

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
NAGAPATTINAM – 611 002



B.E. Mechanical Engineering

Fourth Year – Seventh Semester

Course Code	Course Name	L	T	P	C	Maximum Marks		
						CA	ES	Total
Theory Course								
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
Laboratory Course								
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

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

1702ME701

AUTOMOBILE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

1. To impart knowledge on the principles of operation and constructional details of various automobile components.
2. To provide knowledge on the working of fuel supply system in various automobiles.
3. To learn the function of various components in transmission and drive lines of a vehicle.
4. To study the concept and working of steering, brakes and suspension systems in automobile.
5. To impart knowledge on electrical and electronic systems of automobiles.

UNIT I VEHICLE STRUCTURE AND ENGINES

09 Hours

Types of Automobiles - vehicle construction, chassis, frame and body. Engines Supercharger, turbo chargers, engine emission control by 3 Way catalytic controller. Alternative energy resources Liquefied petroleum gas, Bio Diesel.

UNIT II FUEL SUPPLY SYSTEMS

09 Hours

Spark ignition engine Carburetor-Types simple carburettor, solex carburettor, carter carburetor. Electronic fuel injection system, mono-point and multi Point injection systems. Compression ignition Engine-Inline fuel injection system, Common rail direct fuel injection system.

UNIT III TRANSMISSION AND DRIVE LINES

09 Hours

Clutch types single plate clutch, multi plate clutch. Gearbox - synchromesh gear box, sliding mesh gear box, constant mesh gear box. Fluid flywheel, torque convertors, propeller shaft, slip joint, universal Joints, differential and rear axle hotchkiss drive and torque tube drive.

UNIT IV STEERING, BRAKES AND SUSPENSION

09 Hours

Wheels and Tyres Construction. Steering geometry and types of steering gearbox rack and pinion steering gear, recirculating ball type gear and Power steering construction and working principle. Suspension systems types rear suspension and front suspension. Braking systems-types disc brake, drum brake, hydraulic brake and air brake.

UNIT V ELECTRICAL AND ELECTRONICS SYSTEMS

09 Hours

Electrical systems, battery types, construction and working principle of lead acid battery. Generator starting motor and drives, lighting and ignition (Battery, Magneto Coil and+ Electronic type), regulators, cut outs. Common rail direct fuel injection system. Different electronic control unit used in the engine management, block diagram of the engine management system.

TOTAL: 45 HOURS

REFERENCES:

1. Kirpal Singh, Automobile Engineering Volume.1 and 2, Standard Publishers, New Delhi.2009.
2. Crouse and Anglin, Automotive Mechanism, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2003.
3. Newton, Steeds and Garet, Motor vehicles, Butterworth Publishers, 2000.
4. S. Srinivasan, Automotive Mechanics, 2003, Tata McGraw Hill Publishing Company Private Limited, New Delhi, 2003.
5. Joseph Heitner, Automotive Mechanics, East-West Press, 2006.
6. <http://nptel.ac.in/syllabus/125106002/>

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- Moving data, 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

REFERENCES:

1. W. Bolton, Mechatronics, Pearson Education, New Delhi, 2012.
2. Butterworth-Heinemann, Mechatronics: Principles and Applications Butterworth-Heinemann Ltd, 2005.
3. Nitaigour Premchand Mahalik, Mechatronics: Principles, Concepts and Applications, Tata McGraw Hill Publishing Company Pvt. Ltd., New Delhi, 2008
4. Krishna Kant, Microprocessors & Microcontrollers, Prentice Hall of India, 2007.
5. K. P. Ramachandran, G. K. Vijayaraghavan, and M. S. Bala-Sundram, Mechatronics: Integrated Mechanical Electronic Systems, Wiley India Pvt. Ltd., New Delhi 2008.
6. <http://nptel.iitm.ac.in/courses/Webcourse-contents/IIT-roorkee/industrialengineering/index.ht>

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

COURSE OBJECTIVES:

1. To impart the knowledge on construction and working of Computer Numerical Control (CNC) Machines, maintenance and retrofitting of CNC machines.
2. To provide knowledge on interfacing, communication and control of CNC drives.
3. To introduce programming of CNC turning center
4. To provide exhaustive skill on programming of CNC machining center
5. To educate the concept, applications and emerging trends in Additive Manufacturing (AM) technologies.

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

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

Five Axis CNC machines - User defined cycles - Rapid Manufacturing.

REFERENCES:

1. HMT, Mechatronics, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2. P. M. Agrawal and V. J. Patel, CNC Fundamentals and Programming, Charotar Publishing House Pvt. Ltd., 2014.
3. P. Radhakrishnan, Computer Numerical Control Machines, New Central Book Agency, 2004.
4. G. E. Thyer, Computer Control of Machine Tools, Butterworth-Heinemann Ltd, 1991.
5. Mikell P. Groover, Automation, Production System and Computer Integrated Manufacturing, Prentice Hall of India, New Delhi, 2008
6. [http://nptel.ac.in/courses/Webcourse-contents/IIT_Delhi/Computer %20 Aided %20 Design % 20 & %20ManufacturingII/index.htm](http://nptel.ac.in/courses/Webcourse-contents/IIT_Delhi/Computer%20Aided%20Design%20&%20ManufacturingII/index.htm)

1701MGX02

INDUSTRIAL ECONOMICS

L	T	P	C
3	2	0	4

COURSE OBJECTIVES:

1. To introduce the concepts of micro, macroeconomic systems and business decisions in industry.
2. To acquire knowledge on laws of demand & supply and methods of forecasting the demand
3. To emphasis the systematic evaluation of the costs, breakeven point for return on economics and diseconomies

UNIT I INTRODUCTION

9 Hours

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 Hours

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 Hours

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 Hours

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

UNIT V INTRODUCTION TO MACRO ECONOMICS AND FINANCIAL

9 Hours

ACCOUNTING

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

TOTAL: 45 HOURS

FURTHER READING / CONTENT BEYOND SYLLABUS / SEMINAR :

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

REFERENCES:

1. A Ramachandra Aryasri and V V Ramana Murthy, Engineering Economics and Financial Accounting, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.
2. R Kesavan, C Elanchezhian and T Sunder Selwyn, Engineering Economics and Financial Accounting, Laxmi Publication Ltd, New Delhi, 2005.
3. V L Samuel Paul and G S Gupta, Managerial Economics Concepts and Cases, Tata McGraw Hill Publishing Company Limited, New Delhi, 1981.
4. S N Maheswari, Financial and Management Accounting, Sultan Chand
5. V L Samuel Paul and G S Gupta, Managerial Economics-Concepts and Cases.
6. <http://nptel.ac.in/courses/112107209/>

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

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

COURSE OBJECTIVES:

1. To provide knowledge on modeling and creating tool path of machine components using computer aided manufacturing softwares.
2. To impart part programming knowledge on CNC lathe.
3. To expose part programming knowledge on CNC milling machine.
4. To study the working of wire cut EDM for cutting various shapes.
5. To impart knowledge on developing the prototype by additive manufacturing process.

LIST OF EXPERIMENTS:

1. To make a protected type flanged coupling to transmit the power from $\phi 20$ mm shaft
2. To manufacture a following component as shown below
3. To fabricate a stand as shown in figure.
4. To machine a logo of EGSPEC
5. To make a profile of the following component.
6. To make an injection molding die for simple part using CNC milling and EDM/wire cut EDM Machine
7. Exercise on reverse engineering of pump impeller using 3D scanner and printer.
8. Redesign and make an extruder assembly of a 3D printer to hold three filaments using design for additive
9. Manufacturing principles.

TOTAL: 30 HOURS

1704ME753	MINI PROJECT III (Simulation and analysis)	L	T	P	C
		0	0	2	1

Course Objectives

- To develop skills to formulate a technical project.
- To give guidance on the various tasks of the project and standard procedures.
- To teach use of new tools, algorithms and techniques required to carry out the projects.
- To give guidance on the various procedures for validation of the product and analyse the cost effectiveness.
- To provide guidelines to prepare technical report of the project.

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: 30 Hrs