

**MAHATMA GANDHI INSTITUTE OF TECHNOLOGY**

(Autonomous) Gandipet, Hyderabad – 500 075

**DEPARTMENT OF MECHANICAL ENGINEERING****List of Open Electives Offered by Mechatronics Department to CSB, CSD and CSM****branches under MR-21 Regulation****VI Semester Open Elective-I for CSB, CSM and CSD branches**

<b>S,No</b>	<b>Code</b>	<b>Name of the Course</b>
1	MT631OE	Fundamentals of Electrical Vehicle Technology
2	MT632OE	Fundamentals of Mechatronics

**VII Semester Open Elective-II for CSB, CSM and CSD branches**

<b>S,No</b>	<b>Code</b>	<b>Name of the Course</b>
1	MT731OE	Introduction to Industry 4.0
2	MT732OE	Principles of Entrepreneurship

**VIII Semester Open Elective-III for CSB, CSM and CSD branches**

<b>S,No</b>	<b>Code</b>	<b>Name of the Course</b>
1	MT831OE	Fundamentals of Animatronics
2	MT832OE	Total Quality Management

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### Open Elective for other Departments

#### VI Semester Syllabus

#### MT631OE: Fundamentals of Electrical Vehicle Technology (Open Elective-I)

(Common to CSB, CSD & CSM)

#### Course Objectives:

The objectives of the course is to make the students

- Familiarize with the basic electric components configuration and layout of Electrical vehicles
- Familiarize with different energy storage systems and Hybrid vehicles
- Understand the dynamics of automobile
- Learn the working of various electric motors
- Understand the rules and safety measures related to electrical vehicles

#### Course Outcomes:

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

- Distinguish various advantages and scope for Electrical vehicles
- Apply energy management system strategies for various problems
- Evaluate the performance of the vehicle
- Apply the controls of different motors for drive system efficiency
- Understand various driver circuits and commercial applications including policies and regulations

#### UNIT- I

**Electric Vehicles:** History, Components of Electric Vehicle, General Layout of EV, EV classification Comparison with Internal combustion Engine: Technology, Advantages & Disadvantages of EV, Overview of Tesla car.

#### UNIT- II

**Hybrid Electric Vehicles:** History, Components of Hybrid Electric Vehicle, General Layout of Hybrid EV, Comparison with Electric Vehicles, Advantages & Disadvantages of Hybrid EV, Overview of Toyota prius

#### UNIT- III

**Vehicle Fundamentals:** Vehicle resistance, Types: Rolling Resistance, grading resistance, Torque Required On The Drive Wheel, Transmission: Differential, clutch & gear box, Braking performance.

#### UNIT- IV

**Motors:** Principle and working of DC motor, Characteristics and Types of DC Motors, Overview (Speed torque characteristics) of Permanent Magnet motor, BLDC Motor, Induction motor. Comparison of all motors

#### UNIT- V

**Converters:** Introduction of DC-DC, AC-AC AC-DC, DC-AC, four-quadrant operation, Driver circuits.

**Indian and Global Scenario:** Technology Scenario, Market Scenario, Policies and Regulations, Payback and commercial model, Policies in India.

#### REFERENCE BOOKS:

1. Electrical vehicle technology: John Lowry and James Larminie
2. Modern electric, hybrid electric, and fuel cell vehicles: Fundamentals theory and design Mehrdad Ehsani and Yimin Gao, power electronics and applications series, second edition
3. Electric and hybrid vehicles: Design fundamentals, Iqbal Hussain
4. Build your own electric vehicles, Seth Leitman and Bob Brant
5. introduction to hybrid vehicle system modelling and control, Wei Liu

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**Open Elective for other Departments  
VI Semester Syllabus**

**MT632OE: Fundamentals of Mechatronics (Open Elective-I)**  
(Common to CSB, CSD & CSM)

**Course Objectives:**

The Objective of this course is

- To develop an ability to identify, formulate, and solve engineering problems
- To develop an ability to design a system, component, or process to meet desired needs within realistic constraints.
- To understand and develop PLC Programs
- To develop an ability to use the techniques, skills, and modern engineering tools
- necessary for engineering practice.

**Course Outcomes:**

At the end of the course, the student will be able to,

- Model, analyze and control engineering systems
- Analyze the design aspects in machine structures
- Identify sensors, transducers and actuators to monitor and control the behavior of a process or product
- Develop PLC programs for a given task
- Evaluate the performance of mechatronic systems.

**UNIT – I****Introduction:**

Definition – Trends - Control Methods: Standalone, PC Based (Real Time Operating Systems, Graphical User Interface, Simulation) - Applications: identification of sensors and actuators in Washing machine, Automatic Camera, Engine Management, SPM, Robot, CNC, FMS, CIM. Signal Conditioning: Introduction – Hardware - Digital I/O , Analog input – ADC, resolution, Filtering Noise using passive components – Resistors, capacitors – Amplifying signals using OP amps –Software - Digital Signal Processing – Low pass , high pass , notch filtering

**UNIT – II**

**Precision Mechanical Systems:** Modern CNC Machines – Design aspects in machine structures, guide ways, feed drives, spindle and spindle bearings, measuring systems, control software and operator interface, gauging and tool monitoring. Electronic Interface Subsystems: TTL, CMOS interfacing - Sensor interfacing – Actuator interfacing – solenoids, motors Isolation schemes- opto- coupling, buffer IC's – Protection schemes – circuit breakers, over current sensing , resettable fuses , thermal dissipation -Power Supply - Bipolar transistors / mosfets

**UNIT – III****Electromechanical Drives:**

Relays and Solenoids - Stepper Motors - DC brushed motors –DC brushless motors - DC servo motors - 4-quadrant servo drives , PWM's - Pulse Width Modulation – Variable Frequency Drives, Vector Drives - Drive System load calculation. Microcontrollers Overview: 8051 Microcontroller, micro-processor structure – Digital Interfacing - Analog Interfacing - Digital to Analog Convertors - Analog to Digital Convertors - Applications. Programming –Assembly, C (LED Blinking, Voltage measurement using ADC).

**UNIT – IV**

**Programmable Logic Controller:** Basic Structure - Programming : Ladder diagram –Timers, Internal Relays and Counters - Shift Registers - Master and Jump Controls - Data Handling -Analog input / output - PLC Selection - Applications.

**UNIT – V****Programmable Motion Controllers:**

Introduction - System Transfer Function – Laplace transform and its application in analysing differential equation of a control system – Feedback Devices : Position , Velocity Sensors - Optical Incremental encoders - Proximity Sensors :Inductive , Capacitive , Infrared - Continuous and discrete processes - Control System, Performance & tuning - Digital Controllers - P , PI , PID Control - Control modes – Position, Velocity and Torque - Velocity Profiles – Trapezoidal- S. Curve - Electronic Gearing -Controlled Velocity Profile - Multi axis Interpolation , PTP , Linear , Circular – Core functionalities – Home , Record position , GOTO Position - Applications : SPM, Robotics.

**TEXT BOOKS:**

1. Mechatronics Electronics Control Systems in Mechanical and Electrical Engineering - Bolton /Pearson.
2. Introduction to Mechatronics, Appukuttan, Oxford Press

**REFERENCE BOOKS:**

1. Mechatronics Principles concepts & Applications / N.P.Mahalik / McGraw Hill
2. “Designing Intelligent Machines”. open University, London.

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**Open Elective for other Departments**  
**VII Semester Syllabus**  
**MT731OE: Introduction to Industry 4.0 (Open Elective-II)**  
 (Common to CSB, CSD & CSM)

**Course Objectives:**

The objectives of the course is to make the students

- Introduce basics of Industry 4.0 and its application in the business world
- Understand the smart cities, smart factories concept
- Understand various systems used in Industry 4.0
- Learn integration of Robotics, IoT and smart sensors in manufacturing
- Know the benefits of any organization and individuals to reap benefits while relying on Industry 4.0

**Course Outcomes:**

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

- Understand the drivers and enablers of 4.0
- Apply the technology to build future smart devices and services
- Outline the advantages of manufacturing unit in Industry 4.0
- Realize the power of cloud computing in a networked economy
- Understand the opportunities and challenges brought by Industry 4.0

**UNIT- I**

**Introduction:** core idea of Industry 4.0, origin concept of Industry 4.0, Industry 4.0 production system, current state of Industry 4.0, Technologies, India status on Industry 4.0

**UNIT- II****A conceptual framework for Industry 4.0**

Introduction, Main concepts and components of Industry 4.0, state of Art, supportive Technologies, Proposed Framework for Industry 4.0

**UNIT- III****Technology Roadmap for Industry 4.0**

Introduction, proposed framework for Technology road map, strategy Phase, New product and process development phase

**UNIT- IV****Advances in Robotics in the Era of Industry 4.0**

Introduction- recent technological components of the Robots – Advanced sensor technologies, Internet of Robotic things, Cloud Robotics, and cognitive Architecture for cyber – physical robotics, Industrial robotic applications.

**UNIT- V**

**The role of Augmented Reality in the age of Industry 4.0:** Introduction, AR hardware and software Technology, Industrial Applications of AR

**Obstacles and Framework conditions for Industry 4.0:** Digital strategy alongside Resource scarcity, Lack of standards and poor data security.

**REFERENCE BOOKS**

1. "Industry 4.0: Managing The Digital Transformation" by Alp Ustundag
2. "The Concept Industry 4.0" by Christoph Jan Bartodzie
3. "The fourth Industrial revolution" by Klaus Scab
4. "The Challenges of Industry 4.0 for Small and Medium-sized Enterprises" by Christian Schröder

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### Open Elective for other Departments

#### VII Semester Syllabus

#### MT732OE: Principles of Entrepreneurship (Open Elective-II)

(Common to CSB, CSD & CSM)

#### Course Objectives:

The objectives of the course is to make the students

- Transform their ideas into feasible and successful enterprise.
- Comprehend the financing and managing of new ventures.
- Understand the various industrial financial support services.
- Be acquainted with various production and marketing management
- Know the various labor acts to be adhered to while running a business enterprise

#### Course Outcomes

After completing this course, the students should be able to

- Be aware of the basics of Entrepreneurship and a business plan.
- Understand the various activities related to financing and starting the new ventures.
- Understand the functions of government bodies in implementation of policies and schemes for providing infrastructure and support services.
- Be aware of production techniques and marketing the products.
- Gain knowledge of Labour Legislation in India.

#### UNIT – I

Introduction to Entrepreneurship: Definition of Entrepreneur Entrepreneurial Traits. Entrepreneur vs Manager, creating and starting the venture: sources of new ideas, method of generating ideas, creative problem solving – writing business plan, evaluating business plans. Launching formalities.

#### UNIT – II

Financing and Managing the new ventures: sources of capital, record keeping, recruitment, motivating and leading teams, financial controls. Marketing and sales controls. E commerce and Entrepreneurship, internet advertising – new venture expansion strategies and issues.

#### UNIT – III

Industrial Financial Support: schemes and functions of directorate of industries, District industries centre (DICs) Industrial development corporation (IDC), State Financial corporation (SFCs), small scale industries development corporation (SSIDCs) Khadhi and village industries commission (KVIC) Technical Consultancy organisation (TCO), Small industries service institute (SISI), national small industries corporation (NSIC), small industries development bank of india (SIDBI).

#### UNIT – IV

Production and marketing management: Thrust areas of production management, selection of production techniques, plant utilisation and maintenance, designing the work place, inventory control, material handling and quality control. Marketing functions, market segmentation market research and channels of distribution, sales promotion and product pricing.

**UNIT – V**

Labour legislation, salient provision of health, safety, and welfare under Indian factories Act, Industrialdispute act, employees state insurance act, workmen's compensation act and payment of bonus act .

**TEXT BOOKS:**

1. Robert Hisrich, & Michael Peters: Entrepreneurship, TMH, 2009.
2. Dollinger: Entrepreneurship, Pearson, 2009.

**REFERENCE BOOKS:**

1. Vasant Desai, Dynamics of Entrepreneurial Development and Management, Himalaya PublishingHouse, 2009.
2. Harvard Business Review on Entrepreneurship, HBR Paper Back.
3. Robert J. Calvin: Entrepreneurial Management, TMH, 2009.
4. Gurmeet Naroola: The entrepreneurial Connection, TMH, 2009.
5. Bolton & Thompson: Entrepreneurs—Talent, Temperament and Techniques, ButterworthHeinemann, 2009.
6. Agarwal: Indian Economy, Wishwa Prakashan 2009.
7. Dutt & Sundaram: Indian Economy, S. Chand, 2009.
8. B D Singh.: Industrial Relations & Labour Laws, Excel, 2009.
9. Aruna Kaulgud: Entrepreneurship Management by, Vikas publishing house, 2009.
10. Essential of entrepreneurship and small business management by Thomas W. Zimmerer & Norman M. Scarborough, PHI-2009.
11. ND Kapoor: Industrial Law, Sultan Chand & Sons, 2009.



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### Open Elective for other Departments

#### VIII Semester Syllabus

#### MT831OE: Fundamentals of Animatronics (Open Elective-III)

(Common to CSB, CSD & CSM)

#### Course Objectives:

The objectives of the course is to make the students

- Know the evolution of Animatronics concept and its interdisciplinary relation with Arts, Design and Electronics
- Learn Engineering design and product development that facilitates Animatronics products
- List various materials used for fabrication of Animatronics figures along with advantages and disadvantages
- Understand various metal removal and cutting operations and shell fabrication
- Understanding the operations of various drives used in Automation system

#### Course Outcomes:

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

- Understand the challenges and scope of Animatronics
- Apply principles of DFMA in Industrial design
- Analyze various designs and processes used for obtaining Animatronics objects
- Apply suitable material removal process that suits a required application and the use of soft plastics in various Animatronics products
- Distinguish various drives that are used in Animatronic objects

#### UNIT- I

**Engineering Design and Product Development Process:** Methodology involved in engineering and product, prototyping and testing, DFMA (design for manufacture and assembly), Industrial design, Product-life cycle

#### UNIT- II

Concept Development and Artistic Design, Concept development, Artistic design, boarding, modelling with clays to be utilized as visual aids or patterns for moulding

#### UNIT- III

Mould Design and Fabrication, Sand casting, Plastics processing, injection moulding, gravity based moulding processes using various materials including Plaster of Paris or Urethane, Shell fabrication by use of Rubber Latex and soft plastics

#### UNIT- IV

Mechanism Design and Armature Fabrication, Joints, Mechanisms - Continuous and Intermittent, Power Transmission and related components such as drives and gears, forming processes in shaping links, linkages and structural components, Costuming through Fabrics, Soft Plastics and Painting

**UNIT- V**

Actuators and Sensors Fundamentals of Electricity and Electronics, Electric motors (DC, RC, servo or stepper), switches, sensors, Controllers and Programming, RC or autonomous systems and InteractiveC programming

**REFERENCE BOOKS**

1. Robots, Androids and Animatrons by John Iovin
2. AC 2011-190: Employing Animatronics in Teaching Engineering Design by Arif Sirinterlikci, Robert Morris University

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**Open Elective for other Departments  
VIII Semester Syllabus**

**MT832OE: Total Quality Management (Open Elective-III)  
(Common to CSB, CSD & CSM)**

**Course Objectives:**

To facilitate students to understand

- the philosophy of quality and use of statistical control tools and control chart techniques relating to total quality management
- Bench marking practices and various tools of TQM
- Understand the implication of quality on Business
- Implement Quality implementation programs
- concept of quality circle, performance of quality management system, ISO 9000 and quality audit

**Course Outcomes:**

Upon successful completion of this course, student should be able to

- Understand quality management philosophies, techniques and frameworks. Develop an ability to apply the basic concepts of quality monitoring methods including control charts, acceptance sampling etc.
- Understand the bench mark procedure for assurance of quality by focusing customer satisfaction
- Understanding of some of the TQM tools and techniques for effective real life applications
- Apply TQM process and concepts to enhance the performance of systems
- Understand the implications of standard quality management system ISO 9000, quality audit and implementation

**UNIT-I**

**Concept of TQM and Management of Process Quality:** Introduction, The concept of TQM, Quality and Business performance, attitude, and involvement of top management, communication, culture and management systems. **Management of Process Quality:** Definition of quality, Quality Control, a brief history, Product Inspection vs. Process Control, Statistical Quality Control, Control Charts and Acceptance Sampling.

**UNIT-II**

**Quality Focus and Bench Marking:** Process vs. Customer, internal customer conflict, quality focus, Customer Satisfaction, role of Marketing and Sales, Buyer - Supplier relationships. **Bench Marking:** Evolution of Bench Marking, meaning of bench marking, benefits of bench marking, the bench marking procedure, pitfalls of bench marketing.

**UNIT-III**

**Tools for TQM :** The systems approach, organizing for quality implementation, making the transition from a traditional to a TQM organization, Quality Circles, seven Tools of TQM: Stratification, check sheet, Scatter diagram, Ishikawa diagram, pareto diagram, Kepner & Tregoe Methodology.

**UNIT-IV**

**The Cost of Quality:** Definition of the Cost of Quality, Quality Costs, Measuring Quality Costs, use of Quality Cost information, Accounting Systems and Quality Management

**UNIT-V**

**ISO 9000:** Universal Standards of Quality: ISO around the world, The ISO 9000 ANSI/ASQC Q- 90. Series Standards, benefits of ISO 9000 certification, the third party audit, Documentation ISO9000 and services, the cost of certification implementing the system.

**TEXT BOOKS:**

1. Joel E. Ross, Total Quality Management, Taylor and Francis Limited, Third Edition, 1999
2. Mukherjee, P.N., Total Quality Management, PHI,2006

**REFERENCE BOOKS:**

1. Robert L Flood, Beyond TQM, Wiley, 1<sup>st</sup> Edition,1993
2. Grant, E.L. and Leavenworth, R.S., Statistical Quality Control, TMH, 7<sup>th</sup> Edition,2012
3. Lal, H., Total Quality Management: A Practical Approach, New Age International,1990
4. Kanishka Bedi, Quality Management, Oxford University Press, First Edition,2006
5. Sunil Sharma, Total Engineering Quality Management, Macmillan India Ltd.,2003