

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

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.,ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt Ltd. 1998.
4. Grewal B.S and Grewal J.S, Nummerical methods in Engineering and Science, 6th edition,Khanna puplishers,2004
5. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc-GrawHill Publishing Company Limited, New Delhi, 2008.
6. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
7. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
8. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata McGraw Hill Education Pvt Ltd, Sixth Edition, New Delhi, 2012.
9. nptel.ac.in/courses/111105035, www.nptelvideos.in/2012/11/Mathematics.html
10. www.learnerstv.com/Free-maths-video-lectures-ltv348-page1.html

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

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 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 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 RSHF, GS HF, ESHF- Cooling Load calculations.					
Total:					60 Hours

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 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 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

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>

1901ME404

BIOLOGY FOR ENGINEERS

L	T	P	C
3	0	0	3

Module I Biology Introduction and its Classification

7 Hours

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.

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

Module II Genetics and Macromolecular analysis

10 Hours

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.

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.

Module III Biomolecules and Enzymes

10 Hours

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.

Enzymes - monitor enzyme catalyzed reactions. Enzyme catalyzed reactions. Enzyme classification. Mechanism of enzyme action -two examples. Enzyme kinetics and kinetic parameters. RNA catalysis.

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.

Module IV Metabolism and Microbiology

8 Hours

Metabolism: principles of energy transactions. Thermodynamics to biological systems. Exothermic and endothermic versus endergonic and exergonic reactions. Concept of K_{eq} and its relation to standard free energy. Spontaneity. ATP - energy currency. Breakdown of glucose to $CO_2 + H_2O$ (Glycolysis and Krebs cycle) - synthesis of glucose from CO_2 and H_2O (Photosynthesis). Energy yielding and energy consuming reactions. Concept of Energy charge

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.

Module V Bio-inspired Engineering **10 Hours**

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.

Total: **45 Hours**

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 ENGG. LABORATORY

L T P C

0 0 2 1

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 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

REFERENCES:

1. Rajput. R. K., "Thermal Engineering" S.Chand Publishers, Ninth edition
2. Sarkar, B.K,"Thermal Engineering" Tata McGraw-Hill Publishers, 2007
3. Kothandaraman.C.P., Domkundwar.S,Domkundwar. A.V., "A course in thermal engineering,"Dhanpat Rai &sons ,Fifth edition, 2002
4. Arora.C.P, "Refrigeration and Air Conditioning ," Tata McGraw-Hill Publishers 1994

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

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 - I, S Chand and Company Private Limited, New Delhi,2010.
5. <http://nptel.ac.in/courses/112107144/1>.

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

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

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 **L T P C**
(Common to All Branches - Mandatory Course) **2 0 0 0**

UNIT 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.

UNIT 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

Local Government: Panchayat Raj Institutions, Urban Government

UNIT III RIGHTS AND DUTIES: **6 Hours**

Fundamental Rights, Directive principles, Fundamental Duties

UNIT IV F RELATION BETWEEN FEDERAL AND PROVINCIAL UNITS: **6 Hours**

Union-State relations, Administrative, legislative and Financial, Inter State council, NITI Ayog, Finance Commission of India

UNIT V STATUTORY INSTITUTIONS: **6 Hours**

Elections-Election Commission of India, National Human Rights Commission, National Commission for Women

Total: 30 Hours

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.