

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 (CIVIL, CSE, ECE, EEE, IT, MECH)
NAGAPATTINAM – 611 002



B.E Mechanical Engineering FullTimeCurriculum And Syllabus

Third Year – Sixth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
1701MGX01	Professional Ethics	3	0	0	3	40	60	100
1702ME601	Finite Element Analysis	2	2	0	3	40	60	100
1702ME602	Gas Dynamics and Jet Propulsion	2	2	0	3	40	60	100
1702ME603	Dynamics of Machines	3	0	0	3	40	60	100
	Elective III	3	0	0	3	40	60	100
	Elective IV (Open)	3	0	0	3	40	60	100
1702ME651	Dynamics of Machines Laboratory	0	0	2	1	50	50	100
1702ME652	Computer Aided Analysis Laboratory	0	0	2	1	50	50	100
1704ME653	Mini Project II	0	0	2	1	100	-	100
1704ME654	Industrial Visit Presentation	0	0	0	1	100	-	100
1704GE651	Life Skills: Aptitude II	0	0	2	1	100	-	100
		16	4	8	23	640	460	1100

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

1701MGX01	PROFESSIONAL ETHICS	L	T	P	C
		3	2	0	4

Course Objectives

1. To understand Human values, ethical theory, codes of ethics, work place responsibilities and rights.
2. To understand engineering experimentation, global issues and contemporary ethical issues.
3. To understand personal ethics, legal ethics, cultural associated ethics and engineer's responsibility.

UNIT I HUMAN VALUES 12 Hours

Morals and Ethics - Honesty - Integrity - Values - Work Ethic - Civic Virtue - Respect for Others - Living Peacefully - Caring and Sharing - Self-Confidence - Courage - Co-operation - Commitment – Empathy

UNIT II ENGINEERING ETHICS AND PROFESSIONALISM 12 Hours

Scope of 'Engineering Ethics'- Variety of moral issues - Types of inquiry - Accepting and sharing responsibility - Ethical dilemmas - Moral autonomy - Kohlberg's and Gilligan's theory - Consensus and controversy - Profession and Professionalism - Models of Professional Roles - Right action theories - Senses of corporate responsibility - Codes of ethics: Importance - justification - limitation - Abuse - Sample codes NSPE - IEEE - Institution of Engineers (India).

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 12 Hours

Engineering as experimentation - Engineers as responsible experimenters - Balanced outlook on law - Cautious optimism - Safety and risk - Assessing and reducing risk - Safe exits - The Challenger case study - Bhopal Gas Tragedy - The Three Mile Island and Chernobyl.

UNIT IV WORKPLACE RESPONSIBILITIES AND RIGHTS 12 Hours

Fundamental Rights - Responsibilities and Duties of Indian Citizens - Teamwork - Ethical corporate climate - Collegiality and loyalty - Managing conflict - Respect for authority - Collective bargaining - Confidentiality - Conflicts of interest - Occupational crime - Professional rights - Employee rights

UNIT V GLOBAL ISSUES 12 Hours

Multinational corporations: Technology transfer and appropriate technology - International rights promoting morally just measures - Environmental ethics: Engineering, ecology - economics - Human and sentient centred - and bio and eco centric ethics - Computer ethics and internet - Engineers as managers - Consulting engineers - Engineers as expert witnesses and advisors - Moral leadership.

FOR FURTHER READING – SEMINAR – CPS Total 60 Hours

:

1. Sample code of ethics like IETE, ASME, ASCE, Indian Institute of Materials Management.
2. Virtues for life

**Course Outcomes
(COs)**

1. Articulate engineering ethics theory with sustained lifelong learning to strengthen autonomous engineering decisions.
2. Be an example of faith, character and high professional ethics, and cherish the workplace responsibilities, rights of others, public's welfare, health and safety.
3. Contribute to shape a better world by taking responsible and ethical actions to improve the environment and the lives of world community.
4. Fortify the competency with facts and evidences to responsibly confront moral issues raised by technological activities, and serve in responsible positions of leadership.
5. Be Proficient in analytical abilities for moral problem solving in engineering situations through exploration and assessment of ethical problems supported by established experiments.
6. Develop concepts based on moral issues and enquiry.

Reference(s)

1. Mike W Martin and Roland Schinzinger, Ethics in Engineering, 4th edition, Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi, 2014.
2. M Govindarajan, S Natarajan and V S Senthil Kumar, Engineering Ethics, PHI Learning Private Ltd, New Delhi, 2012.
3. R S Naagarazan, A text book on professional ethics and human values, New age international limited, New Delhi, 2006.
4. Charles E Harris, Michael S Protchard and Michael J Rabins, Engineering Ethics - Concepts and Cases, Wadsworth Thompson Learning, United States, 2005.
5. [http://www.slideworld.org/slidestag.aspx/human-values-and- Professional-ethics](http://www.slideworld.org/slidestag.aspx/human-values-and-Professional-ethics).

1702ME601

FINITE ELEMENT ANALYSIS

**L T P C
 2 2 0 3**

UNIT I INTRODUCTION

(12)

Relevance and scope of finite element methods -strain vs displacement relations - natural and essential boundary conditions - Rayleigh Ritz - Galerkin method - FEM procedure - Discretisation of domain-element shapes, types, size, location and numbers.

UNIT II ONE-DIMENSIONAL (1D) ELEMENTS

(12)

Coordinate system types-global, local and natural shape function of 1D bar element -Finite element formulation - stiffness matrix, load vector, boundary condition and assembly of global equation-1D bar element and two node truss element- problems in 2D truss, Introduction to beam element.

UNIT III TWO-DIMENSIONAL (2D) ELEMENTS

(12)

Shape function for linear triangular element-Finite element formulation- Constant Strain Triangular (CST) element -plane stress, plane strain -axisymmetric elements - problems.

UNIT IV HEAT TRANSFER APPLICATIONS

(12)

Shape function for 1D and 2D triangular element heat conduction - stiffness matrix, load vector and assembly of global equation for 1D and 2D triangular element heat conduction, heat generation with convective boundary conditions for linear element.

UNIT V HIGHER ORDER AND ISOPARAMETRIC ELEMENTS

(12)

Selection of order of polynomial-linear, simplex, complex and multiplex elements. Iso, Sub and Super parametric element. Shape functions for a 2-D four noded and eight noded Isoperimetric rectangular element using natural coordinate system - problems. Gaussian quadrature method-problems.

TOTAL : 45 PERIODS

Text / Reference Books

Sl. No.	Title of the Book	Author(s)	Publisher
TEXT BOOKS			
T1	Finite Element Method in Engineering	S. S. Rao	Elsevier India, 2005
T2	Finite Element Analysis	P.Seshu	PHI Learning Private limited, Delhi, 2014
REFERENCES			
R1	Concepts and Applications of Finite Element Analysis	Robert D. Cook, S. David, Malkucs Michael E. Plesha	John Wiley, New Delhi, 2007.
R2	Introduction to Finite Elements Engineering	T. R. Chandrupatla and A. D. Belegundu	Pearson Education, New Delhi, 2002.
R3	Finite Element Analysis	S. S. Bhavikati	New Age International Publishers, 2005.

REFERENCE WEBSITES	
1	www.wikipedia.com
2	www.NPTEL.com
3	www.castle.net

Course Outcomes (COs):

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

Comp	Competency
CO1	Explain steps involved in FEA and the types of functional approximation method.
CO2	Use FEA for solving one dimensional structural problem.
CO3	Make use of FEA for solving two dimensional problems.
CO4	Solve heat transfer applications problems.
CO5	Determine the solution techniques for higher order elements
CO6	Determine the solution techniques for iso-parametric elements

1702ME602	GAS DYNAMICS AND JET PROPULSION	L	T	P	C
		2	2	0	3

UNIT I COMPRESSIBLE FLOW FUNDAMENTALS 12 Hours

Introduction to compressible flow - Integral and differential forms of conservation equations, velocity of sound, Mach number, various regimes of flow, wave propagation, Mach cone and Mach angle- Stagnation state - stagnation enthalpy, stagnation temperature, stagnation pressure and stagnation density - critical state - reference velocities, reference Mach number. Effect of Mach number on compressibility.

UNIT II FLOW THROUGH VARIABLE AREA DUCTS 12 Hours

Isentropic flow through variable area ducts - effect of area change on flow parameters, area ratio as a function of Mach number, impulse function, mass flow rate equations, choking flow, effect of back pressure on performance of convergent and De level nozzle.

UNIT III FLOW THROUGH CONSTANT AREA DUCTS 12 Hours

Flow in constant area ducts with friction (Fanno flow) Governing equations, fanno curves and Fanno flow equations, variation of flow properties, variation of Mach number with duct length. Flow in constant area ducts with simple stagnation temperature change (Rayleigh Flow) - Governing equations, Rayleigh line and Rayleigh flow equation, variation of flow properties, maximum heat transfer in Rayleigh flow.

UNIT IV FLOW WITH NORMAL SHOCK 12 Hours

Governing equations - variation of flow properties like static pressure, static temperature, density, stagnation pressure and entropy across the normal shock - Prandtl equation - Rankine Hugoniot equation. Impossibility of shock in subsonic flows, flow in convergent and divergent nozzle with normal shock - normal shock in Fanno and Rayleigh flows.

UNIT V AIRCRAFT AND ROCKET PROPULSION 12 Hours

Aircraft propulsion - types of jet engines, energy flow through jet engines. Performance of turbo jet engines - thrust, thrust power, propulsive and overall efficiencies - thrust augmentation in turbo jet engine. Ram jet, Scram jet and Pulse jet engines. Rocket Propulsion - Classification of rocket engines. Propellants - solid, liquid and hybrid propellants, rocket engines thrust equation, effective jet velocity, specific impulse. Rocket engine performance.

TOTAL: 60 HOURS

FOR FURTHER READING/SEMINAR/CBS

Case Study: Advanced Aircraft Engines, select Fuel for Air-craft engines.

REFERENCES:

- 1.Hill. P. and C. Peterson, "Mechanics and Thermodynamics of Propulsion", Addison – Wesley Publishing company, 1992.
- 2.Zucrow. N.J., "Aircraft and Missile Propulsion", Vol.1 & II, John Wiley, 1975.
- 3.Zucrow. N.J., "Principles of Jet Propulsion and Gas Turbines", John Wiley, New York, 1970.
- 4.Sutton. G.P., "Rocket Propulsion Elements", John wiley, New York,1986,.
- 5.Shapiro. A.H., " Dynamics and Thermodynamics of Compressible fluid Flow", John Wiley, New York,1953.
- 6.Ganesan. V., "Gas Turbines", Tata McGraw Hill Publishing Co., New Delhi, 1999.
- 7.Somasundaram. PR.S.L., "Gas Dynamics and Jet Propulsions", New Age International Publishers, 1996.
- 8.Babu. V., "Fundamentals of Gas Dynamics", ANE Books India, 2008.

COURSE OUTCOMES

At the end of the course students will be able to

CO1	Employ the basic concepts of compressible fluid flow.
CO2	Employ the concepts of isentropic flow through variable area ducts.
CO3	Calculate flow properties in fanno flow and rayleigh flow.
CO4	Determine various flow parameters for normal shock waves..
CO5	Utilize thrust equation for performance calculation of various jet engines.
CO6	Utilize thrust equation for performance calculation of rocket engines

1702ME603

DYNAMICS OF MACHINES

L	T	P	C
3	0	0	3

Course Objectives

- To impart knowledge in dynamic analysis of simple mechanism and design of flywheel.
- To provide knowledge on balancing of rotating and reciprocating masses.
- To study the working principle of governor and gyroscope.
- To learn the concept of free and forced vibration.
- To learn the concept of transverse and torsional vibration

UNIT I DYNAMIC FORCE ANALYSIS OF MECHANISMS 9 Hours

Principle of superposition, Condition for dynamic analysis, Dynamic analysis of four bar & slider crank mechanism - Engine force analysis. Turning moment diagram for steam & IC Engine. Energy stored in flywheel, Dimension of flywheel rim, Flywheel in punching press.

UNIT II BALANCING 9 Hours

Introduction - Static balancing and dynamic balancing, Balancing of Rotating mass several masses in same and different plane. Balancing of reciprocating mass Swaying couple, Tractive force, Hammer Blow. Balancing of coupled locomotives.

UNIT III GOVERNOR AND GYROSCOPE 9 Hours

Governor Terminology, working principle, Types - Watt, Porter and Proell governor, Characteristics of Governor-sensitiveness, Hunting, Ichoronism, Stability. Gyroscope- Gyroscopic effect, gyroscopic couple, gyroscopic effect on aero planes and naval ships.

UNIT IV FUNDAMENTAL OF VIBRATION 9 Hours

Introduction-Terminology, Classification, elements of vibration, free undamped vibration, Free Damped vibration (Viscus Damping) - Damping ratio and logarithmic decrement. Force damped vibration - Magnification factor. Vibration isolation and transmissibility.

UNIT V TRANSVERSE AND TORSIONAL VIBRATION 9 Hours

Transverse vibration of shafts and beams Shaft carrying several loads, whirling of shafts. Torsional vibration- effect of inertia on torsional vibration-Torsionally equivalent Shaft, single rotor, two rotors and three rotors system.

FOR FURTHER READING – SEMINAR – CPS

Total 45 Hours

:

Turning moment balancing of W, V8, V12 engine, Instruments for dynamic measurements, vibration and noise standards, Multifilar systems.

Course Outcomes (COs)

After completion of the course students will be able to

- 1.Prepare the force-motion relationship in components subjected to external forces.
- 2.Calculate the inertia effect on standard mechanisms.
- 3.Determine the undesirable effects of unbalances resulting from prescribed motions in mechanism.
- 4.Determine the effect of dynamics of undesirable vibrations.
- 5.Calculate the characteristics of a mechanisms used for speed control and stability control.
- 6.Determine the performance of gyroscope in various applications (Automobiles, ships and planes).

Reference(s)

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms" ,3rd Edition, Oxford University Press, 2009.
2. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009
3. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
4. 2. Cleghorn. W. L, "Mechanisms of Machines", Oxford University Press, 2005
5. 3. Benson H. Tongue, "Principles of Vibrations", Oxford University Press, 2nd Edition, 2007

1702ME651

DYNAMICS OF MACHINES LABORATORY

L T P C

0 0 2 1

Course Objectives:

1. To supplement the principles, learn to kinematics and Dynamics of Machinery.
2. To understand how certain measuring devices are used for dynamic testing.
3. To study the working principle of governor and gyroscope.
4. To learn the concept of free and forced vibration.
5. To learn the concept of transverse and torsion vibration.

List of Experiments:

1. Determination of mass moment of inertia of axisymmetric bodies using turn table apparatus
2. Determine the characteristics and effort of Watt, Porter Proell and Hartnell Governors
3. Exercise on Balancing of reciprocating masses.
4. Exercise on Balancing of four rotating masses placed on different plane.
5. Analyze the gyroscopic effect using Gyroscope and verify its laws.
6. Determination of critical speed of shaft with concentrated loads by Whirling of shaft & vibration table apparatus.
7. Determine the moment of inertia of object by Bifilar suspension, Trifilar & method of oscillation.
8. Kinematic analysis of cam model, Epicycle gear train and differential model.
9. Determination of natural frequency of single degree of freedom system & two rotor system.
10. Determine the frequency of forced vibration using Cantilever beam.

TOTAL – 30 Hrs

Course Outcomes:

1. Measure the mass moment of inertia of axisymmetric objects using Turn table apparatus, bi-filar suspension and compound pendulum. (K3)
2. Experiment with vibrations and balancing of rotating and reciprocating masses in dynamic balancing machine. (K3)
3. Make use of Watt, Porter, Proell and Hartnell governors for determination of range sensitivity. (K3)
4. Do experimentation of the critical speed of shaft under the given load conditions. (K3)
5. Perform the torsional natural frequency of single and double rotor systems. (K3)
6. Make use of whirling of shaft for determination of critical speed of a shaft with concentrated loads. (K3)

1702ME652	COMPUTER AIDED ANALYSIS LABORATORY	L	T	P	C
		0	0	2	1

LIST OF EXPERIMENTS

LIST OF EXPERIMENTS

1. Stress analysis using link elements in Trusses, cables etc.
2. Stress and deflection analysis in beams with different support conditions.
3. Stress analysis of plate with hole.
4. Stress analysis of axisymmetric components.
5. Thermal stress analysis of conduction boundary.
6. Thermal stress analysis of mixed boundary.
7. Model analysis of Beams.
8. Harmonicanalysis of simple systems.
9. Plane stress analysis of plate.
10. Stress analysis of 3D beam.
11. Stress analysis of bracket.

Total: 30 Hours

Course Outcomes (COs):

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

	Competency	Cognitive level
CO1	Examine Stress and deflection analysis of beams with different conditions and link	Apply
CO2	Examine Stress analysis of plate with hole, brackets .	Apply
CO3	Establish thermal analysis of plates with conduction boundary and mixed boundary.	Apply
CO4	Establish modal analysis of beams.	Apply
CO5	Establish harmonic analysis of beams.	Apply
CO6	Examine Stress analysis of Axi-symmetric component.	Apply

1703ME007	PROCESS PLANNING AND COST ESTIMATION	L	T	P	C
		3	0	0	3

Course Objectives

- To introduce the process planning concepts.
- To impart the importance of cost estimation process and procedures.
- To study the procedure to calculate direct, indirect and overhead expenses.
- To learn the procedure to estimate the various machine costs.
- To learn procedure to estimate the machining time for Lathe, drilling, boring, shaping, milling and grinding operations

UNIT I PROCESS PLANNING 9 Hours

Definition - Objective - Scope - Process planning activities - Approaches - Manual, Computer Aided Process planning - Retrieval, Generative and Semi- generative - Selection processes - Machine selection - Material selection parameters - Set of documents for process planning. Production time calculation - Selection of cost optimal processes.

UNIT II INTRODUCTION TO COST ESTIMATION

8 Hours

Objectives and functions of Estimating - Costing - Importance and aims of Costing - Difference between Costing and Estimation - Methods of Costing - Types of estimates - Methods of estimates - Importance of Realistic Estimates - Estimating procedure.

UNIT III ELEMENTS OF COST 8 Hours

Introduction - Material Cost - Direct and Indirect - Labour cost - Direct, Indirect and Determination of Direct Labour Cost - Expenses - Direct and Indirect - Analysis of overhead expenses - Administrative expenses - Selling and Distributing expenses - Allocation of overhead expenses- Depreciation - Causes and methods of depreciation.

UNIT IV PRODUCTION COST ESTIMATION 10 Hours

Estimation in forging shop - Losses in forging and forging cost - Problems - Estimation in Gas cutting and welding shop - Material cost, Labour cost and Finish on cost -Problems - Estimation in foundry shop - Pattern cost, Foundry cost and casting cost - Problems

UNIT V ESTIMATION OF MACHINING TIME 10 Hours

Importance of machine time calculations - Estimation of machining time for Lathe, drilling, boring, shaping, milling and grinding operations - Problems

FOR FURTHER READING – SEMINAR – CPS

Total: 45 Hours

Case studies in Plant Layout design, Equipment selection, and process planning,
Cost Evaluation of Layout - Implementation process.

Course Outcomes (COs)

At the end of this course, students will be able to

- CO1 Describe functions of production control, various production system, different aspects of product development and break even analysis.
- CO2 Explain concept of Method study, Motion study and work measurement techniques.
- CO3 Interpret analysis of problems in lack of product planning, quantity determination in batch production and analysis of process capabilities in a multi product system.
- CO4 Discuss about production scheduling, production control systems, progress reporting and expediting and techniques for aligning completion times and due dates.
- CO5 Calculate economic order quantity and economic lot size in inventory control.
- CO6 Design route sheet for various machining processes.

Reference(s)

1. M.Adithan, Process Planning and Cost Estimation, New Age International Publications, 2007.
2. Peter scalon, Process planning, Design/Manufacture Interface, Elsevier science technology Books, Dec-2002.
3. B. P. Sinha, Mechanical Estimating and Costing, Tata McGraw Hill Publishing Company Private. Limited., 2001.
4. R. Kesavan, E. Elanchezhian, B. Vijaya Ramnath, Process planning and cost estimation, New Age International Publications, 2008.
5. S. K. Mukhopadhyay, Production Planning and Control-Text and cases, Prentice Hall of India Private Limited, 2007.
6. <http://nptel.ac.in/courses/105103023/35>.

1704GE651

LIFE SKILLS: APTITUDE -II

L	T	P	C
0	0	2	1

COURSE OBJECTIVES:

1. To brush up problem solving skill and to improve intellectual skill of the students.
2. To be able to critically evaluate various real life situations by resorting to Analysis of key issues and factors.
3. To be able to demonstrate various principles involved in solving mathematical problems and thereby reducing the time taken for performing job functions.
4. To enhance analytical ability of students.
5. To augment logical and critical thinking of Students.

UNIT I PARTNERSHIP, MIXTURES AND ALLEGATIONS, PROBLEM ON AGES, SIMPLE INTEREST, COMPOUND INTEREST 6 Hours

Introduction Partnership - Relation between capitals, Period of investments and Shares- Problems on mixtures - Allegation rule - Problems on Allegation – Problems on ages - Definitions Simple Interest - Problems on interest and amount - Problems when rate of interest and time period are numerically equal - Definition and formula for amount in compound interest - Difference between simple interest and compound interest for 2 years on the same principle and time period.

UNIT II BLOOD RELATIONS, , CLOCKS, CALENDARS 6 Hours

Defining the various relations among the members of a family - Solving Blood Relation puzzles - Solving the problems on Blood Relations using symbols and notations - Finding the angle when the time is given - Finding the time when the angle is known - Relation between Angle, Minutes and Hours - Exceptional cases in clocks - Definition of a Leap Year - Finding the number of Odd days - Framing the year code for centuries - Finding the day of any random calendar date.

UNIT III TIME AND DISTANCE, TIME AND WORK 6 Hours

Relation between speed, distance and time - Converting kmph into m/s and vice versa - Problems on average speed - Problems on relative speed - Problems on trains - Problems on boats and streams - Problems on circular tracks - Problems on races - Problems on Unitary method - Relation between Men, Days, Hours and Work - Problems on Man-Day-Hours method - Problems on alternate days - Problems on Pipes and Cisterns.

UNIT IV DATA INTERPRETATION AND DATA SUFFICIENCY 6 Hours

Problems on tabular form - Problems on Line Graphs - Problems on Bar Graphs - Problems on Pie Charts - Different models in Data Sufficiency - Problems on data redundancy

UNIT V ANALYTICAL AND CRITICAL REASONING 6 Hours

Problems on Linear arrangement - Problems on Circular arrangement - Problems on Double line-up - Problems on Selections - Problems on Comparisons - Finding the Implications for compound statements -
Finding the Negations for compound statements- Problems on assumption - Problems on conclusions - Problems on inferences - Problems on strengthening and weakening of arguments.

TOTAL: 30 HOURS

REFERENCES:

1. Arun Sharma, „How to Prepare for Quantitative Aptitude for the CAT“, 7th edition, McGraw Hills publication, 2016.
2. Arun Sharma, „How to Prepare for Logical Reasoning for CAT“, 4th edition, McGraw Hills publication, 2017.
3. R S Agarwal, „A modern approach to Logical reasoning“, revised edition, S. Chand publication, 2017.
4. R S Agarwal, „Quantitative Aptitude for Competitive Examinations“ revised edition, S. Chand Publication, 2017.
5. Rajesh Verma, “Fast Track Objective Arithmetic”, 3rd edition, Arihant publication, 2018.
6. B.S. Sijwali and Indu Sijwali, “A New Approach to REASONING Verbal & Non-Verbal”, 2nd edition, Arihant publication, 2014.