a flux coated material on the specimen.

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