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

Fourth Year – Seventh Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
1702ME701	Automobile Engineering	3	0	0	3	40	60	100
1702ME702	Mechatronics	3	0	0	3	40	60	100
1702ME703	Computer Aided Manufacturing	3	0	0	3	40	60	100
1701MGX02	Industrial Economics	3	0	0	3	40	60	100
	Elective V	3	0	0	3	40	60	100
	Elective VI (Open)	3	0	0	3	40	60	100
1702ME751	Mechatronics Laboratory	0	0	2	1	50	50	100
1702ME752	Computer Aided Manufacturing Laboratory	0	0	2	1	50	50	100
1704ME753	Mini Project III (Simulation and analysis)	0	0	2	1	100	-	100
1704ME754	In-Plant Training/Internship Presentation	0	0	0	1	100	-	100
1704GE751	Life Skills : Competitive Exams Preparation	2	0	0	2	100	-	100
		20	0	6	24	640	460	1100

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

1702ME701   **AUTOMOBILE ENGINEERING**   **L T P C**
                                                                                 3 0 0 3

OBJECTIVES

To understand the construction and working principle of various parts of an automobile.
To have the practice for assembling and dismantling of engine parts and transmission system

UNIT I VEHICLE STRUCTURE AND ENGINES   **9**

Types of automobiles, vehicle construction and different layouts, chassis, frame and body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components functions and materials, variable valve timing (VVT).

UNIT II ENGINE AUXILIARY SYSTEMS   **9**

Electronically controlled gasoline injection system for SI engines, Electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III TRANSMISSION SYSTEMS   **9**

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, Fluid flywheel, torque converter, propeller shaft, slip joints, universal joints ,Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS   **9**

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V ALTERNATIVE ENERGY SOURCES   9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

                                                                TOTAL: 45 PERIODS

COURSE OUTCOME

CO1	Explain types of chassis, frame and engine parts of automobiles.	Understand
CO2	Describe engine auxiliary systems used in SI and CI engines.	Understand
CO3	Distinguish between manual transmission system and automatic transmission system.	Understand
CO4	Demonstrate how the steering, brakes and the suspension system operate.	Understand
CO5	Experiments differents alternative fuels in IC engines.	Apply
CO6	Make use of differential unit to calculate the gears ratio.	Apply

Text / Reference Books

Sl. No.	Title of the Book	Author(s)	Publisher
TEXT BOOKS			
T1	Automobile Engineering	Kirpal Singh,	Vol 1 & 2, Seventh Edition, Standard Publishers, New Delhi, 1997.
T2	Automobile Engineering	Jain K.K. and Asthana .R.B	Tata McGraw Hill Publishers, New Delhi, 2002.
REFERENCES			
R1	Motor Vehicles	Newton ,Steeds and Garet,	Butterworth Publishers,1989.
R2	Automotive Mechanics,"	Joseph Heitner	Second Edition, East-West Press, 1999.
R3	Automotive Mechanics Fundamentals	Martin W, Stockel and Martin T Stockle	The Good heart –Will Cox Company Inc, USA ,1978.
R4	Internal Combustion Engines	Ganesan V.	Third Edition, Tata McGraw-Hill, 2007

1702ME702	**MECHATRONICS**	**L T P C**
		3 0 0 3

COURSE OBJECTIVES:
1. To introduce the concept and working of sensors used in mechatronic system.
2. To study different types of actuators used in mechatronic system.
3. To provide knowledge on feedback mechanism for improving the reliability of mechatronic system.
4. To impart knowledge on working of microcontroller in mechatronic systems
To learn the Programmable Logic Controller (PLC) used in mechatronic systems

UNIT I SENSORS   **09 Hours**
Components of mechatronics system, Sensor - terminology and Mathematical equation - Potentiometer, Linear Variable differential transformer, strain gauge, Piezoelectric sensor, Optical encoder, Hall effect sensor, Thermistor, Thermo-couple, Light sensor.

UNIT II ACTUATOR   **09 Hours**
Terminology, mathematical equation of Mechanical Actuation system - cam, gear, belt & chain, Ball screw, Mechanical aspects of motor selection. Pneumatic & hydraulic Actuation system. Electrical actuation system -relay & solenoid, working & control of Brush & brushless DC motor, working & control of Stepper & servo motor.

UNIT III FEEDBACK CONTROL   **09 Hours**
Transfer Function, Mathematical Modeling of Mechanical & Electrical system, Electrical analogy, Electromechanical system, First order system, second order system, Proportional control, derivative control, Integral control, PID control, Controller tuning, Concept of stability.

UNIT IV MICROCONTROLLER   **09 Hours**
Architecture of 8051- I/O Pins, Ports and Circuits, memory, counter, Timer, Interrupt, Instruction set- Movingdata, Logical, arithmetic operation, Jump & call instruction, LCD & Keyboard Interfacing. Examples -Windscreen wiper motion, Car engine management.

UNIT V PROGRAMMABLE LOGIC CONTROLLER   **09 Hours**
Basic Structure - Input / Output Processing - Programming - Mnemonics - Timers, Internal relays and counters - Shift Registers - Master and Jump Controls - Data Handling - Analogue Input / Output - Selection of PLC. Examples -Pick and place robot. Car Park barrier system.

TOTAL: 45 HOURS

Outcomes (COs): After successful completion of the course, students will be able to

	Competency	**Cognitive level**
CO1	Describe various concepts of mechatronic systems and sensors.	Understand
CO2	Use hydraulic and pneumatic simulation software for various applications.	Apply
CO3	Describe the working principle of 8255 program peripheral interface and its applications.	Apply
CO4	Measure torque variance of servo motor for different speeds.	Apply
CO5	Use 8085 microprocessor and 8051 microcontrollers for doing various operations.	Apply
CO6	Use PLC for actuating pneumatic, hydraulic and electrical circuits.	Apply

1702ME703	COMPUTER AIDED MANUFACTURING	L	T	P	C
		3	0	0	3

UNIT I   CONSTRUCTION OF CNC AND MOTION CONTROL   9 Hours

Evolution of CNC Technology - CNC machine -Concept, classification, features and applications - Constructional features and applications - Linear motion and Recirculating ball bearings - CNC controller and Interpolator - Maintenance and retrofitting

UNIT II   DRIVES AND CONTROL   9 Hours

Spindle and feed drives - Sensors -Position, Encoders, Proximity, Limit switch -Interfacing system - Microcontroller and PLC based -Introduction to Graphical User interface -Communication protocol - RS232, RS 485, USB, Ethernet -PLC -Ladder diagram -Peripherals -Timer, Counter, Encoder interface, Human Machine Interface

UNIT III   PROGRAMMING OF CNC LATHE   9 Hours

Coordinate system - structure of a part program -G & M Codes -Programming for FANUC and SIEMENS controller -Single pass and canned cycle -Turning, facing and threading -Multi-pass canned cycle -Rough and Finish turning, facing, pattern repeating, grooving, threading, drilling, boring, peck drilling, high speed drilling cycle -Subprogram and Macro programming -Tool length and nose radius compensation - offset -Tool, work and coordinate -Insert -Materials, Classification, Nomenclature and Selection -Tool and Work holding devices - Automatic tool changer -Turret and drum type -Tool holder nomenclature and selection -CNC part programming using CAD/CAM software and interfacing with CNC machine

UNIT IV   PROGRAMMING OF CNC MACHINING CENTRE   9 Hours

Coordinate system - G & M Codes for machining centre - Programming for FANUC and SIEMENS controller - Machining cycles - Linear and circular interpolation, Contouring, rectangular and circular pocketing, drilling, peck drilling, high speed drilling, Back boring, counter boring and tapping cycle - Cutter diameter compensation - Nomenclature of multi-point cutting tool and tool holder -Tool and work holding devices -Automatic Pallet changer.

UNIT V   ADDITIVE MANUFACTURING   9 Hours

Introduction to additive manufacturing - Applications of AM in Automotive, Aerospace, Business, Consumer Electronics, Die & Mould, Jewellery and Medical industries -Generic process chain - Classification -Components, working principle, Materials processed and Applications - Stereolithography (SLA), Fusion Deposition Modelling (FDM), 3D Printing (3DP), Selective Laser Sintering (SLS), Electron Beam Additive Manufacturing (EBAM)

TOTAL: 45 HOURS

Text / Reference Books

Sl. No.	Title of the Book	Author(s)	Publisher
TEXT BOOKS			
T1	Computer Aided Manufacturing	Dr.V.Jayakumar	Suchitra Publications (A Group of Lakshmi Publications), 2017
T2	Computer Aided Manufacturing	T.K.Kundra	Tata McGraw Hill,2010
REFERENCES			
R1	Computer Numerical Control Machines	P.Radhakrishnan	New Central Book Agency, 2004.
R2	Computer Control of Machine Tools	G. E. Thyer	Butterworth-Heinemann Ltd, 1991.
R3	Automation, Production System and Computer Integrated Manufacturing	Mikell P. Groover	Prentice Hall of India, New Delhi, 2008

REFERENCE WEBSITES	
1	http://nptel.ac.in/courses/Webcourse-contents
2	https://freevideolectures.com/course/2678/computer aided manufacturing
3	https://swayam.gov.in/nd1_noc20_ma23/preview
4	https://swayam.gov.in/nd2_cec20_ma10/preview

Course Outcomes (COs):

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

	Competency	Cognitive level
CO1	Understand evolution, principle of CNC machine tools, and constructional features of CNC machine tools	Understand
CO2	Explain drives, feedback devices used in CNC machine tools namely programmable logic control (PLC) and other peripherals.	Understand
CO3	Prepare programs for CNC turning center by selecting suitable tool, work holding devices, etc.	Apply
CO4	Prepare programs for CNC machining center by considering popular controllers.	Apply
CO5	Understand various technologies of Additive Manufacturing to manufacture a prototype.	Understand
CO6	Explain the processes used in additive manufacturing for a range of materials and applications	Understand

1701MGX02	**INDUSTRIAL ECONOMICS**	**L**	**T**	**P**	**C**
		3	**2**	**0**	**4**

UNIT I   INTRODUCTION   **9 hrs**

Introduction to Industrial economics- Micro and Macro economics - Kinds of Economic Systems - Production Possibility Frontier - Opportunity Cost - Objective of Organizations - Kinds of Organization.

UNIT II   DEMAND AND SUPPLY   **9 hrs**

Functions of Demand and Supply - Law of diminishing Marginal Utility - Law of Demand and Supply Elasticity of Demand - Demand Forecasting Methods - Indifference curve

UNIT III   PRODUCTION AND COST   **9 hrs**

Production Function - Returns to Scale - Law of Variable Proportion - Cost and Revenue concepts and Cost Curves - Revenue curves - Economies and Dis-Economies of scale - Break Even point.

UNIT IV   MARKET STRUCTURE   **9 hrs**

Market Structure - Perfect Competition - Monopoly - Monopolistic - Oligopoly - Components of Pricing - Methods f Pricing - Capital Budgeting IRR - ARR - NPV - Return on Investment - Payback Period.

UNIT V   INTRODUCTION TO MACRO ECONOMICS AND FINANCIAL   9 hrs
**   ACCOUNTING**

National Income - Calculation Methods - Problems - Inflation - Deflation - Business Cycle - Taxes - Direct and Indirect Taxes - Fiscal and monetary policies.

FOR FURTHER READING – SEMINAR – CPS   **Total: 45 Hrs**

1. Nature and characteristics of Indian Economy
2. Role and functions of Central bank - LPG - GATT - WTO.

Sl. No.	Title of the Book	Author(s)	Publisher
REFERENCES			
R1	Engineering Economics and Financial Accounting	A Ramachandra Aryasri and V VRamana Murthy	Tata McGraw Hill Publishing Company Limited, New Delhi, 2006
R2	Engineering Economics and Financial Accounting	R Kesavan, C Elanchezhianand T Sunder Selwyn	Laxmi Publication Ltd, New Delhi, 2005.
R3	Managerial Economics Concepts and Cases	V L Samuel Paul and G S Gupta	Tata McGraw Hill Publishing Company Limited, New Delhi,1981.
R4	Financial and Management	S N Maheswari	Accounting, SultanChand
R5	rial Economics-Concepts and Cases.	V L Samuel Paul and G S Gupta	-
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

Cos	Competency
CO1	Understand the micro and macroeconomic environment for a favorable business environment.
CO2	Apply laws of demand and supply in engineering economy and forecast the demand.
CO3	Analyze the various costs and breakeven point for organizational profitability.
CO4	Discuss the concepts of equilibrium price in different market situations and Capital Budgeting methods.
CO5	Summarize the objectives behind micro economics and financial accounting.
CO6	Explain the concepts of taxation, and Government's economic policies.

1702ME751	MECHATRONICS LABORATORY	L T P C
		0 0 2 1

COURSE OBJECTIVES:

1. To impart knowledge on modeling and simulation of mechatronics system.
2. To provide knowledge on design of fluid power circuit in mechatronic system.
3. To understand the working of microcontroller and PLC in mechatronic systems
through experiments.
4. To expose knowledge on force, acceleration and displacement measurements.
5. To gain the knowledge for controlling the position, velocity and force in
Mechatronics system.

LIST OF EXPERIMENTS:

1. Modeling and simulation of mechatronics system using MATLAB.
2. Modeling and design of PID controller for Mechatronics system.
3. Study and simulation of various hydraulic and pneumatic components using FLUIDSIM software.
4. Design and testing of fluid power circuits for automatic opening and closing for
doors and to control its velocity and direction.
5. Position and speed control of DC Motor using Microcontroller Board.
6. Speed control of Stepper Motor using Microcontroller Interface Board.
7. Measurement of force, acceleration and displacement using Virtual instrumentation.
8. Design of Programmable logic Controller based timer controller for multiple pneumatic cylinder
Sequencing in assembly operations
9. Position and velocity control of pick and place robot arm for loading and unloading Application
using robot Programming language.
10. Measurement and control of temperature of an application using Virtual
instrumentation

TOTAL: 30 HOURS

Course Outcomes (COs):

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

	Competency	Cognitive level
CO1	1. Develop mathematical model of mechatronics system.	Apply
CO2	2. Simulate fluid power circuit using Simulation software.	Apply
CO3	3. Develop mechatronics system using microcontroller & PLC.	Apply
CO4	4. Measure the force, acceleration and displacement of a system using microcontroller program.	Apply
CO5	5. Control the position, velocity and force of mechatronics system.	Apply
CO6	Acquire about PID temperature control system	Apply

1702ME752   COMPUTER AIDED MANUFACTURING LABORATORY   L T P C
                                                                                         0 0 2 1

Course Objectives:

- To provide knowledge on modeling and creating tool path of machine components usingcomputer aided manufacturing software.
- To impart part programming knowledge on CNC lathe.
- To expose part programming knowledge on CNC milling.
- To impart part programming for molding die using CNC milling.
- To impart knowledge on developing the prototype by additive manufacturing process.

EXPERIMENT 1   **6 Hours**
To make a flanged coupling to transmit the power from shaft in using CNC machine.

EXPERIMENT 2   **2 Hours**
To impart part programming for a drilling operations using CNC milling software.

EXPERIMENT 3   **2 Hours**
To impart part programming for a pocketing operation using CNC milling software.

EXPERIMENT 4   **2 Hours**
To impart part programming for a contouring operation using CNC milling software.

EXPERIMENT 5   **2 Hours**
To machine a logo of EGSPEC using CNC milling

EXPERIMENT 6   **4 Hours**
To impart part programming for molding die of simple part using CNC milling software.

EXPERIMENT 7   **4 Hours**
To impart part programming for a turning operation using CNC turning software.

EXPERIMENT 8   **2 Hours**
To impart part programming for an undercut operation using CNC turning software.

EXPERIMENT 9   **6 Hours**
Exercise on reverse engineering of pump impeller using 3D printer.

FOR FURTHER READING – SEMINAR – CPS   **Total: 30 Hours**

Course Outcomes (COs):

1. Simulate the tool path for circular pats using machining programs.
2. Prepare and execute a part program for the machining component using CNC lathe.
3. Prepare and execute a part program for the machining component using CNC milling.
4. Prepare and execute a part program for the molding die using CNC milling.
5. Build a model using additive manufacturing process.
6. Make use of the features and specifications of CNC machines.

1704GE751   LIFE SKILLS: COMPETITIVE EXAM PREPARATION   L   T   P   C
                                                                                              2   0   0   2

COURSE OBJECTIVES:

1. To recollect the fundamentals of electrical and electronic systems.
2. To remember the analysis of electrical and electromagnetic theories, electrical circuits, electrical machines and other systems in electrical and electronics engineering.
3. To test the analytical skills of students in the field of electrical circuits, electronics, electrical machines and power systems.

Electric Circuit Analysis: DC Circuits and AC Circuits - Theorems, Transient Analysis of circuits, and Resonance circuits.

Analog and Digital Electronics: Diode, BJT, FET - Device Structures, Circuits and Applications; Logic Gates, Code Converters, Flip Flops, Counters, Analysis and Design of Sequential Circuits, Memory Logic Devices.

Electromagnetic Theory: Divergence Theorem, Stroke's Theorem, Coulombs Law, Gauss Law, Electric and Magnetic Field Intensity, Electric and Magnetic Flux Density, Magnetization and Permeability, Self-Inductance and Mutual Inductances, Maxwell's Equation.

Linear Integrated Circuits: Operational Amplifier – Characteristics, Applications – Inverting & Non-Inverting Amplifier, Summing & Differential Amplifier, Integrator, Differentiator, Oscillators and Signal Converters; Special Function ICs.

Electrical Machines: Generator, Motor and Transformer - Construction, Principle of Operation, Working, Characteristics and Classifications of, testing of electrical machines. Starting of electrical machines.

Electrical Drives and Control: Rectifier, Inverter, Chopper, AC Voltage Controller, Cycloconverter – Modes of Operation, V-I Characteristics, Power Converter Fed Electrical Drives, Closed Loop Operation of Electrical Drives with Speed and Current Controller. Quadrant of Operation of Electrical Drives, Microprocessor / Microcontroller – Instruction Set, Addressing Modes, Interfacing, and Applications in Drives. Linear Control Systems - Stability Analysis, Time and Frequency Response

Power Generation, Transmission and Distribution: Power Generation from Thermal Plants, Hydro Power Plants, Diesel/Gas Plants, Nuclear Plants, Renewable Energy Sources, HVDC and HVAC Transmission Systems, Types of Conductors, Skin and Proximity effects, Classification of Lines, Ferranti Effect, Types and Testing of Insulators, Underground Cables.

Power System Analysis: Load Flow Analysis, Symmetrical Components, Symmetrical and Unsymmetrical Faults, Power System Stability.

TOTAL: 30 HOURS

REFERENCES:

1. A. Sudhakar and S.P. Shyammohan, "Circuits and Networks: Analysis and Synthesis", TMH, 4th Edition, 2010.
2. M.Nahvi and Joseph A.Edminister, "Electric Circuits", Schaum's Outline series, Tata McGraw Hill, New Delhi, 6 th Edition,2014.
3. Milman, Halkias and satyabrata Jit, ―Electronic Devices and Circuits 4th Edition, McGraw Hill Education (India) Private Ltd., 2015.
4. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 11th Edition, PHI Ltd., 2015.
5. M.Morris Mano, ―Digital Logic and Computer Design, Prentice Hall of India, 4th edition, 2013.
6. William H.Hayt, „Engineering ElectromagneticsTata McGraw Hill, 2005.
7. D Roy Choudhury and Sheil B.Jani, "Linear Integrated Circuits" 4th Edition, New Age International, New Delhi, 2014.
8. Kothari D.P and I.J. Nagrath, "Electric Machines", Published by Tata McGraw -Hill Education Pvt. Ltd,2010, 5 th Edition.
9. Rashid M H, "Power Electronics-Circuits, Devices and Applications", Prentice Hall of India, New Delhi, 2011.
10. N. K. De, P. K. Sen, "Electric Drives", 16th, PHI Learning PVT. LTD.,2014
11. R S.Gaonkar, "Microprocessor Architecture Programming and Application", Prentice hall, New Delhi, fifth edition,2002.
12. Sunil Mathur, "Microprocessor 8085 and its Interfacing" Prentice hall India learning private limited, New Delhi, second edition,2011.
13. M. Gopal, "Control Systems, Principles and Design", 4th Edition, Tata McGraw Hill, New Delhi,2012.
14. P.K.Nag, PowerPlantEngineering,TataMcGraw-HillPublishingCompanyLtd.,ThirdEdition, 2014.
15. J.Brian, Hardy and Colin R.Bayliss „Transmission and Distribution in Electrical Engineering", Newnes; Fourth Edition, 2012.
16. C.L.Wadhwa, "Electrical Power Systems", New Academic Science Ltd, seventh edition2017.
17. J. D. Glover, M. Sarma and T. Overbye, "Power System Analysis and Design", Fourth Edition,CENGAGE – Engineering, 2007.

18. HadiSaadat, "Power System Analysis", Second Edition, McGraw Hill Publishers, 2002.