E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

NAGAPATTINAM – 611 002.

(Affiliated to Anna University, Chennai | Accredited by NAAC with 'A++' Grade

Accredited by NBA | Approved by AICTE, New Delhi)

B.E MECHANICAL ENGINEERING

Second Year – Fourth Semester

SL.NO	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CREDITS	Max. Marks		
				L	T	P		CA	ES	Total
Theory Courses										
1.	2302ME401	Thermal Engineering	PCC	3	0	0	3	40	60	100
2.	2302ME402	Hydraulics and Pneumatics	PCC	3	0	0	3	40	60	100
3.	2302ME403	Manufacturing Technology II	PCC	3	0	0	3	40	60	100
4.	2302ME404	Metrology and Measurements	PCC	3	0	0	3	40	60	100
5.	2302ME405	Strength of Materials	PCC	3	0	0	3	40	60	100
6.	2301MC40X	Mandatory Course-I[&]	MC	3	0	0	0	-	-	-
7.	2301HSX01	Universal Human Values and Ethics	HSMC	2	0	0	2	100	-	100
Laboratory Courses										
8.	2302ME451	Manufacturing Technology Laboratory II	PCC	0	0	2	1	60	40	100
9.	2302ME452	Strength of Materials Laboratory	PCC	0	0	2	1	60	40	100
10.	2302ME453	Metrology and Measurements Laboratory	PCC	0	0	2	1	60	40	100
11.	2302ME454	Thermal Engineering Lab	PCC	0	0	2	1	60	40	100
12.	2304GE401	Professional Development course 2[$]	EEC	0	0	2	1	100	-	100
13.	2301LS401	**Life skill course** 4[#]	MC	0	0	0	-	-	-	-
		TOTAL		-	-	-	**22**	**640**	**460**	**1100**

& - Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC- I)

$ - Professional Development courses delivered by T&P Dept – Soft skills, Aptitudes I & II

2302ME401	THERMAL ENGINEERING	L	T	P	C
		3	2	0	4

PREREQUISITE:

1. Engineering Mathematics I & II
2. Engineering Thermodynamics

COURSE OBJECTIVES:

1. To learn the concepts and laws of thermodynamics to predict the operation of thermodynamic cycles and performance of Internal Combustion(IC) engines and Gas Turbines.
2. To analyzing the working of IC engines and various auxiliary systems present in IC engines
3. To analyzing the performance of steam nozzle, calculate critical pressure ratio
4. To analyzing the performance of Air Compressor
5. To evaluate the performance of Refrigeration and Air conditioning system

COURSE OUTCOMES:

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

CO1:	Calculate mean effective pressure and air standard efficiency of various gas power cycles.
CO2:	Determine the performance characteristics of internal combustion engines.
CO3:	Describe the performance characteristics of steam nozzles and steam turbines and vapour cycles
CO4:	Calculate the performance characteristics of air compressors.
CO5:	Calculate the performance characteristics of refrigeration and air conditioning systems.
CO6:	Design a suitable air conditioning system by cooling load calculation.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	-	-	1	-	-	-	1
CO2	3	3	3	2	2	-	-	1	-	-	-	1
CO3	3	2	2	2	1	1	1	-	-	-	-	1
CO4	3	3	2	2	2	2	1	1	-	-	-	1
CO5	3	2	2	2	1	1	2	-	-	-	-	1
CO6	3	2	3	3	1	2	3	-	-	-	-	1

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

COURSE CONTENTS:

MODULE I **GAS POWER CYCLES** **12 Hours**

Otto, Diesel, Dual, Brayton cycles, Calculation of mean effective pressure, and air standard efficiency - Comparison of cycles.

MODULE II	**INTERNAL COMBUSTION ENGINES**	**12 Hours**
Classification - Components and their function. Valve timing diagram and port timing diagram - actual and theoretical p-V diagram of four stroke and two stroke engines. Simple and complete Carburettor.MPFI, Diesel pump and injector system.Battery and Magneto Ignition System - Principles of Combustion and knocking in SI and CI Engines.Lubrication and Cooling systems.Performance calculation.		
MODULE III	**STEAM NOZZLES,STEAM TURBINE AND VAPOUR CYCLE**	**12 Hours**
Flow of steam through nozzles, shapes of nozzles, effect of friction, critical pressure ratio, supersaturated flow.Impulse and Reaction principles, compounding, velocity diagram for simple and multi-stage turbines, speed regulations –Governors, simple rankine cycle, reheat , reheat & regenerative cycles.		
MODULE IV	**AIR COMPRESSOR**	**12 Hours**
Classification and working principle of various types of compressors, work of compression with and without clearance, Volumetric efficiency, Isothermal efficiency and Isentropic efficiency of reciprocating compressors, Multistage air compressor and inter cooling –work of multistage air compressor		
MODULE V	**REFRIGERATION AND AIR CONDITIONING**	**12 Hours**
Refrigerants - Vapour compression refrigeration cycle- super heat, sub cooling – Performance calculations - working principle of vapour absorption system, Ammonia –Water, Lithium bromide – water systems (Description only) .Air conditioning system - Processes, Types and Working Principles. - Concept of RSHF, GSHF, ESHF- Cooling Load calculations.		
		TOTAL: 60 HOURS

REFERENCES:

1. *Rajput.R.K.,"ThermalEngineering"S.ChandPublishers,Ninthedition*
2. *Sarkar,B.K,"ThermalEngineering"TataMcGraw-HillPublishers,2007*
3. *Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 1994*
4. *GanesanV.."InternalCombustionEngines",ThirdEdition,TataMcgraw-Hill2007*
5. *Rudramoorthy,R,"ThermalEngineering",TataMcGraw-Hill,NewDelhi,2003.*

2302ME402	HYDRAULICS AND PNEUMATICS	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Fluid Mechanics and Machinery

COURSE OBJECTIVES:

1. To provide knowledge on the working principles of fluid power systems.
2. To study the fluids and components used in modern industrial fluid power system.
3. To develop the design, construction, and operation of fluid power circuits.
4. To learn the working principles of a pneumatic power system and its components.
5. To provide knowledge of troubleshooting methods in fluid power systems

COURSE OUTCOMES:

At the end of the course the students would be able to

CO1:	Apply the working principles of fluid power systems and hydraulic pumps
CO2:	Apply the working principles of hydraulic actuators and control components.
CO3:	Design and develop hydraulic circuits and systems.
CO4:	Apply the working principles of pneumatic circuits and power system and its components.
CO5:	Identify various troubles shooting methods in fluid power systems.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	2	1	1
CO2	2	1	1
CO3	2	1	1
CO4	2	1	1
CO5	2	1	1

COURSE CONTENTS:

MODULE I	FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS	9 Hours

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.

MODULE II	HYDRAULIC ACTUATORS AND CONTROL COMPONENTS	9 Hours

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.

MODULE III	**HYDRAULIC CIRCUITS AND SYSTEMS**	**9 Hours**

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.

MODULE IV	**PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS**	**9 Hours**

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.

MODULE V	**TROUBLE SHOOTING AND APPLICATIONS**	**9 Hours**

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 HOURS

REFERENCES:

1. *Anthony Esposito, "Fluid Power with Applications", Pearson Education 2005.*
2. *Majumdar S.R., "Oil Hydraulics Systems- Principles and Maintenance", Tata McGrawHill, 2001*
3. *Anthony Lal, "Oil hydraulics in the service of industry", Allied publishers, 1982.*
4. *Dudelyt, A. Pease and John T. Pippenger, "Basic Fluid Power", Prentice Hall, 1987.*
5. *Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995*
6. *Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.*
7. *Shanmugasundaram.K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.*

2302ME403	MANUFACTURING TECHNOLOGY – II	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Workshop Practice Laboratory
2. Fundamentals of Mechanical Engineering
3. Manufacturing Technology – I

COURSE OBJECTIVES:

1. To impart knowledge about the methods of manufacturing process.(Casting, Moulding ,forging and sheet metal operations)
2. To impart knowledge about the metal joining process.
3. To impart knowledge about the operation of lathe machine.

COURSE OUTCOMES:

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

CO1:	Measure various cutting forces for doing cutting operations.
CO2:	Produce the simple component by shaping, milling and gear cutting operations.
CO3:	produce the component using reciprocating machines, drilling and boring machines.
CO4:	Explain broaching and grinding machine and their operation.
CO5:	Explain CNC machine and their operation.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	3	-
CO2	-	2	-
CO3	-	3	-
CO4	-	2	-
CO5	-	3	-

COURSE CONTENTS:

MODULE I **METAL CUTTING THEORY** **9 Hours**

Introduction - Orthogonal, Oblique Cutting and types of chip formation. Mechanisms of metal cutting - Shear plane, Stress, Strain and cutting forces. Merchants Circle - Deriving the forces, calculations. Cutting tool - Properties, materials, wear, single point tool nomenclature, tool life and its calculations. cutting fluids - Types and its properties.

MODULE II	**MILLING MACHINE AND GEAR CUTTING MACHINES**	**9 Hours**
Milling - Introduction, types, up milling, down milling, operations, and nomenclature of plain milling cutter. Indexing - simple and differential indexing methods. Gear cutting-gear milling, gear shaper and gear hobber		
MODULE III	**RECIPROCATING MACHINES, DRILLING AND BORING MACHINES**	**9 Hours**
Shaper, Planer and Slotter - Introduction, types, specification and quick return mechanisms. Drilling - Introduction, types, construction of universal drilling machine, specification, types of drills and nomenclature of twist drill. Introduction to horizontal boring machine.		
MODULE IV	**BROACHING AND FINISHING PROCESSES**	**9 Hours**
Broaching - Introduction, types and tool nomenclature. Finishing processes - Grinding -Introduction, types, grinding wheel- specification, selection, glazing, loading, dressing and truing. Fine finishing processes - Honing, lapping, polishing, buffing and super finishing.		
MODULE V	**CNC MACHINES**	**9 Hours**
Computer Numerical Control (CNC) machine tools, Constructional details,special features – Drives, Recirculating ball screws, tool changers; CNC control systems – Open/closed, point-to-point/continuous - Turning and machining centres – Work holding methods in Turning and machining centres, Coolant systems,Safety features.		
		TOTAL: 45 HOURS

REFERENCES:

1. *J. P. Kaushish, Manufacturing Processes, Prentice Hall India Learning Private Limited., New Delhi, 2013.*
2. *SeropeKalpakjian and Steven R Schmid, Manufacturing Engineering and Technology, Pearson Education Limited., New Delhi, 2013*
3. *P. N. Rao, Manufacturing Technology- Metal Cutting and Machine Tools, Tata McGraw Hill Publishing Company Private Limited., New Delhi, 2013*
4. *S. K. HajraChoudhury, Elements of Workshop Technology. Vol. II, Media Promoters & Publishers Private Limited., Mumbai, 2013.*
5. *http://nptel.ac.in/courses/112105126*

2302ME404	METROLOGY & MEASUREMENTS	L	T	P	C
		3	0	0	3

PREREQUISITE:

1. Engineering Science
2. Engineering Mathematics
3. Engineering Measurements

COURSE OBJECTIVES:

1. To study the concepts of measurement and characteristics of instruments.
2. To learn the method of linear and angular measurements.
3. To provide knowledge on measurement of thread and gear terminologies using suitable instruments
4. To study the use of laser and advances in metrology for linear geometric dimensions.
5. To provide knowledge on measurement of mechanical parameters using suitable instruments.

COURSE OUTCOMES:

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

CO1:	Explain the basic concepts of measurement and characteristics of measuring instruments..
CO2:	Practice the appropriate linear and angular measurements using precision measuring instruments.
CO3:	Examine the major terminologies for screw thread, gear and roundness measurement.
CO4:	Apply the advanced techniques in metrology to calculate the geometric dimensions.
CO5:	Explain the methods used to measure the mechanical parameters.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	2	-
CO3	-	2	-
CO4	-	2	-
CO5	-	2	-

COURSE CONTENTS:

MODULE I **CONCEPT OF MEASUREMENT** **9 Hours**

Introduction: Definition, Objectives, Elements of Measuring System, Accuracy and Precision - Units and Standards - Characteristics of measuring instrument: Sensitivity, Stability, Interchangeability, Range of accuracy, Readability, Reliability, Backlash, Repeatability and Reproducibility – Calibration - Errors in Measurement: Static and dynamic errors - Care of Measuring Instruments

MODULE II	**LINEAR AND ANGULAR MEASUREMENTS**	**9 Hours**
Linear Measurements: Vernier Caliper, Vernier Height and Depth Gauges, Micrometer and depth micrometer, Slip gauge, limit gauge and its classification - Comparator: Mechanical, Pneumatic and Electrical types - Angular Measurements: Bevel protractor, Sine bar, Angle Decker, Autocollimator.		
MODULE III	**FORM MEASUREMENT**	**9 Hours**
Thread Measurement: Terminologies, Errors - External Thread Measurement: Pitch Gauge, Tool Maker's microscope, Floating Carriage micrometer with One, Two and Three wires - Internal Thread Measurement: Taper Parallels and Rollers method. Gear Measurement: Terminologies, Errors, Gear Tooth Vernier caliper, Profile Projector, Base pitch measuring instrument, Involutes tester, Parkinson Gear Tester - External and Internal Radius measurements - Roundness measurement: Circumferential confining gauge, Assessment using V block and Rotating centres.		
MODULE IV	**LASER AND ADVANCES IN METROLOGY**	
Interferometer: NPL Flatness, Laser, Michelson - Computer Aided Inspection - Digital Devices - Machine Vision System - Coordinate Measuring Machine: Basic concept, Types, Constructional features, Probes, Accessories - Surface Roughness Measurement - Straightness Measurement - Squareness Measurement - Machine Tool Metrology.		
MODULE V	**MEASUREMENT OF MECHANICAL PARAMETERS**	**9 Hours**
Measurement of Force - Principle, analytical balance, platform balance, proving ring. Torque - Prony brake, hydraulic dynamometer. Measurement of Power: Linear and Rotational - Pressure Measurement: Principle, use of elastic members, Bridgeman gauge, Mcleod gauge, Pirani gauge - Temperature Measurement: bimetallic strip, thermocouples, metal resistance thermometer, pyrometers.		
		TOTAL: 45 HOURS

REFERENCES:

1. *Jain R.K. "Engineering Metrology", Khanna Publishers, 2005.*
2. *Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.*
3. *Charles Reginald Shotbolt, "Metrology for Engineers", 5th edition, Cengage Learning EMEA, 1990.*
4. *Backwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education, 2006.*
5. *https://nptel.ac.in/courses/112106179/*

2302ME405	STRENGTH OFMATERIALS	L	T	P	C
		3	2	0	4

PREREQUISITE:

1. Engineering Physics
2. Engineering Mathematics
3. Engineering Mechanics

COURSE OBJECTIVES:

1. To understand the concepts of stress, strain, principal stresses and principal planes.
2. To study the stresses and deformations induced in thin and thick shells.
3. To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses.
4. To compute slopes and deflections in determinate beams by various methods.
5. To determine stresses and deformation in circular shafts and helical spring due to torsion.

COURSE OUTCOMES:

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

CO1:	Find the stress distribution and strains in regular and composite structures subjected to axial loads.
CO2:	Evaluate the compound stresses in two dimensional systems and thin cylinders.
CO3:	Assess the shear force, bending moment and bending stresses in beams under transverse loading.
CO4:	Evaluate the slope and deflection of beams under different boundary conditions.
CO5:	Apply torsion equation in design of circular shafts and helical springs.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	2	-	-
CO3	2	-	-
CO4	2	-	-
CO5	2	-	-

COURSE CONTENTS:

MODULE I **STRESS,STRAINAND DEFORMATION OFSOLIDS** **12 Hours**

Introduction to material properties. Stresses and strains due to axial force, shear force, impact force and thermal effect-stepped and composite bars-uniformly varying cross section. Stress-strain curve for ductile and brittle materials Hooke-law - Factor of safety Poisson-ratio. Elastic constants and their relationship.

MODULE II	**ANALYSIS OFSTRESSES INTWO DIMENSIONS**	**12 Hours**
State of stresses at a point- Normal and shear stresses on inclined planes - Principal planes and stresses Plane of maximum shear stress – Mohr's -circle for biaxial stress with shear stress. Hoop and longitudinal stresses in thin cylindrical and spherical shells - Changes in dimensions and volume.		
MODULE III	**LOADS ANDSTRESSESINBEAMS**	**12 Hours**
Types of beams- Supports and Loads, Shear force and Bending Moment in beams, Cantilever, simply supported and overhanging beams - Point of contra flexure. Theory of simple bending - bending and shear stress - stress variation along the length and section of the beam, Section modulus.		
MODULE IV	**DEFLECTION OFBEAMS**	**12 Hours**
Elastic curve – Governing differential equation - Double integration method - Macaulay's method – Area moment method - Conjugate beam method for computation of slope and deflection of determinant beams.		
MODULE V	**TORSIONINSHAFT AND HELICALSPRING**	**12 Hours**
Analysis of torsion of circular solid and hollow shafts-stepped shaft-compound shaft- Shear stress distribution, angle of twist and torsional stiffness. Closed coil helical spring- stresses and deflection under axial load- Maximum shear stress in spring section.		
		TOTAL: 60 HOURS

REFERENCES:

1. *Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand& company Ltd., New Delhi, 7th edition, 2018.*
2. *Rattan S.S., "Strength of Materials", Tata McGraw Hill Education Pvt .Ltd., New Delhi, 2017.*
3. *Singh. D.K., "Strength of Materials", Ane Books Pvt Ltd., New Delhi, 2021.*
4. *Beer. F.P. & Johnston. E.R. "Mechanics of Materials", Tata McGraw Hill, 8th Edition, New Delhi2019.*
5. *Egor P Popov, "Engineering Mechanics of Solids", 2nd edition, PHI Learning Pvt. Ltd., NewDelhi, 2015.*
6. *http://www.nptel.ac.in/courses/Webcourse-contents/IIT*

2301HSX01	UNIVERSAL HUMAN VALUES AND ETHICS	L	T	P	C
		2	0	0	2

PREREQUISITE:

1. Professional Ethics

COURSE OBJECTIVES:

2. Reinstate India's rich cultural legacy and human values of which we are the custodians.
3. Focus on professional ethics, which help citizens to discern desirable and undesirable actions.
4. Re-emphasize constitutional values, universal values, and holistic education to create integrated citizens.
5. Lay down broader guidelines of human values and ethics for internal and external stakeholders.

COURSE OUTCOMES:

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

CO1:	Apply critical thinking skills to solve problems and make informed decisions in various contexts.
CO2:	Analyze the principles of effective self - governance and evaluate their implementation in different scenarios.
CO3:	Understand the importance of a fair and transparent system of rewards and reprimand in constitution of India and apply these principles in real-world situations.
CO4:	Analyze the role of an individual to develop social reliability and create awareness about their assertiveness and self - confidence.
CO5:	Understand the knowledge of inner qualities and instruments of one's self in stress management and analyze the effects of meditation in one's physical, mental, social and spiritual well - being.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2
CO1	-	-
CO2	-	-
CO3	-	-
CO4	-	-
CO5	-	-

COURSE CONTENTS:

MODULE I	INTRODUCTION TO INDIAN ETHOS	8 Hours

Meaning of ethos and cultural essence of India – Scriptures as the base of the Indian Knowledge System (IKS) – Integrating the two methodologies: interiorization process for self-exploration, and exterior scientific pursuit for the prosperity of world – The Law of Karma and Nishkama Karma (The Law of action and selfless action).

Practical: Five hours of Yoga practice per week, Ethics through Music and Indian Poetry, Community Engagement.

MODULE II	**Human Values and Ethics**	**9 Hours**

Knowing the Self and the universal values that we stand for - This is self enquiry & self discovery – Background conversations and deep listening - recognizing the assumptions that we make - the biases we have - and the implications for ethical action – Self-identity: distinguishing and embracing oneself (and others) four profiles (inner-potential, social, professional, personality) – Distinguish ideology, perspectives beliefs from embodying values.

Practical: Self-discovery, self-enquiry and Mindfulness, Yama & Niyama of Ashthang Yoga.

MODULE III	**Constitutional Values and Global Citizenship**	**9 Hours**

Values embedded in the Preamble of the Indian Constitution Integration of Human Rights and duties – Directive principles and responsibilities as citizens of India – Sensibility and responsibilities towards global environment, Loksangraha and Vasudhaiva Kutumbakam.

Practical: Debates and Theatre on diversity and plurality, research on similarities and differences in the ethos of different countries.

MODULE IV	**Values and Skills for Youth**	**9 Hours**

Designing to make a difference through strategies using the Conscious Full Spectrum Response model – Listening for commitment behind complaints to transform contentious arguments and create a space for listening and change – Distinguishing judgement from discernment – Being assertive and confident (assertiveness incorporates self-confidence).

Practical : Development of concentration among students through music, fine arts, mathematics, sports, yoga and mindfulness

MODULE V	**Integrated Personality and Well-being**	**10 Hours**

The three gunas (qualities of sattva—purity and harmony, rajas —activity and passion, tamas —darkness and chaos), the four antah-karanas (inner instruments), and panchkosha (five sheaths) – Stress management: meditated personality and agitated personality – Oneness, non-duality, and equanimity – Physical, mental, social, and spiritual well-being.

Practical : Talks on importance of the Ayurvedic concept of well being and nutrition,sports activities

TOTAL: 60 HOURS

REFERENCES:

1. *Blanchard, Kenneth and Peale, Norman Vincent. 1988. The Power of Ethical Management. New York: William Morrow and Company, Inc.*
2. *Gandhi, Mohandas Karamchand. 1971. Pathway to God compiled by MS Deshpande. Ahmedabad: Navajivan Mudranalaya, Navjivan Trust.*
3. *https://fdp-si.aicte-india.org/UHV-II%20Class%20Note.php*

2302ME451	MANUFACTURING TECHNOLOGY- II LAB	L	T	P	C
		0	0	4	2

PREREQUISITE:

1. Workshop Practice Laboratory
2. Manufacturing Technology- I Lab

COURSE OBJECTIVES:

1. To impart the knowledge about the basic operation of lathe.
2. To impart the knowledge about the basic operation of welding machines.
3. To impart the knowledge about stir casting process.

COURSE OUTCOMES:

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

CO1:	Produce spur gear by using universal milling machine, gear hobbing machine, gear shaping machine.
CO2:	Do the surface grinding operation using horizontal grinding machine, vertical grinding machine, cylindrical grinding machine
CO3:	Produce a single point tool using tool and cutter grinder
CO4:	Use the planner machine & vertical milling machine to perform contour, key way operation.
CO5:	Measure the cutting force using milling tool dynamometer.
CO6:	Do the square head shaping and hexagonal head shaping using shaper machine

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	-	2	-	3	-	3	-	-	-	3
CO2	3	3	-	2	-	3	-	3	-	-	-	3
CO3	3	3	-	2	-	3	-	3	-	-	-	3
CO4	3	3	-	2	-	3	-	3	-	-	-	3
CO5	3	3	-	2	-	3	-	3	-	-	-	3
CO6	3	3	-	2	-	3	-	3	-	-	-	3

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	3	-
CO2	-	3	-
CO3	-	3	-
CO4	-	3	-
CO5	-	3	-
CO6	-	3	-

LIST OF EXPERIMENTS:

1. Contour milling using vertical milling maching.
2. Spur gear cutting in milling machine
3. Gear generation in hobbing machine

4. Gear generation in gear shaping machine
5. Horizontal surface grinding
6. Grind the given rod using Cylindrical grinding
7. Grind the given rod using Centreless grinding machine.
8. Drilling and Reaming using drilling machine.
9. Tool angle grinding with tool and Cutter Grinder
10. Square Head Shaping
11. Hexagonal Head Shaping
12. Vertical surface grinding
13. Make a v-block using planner machine.
14. Borning and horning.
15. Measurement of cutting forces in Milling.
TOTAL: 30 HOURS
REFERENCES:
1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company Private Limited, New Delhi, 2010.
2. Serope Kalpakjian, Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Education Limited, New Delhi, 2013.
3. J. P. Kaushish, Manufacturing Processes, Prentice Hall of India Learning Private Limited, New Delhi, 2013.
4. P.C. Sharma, Manufacturing Technology - I, S Chand and Company Private Limited, New Delhi, 2010.
5. S K Hajra Choudhury, Elements of Workshop Technology - Vol. I, Media Promoters & Publishers Private Limited, Mumbai,2013.
6. http://nptel.ac.in/courses/112107144/1.

2302ME452	STRENGTH OF MATERIALS LAB	L	T	P	C
		3	2	0	4

PREREQUISITE:

1. Strength of Materials Basics
2. Physics

COURSE OBJECTIVES:

1. To determine experimental data include universal testing machines and torsion equipment.
2. To determine experimental data for spring testing machine, compression testing machine, impact and hardness tester.
3. To determine stress analysis and design of beams subjected to bending and shearing loads using several methods.

COURSE OUTCOMES:

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

CO1:	Perform the tensile, compressive and shear test on Universal testing machine.
CO2:	Determine the torsion and hardness properties of metals by testing.
CO3:	Determine the stiffness properties of helical spring.
CO4:	Determine the material properties by using load deflection test.
CO5:	Determine the wear properties of the given material with various applied load and sliding speed.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	2	-	-
CO2	2	-	-
CO3	2	-	-
CO4	2	-	-
CO5	2	-	-

LIST OF EXPERIMENTS:

1. Find the hardness of the material using Rockwell and Brinell hardness tester.
2. Determine the micro hardness of the material by using Vickers micro hardness tester.
3. Wear study for the given specimen by using pin on disk apparatus.
4. Experimentally calculate the strain energy of a material subjected to impact loading. (Izod & Charpy

testing)
5. Experiment alanalysis of an axial bar under tension to obtain the stress strain curve by using UTM.
6. Determine the Young-modulus and stiffness of a metaleam through load deflection curve.
7. Experimentally calculate the compressive strength of the materials by using hydraulic press.
8. Experimentally calculate the double shear strength of the materials by using UTM.
9. Determination of spring constant through load vs deflection curve.
10. Experiment alanalysis of a bar under torsion to obtain stiffness and angle of twist.
TOTAL: 30 HOURS
REFERENCES:
1. Joseph A. Unfener, Robert L. Mott, "A Text Book of Applied Strength of Materials", sixth Edition
2. S.S.Bhavikatti, "A Text Book of Strength of Materials".
3. Esor P. popov, "A Text Book of Strength of Materials"

2302ME453	ENGINEERING METROLOGY & MEASUREMENTS LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Engineering Metrology & Measurements Basics

COURSE OBJECTIVES:

1. To familiar with different measurement equipments and use of this industry for quality inspection.

COURSE OUTCOMES:

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

CO1:	Ability to handle different basic measurement tools and perform precise measurements.
CO2:	Ability to measure the surface roughness
CO3:	Ability to measure the Straightness using Autocollimator
CO4:	Ability to measure Temperature using Thermocouple
CO5:	Ability to calibrate the measuring device

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	-	2	-
CO2	-	2	-
CO3	-	2	-
CO4	-	2	-
CO5	-	2	-

LIST OF EXPERIMENTS:

1. Comparing the accuracy of Vernier Caliper, Vernier Height Gauge, Vernier Depth Gauge and Micrometer to check the various dimensions of a given specimen.
2. Checking the dimensional limits of ten similar components using Mechanical Comparator.
3. Measurement of taper angle of a given specimen by using Sinebar.
4. Measurement of screw thread specifications by Floating Carriage Micrometer.
5. Measurement of gear tooth specifications by using Gear Tooth VernierCalliper.
6. Measurement of gear tooth specifications by using Tool Maker‟s Microscope
7. Differentiate the work piece by its Surface Roughness value
8. Measurement of Straightness of a given job by using Autocollimator
9. Temperature measurement by using Thermocouple.
10. Measurement of force using Force Measuring Setup.

11. Measurement of Torque using Torque Measuring Setup
12. Measurement of Displacement using LVDT.
13. Measurement of bore diameter using Telescopic Gauge
TOTAL: 30 HOURS
REFERENCES:
1. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005
2. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997.
3. Beckwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education,2006
4. Donald Deckman, "Industrial Instrumentation", Wiley Eastern, 1985.

2302ME454	THERMAL ENGINEERING LABORATORY	L	T	P	C
		0	0	2	1

PREREQUISITE:

1. Thermal Engineering Basics

COURSE OBJECTIVES:

1. To study the valve and port timing diagram and performance characteristics of IC engines
2. To study the Performance of refrigeration cycle / components

COURSE OUTCOMES:

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

CO1:	Draw the port timing and valve timing diagram of two stroke and four stroke internal Combustion Engines
CO2:	Determine the flash point , fire point and Viscosity of the given oil sample.
CO3:	Test the performance of four stroke IC engines with Different Loading.
CO4:	Assess the performance of two stage reciprocating air compressor.
CO5:	Conduct Morse test on multi cylinder petrol engine.
CO6:	Conduct tests to evaluate the performance of refrigeration and airconditioning test rigs

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1	1	1	-	-	-	-	-	-	1
CO2	3	2	1	1	-	-	-	-	-	-	-	1
CO3	3	3	2	2	1	1	1	-	-	-	2	1
CO4	3	2	2	2	2	1	1	-	-	-	-	1
CO5	3	2	2	1	1	1	2	-	-	-	-	1
CO6	3	2	1	1	1	2	2	-	-	-	-	1

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	3	-	-
CO2	3	-	-
CO3	3	-	-
CO4	3	-	-
CO5	3	-	-
CO6	3	-	-

LIST OF EXPERIMENTS:

1. Port timing and valve timing diagram of IC engines.
2. Determination of flash point and fire point of the given oil sample.
3. Determination of dynamic is cosity of the given oil sample using Red wood viscometer
4. Performance on 4-Stroke diesel engine with mechanical loading.
5. Performance on 4-Stroke diesel engine with electrical loading
6. Performance on 4-Stroke diesel engine with hydraulic loading.
7. Heat balance test on 4-Stroke diesel engine with mechanical loading.

8. Morse test on multi-cylinder petrol engine.
9. Retardation test on 4-Strokedieselengine with mechanical loading.
10. Performance of two stage reciprocating air compressor.
11. Determination of Coefficient of Performance of refrigeration system
12. Determination of Coefficient of Performance of Air-conditioning system.
TOTAL: 30 HOURS
REFERENCES:
1. *Rajput.R.K.,"ThermalEngineering"S.ChandPublishers,Ninthedition*
2. Sarkar,B.K,"ThermalEngineering"TataMcGraw-HillPublishers,2007
3. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 1994
4. GanesanV.."InternalCombustionEngines",ThirdEdition,TataMcgraw-Hill2007