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

Third Year – Sixth Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
1902ME601	Materials science and Metallurgy	3	0	0	3	40	60	100
1902ME602	Design of Transmission systems	3	2	0	4	40	60	100
1902ME603	Dynamics of Machines	3	2	0	4	40	60	100
	PC Elective II	3	0	0	3	40	60	100
	HSS Elective 1	3	0	0	3	40	60	100
	Open Elective I	3	0	0	3	40	60	100
Laboratory Course								
1902ME651	Theory of Machines Laboratory	0	0	2	1	50	50	100
1904ME652	Mini project (Design and fabrication Project)	0	0	4	2	50	50	100
1904ME653	Industrial Visit Presentation	0	0	0	1	100	-	100
1904GE651	Life Skills: Aptitude II & GD	0	0	2	1	100	-	100

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

1902ME601	MATERIALS SCIENCE AND METALLURGY	L	T	P	C
		3	0	0	3

MODULE I	PHASE DIAGRAMS AND CONSTITUTION OF ALLOYS	9 Hours

Alloys, Solid solutions - Phase diagram, phase rule, lever rule, Binary phase diagram -Isomorphous, eutectic, peritectic, eutectoid reactions - Iron-Carbon phase diagram - Metallography, microstructure.

MODULE II	ENGINEERING METALS AND ALLOYS	9 Hours

Classification of Engineering materials - Ferrous metals -Plain carbon steel (low, medium and high carbon steels), microstructure/composition, properties, applications - Alloy steels, effect of alloying additions on steels - stainless steels, High Strength Low Alloy Steels (HSLA), maraging, tool steels - Cast iron - grey, white, malleable, spheroidal graphite cast iron, microstructure, properties, applications – Non-ferrous metals - Nickel, Copper, Titanium, Aluminium, Magnesium, Zinc alloys, properties and applications - Bearing materials.

MODULE III	HEAT TREATMENT OF STEELS	9 Hours

Purpose of heat treatment - Annealing (stress relief, recrystallization, spheroidizing) -Normalizing - Hardening and Tempering, Isothermal transformation diagrams (T-T-T diagrams), Cooling curves superimposed on T-T-T diagrams (martensite and bainite phase formation) -Hardenability, Jominy end quench test, Case hardening processes, carburizing, nitriding, carbonitriding, cyaniding, flame hardening, induction hardening.

MODULE IV	INTRODUCTION TO POLYMERS AND ENGINEERING CERAMICS	9 Hours

Polymers - Plastics and elastomers - Thermoplasts and thermosets, properties and applications (polyethylene, polypropylene, polyurethane, polystyrene, poly vinylchloride, polymethyl methacrylate, polyethylene terapthalate, polycarbonate, polyamide, acrylonitrile butadiene styrene, polyamide, polyamideimide, polypropyleneoxide, polypropylene sulphide, polyetheretherketone, polytetrafluroethylene, urea formaldehyde, phenol formaldehyde, polyester, nylon, epoxy) – Rubber and its types - Types of Ceramics and applications.

MODULE V	MECHANICAL PROPERTIES AND MATERIALS TESTING	9 Hours

Elastic and plastic deformation, slip and twinning - Tensile test, stress-strain behavior of ductile and brittle materials - Stress-strain behaviour of elastomers - Viscoelasticity - Compression test – Hardness and testing methods -Impact test - Fatigue test, Stress vs number of cycles (S-N) curve, endurance limit, factors affecting fatigue - Creep test, creep curves -Types of fracture - Fracture toughness – Three crack propagation modes.

FOR FURTHER READING – SEMINAR – CPS

Review on Super alloys, Shape memory alloys, Composite Materials, Case studies in Metallurgical failure analysis.

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

CO1:	Understand phase diagrams of different engineering materials.
CO2:	Discuss the properties and applications of various metals and alloys.
CO3:	Identify appropriate heat treatment processes for the given applications.
CO4:	Summarize the properties and applications of Polymers and engineering ceramics.
CO5:	Test the mechanical properties of the materials

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

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

REFERENCES:

1. William D Callister Jr., Materials Science and Engineering: An Introduction, 7th Edition, John Wiley & Sons Inc., New York, 2007.
2. G. E. Dieter, Mechanical Metallurgy, McGraw Hill, 2007.
3. V. Raghavan, Materials Science and Engineering, Prentice Hall of India, Delhi, 2009.
4. William Smith and Javed Hashemi, Foundations of Materials Science and Engineering, 5th Edition, McGraw Hill, New York, 2009.
5. G. Murray, C. White and W. Weise, Introduction to Engineering Materials, 2nd Edition, Chemical Rubber Company (CRC) Press, Taylor & Francis Group, Florida, 2007.
6. https://onlinecourses.nptel.ac.in/noc18_mm05/preview

1902ME602	DESIGN OF TRANSMISSION SYSTEMS	L	T	P	C
		3	2	0	4

MODULE I	DESIGN OF FLEXIBLE ELEMENTS	12 Hours

Design of Flat belts and pulleys - Selection of V belts and pulleys – Selection of hoisting wire ropes and pulleys – Design of Transmission chains and Sprockets.

MODULE II	SPUR GEARS AND PARALLEL AXIS HELICAL GEARS	12 Hours

Speed ratios and number of teeth-Force analysis -Tooth stresses - Dynamic effects – Fatigue strength - Factor of safety - Gear materials – Design of straight tooth spur & helical gears based on strength and wear considerations – Pressure angle in the normal and transverse plane- Equivalent number of teeth-forces for helical gears.

MODULE III	BEVEL, WORM AND CROSS HELICAL GEARS	12 Hours

Straight bevel gear: Tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating the dimensions of pair of straight bevel gears. Worm Gear: Merits and demerits- terminology. Thermal capacity, materials-forces and stresses, efficiency, estimating the size of the worm gear pair. Cross helical: Terminology-helix angles-Estimating the size of the pair of cross helical gears.

MODULE IV	GEAR BOXES	12 Hours

Geometric progression - Standard step ratio - Ray diagram, kinematics layout -Design of sliding mesh gear box - Design of multi speed gear box for machine tool applications - Constant mesh gear box - Speed reducer unit. – Variable speed gear box, Fluid Couplings, Torque Converters for automotive applications.

MODULE V	FUELS CAMS, CLUTCHES AND BRAKES ENGINEERING MATERIALS	12 Hours

Cam Design: Types-pressure angle and under cutting base circle determination-forces and surface stresses. Design of plate clutches –axial clutches-cone clutches-internal expanding rim clutches- Electromagnetic clutches. Band and Block brakes - external shoe brakes – Internal expanding shoe brake.

FOR FURTHER READING

Design of Machine Tool Structures: Functions of Machine Tool Structures and their Requirements, Design for Strength.

TOTAL: 60 HOURS

COURSE OUTCOMES:

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

CO1:	Design the belt drives (flat belt, V- belt), chain drive, rope drives, belt drive, pulleys and chain sprockets.
CO2:	Solve the problem of spur and straight helical gear based on strength and wear consideration.
CO3:	Solve the problem of bevel and worm gear based on strength and wear consideration.
CO4:	Construct the various gear boxes (sliding mesh, constant mesh, multispeed) through geometric progression, standard step ratio, ray diagram, kinematics layout.
CO5:	Design cam, clutches and internal - external shoe brakes from using basic knowledge acquired earlier studies.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

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

REFERENCES:

1. Bhandari V, "Design of Machine Elements", 3rd Edition, Tata McGraw-Hill Book Co, 2010.
2. Joseph Shigley, Charles Mischke, Richard Budynas and Keith Nisbett "Mechanical Engineering Design", 8th Edition, Tata McGraw-Hill, 2008.
3. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
4. C.S.Sharma, Kamlesh Purohit, "Design of Machine Elements", Prentice Hall of India, Pvt. Ltd., 2003.
5. Bernard Hamrock, Steven Schmid, Bo Jacobson, "Fundamentals of Machine Elements", 2nd Edition, Tata McGraw- Hill Book Co., 2006.
6. http://nptel.ac.in/courses/108102047/

1902ME603	DYNAMICS OF MACHINES	L	T	P	C
		3	2	0	4

MODULE I	DYNAMIC FORCE ANALYSIS OF MECHANISMS	12Hours

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.

MODULE II	BALANCING	12 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.

MODULE III	GOVERNOR AND GYROSCOPE	12 Hours

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

MODULE IV	FUNDAMENTAL OF VIBRATION	12 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.

MODULE V	TRANSVERSE AND TORSIONAL VIBRATION	12 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.

TOTAL: 60 HOURS

COURSE OUTCOMES:

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

CO1:	Calculate the dynamic force analysis of different mechanisms.
CO2:	Calculate the balancing masses and their locations of reciprocating and rotating masses.
CO3:	Calculate the speed and lift of the governor and estimate the gyroscopic effect on ships and airplanes.
CO4:	Compute the frequency of free vibration, forced vibration and damping coefficient.
CO5:	Compute the effect of inertia force on transverse and torsional vibrations for single, two and three rotor systems.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

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

REFERENCES:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms" ,3rd Edition,
2. Oxford University Press, 2009.
3. Rattan, S.S, "Theory of Machines", 3rd Edition, Tata McGraw-Hill, 2009

4. Thomas Bevan, "Theory of Machines", 3rd Edition, CBS Publishers and Distributors, 2005.
5. Cleghorn. W. L, “Mechanisms of Machines”, Oxford University Press, 2005
6. Benson H. Tongue, ”Principles of Vibrations”, Oxford University Press, 2nd Edition, 2007
7. http://nptel.ac.in/12106166.

1903ME015	REFRIGERATION AND AIR CONDITIONING (PC ELECTIVE II)	L	T	P	C
		3	0	0	3

MODULE I	AIR REFRIGERATION SYSTEMS AND REFRIGERANTS	8 Hours

First and Second law of thermodynamics applied to refrigerating machines - Reversed Carnot cycle, unit of refrigeration, co-efficient of performance. Air refrigeration: Bell-Coleman cycle, Types of air refrigeration systems. Refrigerants- Desirable properties of refrigerants, Recent substitute for refrigerants.

MODULE II	VAPOUR COMPRESSION REFRIGERATION SYSTEM	9 Hours

Vapor compression cycle : p-h and T-s diagrams - deviations from theoretical cycle – subcooling and super heating- effects of condenser and evaporator pressure on COP- multi pressure system – low temperature refrigeration - Cascade systems – problems. Equipment: Type of Compressors, Condensers, Expansion devices, Evaporators.

MODULE III	OTHER REFRIGERATION SYSTEMS	9 Hours

Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic -Vortex and Pulse tube refrigeration systems.

MODULE IV	PSYCHROMETRIC PROPERTIES AND PROCESSES	9 Hours

Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air-conditioning processes, mixing of airstreams

MODULE V	AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION	10 Hours

Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer &winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators &Safety controls

FOR FURTHER READING – SEMINAR – CBS

Solar refrigeration system, HVAC, Automobile refrigeration system

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

CO1:	Describe about the air refrigeration systems and the refrigerants being used.
CO2:	Demonstrate the working of single and multistage vapour compression refrigeration systems.
CO3:	Explain the operation of vapour absorption and other refrigeration systems.
CO4:	Discuss about Psychometrics and its applications.
CO5:	Analyze the parameters involved in design of air conditioning systems.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

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

REFERENCES:

1. C. P. Arora, "Refrigeration and Air Conditioning", Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2017.
2. Khurmi R.S. and Gupta J.K., "Refrigeration and Air conditioning", Eurasia Publishing House Pvt. Ltd.
3. Basic Refrigeration and Air conditioning by Ananthanarayanan, Mcgraw hill,4th edition
4. N. F Stoecker and Jones, Refrigeration and Air Conditioning, Tata McGraw Hill Publishing Company, New Delhi, 2008.
5. Manohar Prasad, Refrigeration and Air Conditioning, Wiley Eastern Limited, 2007.
6. https://nptel.ac.in/courses/112105129/

1903ME018	GAS DYNAMICS AND JET PROPULSION (PC ELECTIVE II)	L	T	P	C
		3	0	0	3

MODULE I	BASIC CONCEPTS AND ISENTROPIC FLOW	9 Hours

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers.

MODULE II	FLOW THROUGH DUCTS	9 Hours

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno flow) – variation of flow properties.

MODULE III	NORMAL AND OBLIQUE SHOCKS	9 Hours

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Applications.

MODULE IV	JET PROPULSION	9 Hours

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency – Operating principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

MODULE V	SPACE PROPULSION	9 Hours

Types of rocket engines – Propellants-feeding systems – Ignition and combustion – Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic velocity – Applications – space flights.

FOR FURTHER READING – SEMINAR – CBS

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

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

CO1:	Employ the basic concepts of isentropic flow.
CO2:	Calculate the flow properties for fanno flow and Rayleigh flow
CO3:	Determine various flow parameters for normal shock and oblique shock waves
CO4:	Utilize thrust equation for performance calculation of various jet engines.
CO5:	Utilize thrust equation for performance calculation of rocket engines

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

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

REFERENCES:

1. Patrick H. Oosthuizen and William E. Carscallen, Introduction to Compressible Fluid Flow, 2nd edition, CRC Press, Taylor & Francis Group, Florida,2014.
2. Robert D. Zucker, Fundamentals of Gas Dynamics, 2nd edition, John Wiley & Sons Inc., New York,2002
3. George P. Sutton and Oscar Biblarz, Rocket Propulsion Elements, 9th edition, John Wiley &Sons Inc., New York,2016.
4. S. M. Yahya, Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion, 6th edition, New Age International private Limited,2018.

1901MGX01	TOTAL QUALITY MANAGEMENT	L	T	P	C
		3	0	0	3

MODULE I	INTRODUCTION	9 Hours

Introduction – Need for quality – Evolution of quality – Definitions of quality – Dimensions of product and service quality – Basic concepts of TQM – TQM Framework – Contributions of Deming, Juran and Crosby – Barriers to TQM – Quality statements – Customer focus – Customer orientation, Customer satisfaction, Customer complaints, Customer retention – Costs of quality.

MODULE II	TQM PRINCIPLES	9 Hours

Leadership – Strategic quality planning, Quality Councils – Employee involvement – Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal – Continuous process improvement – PDCA cycle, 5S, Kaizen – Supplier partnership – Partnering, Supplier selection, Supplier Rating.

MODULE III	TQM TOOLS AND TECHNIQUES I	9 Hours

The seven traditional tools of quality – New management tools – Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT – Bench marking – Reason to bench mark, Bench marking process – FMEA – Stages, Types.

MODULE IV	TQM TOOLS AND TECHNIQUES II	9 Hours

Control Charts – Process Capability – Concepts of Six Sigma – Quality Function Development (QFD) – Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures

MODULE V	QUALITY SYSTEMS	9 Hours

Need for ISO 9000 – ISO 9001-2008 Quality System – Elements, Documentation, Quality Auditing – QS 9000 – ISO 14000 – Concepts, Requirements and Benefits – TQM Implementation in manufacturing and service sectors.

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

CO1:	Explain the basic concepts of the Total Quality Management
CO2:	Describe the Total Quality Management principles
CO3:	Describe the Statistical Process Control (SPC) techniques
CO4:	Enumerate the Total Quality Management Tools
CO5:	Elaborate the principles of Quality Systems

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

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

REFERENCES:

1. Dale H.Besterfield et al, Total Quality Management, Third edition, Pearson Education (First Indian Reprints 2004).
2. ShridharaBhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.

1902ME651	THEORY OF MACHINES LABORATORY	L	T	P	C
		0	0	2	1

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.
11. Determination of natural frequency of Torque measurement system.

TOTAL: 30 HOURS

COURSE OUTCOMES:

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

CO1:	Measure the mass moment of inertia of axisymmetric objects using Turn table apparatus, bi-filar suspension and compound pendulum.
CO2:	Experiment with vibrations and balancing of rotating and reciprocating masses in dynamic balancing machine.
CO3:	Make use of Watt, Porter, Proell and Hartnell governors for determination of range sensitivity.
CO4:	Do experimentation of the critical speed of shaft under the given load conditions.
CO5:	Perform the torsional natural frequency of single and double rotor systems.
CO6:	Make use of whirling of shaft for determination of critical speed of a shaft with concentrated loads.
CO7:	Prepare the motion curves for the given cam follower setup.
CO8:	Measure the transmissibility ratio using vibrating table.

COs Vs POs MAPPING:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1			3		3			2
CO2	3	2	2	1			3		3			2
CO3	3	2	2	1			3		3			2
CO4	3	2	2	1			3		3			2
CO5	3	2	2	1			3		3			2
CO6	3	2	2	1			3		3			2
CO7	3	2	2	1			3		3			2
CO8	3	2	2	1			3		3			2

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1		3	3
CO2		3	3
CO3		3	3
CO4		3	3
CO5		3	3
CO6		3	3
CO7		3	3
CO8		3	3

1904ME652	MINI PROJECT (DESIGN AND FABRICATION PROJECT)	L	T	P	C
		0	0	4	2

GUIDELINE FOR REVIEW AND EVALUATION

The students may be grouped into 2 to 4 and work under a project supervisor. The device/ system/component(s) to be fabricated may be decided in consultation with the supervisor and if possible with an industry. A project report to be submitted by the group and the fabricated model, which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report jointly by external and internal examiners constituted by the Head of the Department.

TOTAL: 45 HOURS

COURSE OUTCOMES:

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

CO1:	Develop conceptual engineering design of any components by using basic design principles
CO2:	Fabricate any components using different manufacturing tools.
CO3:	Demonstrate their practical ability in the form of working models.
CO4:	Evaluate design concepts and fabrication sequence.
CO5:	Develop patentable concepts and innovations.

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

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

1904ME653	INDUSTRIAL VISIT PRESENTATION	L	T	P	C
		0	0	0	1

GUIDELINE FOR REVIEW AND EVALUATION

In order to provide the experiential learning to the students, shall take efforts to arrange at least one industrial visit / field visits in a year. A presentation based on Industrial visits shall be made in this semester and suitable credit may be awarded by the Committee constituted by the Head of the Department at the end of the semester examination

COURSE OUTCOMES:

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

CO1:	Know the safety measures, standards, policy practice in industry
CO2:	Identify the concepts for the own area of interest
CO3:	Realize the Experience of the real time working in the industry
CO4:	Compare the theoretical concepts in the industry
CO5:	Explain the various industrial equipments,machinery
CO6:	Make a real time product use of some tools

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

COs	PSO1	PSO2	PSO3
CO1	2	3	2
CO2	3	2	2
CO3	2	2	3
CO4	3	3	3
CO5	2	2	2
CO6	3	3	3

1904GE651	LIFE SKILLS: APTITUDE – II & GD (Common to All Branches)	L	T	P	C
		0	0	2	1

MODULE 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.

MODULE 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.

MODULE 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.

MODULE 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.

MODULE 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

COURSE OUTCOMES:

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

CO1:	Solve problems on Partnership, Mixture & Allegation and ages least time using shortcuts and apply real life situations.
CO2:	Workout family relationships concepts, ability to visualize clocks & calendar and understand the logic behind a Sequence.
CO3:	Calculate concepts of speed, time and distance, understand timely completion using time and work.
CO4:	Learners should be able to understand various charts and interpreted data least time.
CO5:	Workout puzzles, ability to arrange things in an orderly fashion

COs Vs POs MAPPING:

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

COs Vs PSOs MAPPING:

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

REFERENCES:

1. Dale H.Besterfield et al, Total Quality Management, Third edition, Pearson Education (First Indian Reprints 2004).
2. ShridharaBhat K, Total Quality Management – Text and Cases, Himalaya Publishing House, First Edition 2002.