E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

NAGAPATTINAM – 611002

(Affiliated to Anna University, Chennai | Accredited by NAAC with 'A++' Grade | Accredited by NBA T1(B.E. – CSE, CIVIL, ECE, EEE, MECH& B.Tech – IT) | Approved by AICTE, New Delhi)

B.E. – MECHANICAL ENGINEERING R- 2023

THIRD YEAR

CURRICULUM AND SYLLABUS FOR FIFTH SEMESTER

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
2302ME501	Design of Machine Elements	3	1	0	4	40	60	100
2302ME502	Engineering Materials and Metallurgy	3	0	0	3	40	60	100
2302ME503	Kinematics of Machines	2	1	0	3	40	60	100
	Elective I	3	0	0	3	40	60	100
	Elective II	3	0	0	3	40	60	100
	Open Elective–I	3	0	0	3	40	60	100
Laboratory Course								
2302ME551	Computer Aided Design Laboratory	0	0	2	1	60	40	100
2302ME552	Material Testing and Characterization	0	0	4	2	60	40	100
	Professional Development course -III	0	0	0	1	100	-	100
	Life skill course-V	0	0	0	0	100	-	100
	TOTAL	**17**	**2**	**6**	**23**	**560**	**440**	**1000**

L–Lecture | T–Tutorial | P –Practical | CA – Continuous Assessment | ES–End Semester

2302ME501 DESIGNOFMACHINEELEMENTS L T P C
3 1 0 4

PREREQUISITE:

1. Engineering mechanics
2. Strength of Materials

COURSE OBJECTIVES:

1. To learn the various steps involved in the Design Process.
2. To Learn designing shafts and couplings for various applications.
3. To Learn the design of temporary and permanent Joints.
4. To Learn designing helical, leaf springs, flywheels, connecting rods and crank shafts for various applications.
5. To Learn designing and select sliding and rolling contact bearings, seals and gaskets.(Use of PSG Design Data book is permitted)

COURSE OUTCOMES:

On the successful completion of the course, students will be ableto

CO1: Explain the design machine members subjected to static and variable loads.
CO2: Apply the concepts design to shafts, key and couplings.
CO3: Apply the concepts of design to bolted, Knuckle, Cotter, riveted and welded joints.
CO4: Apply the concept of design helical, leaf springs, flywheels, connecting rods and crankshafts.
CO5: Apply the concepts of design and select sliding and rolling contact bearings, seals and gaskets.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	3	-	-	-	-	1	1	-	-	2	-	-	3
CO2	2	2	3	-	-	-	-	1	1	-	-	2	-	-	3
CO3	2	2	3	-	-	-	-	1	1	-	-	2	-	-	3
CO4	2	2	3	-	-	-	-	1	1	-	-	2	-	-	3
CO5	2	2	3	-	-	-	-	1	1	-	-	2	-	-	3

COURSE CONTENTS:

MODULE I FUNDAMENTALCONCEPTSINDESIGN 12 Hours

Introduction to the design process - factors influencing machine design, selection of materials based on mechanical properties- Direct, Bending and torsional loading – Modes of failure –Factor of safety–Principal stresses–Design of straight and curved beams–Crane hook and 'C' frame-Theories of failure–stress concentration–Design for variable loading - Soderberg, Goodman, Gerber methods and combined stresses.

MODULE II DESIGNOFSHAFTSANDCOUPLINGS 12 Hours

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

MODULE III DESIGNOFTEMPORARYANDPERMANENTJOINTS 12 Hours

Threaded fasteners-Bolted joints including stresses due to static loading, eccentrically loading–Welded joints-Butt, Fillet andparallel transverse filletwelds–welded joints subjected tobending, torsional and eccentric

loads.

MODULE IV DESIGNOFENERGYSTORINGELEMENTSANDENGINE COMPONENTS **12 Hours**

Types of springs, design of helical springs–surge in springs, concentricsprings, Design of leaf springs- rubber springs - Flywheels considering stresses in rims and arms for engines.

MODULE V DESIGNOFBEARINGSANDMISCELLANEOUSELEMENTS **12 Hours**

Types of bearing- Hydrodynamic journal bearings, Sommerfeld Number- Ball bearing and rolling contact bearings - Selection of Rolling Contact bearings.

TOTAL: 60 HOURS

REFERENCES:

1. *BhandariVB,"DesignofMachineElements",4thEdition,TataMcGraw-HillBookCo,2016*
2. *JosephShigley,RichardG.BudynasandJ.KeithNisbett"MechanicalEngineeringDesign", 10thEdition,TataMcGraw-Hill,2015.*
3. *AnselCUgural,"MechanicalDesign–AnIntegralApproach",1stEdition,TataMcGraw-HillBook Co, 2004.*
4. *MerhyleFranklinSpotts,TerryE.Shoup,andLeeEmreyHornberger,"DesignofMachineElements" 8thEdition,PrinticeHall,2004.*
5. *RobertC.JuvinallandKurtM.Marshek,"FundamentalsofMachinecomponentDesign",6thEdition,Wiley, 2017.*
6. *SundararajamoorthyT.V.and Shanmugam .N,"MachineDesign",AnuradhaPublications,Chennai,*
7. *2003.*
8. *DesignofMachineElements|SIEdition|EighthEdition|ByPearsonbyM.F.Spotts,TerryE. Shoup, et al. | 25 March 2019*

2302ME502 ENGINEERINGMATERIALSANDMETALLURGY L T P C
3 0 0 3

PREREQUISITE:

1. Basic Physics
2. Basic Chemistry

COURSE OBJECTIVES:

1. To learn the constructing the phase diagram and using of iron-iron carbide phase diagram for microstructure formation.
2. To learn selecting and applying various heat treatment processes and its microstructure formation.
3. To illustrate the different types of ferrous and non-ferrous alloys and their uses in engineering field.
4. To illustrate the different polymer, ceramics and composites and their uses in engineering field.
5. To learn the various testing procedures and failure mechanism in engineering field.

COURSE OUTCOMES:

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

CO1: Explain alloys and phase diagram, Iron-Iron carbon diagram and steel classification.
CO2: Explain isothermal transformation, continuous cooling diagrams and different heat treatment processes.
CO3: Clarify the effect of alloying elements on ferrous and non-ferrous metals.
CO4: Summarize the properties and applications of non-metallic materials.
CO5: Explain the testing of mechanical properties.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	3	2	-	-	-	-	-	-	-	2	2	-	1
CO2	3	1	3	1	-	2	-	1	-	-	-	2	2	-	1
CO3	3	1	3	-	-	-	-	-	-	-	-	2	2	-	1
CO4	3	1	3	-	-	-	2	-	-	-	-	2	2	-	1
CO5	3	1	3	2	-	-	-	-	-	-	-	2	2	-	1

COURSE CONTENTS:

MODULE I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9 Hours

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

MODULE II HEATTREATMENT 9 Hours

Definition – Full annealing, stress relief, recrystallisation and spheroidising –normalizing, hardening and tempering of steel. Isothermal transformation diagrams – cooling curves superimposed on I.T. diagram – continuous cooling Transformation (CCT) diagram – Austempering, Martempering – Hardenability,Jominy end quench test -case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction

hardening – Vacuum and Plasma hardening – Thermo-mechanical treatments- elementary ideas on sintering.

MODULE III FERROUS AND NON-FERROUS METALS 9 Hours

Effect of alloying additions on steel (Mn, Si, Cr, Mo, Ni, V,Ti& W) – stainless and tool steels – HSLA - Maraging steels – Grey, white, malleable, spheroidal – alloy cast irons, Copper and its alloys – Brass, Bronze and Cupronickel – Aluminium and its alloys; Al-Cu – precipitation strengthening treatment – Titanium alloys, Mg-alloys, Ni-based super alloys – shape memory alloys- Properties and Applications overview of materials standards

MODULE IV NON-METALLIC MATERIALS 9 Hours

Polymers – types of polymers, commodity and engineering polymers – Properties and applications of PE, PP,PS,PVC,PMMA,PET,PC,PA,ABS,PAI,PPO,PPS,PEEK,PTFE,Thermosetpolymers–Ureaand
Phenol formaldehydes –Nylon, Engineering Ceramics – Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON – intermetallics- Composites- Matrix and reinforcement Materials applications of Composites - Nano composites.

MODULE V MECHANICAL PROPERTIES AND DEFORMATION MECHANISMS 9 Hours

Mechanisms of plastic deformation, slip and twinning – Types of fracture – fracture mechanics- Griffith's theory- Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), Micro and nano-hardness tests, Impact test lzod and charpy, fatigue and creep failure mechanisms.

TOTAL: 45 HOURS

REFERENCES:

1. *KennethG .Budinski and MichaelK. Budinski, "Engineering Materials", Prentice HallofIndiaPrivateLimited,9th edition,2018.*
2. *SydneyH.Avner,"IntroductiontoPhysicalMetallurgy",McGrawHillBookCompany, 1994*
3. *Alavudeen, N.Venkateshwaran, and J.T .WinowlinJappes, A Textbook of Engineering Materials and Metallurgy, Laxmi Publications, 2006.*
4. *AmandeepSinghWadhwa,andHarvinderSinghDhaliwal,ATextbookofEngineeringMaterialand Metallurgy, University Sciences Press, 2008.*
5. *G.S.UpadhyayandAnishUpadhyay,"MaterialsScienceandEngineering",VivaBooksPvt.Ltd,New Delhi,2020.*
6. *Raghavan.V,"MaterialsScienceandEngineering",PrenticeHallofIndiaPvt.Ltd.6thedition,2019.*
7. *Williams D Callister,"Material Science and Engineering "Wiley India Pvt Ltd,2ndedition Reprint.*

2302ME503 KINEMATICSOFMACHINES L T P C
2 1 0 3

PREREQUISITE:

1. Engineering Mechanics
2. Mathematics
3. Engineering Graphics

COURSE OBJECTIVES:

1. To understand the basic components and layout of linkages in the assembly of a system/ machine.
2. To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
3. To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions.
4. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.

COURSE OUTCOMES:

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

CO1: Differentiate the basic machine mechanisms.
CO2: Calculate velocity and acceleration of machine mechanisms.
CO3: Construct the cam profile for different types of follower motion.
CO4: Describethekinematicterminologiesofspurgearandcalculatespeedratioofvarious typesofgeartrain
CO5: Solve the amount of power transmitted by friction drives.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	2	-	2	-	-	2	-	-	2	-	-	3
CO2	3	2	3	2	-	2	2	1	2	-	-	-	-	-	3
CO3	2	2	3	2	-	2	-	-	2	-	-	2	-	-	3
CO4	2	2	-	2	-	-	2	2	-	-	-	-	-	-	3
CO5	3	3	-	2	-	-	2	-	-	-	-	-	-	-	3

COURSE CONTENTS:

MODULE I FUNDAMENTALS OF MECHANISMS 9 Hours

Basic Terminology –Kinematic link, Pair, joints, Structure, Machine, Degree of freedom, Grubler & Kutzbach Criterion- Inversions of four bar mechanism, Mechanical advantage –Transmission Angle ,Inversion of single slider and double slider crank mechanisms. Common Mechanisms-Straight line mechanism, Dwell mechanism.

MODULE II KINEMATIC ANALYSIS OF MECHANISMS 9 Hours

Relative velocity of kinematic link, Rubbing Velocity of kinematic pair, Construction of velocity and acceleration diagram by graphical method (Relative Velocity Method), Four bar mechanism, slider crank mechanisms and complex mechanism.

MODULE III CAM AND FOLLOWER MECHANISMS 9 Hours

Introduction - Terminology, Classifications, Types of follower motion - Uniform Velocity Motion, Simple Harmonic Motion, Uniform Acceleration and Retardation Motion and Cycloidal Motion-Construction of Cam profile-Knife edge follower, Roller and flat faced follower.

MODULE IV GEARANDGEARTRAIN 9 Hours

Gears - Terminology, Law of gearing, Length of path of contact, Length of arc of contact, contact ratio-Interference and undercutting. Gear trains-Speed ratio, train value. Simple gear train, compound gear train, Epicyclic gear train- speed calculation by tabular method.

MODULE V FRICTIONDRIVES 9 Hours

Introduction – Frictionclutch, types -single plate, Multiplate and nconeclutch. FlatBelt Drives Velocity,slip, creepandCentrifugaleffectofbelt,lengthofopenandcrossbeltdrives,Maximumpowertransmitted,ratio Of driving tension in flat belt drives-V Belt drives.

TOTAL: 45 HOURS

REFERENCES:

1. *S.S.Rattan,TheoryofMachines,TataMcGrawHillPublishingCompanyPvt.Ltd,NewDelhi,2014.*
2. *J.J.Uicker,G.R.PennockandJ.E.Shigley,TheoryofMachinesandMechanisms,OxfordUniversity Press, New York,2011.*
3. *BallaneyPL,TheoryofMachinesandMechanisms,KhannaPublishers,NewDelhi,2005.*
4. *SadhuSingh,TheoryofMachines,PearsonEducation,SecondEdition,2012.*
5. *RaoJSandDukkipati,MechanismandMachineTheory,Wiley-EasternLtd.,NewDelhi,2006.*
6. *http://nptel.ac.in/courses/112104121/1*

2303ME066 NON-TRADITIONALMACHINING PROCESSES L T P C
3 0 0 3

PREREQUISITE:

1. Manufacturing Technology I&II

COURSE OBJECTIVES:

1. To classify non-traditional machining processes and describe mechanical energy based non- traditional machining processes.
2. To describe thermo-electric energy based processes
3. To differentiate chemical and electro chemical energy based processes.
4. To explain nano finishing processes.
5. To introduce hybrid non-traditional machining processes and differentiate hybrid non-traditional machining processes

COURSE OUTCOMES:

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

CO1: Formulate different types of non-traditional machining processes and evaluate mechanical energy based non- traditional machining processes.
CO2: Evaluate thermo – electric energy based processes.
CO3: Illustrate chemical and electro chemical energy based processes.
CO4: Interpret nano finishing processes.
CO5: Analyse hybrid non – traditional machining processes and differentiate non –traditional machining processes.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	2	-	-	-	-	-	-	1	2	-	-
CO2	2	1	-	-	2	-	-	-	-	-	-	1	2	-	-
CO3	2	1	-	-	2	-	-	-	-	-	-	1	2	-	-
CO4	2	1	-	-	2	-	-	-	-	-	-	1	2	-	-
CO5	2	1	-	-	2	-	-	-	-	-	-	1	2	-	-

COURSE CONTENTS:

MODULE I INTRODUCTIONANDMECHANICALENERGYBASEDPROCESSES 9 Hours

Introduction - Need for non-traditional machining processes - Classification of non-traditional machining processes - Applications, advantages and limitations of non-traditional machining processes - Abrasive jet machining, Abrasive water jet machining, Ultrasonic machining their principles, equipment, effect of process parameters, applications, advantages and limitations.

MODULE II THERMO-ELECTRICENERGYBASEDPROCESSES 9 Hours

Principles, equipments, effect of process parameters, applications, advantages and limitations of Electric discharge machining, Wire electric discharge machining, Laser beam machining, Plasma arc machining, Electron beam machining, Ion beam machining.

MODULE III CHEMICALANDELECTROCHEMICALENERGYBASEDPROCESSES 9 Hours

Principles, equipments, effect of process parameters, applications, advantages and limitations of Chemical

machining, Electro-chemical machining, Electro-chemical honing, Electro-chemical grinding, Electro chemical deburring.

MODULE IV NANOFINISHINGPROCESSES **9 Hours**

Principles, equipments, effect of process parameters, applications, advantages and limitations of Abrasive flow machining – Chemo mechanical polishing, Magnetic abrasive finishing, Magneto rheological finishing, Magneto rheological abrasive flow finishing.

MODULE V HYBRIDNON-TRADITIONALMACHININGPROCESSES **9 Hours**

Introduction - Various hybrid non-traditional machining processes, their working principles, equipments, effect of process parameters, applications, advantages and limitations. Selection and comparison of different non-traditional machining processes.

TOTAL: 45 HOURS

REFERENCES:

1. *Adithan.M.,"UnconventionalMachiningProcesses",Atlantic,NewDelhi,India,2009.ISBN 13:9788126910458*
2. *AnandPandey,"ModernMachiningProcesses",AneBooksPvt.Ltd.,NewDelhi,India,2019.*
3. *Benedict,G.F.,"Non-traditionalManufacturingProcesses",MarcelDekkerInc.,NewYork*
4. *CarlSommer,"Non-TraditionalMachiningHandbook",AdvancePublishing.,UnitedStates, 2000,ISBN-13:978-1575373256.*
5. *Jagadeesha T., "Non-Traditional Machining Processes", I.K. International Publishing House Pvt. Ltd., New Delhi, India, 2017, ISBN-13: 978-9385909122.*
6. *Kapil Gupta, Neelesh K. Jain and Laubscher R.F., "Hybrid Machining Processes: Perspectives on Machining and Finishing", 1st edition, Springer International Publishing., Switzerland,2016, ISBN-13: 978-3319259208.*

2303ME057 AUTOMOBILEENGINEERING

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Engineering Mechanics
2. Thermodynamics
3. Material Science

COURSE OBJECTIVES:

1. To study the construction and working principle of various parts of an automobile.
2. To study the practice for assembling and dismantling of engine parts and transmission system
3. To study various transmission systems of automobile.
4. To study about steering, brakes and suspension systems
5. To study alternative energy sources

COURSE OUTCOMES:

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

CO1: Recognize the various parts of the automobile and their functions and materials.
CO2: Discuss the engine auxiliary systems and engine emission control.
CO3: Distinguish the working of different types of transmission systems.
CO4: Explain the Steering, Brakes and Suspension Systems.
CO5: Predict possible alternate sources of energy for IC Engines.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	2	1	-	-	-	-	1	-	-	1	1	2	` 1
CO2	2	1	2	1	-	-	-	-	1	-	-	1	1	2	1
CO3	2	1	2	1	-	-	-	-	1	-	-	1	1	2	1
CO4	2	1	2	1	-	-	-	-	1	-	-	1	1	2	1
CO5	2	1	2	1	-	-	-	-	1	-	-	1	1	2	1

COURSE CONTENTS:

MODULE I VEHICLESTRUCTUREANDENGINES **9 Hours**

Types of automobiles vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (variousresistancesandmomentsinvolved),ICengines–components-functionsandmaterials,variablevalve timing(VVT)

MODULE II ENGINEAUXILIARYSYSTEMS **9 Hours**

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

MODULE III TRANSMISSIONSYSTEMS **9 Hours**

Clutch-types and construction, gearboxes – manual and automatic, gear shift mechanisms, Overdrive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and Rear axle, Hotchkiss Drive and Torque Tube Drive.

MODULE IV STEERING, BRAKES AND SUSPENSIONSYSTEMS **9 Hours**

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

MODULE V ALTERNATIVE ENERGY SOURCES **9 Hours**

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

TOTAL: 45 HOURS

REFERENCES:

1. *Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, NewDelhi, 2002.*
2. *KirpalSingh,"AutomobileEngineering",Vol1&2,SeventhEdition,StandardPublishers, NewDelhi,13thEdition 2014.*
3. *GanesanV."InternalCombustionEngines",ThirdEdition,TataMcGraw-Hill,2012.*
4. *HeinzHeisler,"AdvancedEngineTechnology,"SAEInternationalPublicationsUSA,1998.*
5. *JosephHeitner,"AutomotiveMechanics,"SecondEdition,East-WestPress,1999*

2303ME077 **INDUSTRIALROBOTICS (OpenElective)**

L	T	P	C
3	0	0	3

PREREQUISITE:

1. Manufacturing Technology
2. Automation

COURSE OBJECTIVES:

1. To explain the fundamentals and working of robots.
2. To describe the importance of drives and end effectors of robots.
3. To explain the types of sensors and concept of machine vision system.
4. To analyze kinematics of robots and its programming.
5. To identify and explain the applications of robots in industries.

COURSE OUTCOMES:

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

CO1: Explain the basics of robots.
CO2: Make use of end effectors and actuators of robots.
CO3: Experiment with sensors and machine vision system of robots.
CO4: Prepare kinematics and programming of robots.
CO5: Describe safety aspects and implementation of robot project, and applications of robots in industries and other fields.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	1	2	1	1	1	1	2	1	2	2	2	1
CO2	2	2	3	2	3	1	1	1	1	2	1	2	3	2	2
CO3	2	3	2	3	3	1	1	1	2	2	1	2	2	2	3
CO4	3	2	3	2	3	1	1	1	2	3	2	2	3	2	3
CO5	2	2	2	2	2	3	2	2	2	3	2	3	2	3	2

COURSE CONTENTS:

MODULE I FUNDAMENTALOF ROBOTICS **9 Hours**

Robot -Definition -scope of industrial robot -Robotics and Automation -Law of robotics -Robot Anatomy -Co- ordinateSystems,WorkEnvelope,classification-Specifications-Pitch,Yaw,Roll,JointNotations,Speedof Motion,PayLoad -Need forRobots.

MODULE II ROBOTDRIVESYSTEMANDENDEFFECTORS **9 Hours**

Pneumatic Drives, Hydraulic Drive, Mechanical Drives and Electrical Drives. End Effectors – Grippers-Pneumatic gripper, Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers, and Mechanical Grippers – Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers.

MODULE III SENSORSANDMACHINEVISIONSYSTEMS **9 Hours**

Sensors-types-tactile sensors, proximity and range sensors, contact and non contact sensors, velocity sensors, touch and slip sensors, force and torque sensors. Robotic vision systems, imaging components, image representation, picture coding, object recognition and categorization, visual inspection.

MODULE IV ROBOTKINEMATICSANDROBOTPROGRAMMING 9 Hours

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional)–Derivations.TeachPendantProgramming,Leadthroughprogramming,Robotprogramming Languages - VAL Programming - Motion Commands, Sensor Commands, End effecter commands, and Simple programs.

MODULE V IMPLEMENTATIONANDAPPLICATION 9 Hours

Implementation of Robots in Industries – Various Steps-Application of robots in machining - Welding-Assembly-Material handling-Loading and unloading – hostile and remote environments. Inspection and future application-safety, training, maintenance and quality.

TOTAL: 45 HOURS

REFERENCES:

1. *M.P.Groover,IndustrialRoboticsTechnology,ProgrammingandApplications,TataMcGrawHill Publishing Company Pvt. Ltd., New Delhi, 2001.*
2. *D.Richard,Klafter,A.Thomas,ChmielewskiandMichaelNegin,RoboticsEngineering,AnIntegrated Approach, Prentice Hall of India, New Delhi, 2001.*
3. *K.S.Fu,R.C.GonzalezandC.S.G.Lee,RoboticsControl,Sensing,VisionandIntelligence,Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2003*
4. *YoramKoren,RoboticsforEngineers,TataMcGrawHillPublishingCompanyPvt.Ltd.,NewDelhi, 2004.*
5. *SubirKumarSaha,IntroductiontoRobotics,TataMcGrawHillPublishingCompanyPvt.Ltd.,New Delhi, 2008.*

2303ME078	RENEWABLEENERGYSOURCES (OpenElective)	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Thermal Engineering
2. Engineering thermodynamics

COURSE OBJECTIVES:

1. To learn about solar radiation and solar thermal system application.
2. To provide knowledge on fundamentals and sizing of solar photovoltaics .
3. To study about the potential and energy conversion process of Wind Energy and Bio Energy.
4. To impart fundamental knowledge about Ocean Thermal Energy and Geothermal Energy.
5. To provide knowledge about the recent trends in Hydrogen and Fuel Cells.

COURSE OUTCOMES:

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

CO1: Understand the necessity of renewable energy sources and its potential in and around the world.
CO2: Explain the concept of the various methods of solar thermal energy conversion system and Photovoltaic system
CO3: To study about the potential and energy conversion process of Wind Energy.
CO4: Explain bio gas sources, generation and its impact on environment.
CO5: To impart fundamental knowledge about Ocean Thermal Energy and Geothermal Energy.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	-	-	-	-	-	-	-	2	2	-	-
CO2	2	2	3	-	2	-	-	-	-	-	-	2	2	-	-
CO3	2	2	3	-	2	-	-	-	-	-	-	2	2	-	-
CO4	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-
CO5	2	2	2	-	2	-	-	-	-	-	-	2	2	-	-

COURSE CONTENTS:

MODULE I INTRODUCTION **9 Hours**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamil nadu, India and around the World – Potentials - Achievements /Applications – Economics of renewable energy systems.

MODULE II SOLARENERGY **9 Hours**

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

MODULE III WINDENERGY **9 Hours**

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects.

MODULE IV BIO– ENERGY **9 Hours**

Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters –Ethanol production – Biodiesel – Cogeneration – Biomass Applications.

MODULE V OTHER RENEWABLE ENERGY SOURCES **9 Hours**

Tidal energy – Wave Energy– Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy –Hydrogen and Storage – Fuel Cell Systems – Hybrid Systems.

TOTAL: 45 HOURS

REFERENCES:

1. *1.Rai.G.D.,"NonConventionalEnergySources",KhannaPublishers,NewDelhi,2018.*
2. *2.Twidell,J.W.&Weir,A.,"RenewableEnergySources",EFNSponLtd.,UK,secondedition*
3. *3.Boyle,Godfrey.2004."RenewableEnergy(2ndedition)".OxfordUniversityPress,450pages (ISBN:0-19-926178-4).*
4. *4.JADuffieandWABeckman"SolarEngineeringofThermalProcesses" 3rd edition*
5. *5.Sukhatme,SuhasP.,andJ.K.Nayak."Solarenergy",McGraw-HillEducation,2017.*
6. *6. https://onlinecourses.nptel.ac.in/noc19_ge11/course*

2302ME551 COMPUTER AIDED DESIGN LABORATORY

L	T	P	C
0	0	2	1

PREREQUISITE:

1. Engineering Graphics

COURSE OBJECTIVES:

1. Introduce students to 3D modeling software
2. Develop skills in creating 3D part models of mechanical components.
3. Teach assembly modeling techniques for machine elements.
4. Enhance understanding of real – world mechanical systems through 3D visualization.
5. Prepare students for industry – standard design practices using software tools.

COURSE OUTCOMES:

After completing this course, students will be able to

CO1: Apply the interface and tools of 3D modeling software.
CO2: Create 3D part models of mechanical components with proper dimensions and constraints.
CO3: Assemble machine components using mating conditions (constraints, joints, etc.).
CO4: Analyze the functionality of mechanical assemblies through virtual simulation.
CO5: Apply industry best practices in 3D modeling for real-world applications.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	-	-	-	-	3	-	2	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	-	2	3
CO3	3	3	3	3	3	-	-	-	-	-	-	3	-	2	3
CO4	3	3	3	3	3	-	-	-	-	-	-	3	-	2	3
CO5	3	3	3	3	3	-	-	-	-	-	-	3	-	2	3

LIST OF EXPERIMENTS:

1. Modeling of Horizontal Shaft Support
2. Modeling of Ribbedangle Plate
3. Modeling of Jig Plate
4. Modeling of Tail Stock
5. Modeling and assembly of Flange Coupling
6. Modeling and assembly of knuckle Joint
7. Modeling and assembly of Screw Jack
8. Modeling and assembly of Universal Coupling
9. Modeling and assembly of Gland and Stuffing box
10. Modeling and assembly of Connecting rod

TOTAL: 30 HOURS

REFERENCES:

1. *Automation,Productionsystem&ComputerIntegratedmanufacturing,M.P.GrooverPersonIndia, 2007 2nd edition.*
2. *PrinciplesofComputerIntegratedManufacturing,S.KantVajpayee,PrenticeHallIndia.*
3. *IbrahimZeid,CAD/CAMTheoryandPractice,McGrawHill,2007*
4. *MikellP.GrooverandEmoryW.Zimmer,CAD/CAM–Computeraideddesignandmanufacturing, Pearson Education,1987*
5. *T.R.ChandrupatlaandA.D.Belagundu,IntroductiontoFiniteElementsinEngineering,Pearson Education, 2012*

2302ME552 MATERIALTESTING AND CHARACTERIZATION LABORATORY

L	T	P	C
0	0	4	2

PREREQUISITE:

1. Engineering Materials
2. Physics and Chemistry
3. Metrology and Measurement Techniques

COURSE OBJECTIVES:

1. To understand and analyze the wear behavior of different materials under dry and lubricated conditions
2. To investigate micro hardness of metals
3. To explore fatigue and delamination behavior in various materials.
4. To program and operate Wire Electrical Discharge Machining (WEDM) for precision machining applications

COURSE OUTCOMES:

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

CO1: Analyze wear characteristics of materials under dry, lubricated, and thermal conditions.
CO2: Perform fatigue and delamination tests and interpret failure mechanisms.
CO3: Conduct micro – hardness testing
CO4: Use optical microscopy to identify and interpret macrostructures in alloys and composites.
CO5: Program WEDM parameters and machine complex shapes with precision.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	2	2	-	-	-	-	2	-	2	3	-	1
CO2	3	2	2	2	-	-	-	-	-	2	-	2	3	-	1
CO3	3	-	2	-	-	-	-	-	-	-	-	1	3	-	1
CO4	3	-	2	-	2	-	-	-	-	-	-	1	3	-	1
CO5	3	2	2	2	3	-	-	-	-	-	-	2	3	-	1

LIST OF EXPERIMENTS:

1. Study of Dry Sliding wear of a various materials
2. Study of wear testing of various materials with lubricant recirculation
3. Study of wear testing with Pinheating of various materials
4. Fatigue delamination of materials
5. Micro hardness testing on alloy and composite
6. Optical microscopic study using video microscope
7. Programming of WEDM process parameter
8. Machining of various model using WEDM.

TOTAL: 30 HOURS

REFERENCES:

1. *Callister,W.D.,&Rethwisch,D.G,Materials ScienceandEngineering:AnIntroduction(10thed.) 2020*
2. *Kalpakjian,S.,&Schmid,S.R.,ManufacturingEngineeringandTechnology(7thed.).Pearson Education., 2014*
3. *ASMInternational.,ASMHandbookVolume8:MechanicalTestingandEvaluation.ASM International., 2002*
4. *SeropeKalpakjian&StevenR.Schmid,MaterialsandProcessesinManufacturing(11thed.).,2016*