

E.G.S. PILLAY ENGINEERING COLLEGE

(Autonomous)

Approved by AICTE, New Delhi | Affiliated to Anna University, Chennai

Accredited by NAAC with 'A' Grade | Accredited by NBA (CSE, EEE, MECH)

NAGAPATTINAM – 611 002



B.E MECHANICAL ENGINEERING

Second Year – Fourth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1901MA402	Engineering Mathematics III	3	2	0	4	40	60	100
1902ME401	Engineering metrology & measurements	3	0	0	3	40	60	100
1902ME402	Thermal Engineering	3	2	0	4	40	60	100
1902ME403	Manufacturing Technology II	3	0	0	3	40	60	100
1901ME404	Biology for Engineers	3	0	0	3	40	60	100
Laboratory Course								
1902ME451	Thermal Engineering lab	0	0	2	1	50	50	100
1902ME452	Manufacturing Technology II lab	0	0	2	1	50	50	100
1902ME453	Engineering metrology & measurements lab	0	0	2	1	50	50	100
1904GE451	Life Skills: Verbal Ability	0	0	2	1	100	-	100
Audit Course								
1901MCX02	Constitution of India	2	0	0	0	-	-	-

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

1901MA402	ENGINEERING MATHEMATICS III							L	T	P	C	
							3	2	0	4		
MODULE I	FOURIER SERIES							12 Hours				
Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series – Parseval's identity – Harmonic analysis.												
MODULE II	FOURIER TRANSFORMS							12 Hours				
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity												
MODULE III	APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS							12 Hours				
Classification of PDE – Solutions of one-dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.												
MODULE IV	NUMERICAL DIFFERENTIATION							12 Hours				
Approximation of derivatives using interpolation polynomials -Taylor's series method – Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order equations												
MODULE V	NUMERICAL INTEGRATION							12 Hours				
Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's method - Two point and three-point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.												
TOTAL: 60 HOURS												
COURSE OUTCOMES:												
On the successful completion of the course, students will be able to												
CO1:	Use Euler Coefficients to express periodic function of Fourier sine and cosine series.											
CO2:	Solve definite integrals of given functions using Fourier transforms											
CO3:	Solve boundary value problem using partial differential equation											
CO4:	Calculate the numerical solution for first order ordinary differential equation using Euler's, Modified Euler's, Runge-Kutta and Taylor's series method.											
CO5:	Solve the definite integral and differentiation from a set of tabulated values by Newton's, Trapezoidal and Simpson's method.											
COs Vs POs MAPPING:												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	2	1									
CO3	3	2	1									
CO4	3	2	1									
CO5	3	2	1									
COs Vs PSOs MAPPING:												
	COs	PSO1	PSO2	PSO3								
	CO1	1										
	CO2	1										
	CO3	1										
	CO4	1										
	CO5	1										
REFERENCES:												
1. Veerarajan. T., "Transforms and Partial Differential Equations", Second reprint, Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2012.												
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.												
3. Narayanan.S.,Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.												
4. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.												
5. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.												
6. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.												

1902ME401	ENGINEERING METROLOGY & MEASUREMENTS				L	T	P	C				
					3	0	0	3				
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, Involute 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							9 Hours				
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												
COURSE OUTCOMES:												
On the successful completion of the course, students will be able to												
CO1:	Explain the basic concept of measurement and characteristics of measuring instruments.											
CO2:	Make use of precision instruments for linear and angular measurements.											
CO3:	Determine the gear and thread parameters using suitable instruments.											
CO4:	Demonstrate the advanced techniques in metrology for linear geometric dimensions.											
CO5:	Measure the mechanical parameters using suitable instruments.											
COs Vs POs MAPPING:												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1				2						2
CO2	2	1			1	2						2
CO3	3	2		3	2	2			2	1		2
CO4	2	1				2						2
CO5	3	2		3		2		2	2	1		2
COs Vs PSOs MAPPING:												
	COs	PSO1	PSO2	PSO3								
	CO1		2									
	CO2		2									
	CO3		3									
	CO4		2									
	CO5		3									

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/>

1902ME402	THERMAL ENGINEERING				L	T	P	C				
					3	2	0	4				
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 Carburetor. 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 AND TURBINE				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.												
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 RSHP, GSHP, ESHF- Cooling Load calculations.												
TOTAL: 60 HOURS												
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.											
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
COs Vs PSOs MAPPING:												
	COs	PSO1	PSO2	PSO3								
	CO1	3										
	CO2	3										
	CO3	3										
	CO4	3										
	CO5	3										
REFERENCES:												
1. Rajput. R. K., “Thermal Engineering” S.Chand Publishers, Ninth edition												

2. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007
3. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 1994
4. Ganesan V.." Internal Combustion Engines" , Third Edition, Tata McGraw-Hill 2007
5. Rudramoorthy, R, "Thermal Engineering ",Tata McGraw-Hill, New Delhi,2003

1902ME403	MANUFACTURING TECHNOLOGY -II				L	T	P	C				
					3	0	0	3				
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. Merchant's 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	LATHE, SEMI AUTOMATS AND AUTOMATS							9 Hours				
Introduction - Types- Centre Lathe - Construction, specification, operations. Mechanisms - Head stock driven using all geared type and thread cutting. Work holding devices - Centres, chucks, carrier with catch plate and face plates. Calculation of machining time - Capstan and turret lathes - Introduction, turret indexing and bar feeding mechanism. Automats - single spindle, multi spindle and their types.												
MODULE III	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 IV	RECIPROCATING MACHINES, DRILLING & 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 V	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.												
TOTAL: 45 HOURS												
COURSE OUTCOMES:												
On the successful completion of the course, students will be able to												
CO1:	Explain the mechanisms of metal cutting, cutting tool materials, tool wear and cutting fluids.											
CO2:	Discuss about the constructional features of different types of lathe parts and their operations.											
CO3:	Describe the construction and working of milling and gear											
CO4:	Illustrate the various types of reciprocating, drilling and boring machines.											
CO5:	Describe the construction and working of broaching and finishing process.											
COs Vs POs MAPPING:												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3			1	1	1	1	1		3
CO2	3	2	3									3
CO3	3	2	2									
CO4	3	2	3	3								3
CO5	3	2	3		2	1	1	1	1			3
COs Vs PSOs MAPPING:												
	COs	PSO1	PSO2	PSO3								
	CO1		2									
	CO2		2									
	CO3		2									
	CO4		2									
	CO5		2									

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. P.C Sharma, Manufacturing Technology - II, S. Chand & Company Limited. New Delhi, 2012.
6. <http://nptel.ac.in/courses/112105126>

1902ME404	BIOLOGY FOR ENGINEERS			L	T	P	C
				3	0	0	3
MODULE I	BIOLOGY INTRODUCTION AND ITS CLASSIFICATION			7 Hours			
<p>Introduction to Biology, fundamental differences between science and engineering by drawing a comparison between eye and camera, Bird flying and aircraft. Exciting aspect of biology - need to study biology- Discussion about biological observations of 18th Century - major discoveries. Examples from Brownian motion and the origin of thermodynamics - original observation of Robert Brown and Julius Mayor.</p> <p>Classification - morphological, biochemical or ecological. Hierarchy of life forms at phenomenological level. classification based on (a) cellularity- Unicellular or multicellular (b) ultrastructure- prokaryotes or eucaryotes. (c) energy and Carbon utilization -Autotrophs, heterotrophs, lithotropes (d) Ammonia excretion – aminotelic, uricotelic, ureotelic (e) Habitata- aquatic or terrestrial (e) Molecular taxonomy- three major kingdoms of life. Model organisms for the study of biology- E.coli, S.cerevisiae, D. Melanogaster, C. elegance, A. Thaliana, M. musculus</p>							
MODULE II	GENETICS AND MACROMOLECULAR ANALYSIS			10 Hours			
<p>Genetics - Newton’s laws to Physical Sciences”- Mendel’s laws, Concept of segregation and independent assortment. Concept of allele. Gene mapping, Gene interaction, Epistasis. Meiosis and Mitosis - part of genetics. Concepts of recessiveness and dominance. Concept of mapping of phenotype to genes. Single gene disorders in humans. Complementation using human genetics.</p> <p>Macromolecular analysis: analyses of biological processes at the reductionistic level Proteins- structure and function. Hierarch in protein structure. Primary secondary, tertiary and quaternary structure. Proteins as enzymes, transporters, receptors and structural elements.</p>							
MODULE III	BIOMOLECULES AND ENZYMES			10 Hours			
<p>Biomolecules - Molecules of life. monomeric units and polymeric structures. Sugars, starch and cellulose. Amino acids and proteins. Nucleotides and DNA/RNA. Two carbon units and lipids.</p> <p>Enzymes - monitor enzyme catalyzed reactions. Enzyme catalyzereactions. Enzyme classification. Mechanism of enzyme action -two examples. Enzyme kinetics and kinetic parameters. RNA catalysis.</p> <p>Information Transfer - The molecular basis of coding and decoding genetic information - universal Molecular basis of information transfer. DNA - genetic material. Hierarchy of DNA structure- from single stranded to double helix to nucleosomes. Concept of genetic code. Universality and degeneracy of genetic code. Gene in terms of complementation and recombination.</p>							
MODULE IV	METABOLISM AND MICROBIOLOGY			8 Hours			
<p>Metabolism: principles of energy transactions. Thermodynamics to biological systems. Exothermic and endothermic versus endergonic and exergoinc reactions. Concept of Keq and its relation to standard free energy. Spontaneity. ATP - energy currency. Breakdown of glucose to CO₂ + H₂O (Glycolysis and Krebs cycle) - synthesis of glucose from CO₂ and H₂O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge</p> <p>Microbiology Concept of single celled organisms. Concept of species and strains. Identification and classification of microorganisms. Microscopy. Ecological aspects of single celled organisms. Sterilization and media compositions. Growth kinetics.</p>							
MODULE V	BIO-INSPIRED ENGINEERING			10 Hours			
<p>Introduction to biologically-inspired designs (BID for Biomedical and Non-biomedical applications): Human-organs-on-chips; Muscular Biopolymers; Bio-optics; Nanostructures for Drug Delivery; Genetic Algorithms; Artificial neural networks; Swarm intelligence algorithms; Biosensors: role in medical diagnostics (Sensium digital plaster); environmental monitoring; Bio-filters; Bio-robotics; 3D Bio-printing; Self healing concrete.</p>							
TOTAL: 45 HOURS							
COURSE OUTCOMES:							
On the successful completion of the course, students will be able to							
CO1:	Discuss the historical context of biological discoveries and observations impacting engineering.						
CO2:	Discuss the genetic principles and their practical applications in engineering and Macromolecular Analysis: Explore the structure and function of macromolecules, particularly proteins.						
CO3:	Summarize the biological principles to engineering through an understanding of biomolecules and						

	Grasp enzyme catalysis, kinetics, and genetic information decoding.
CO4:	Discuss the Understand energy transactions, metabolism, and microbiology principles relevant to engineering.
CO5:	Summarize the Bio inspired Design in medical and algorithms.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1			
CO2			
CO3			
CO4			
CO5		3	

REFERENCES:

1. Biology for Engineers, Rajiv Singal , CBS Publishers and Distributors Pvt Ltd; First Edition edition (4 June 2019).
2. Biology for Engineers, Wiley Editorial, Wiley (2018).
3. Principles of Soft Computing, S. N. Sivanandam, S. N. Deepa, Wiley; Third edition (2018).
4. Computational Medicine: Tools and Challenges, Zlatko Trajanoski, Springer; 2012 edition (19 September 2012).
5. Health Informatics - E-Book: An Interprofessional Approach, Ramona Nelson, Nancy Staggers, Elsevier; 2 edition (December 8, 2016).
6. Biology for Engineers, G.K..Suraishkumar, Oxford University Press.
7. Biology for Engineers, Arthur T. Johnson, CRC Press.

1902ME451	THERMAL ENGINEERING LABORATORY						L	T	P	C		
						0	0	2	1			
List of Experiments:												
<ol style="list-style-type: none"> 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 viscosity 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-Stroke diesel engine 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												
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 air conditioning 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										
REFERENCES:												
1. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, Ninth edition												
2. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007												
3. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 1994												
4. Kothandaraman.C.P., Domkundwar.S,Domkundwar. A.V., "A course in thermal engineering," Dhanpat Rai &sons ,Fifth edition, 2002												

1902ME452	MANUFACTURING TECHNOLOGY LABORATORY – II	L	T	P	C
		0	0	2	1

List of Experiments:

1. Contour milling using vertical milling machine.
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. Cylindrical grinding
7. Tool angle grinding with tool and Cutter Grinder
8. Measurement of cutting forces in Milling.
9. Square Head Shaping
10. Hexagonal Head Shaping
11. Vertical surface grinding
12. Make a v-block using planner machine.
13. Nomenclature of cutting tool using Tool makers microscope

TOTAL: 30 HOURS

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	

REFERENCES:

1. P. N. Rao, Manufacturing Technology vol. I, Tata McGraw-Hill Publishing Company Private Limited, New Delhi, 2010.
2. Serop 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, S Chand & Company Private Limited, New Delhi, 2010.

1902ME453	ENGINEERING METROLOGY & MEASUREMENTS LABORATORY	L	T	P	C
		0	0	2	1

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 Vernier Calliper.
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

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	

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.

1904GE451	LIFE SKILLS: VERBAL ABILITY						L	T	P	C		
						0	0	2	1			
MODULE I	VOCABULARY USAGE						6 Hours					
Introduction - Synonyms and Antonyms based on Technical terms – Single word Substitution – Newspaper, Audio and video listening activity												
MODULE II	COMPREHENSION ABILITY						6 Hours					
Skimming and Scanning – Social Science passages – Business and Economics passages – latest political and current event based passages – Theme detection – Deriving conclusion from passages.												
MODULE III	BASIC GRAMMAR AND ERROR DETECTION						6 Hours					
Parallelism – Redundancy – Ambiguity – Concord - Common Errors – Spotting Errors – Sentence improvement – Error Detection FAQ in Competitive exams												
MODULE IV	REARRANGEMENT AND GENERAL USAGE						6 Hours					
Jumble Sentences – Cloze Test - Idioms and Phrases – Active and passive voice – Spelling test.												
MODULE V	APPLICATION OF VERBAL ABILITY						6 Hours					
Business Writing - Business Vocabulary - Delivering Good / Bad News - Media Communication - Email Etiquette – Report Writing - Proposal writing – Essay writing– Indexing –Market surveying.												
TOTAL: 30 HOURS												
COURSE OUTCOMES:												
On the successful completion of the course, students will be able to												
CO1:	Construct new words in their day to day communication.											
CO2:	Predict the information swiftly while reading passages											
CO3:	Elaborate their oral and written communication											
CO4:	Rephrase the sentences and able to identify the voice of the sentence.											
CO5:	Summarize their knowledge of the best practices to craft effective business documents											
CO6:	Make use of the etiquette in business.											
COs Vs POs MAPPING:												
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1										3		
CO2										3		
CO3										3		
CO4										3		
CO5												3
CO6												3
COs Vs PSOs MAPPING:												
	COs	PSO1	PSO2	PSO3								
	CO1											
	CO2											
	CO3											
	CO4											
	CO5											
	CO6											
REFERENCES:												
1. Arun Sharma and MeenakshiUpadhyav, How to Prepare for Verbal Ability and Reading Comprehension for CAT, McGrawHill Publication, Seventh Edition 2017												
2. R S Aggarwal and VikasAggarwal , Quick Learning Objective General English ,S.Chand Publishing House, 2017												
3. Dr.K.Alex , Soft Skills, S.Chand Publishing House, Third Revise Edition, 2014												
4. Raymond Murphy, Essential English Grammar in Use, Cambridge University press, New Delhi, Third Edition , 2007												

1901MCX02	CONSTITUTION OF INDIA (Common to All Branches - Mandatory Course)				L	T	P	C					
					2	0	0	0					
MODULE I	EVOLUTION OF THE INDIAN CONSTITUTION						6 Hours						
1909 Act, 1919 Act and 1935 Act. Constituent Assembly: Composition and Functions; Fundamental features of the Indian Constitution.													
MODULE II	UNION , STATE AND LOCAL GOVERNMENT						6 Hours						
Union Government: Executive-President, Prime Minister, Council of Minister State Government: Executive: Governor, Chief Minister, Council of Minister													
MODULE III	RIGHTS AND DUTIES						6 Hours						
Fundamental Rights, Directive principles, Fundamental Duties													
MODULE IV	RELATION BETWEEN FEDERAL AND PROVINCIAL UNITS						6 Hours						
Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India													
MODULE V	STATUTORY INSTITUTIONS						6 Hours						
Elections-Election Commission of India, National Human Rights Commission, National Commission for Women													
TOTAL: 30 HOURS													
COURSE OUTCOMES:													
On the successful completion of the course, students will be able to													
CO1:	Understand the historical background of the constitution making and its importance for building a democratic India.												
CO2:	Explain the functioning of three wings of the government i.e., executive, legislative and judiciary.												
CO3:	Explain the value of the fundamental rights and duties for becoming good citizen of India.												
CO4:	Understand the de centralization of power between central, state and local self-government.												
CO5:	Apply the knowledge in strengthening of Election Commission and UPSC for sustaining democracy.												
COs Vs POs MAPPING:													
	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
	CO1								3				
	CO2								3				
	CO3								3				
	CO4								3				
	CO5								3				
COs Vs PSOs MAPPING:													
	COs	PSO1	PSO2	PSO3									
	CO1												
	CO2												
	CO3												
	CO4												
	CO5												
REFERENCES:													
1. D.D. Basu, Introduction to the constitution of India, Lexis Nexis, New Delhi.													
2. SubhashKashyap, Our Parliament, National Book Trust, New Delhi.													
3. PeuGhosh, Indian Government & Politics, Prentice Hall of India, New Delhi.													
4. B.Z. Fadia&KuldeepFadia, Indian Government & Politics, Lexis Nexis, New Delhi													