

## Shroff S.R. Rotary Institute of Chemical Technology

**Ref:** UPL University /SRICT/BOS/ME/2022-23/01

**Date:** 24-01-2023

### Teaching Scheme for Third Year Diploma in Mechanical Engineering

#### Semester-V (Mechanical Engineering) Structure

Sl. No	Category	Code No.	Course Title	Hours per week			Total contact hrs/ week	Credits	E	M	I	V	Total
				L	T	P							
1	Program core course	ME1301	Advanced manufacturing processes	3	0	2	5	4	70	30	20	30	150
2	Program core course	ME1302	Theory of machines & Mechanisms	3	0	0	3	3	70	30	0	0	100
3	Program core course	ME1303	Industrial engineering & management	3	0	0	3	3	70	30	0	0	100
4	Humanities and Social Science course	ME1304	Elements of Economics & Management	3	0	0	3	3	70	30	0	0	100
5	Program Elective course	ME1305, ME1306, ME1307	Any one Programme elective-II	3	0	2	5	4	70	30	20	30	150
6	Open Elective	ME1308, ME1309, ME1310	Any one open elective-II	3	0	0	3	3	70	30	0	0	100
7	Audit Course - IC	MH1301	Indian Constitution	2	0	0	2	0	50	0	0	0	50
8	Summer Internship-II (6 weeks) after IVth Sem	MH1302	Summer Internship-II (6 weeks) after IVth Sem	0	0	0	0	3	0	0	50	50	100
<b>Total</b>				<b>20</b>	<b>0</b>	<b>4</b>	<b>24</b>	<b>23</b>	<b>470</b>	<b>180</b>	<b>90</b>	<b>110</b>	<b>850</b>

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5	Programme Elective-II	ME1305	Computer Integrated Manufacturing
	Programme Elective-II	ME1306	Industrial Robotics & Automation
	Programme Elective-II	ME1307	Mechatronics

6	Open Elective-II	ME1308	Advanced Welding Technology
	Open Elective-II	ME1309	Industrial Equipment & Maintenance
	Open Elective-II	ME1310	3-D Printing

### Semester-VI (Mechanical Engineering) Structure

S · N o	Category	Code No.	Course Title	Hours per week			Total conta ct hrs/ wee k	Credits	E	M	I	V	Total
				L	T	P							
1	Program core course	ME1312	Design of machine elements	2	0	2	4	3	70	30	20	30	150
2	Program core course	ME1313	Productio n& operations manageme nt	2	0	0	2	2	70	30	0	0	100
3	Program Elective course	ME1314, ME1315, ME1316	Any one Programm eelective- III	2	0	2	4	3	70	30	20	30	150
4	Program Elective course	ME1317, ME1318, ME1319	Any one Programm eelective- IV	3	0	0	3	3	70	30	0	0	100
5	Open Elective course II	ME1320, ME1321, ME1322	Any one openelective- III	3	0	0	3	3	70	30	0	0	100
6	Major Project	MH1303	Project	0	0	18	18	9	0	0	100	100	200
Total				12	0	4	16	23	350	150	140	160	800

3	Programme Elective-III	ME1314	Refrigeration & Air Conditioning
	Programme Elective-III	ME1315	Power Plant Engineering
	Programme Elective-III	ME1316	Hybrid Vehicles

4	Program me Elective-IV	ME1317	Computer Aided Design & Manufacturing
	Program me Elective-IV	ME1318	Product Design
	Program me Elective-IV	ME1319	Farm Equipment & Farm Machinery

5	Open Elective-III	ME1320	Economics Policies in India
	Open Elective-III	ME1321	Disaster Management
	Open Elective-III	ME1322	Introduction of E-Governance

❖ **Course code and definition:**

Course code	Definitions
L	Lecture
T	Tutorial
P	Practical
E	Theory External Examination Marks
M	Theory Internal Examination Marks
I	Practical Internal Examination Marks
V	Practical External Examination Marks

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Diploma of Engineering

Subject Code: ME 1301

Subject Name: Advanced Manufacturing Process

## Shroff S.R. Rotary Institute of Chemical Technology

Semester: - V

**Type of course:** Engineering Science Course

**Prerequisite:** Zeal to learn the subject of recent advancement in manufacturing process

**Rationale:** To impart comprehensive knowledge about consideration of advance manufacturing processes and metal removal rate during different advanced processes as well as product development processes.

### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

### Content:

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Jigs &amp; Fixtures:</b> Definition of jig; Types of jigs: Leaf jig, Box and Handle jig, Template jig, Plate jig, Indexing jig, Universal jig, Vice. Types of fixtures: Vice fixtures, Milling fixtures, Boring fixtures, Grinding fixtures - constructional details of the above fixtures; Basic principles of location; Locating methods and devices;	06
2	<b>Jig Boring:</b> Introduction; Jig boring on vertical milling machine, Types jig boring machines, Open front machine, Cross rail type machine - constructional details & their working, System of location of holes.	04
3	<b>Plastic Processing:</b> Processing of plastics: Moulding processes, Injection moulding, Compression moulding, Transfer moulding, Extruding, Casting, Fabrication methods-Sheet moulding, Blow moulding, Laminating plastics (sheets, rods & tubes), Reinforcing; Applications of Plastics.	08
<b>SECTION-B</b>		
4	<b>Modern Machining Processes:</b> Introduction – comparison with traditional machining; Ultrasonic Machining: principle, Description of equipment, applications; Electric Discharge Machining: Principle, Description of equipment, Dielectric fluid, tools (electrodes), Process	08

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**Diploma of Engineering**

**Subject Code: ME 1301**

**Subject Name: Advanced Manufacturing Process**

	parameters, Output Characteristics, applications; Wire cut EDM: Principle, Description of equipment, Controlling parameters; applications; Laser Beam Machining: principle, description of equipment, application; Electro Chemical Machining: description of equipment, application.	
<b>5</b>	<b>CNC Machines:</b> Constructional features, Axis identification, Electronic control system. Automatic tool changer and tool magazine. CNC programming: Preparatory functions (G code), miscellaneous functions (M code), Basic Part programming of CNC Turning.	<b>06</b>
<b>6</b>	<b>Machine Tool Automation:</b> Introduction and Need; (A) Single spindle automates, transfer lines.(B) Elements of control system, Limit switches, Proximity switches, Block diagram for feedback and servo control system, Introduction to PLC, Block diagram of PLC.	<b>04</b>

**Text Books:**

1. Production Technology – HMT, Bangalore, Tata Mc-Graw Hill
2. Non-conventional Machining – P. K. Mistra, Narvasa Publishing House

**Reference Books:**

1. Manufacturing Processes – Begman & Amsted, John Willey and Sons.
2. Advanced manufacturing technology – David L. Goetsch

**List of Practical:**

1. Study of Jig & Fixture use in industry.
2. Study of various type of Moulding Process.
3. Study of G-code & M-code use in CNC machine.
4. Make a program using G-code & M code for general step turning.
5. Study of Mechanical type non-conventional machining process.
6. Study of Thermal type non-conventional machining process.
7. Study of Chemical type non-conventional machining process.
8. Study of types of maintenance process & Total Productive Maintenance (TPM).

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**Diploma of Engineering**

**Subject Code: ME 1301**

**Subject Name: Advanced Manufacturing Process**

**Course Outcomes:**

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	<b>Identify</b> the function of Jig & Fixture.
CO-2	<b>Study</b> of Jig Boring machine.
CO-3	<b>Understand</b> the concept of moulding process.
CO-4	<b>Distinguish</b> between non-conventional machining and traditional machining processes.
CO-5	<b>Apply</b> the principles of G-code & M-code in CNC Machine.
CO-6	<b>Illustrate</b> the advancements in the area of machine tool in automation.

**List of Open Source Software/learning website:**

1. <http://nptel.ac.in/>

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Diploma of Engineering

Subject Code: ME1302

Subject Name: Theory of Machines & Mechanisms

## Shroff S.R. Rotary Institute of Chemical Technology

Semester: - V

**Type of course:** Programme core course

**Prerequisite:** Basics of Mechanical Engineering

**Rationale:** Provides the knowledge of kinematics and dynamics of different machine elements and popular mechanism such as four link mechanisms, cam-follower, belt-pulley, chain-sprocket, gears, flywheel, and governor.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Fundamental &amp; Type of Mechanism:</b> Concept and Examples of Kinematics, Kinetics and Dynamics. Basic terminology related to machines and mechanisms, Development of different mechanisms and its inversions like four bar chain mechanism, single slider crank mechanism, double slider crank mechanism, etc.	05
2	<b>Velocity and Acceleration in Mechanism:</b> Basic concept used in solving velocity and acceleration problems, Approach to solve velocity and acceleration related to mechanisms using Relative velocity method for single slider crank mechanism and Four bar chain mechanism, Klein's construction for single slider cranks mechanism.	06
3	<b>Power Transmission:</b> Introduction, Belt and rope drives, open and crossed belt drives, actions	07



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**Diploma of Engineering**

**Subject Code: ME1302**

**Subject Name: Theory of Machines & Mechanisms**

	of belt on pulleys, velocity ratio. Material for belts and ropes, Slip & creep in belts & ropes, Types of belts, Types of pulleys, crowning in pulley, Laws of belting and length of belt (open & cross belt), Chain drive, classification of chains, classification of gears, Gear nomenclature, Forms of teeth, cycloid profile and involute profile teeth, Simple, compound, reverted and epicyclic gear train, Merits and demerits of power transmission drives.	
<b>SECTION-B</b>		
<b>4</b>	<b>Cams &amp; Followers:</b> Introduction, functions and types of cams and cam followers, Types of motions and displacement for different types of cam and cam followers, Construct different types of cam profiles.	<b>05</b>
<b>5</b>	<b>Fly Wheel &amp; Governor:</b> Functions of fly wheel, Kinetic Energy of rotating masses, turning moment diagram, Types of fly wheels, Co-efficient of energy & speed, Functions of governor; comparison between a fly wheel and governor, Types of governors – Principle, construction and working of Watt governor & Porter governor, Simple problems on watt and porter Governor, Terminology used in Governors: Height, equilibrium speed, Hunting, isochronism, stability, sensitiveness.	<b>06</b>
<b>6</b>	<b>Balancing &amp; Vibration:</b> Need of balancing, Concept of static and dynamic balancing, balancing of rotating mass by another mass in the same plane, Concept of reference plane, Simple problems pertaining to several masses rotating in different planes. Introduction of vibration, Types of vibration – longitudinal, transverse and torsional vibration, Causes, remedial measures & harmful effects of vibrations.	<b>07</b>

**Text Books:**

- 1) Theory of Machines, Khurmi R. S., Gupta. J.K, S. Chand & Co Ltd
- 2) Theory of Machines and Mechanism, S. B. Soni, Atul Prakashan

**Reference Books:**

- 1) Theory of Machines, Rattan S. S., Tata McGraw-Hill
- 2) Kinematics and Dynamics of Machinery, Norton R. L., McGraw-Hill
- 3) Mechanism and Machine Theory, Ambekar, A. G., Prentice Hall
- 4) Theory of Machines, Singh Sadhu, Pearson Education

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**Diploma of Engineering**

**Subject Code: ME1302**

**Subject Name: Theory of Machines & Mechanisms**

**Course Outcomes:**

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Understand the basic structure and elements of machines and mechanism.
CO-2	Determine position, velocity and acceleration of linkages in mechanism.
CO-3	Recognize the need and mode of power transmission along with its different modes.
CO-4	Design of cams and follower.
CO-5	Select suitable flywheel and governor for various applications.
CO-6	Understand the concept of balancing and vibration.

**List of Open-Source Software/learning website:**

- <https://archive.nptel.ac.in>

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Diploma of Engineering

Subject Code: ME1303

Subject Name: Industrial Engineering & Management

## Shroff S.R. Rotary Institute of Chemical Technology

Semester: - V

Type of course: Program core course

Prerequisite: None.

**Rationale:** Industrial Engineering course is to prepare students to understand different aspects like: Plant location and its selection, Plant layout within the plant. It also helps to understand and apply different concept of production planning and control. Study of productivity and Work-study are important tools, after studying it student are able to apply it in the industry for productivity improvement. This course gives idea about how to prepare job plan, and also gives knowledge of industrial management. Finally it provides knowledge about quality control.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Plant Engineering:</b> Plant, Selection of industry, Plant layout, Principles of a good layout, Types, Process, Product and Fixed position, Principles of Material handling equipment, Plant maintenance importance, Break down maintenance, Preventive maintenance and Scheduled maintenance.	04
2	<b>Work Study:</b> Productivity, Standard of living, Method of improving Productivity, Objectives and Importance of good working conditions.	07
3	<b>Method Study:</b> Definition, Objectives, Selection of a job for method study, Basic procedure for conduct of Method study, Tools used, Operation process chart, Flow process chart, Two handed process chart, Man Machine chart, String diagram and flow diagram.	07

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**Diploma of Engineering**

**Subject Code: ME1303**

**Subject Name: Industrial Engineering & Management**

<b>SECTION-B</b>		
<b>4</b>	<b>Types of Production:</b> Mass Production, Batch Production and Job Order Production, Characteristics, Economic Batch Quantity (EBQ), Principles of Product and Process Planning, Make or Buy decision, Numerical problems.	<b>04</b>
<b>5</b>	<b>Principles of Management:</b> Definition of Management, Administration, Organization, F.W. Taylor's and Henry Fayol's Principles of Management, Functions of Manager. Modern Management Techniques, Just In Time, Total Quality Management (TQM). Quality circle: Zero defect concept, 5S Concept, Management Information Systems.	<b>07</b>
<b>6</b>	<b>Quality Control:</b> Definition, Objectives, Types of Inspection: First piece, Floor and Centralized Inspection, Advantages and Disadvantages, Statistical Quality Control, Types of Measurements, Method of Variables, Method of Attributes, Uses of X, R, p and c charts, Operating Characteristics curve (O.C curve), Sampling Inspection, Single and Double Sampling plan, Concept of ISO 9001:2008, Quality Management System Registration/Certification procedure, Benefits of ISO to the organization.	<b>07</b>

**Text Books:**

1. Industrial Engineering & Management, S.C. Sharma, Khanna Book Publishing Co. (P) Ltd., Delhi
2. Industrial Engineering and Management, O.P. Khanna, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi – 110002.
3. Principles and Practices of Management, Premvir Kapoor, Khanna Publishing House, N. Delhi

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**Diploma of Engineering**

**Subject Code: ME1303**

**Subject Name: Industrial Engineering & Management**

**Reference Books:**

1. Management, A global perspective, Heinz Wehrich, Harold Koontz, 10<sup>th</sup> Edition, McGraw Hill International Edition 1994.
2. Essentials of Management, 4th Edition, Joseph L.Massie, Prentice-Hall of India, New Delhi 2004.

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	<b>Demonstrate</b> location decision and site selection & use plant layout knowledge for betterment of plant.
CO-2	<b>Apply</b> work study techniques and understands its importance for better productivity.
CO-3	<b>Identify</b> method study techniques for better productivity.
CO-4	<b>Understand</b> the use of Production planning and control.
CO-5	<b>Acquire</b> knowledge of industrial management system.
CO-6	<b>Describe</b> the importance of quality control techniques used in the industry.

**List of Open Source Software/learning website:**

1. <http://nptel.ac.in/>

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**Diploma of Engineering**

**Subject Code: ME1304**

**Subject Name: Elements of Economics & Management**

Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - V**

**Type of course:** Humanities and Social Science

**Prerequisite:** Zeal to learn economics and management in engineering.

**Rationale:** The students should be trained not only in engineering but also in managing activities of industries. The knowledge about plant, safety, work study techniques, personnel management and financial management will definitely mould the students as managers to suit the industries.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Production Planning and Management:</b> Introduction, Major functions of Production Planning and management, Pre planning, Methods of forecasting, Routing and Scheduling, Dispatching and Managing, Concept of Critical Path Method (CPM).	07
2	<b>Material Management:</b> ABC analysis of Inventory, Procurement and Consumption cycle, Economic Order Quantity problems, Supply Chain.	07
3	<b>Work Measurement:</b> Definition, Basic procedure in making a time study, Employees rating factor, Application of time allowances: Rest, Personal, Process, Special and Policy allowances, Calculation of standard time, Numerical Problems, Basic concept of production study, Techniques of Work Measurement, Ratio delay study, Synthesis from standard data, Analytical estimating and Pre determined Motion Time System (PMTS).	04
<b>SECTION-B</b>		
4	<b>Factory Costing:</b> Direct Cost, Indirect Cost, Factory Overhead, Selling Price of a product, Profit, Numerical Problems, Depreciation, Causes.	07

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**Diploma of Engineering**

**Subject Code: ME1304**

**Subject Name: Elements of Economics & Management**

<b>5</b>	<b>Personnel Management:</b> Responsibility of Human Resource Management, Selection Procedure, Training of Workers, Apprentice Training, On the Job training and Vestibule School Training, Job Evaluation and Merit Rating, Objectives and Importance, Wages and Salary Administration, Components of Wages, Wage Fixation, Type of Wage Payment: Halsey's 50% Plan, Rowan's Plan and Emerson's efficiency plan, Numerical Problems.	<b>07</b>
<b>6</b>	<b>Financial Management:</b> Fixed and Working Capital, Resources of Capital, Shares Preference and Equity Shares, Debentures, Type of debentures, Public Deposits.	<b>04</b>

**Text Books:**

1. Industrial Engineering & Management, S.C. Sharma, Khanna Book Publishing Co. (P) Ltd., Delhi
2. Industrial Engineering and Management, O.P. Khanna, Revised Edition, Dhanpat Rai Publications (P) Ltd., New Delhi – 110002.

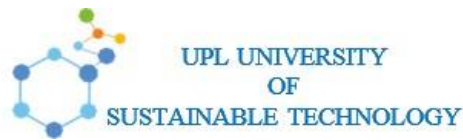
**Reference Books:**

1. Essentials of Management, 4th Edition, Joseph L. Massie, Prentice-Hall of India, New Delhi 2004.
2. Principles and Practices of Management, Premvir Kapoor, Khanna Publishing House, N. Delhi

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	<b>Understand</b> production planning and explain the various method of forecasting.
CO-2	<b>Analyze</b> various inventory method and process of procurement and purchase.
CO-3	<b>Identify</b> method of work measurement and explain various allowances related to HRM
CO-4	<b>Study and calculate</b> various cost associated with operation of factory.
CO-5	<b>Understand and Apply</b> the responsibilities of HRM and working area of HR manager
CO-6	<b>Operate and Control</b> various capital cost and equity and market survey related to factory



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**Diploma of Engineering**

**Subject Code: ME1304**

**Subject Name: Elements of Economics & Management**

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**List of Open Source Software/learning website:**

1. <http://nptel.ac.in/>



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Diploma of Engineering

Subject Code: ME1305

Subject Name: Computer Integrated Manufacturing

Shroff S.R. Rotary Institute of Chemical Technology

Semester: - V

Type of course: Programme Elective

Prerequisite: Nil

**Rationale:** CIM is normally not only limited to machine tools but in real life its use has widened in almost all areas of manufacturing, processes and support activities. In this course an attempt has been made to focus not only programming and tooling of CNC machines but also their design, modelling, planning and analysis so that students may learn to use the CIM based system efficiently for manufacturing desired products.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	Concept of Computer Integrated Manufacturing (CIM): Basic components of CIM; Distributed database system; distributed communication system, computer networks for manufacturing; future automated factory; social and economic factors	4
2	<b>Computer Aided Design (CAD):</b> CAD hardware and software; product modelling, automatic drafting; engineering analysis; FEM design review and evaluation	7
3	<b>Computer Aided Manufacturing (CAM):</b> Computer assisted NC part programming; Fundamentals of Part programming, Types of format, Part Programming for drilling, lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric subroutines.	7
<b>SECTION-B</b>		
4	<b>Programmable Logic Controllers:</b> Relay Device components, Programmable controller architecture, programming a programmable controller, tools for PLC logic design.	3
5	<b>Group Technology and CAPP:</b> Introduction, part families, part classification and coding systems: OPITZ, PFA, FFA, Cell design, rank order clustering, composite part concepts, Benefits of group technology. Approaches to Process Planning, Different CAPP system, application and	8

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**Diploma of Engineering**

**Subject Code: ME1305**

**Subject Name: Computer Integrated Manufacturing**

	benefits, computer aided material requirements planning (MRP)	
<b>6</b>	<b>Integrated Production Management System:</b> Introduction, PPC fundamentals, Problems with PPC, Introduction to ERP. Just in Time philosophy: JIT & GT applied to FMS, concepts of Expert System in Manufacturing and Management Information System.	<b>7</b>

**Text Books:**

1. CAD, CAM, CIM - P.Radhakrishnan and S.Subramanyan, New Age International Publishers.
2. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover, P.H.I. Learning Private Limited

**Reference Books:**

1. CAD, CAM, CIM - P.Radhakrishnan and S.Subramanyan, New Age International Publishers.
2. Computer Integrated Manufacturing - Paul G. Rankey, Prentice Hall.
3. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill, 1993
4. CAD/CAM, Principles and Applications –P N Rao, McGraw Hill, 2010.
5. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007.
6. Computer integrated manufacturing -S. Kant Vajpayee – Prentice Hall of India.

**List of Practical:**

1. 1. To study of Computer aided design : Basics, Types of modelling and automatic drafting
2. 2. Exercise on modelling software for given drawing
3. 3. To study of Computer Integrated System: Basics, Types of Manufacturing, and CIM wheel
4. 4. To Understand NC/CNC technology: Definition, Classification, Specification, Construction details.
5. 5. Exercise CNC part Programming: Lathe jobs
6. 6. Exercise CNC part Programming: Milling jobs
7. 7. Exercise on PLC for Simple problems
8. 8. To study of Group technology and understand part classification and coding systems

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	Summaries the scope of CIM concept with advancement in manufacturing system
CO-2	Apply various CAD modelling softwares and analyse design configurations

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**Diploma of Engineering**

**Subject Code: ME1305**

**Subject Name: Computer Integrated Manufacturing**

CO-3	Illustrate Computer Aided Manufacturing with NC, CNC and PLC technology for Industry
CO-4	Describe use of various PLC circuits with CIM based system
CO-5	Identify and measure the scope of concept of Group technology and level of CAPP required in system
CO-6	Demonstrate Integrated Production Management system.

**List of Open Source Software/learning website:**

- [nptel.ac.in](http://nptel.ac.in)

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Diploma of Engineering

Subject Code: ME1306

Subject Name: Industrial Robotics & Automation

## Shroff S.R. Rotary Institute of Chemical Technology

Semester: - V

Type of course: Programme Elective

Prerequisite: Nil

**Rationale:** The aim of present course is to introduce the students about the basic automation theory and understanding of its devices. Students can think and get innovative idea in the area of shop floor automation. This subject is useful to understand the different types of automation and production system used in industries

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Fundamentals of Robotics:</b> Introduction; Definition; Robot anatomy (parts) and its working; Robot Components: Manipulator, End effectors; Construction of links, Types of joints; Classification of robots; Cartesian, Cylindrical, Spherical, SCARA, Vertical articulated; Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume; Robot work Volumes, comparison; Advantages and disadvantages of robots.	8
2	<b>Robotic controllers and accessories:</b> Microprocessors and Microcontrollers based robotic controllers, Peripheral Interfacing with microcontrollers and its programming in C, Arduino platform as robotic controller, Sensors & Actuators, Grippers interfacing with robotic controller, DC Motors, and Stepper Motors Interfacing and its programming.	6
3	<b>Industrial Applications of Robot :</b> Application of robots in machining; welding; assembly and material handling. Robot cell design, selection of robot. Robot specification	4
<b>SECTION-B</b>		

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**Diploma of Engineering**

**Subject Code: ME1306**

**Subject Name: Industrial Robotics & Automation**

<b>4</b>	<b>Introduction:</b> Automation and types, Automated Manufacturing System, Reasons for Automating, the USA Principle, Strategies for automation and process improvement, automation migration strategies, levels of automations, Types of Automations.	<b>7</b>
<b>5</b>	<b>Automated Machinery:</b> Introductions, Automated transfer machine, automated transfer line, auto-storage and retrieval system, automated guided vehicles, automated material handling system (ASRS system), automated inspection system and CMM. Concept of modular automations, Case study for modular design: Casting shop design, Machine shop design.	<b>7</b>
<b>6</b>	<b>Automation Economy:</b> Plant Economy, feasibility of automation on economical sense, effect of automation on economy, feasibility of automation in Indian market, Scope of automation in Indian industries, Break Even point analysis for automation.	<b>4</b>

**Text Books:**

1. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P. Groover, P.H.I. Learning Private Limited.
2. Industrial Automation and Robotics by Er. A. K. Gupta and S. K. Arora, University Science Press, Laxmi Publishing Pvt. Ltd.

**Reference Books:**

1. S. K. Saha, "Introduction to Robotics", Tata McGraw Hill Education Pvt. Ltd., New Delhi.
2. R. K. Mittal, I. J. Nagrath, "Robotics and Control", Tata McGraw-Hill Publishing Company Ltd.
3. Beginning Arduino by McRoberts Michael, Publication: Technology in Action

**List of Practical:**

1. To study of Robotics: Basics, components, types and coordinate system
2. To understand microprocessors and microcontrollers based robotic controllers
3. To study of various sensors and actuators used in robot system
4. To understand various Grippers and their interfacing with robotic controller
5. Exercise: Programs on logic based on solutions of AND, OR, NOT
6. To study automation: Types of automation, process improvement and automation migration strategies
7. Case study for modular design: Casting shop design, Machine shop design.
8. Case study on feasibility of automation in chosen Industry

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**Diploma of Engineering**

**Subject Code: ME1306**

**Subject Name: Industrial Robotics & Automation**

**Course Outcomes:**

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Summarise the robot anatomy, classification, characteristics of robot, advantages and disadvantages.
CO-2	Identify and explain various types of sensors and actuators used in robot vision system.
CO-3	Demonstrate and analyse the various applications of robots.
CO-4	Overall understanding of automated systems integration using CIM
CO-5	Identify and measure the scope of automation in shop floor production sytem like casting , machining
CO-6	Calculate economic feasibility of automation system in conventional system

**List of Open Source Software/learning website:**

- [nptel.ac.in](http://nptel.ac.in)

(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**  
**Subject Code: ME1307**  
**Subject Name: Mechatronics**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - V**

**Type of course:** Programme elective course

**Prerequisite:** Zeal to learn the subject

**Rationale:** To impart knowledge about the elements and techniques involved in Mechatronics systems which are very much essential to understand the emerging field of automation.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	2	4	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Basic Mechatronics System:</b> Introduction, Need and Scope, Traditional v/s Mechatronics Approach, Block diagram representation of General Mechatronics system showing various components with suitable example, Control System, Open and Closed Loop Systems, Basic Elements of closed loop system.	<b>06</b>
<b>2</b>	<b>Transducers:</b> Introduction, Primary and Secondary Transducers, Working of Primary and Secondary Transducers; Mechanical Device as Primary detectors, Electrical Transducers, Active and Passive Transducers, Analog and Digital Transducers.	<b>05</b>
<b>3</b>	<b>Sensors:</b>	<b>07</b>

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**Diploma of Engineering**  
**Subject Code: ME1307**  
**Subject Name: Mechatronics**

	Introduction, Need of Sensors, Contact and Non-Contact Type of Sensors, Classification, Working and Application of-Potentiometer Sensors, Strain Gauge Elements, Capacitive Elements, Eddy Current, Proximity Sensors, Inductive, Proximity Sensors, Light Sensors, Pressure Sensors, Pneumatic Sensors, Pyro electrical Sensors, Piezoelectric Sensors; Selection of Sensors.	
<b>SECTION-B</b>		
<b>4</b>	<b>Actuators:</b> Introduction and Classification of Actuators, Need and Scope, Introduction and Classification of Actuators, Need and Scope, Electrical Actuation Systems, Electrical Systems Viz., Switching Devices, solenoid type Devices, Drive Systems, Mechanical Switches Viz., Debouncing, Keypads, Electro-Mechanical and Solid-State Relays, Stepper Motors; Selection of Actuators.	<b>05</b>
<b>5</b>	<b>Programmable Logic Controller:</b> Introduction, definition, Basic PLC functions, PLC block diagram, Difference between relay panel and PLC, Power supply, input/output modules (analog, digital) concept of sink/source, set/reset, latch/unlatch; Selection of a PLC, Programing equipment; Programing Formats, Ladder diagrams and sequence listing, PLC auxiliary commands and functions.	<b>06</b>
<b>6</b>	<b>Microcontroller and Applications of Mechatronics System:</b> Comparison of microprocessor and microcontroller; Introduction, Architecture-Pin Configuration of 8051 Microcontroller; Introduction to interfacing of D/A converters and A/D converters with 8051 microcontrollers, Applications-Temperature control Stepper motor control, Application of Mechatronics systems in Washing Machines.	<b>07</b>

**Text Books:**

- 1) A Textbook of Mechatronics, Rajput R. K., Gupta. J.K, S. Chand & Co Ltd.

**Reference Books:**

- 1) Mechatronics, Bolton W. Addison, Wesley Longman Ltd., U.S.A.
- 2) Mechatronics, H.M.T, McGraw-Hill Education.



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**Diploma of Engineering**  
**Subject Code: ME1307**  
**Subject Name: Mechatronics**

- 3) Introduction to mechatronics and Measuring Systems, David G. Alciatore & Michae B. Histan, McGraw-Hill.
- 4) Mechanical Measurements and Instrumentation Sawhney Puneet. Sawhney A.K. Dhanpat Rai and Sons.

**List of Practical/ tutorials:**

- 1) Study of Basic block diagram of Mechatronics system components.
- 2) Study and demonstration of motion / force transducers.
- 3) Study and demonstration of temperature / pressure transducers.
- 4) Study and demonstration of AD/DA converter.
- 5) Study and demonstration of hydraulic actuator/pneumatic actuator.
- 6) Study of Programmable Logic Controller.
- 7) Study of Microprocessors and Microcontrollers.
- 8) Study of Robot/Autonomous guided vehicle.

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	Identify different instruments, sensor, actuators, microprocessor, software and mechanical components in mechatronics-based systems.
CO-2	Use sensor for different mechatronics applications.
CO-3	Use transducers for different mechatronics-based applications.
CO-4	Use actuator for various mechatronics-based applications.
CO-5	Programme PLC for various applications.
CO-6	Use microprocessor and microcontroller for various mechatronics-based applications.

**List of Open-Source Software/learning website:**

- <https://archive.nptel.ac.in>

(Established under Gujarat Private Universities Act, 2009)

Diploma of Engineering

Subject Code: ME1308

Subject Name: Advance Welding Technology

## Shroff S.R. Rotary Institute of Chemical Technology

Semester: - V

Type of course: Open Elective

Prerequisite: Nil

**Rationale:** Welding is one of the major manufacturing processes used in the fabrication of process equipment, steel structures, piping and ship building, Chemical Processing vessels & storage tanks, agricultural equipment, turbines etc. The subject focuses on knowledge and understanding the fundamental principles and their relative merits and demerits. Basic understanding of weldability of different metals and alloys is emphasized. The student will be able to apply knowledge and skills of welding in producing products of quality as per the quality standard of the industries.

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<p><b>Welding Power Sources:</b> Physics of welding Arc, Basic characteristics of power sources for various arc welding processes, Transformer, rectifier and generators.</p> <p><b>Physics of Welding Arc:</b> Welding arc, arc initiation, voltage distribution along the arc, arc characteristics, arc efficiency, heat generation at cathode and anode, Effect of shielding gas on arc, isotherms of arcs and arc blow.</p>	4
2	<p><b>Modern Welding Processes:</b> Manual Metal Arc Welding (MMAW), TIG, MIG, Plasma Arc, Submerged Arc Welding, Electrode Gas and Electroslag, Flux Cored Arc Welding, Resistance welding, Friction welding, Brazing, Soldering and Braze welding processes, Laser beam welding, Electron beam welding, Ultrasonic welding, Explosive welding, Friction Stir Welding, Underwater welding &amp; Microwave welding.</p>	7
3	<p><b>Determination of preheat temperature:</b> Use of Schaeffler's diagram, weldability tests, heat flow in welding - significance, theory of heat flow, cooling rate determination, selection of welding parameters based on heat flow analysis Residual stress and distortion - theory of residual stresses and distortion calculation, welding codes, joint design, analysis of fracture and fatigue of welded joints - fracture, energy consideration fracture toughness testing and its application to welded joints.</p>	7

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**Diploma of Engineering**

**Subject Code: ME1308**

**Subject Name: Advance Welding Technology**

<b>SECTION-B</b>		
<b>4</b>	<b>Repair &amp; Maintenance Welding:</b> Welding defects, weld cracking Phenomena and its prevention, Repairing of weld joints, .Hardfacing, Cladding, Surfacing, Metallizing processes and Reclamation welding.	<b>4</b>
<b>5</b>	<b>Weldment Inspection and Testing:</b> Codes governing welding inspection: Structural welding code; ASME boiler and pressure vessel code, spot examination of welded joints, duties of the inspector, ASTM standards, API standards <b>Testing of Welded joints:</b> Review of Inspection and Chemical, Metallurgical, and Mechanical testing of welded joints, Weld Solidification Cracking Susceptibility Test Methods.	<b>8</b>
<b>6</b>	<b>Automated welding systems:</b> Microprocessor control of arc welding and resistance welding, quality assurance in welding, welding fumes and their effect on the environment	<b>6</b>

**Text Books:**

1. Manufacturing Technology (Foundry, Forming and Welding)-P.N.Rao, Tata Mc-Graw Hill.[publication
2. “Welding Handbook”, Volumes 1, 2 and 3, 9th edition, American Welding Society.
3. Welding Technology- O.P. Khanna, Khanna Publications.

**Reference Books:**

1. Larry J and Jeffus L, “Welding Principles and Applications”, 5th edition, Delmer Publications
2. Parmer R. S., ‘Welding Engineering and Technology’, Khanna Publishers, 1997
3. AWS D1.1 Structural Welding Code
4. API 5L
5. API 1104
6. ASME Section VIII – Division 1,2

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Acquire the theoretical aspects of welding technology in depth
CO-2	Apply the appropriate welding process for a particular application.
CO-3	Designate the basic metallurgy of the melted and heat-affected zone of a weld joint and calculate various stresses in weldjoint.
CO-4	Identify the cause of welding defects and use various method for repairing and analyse effects of various alloying elements on weld ability.
CO-5	Select proper process to check the weldment quality using various inspection and testing methods.
CO-6	Demonstrate the use of automation in conventional welding processes.



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**Diploma of Engineering**

**Subject Code: ME1308**

**Subject Name: Advance Welding Technology**

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**List of Open Source Software/learning website:**

- [nptel.ac.in](http://nptel.ac.in)

(Established under Gujarat Private Universities Act, 2009)

Diploma of Engineering

Subject Code: 1309

Subject Name: Industrial Equipment Maintenance

## Shroff S.R. Rotary Institute of Chemical Technology

Semester: - V

**Type of course:** Open Elective course

**Prerequisite:** Nil

**Rationale:** Industrial equipment maintenance subject is to achieve minimum breakdown and to keep the plant in good working condition at the lowest possible cost.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Introduction:</b> Maintenance, Need of Maintenance Management, Maintenance Policies, Strategies and options in Maintenance management. Maintenance forms/actions and their inter relationships, Brief descriptions of various Maintenance actions.	06
2	<b>Maintenance Organizations:</b> Prerequisites, factors determining effectiveness of a Maintenance organization, objectives of organization design, types of organization.	05
3	<b>Maintenance practices on production machines:</b> Lathe, Drilling, Milling, Welding, and Shaper. Use of computer in maintenance, Machine Reconditioning. Evaluation of Maintenance Management: Need for evaluation a to z objectives, criterion of evaluation.	07
<b>SECTION-B</b>		
4	<b>Maintenance Planning and Control:</b> Establishing a Maintenance Plan- Preliminary consideration, Systematic method of Maintenance Plan and schedule planning and schedule of Plant shut downs.	06
5	<b>Spare Parts Management:</b> Capacity utilization, cost reduction approach to spares, reliability and quality of spares, spare parts procurement, and inventory control of spare parts.	05

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**Diploma of Engineering**

**Subject Code: 1309**

**Subject Name: Industrial Equipment Maintenance**

<b>6</b>	<b>Introduction:</b> Friction, wear and lubrication, Historical background, Purpose of lubrication, Lubrication regimes, Characteristics of lubricants - viscosity, viscosity index, oxidation stability, flash point, classification of lubricants, Lubricating oils – oil refining, types, Lubricants applications – tribological components and industrial machinery, Lubricants testing and test methods, Organization and management of lubrication, lubricant storage and handling, Safety and health hazards, Environmental regulations.	<b>07</b>
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**Text Books:**

1. Maintenance Management Policies, Strategies and Options: July 27–29, 2000, Lecture notes MACT, Bhopal.
2. Maintenance & Spare Parts Management, P. Gopal Krishnan & A.K. Banerji

**Reference Books:**

1. Hand Book of Reliability Engineering & Management: W. Grant Ireson and Clyde F McGraw Hill
2. Maintenance Planning & Control: Anthony Kelley – East West Press.

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	<b>Describe</b> proper use of safety equipment, devices, and procedures in classroom and lab environments.
CO-2	<b>Understanding</b> of the Industrial Equipment Maintenance.
CO-3	<b>Apply</b> the practical laboratory experience to set up and repair industrial equipment and facilities.
CO-4	<b>Relate</b> and contrasts the operations of various industrial machines.
CO-5	<b>Compare</b> theoretical study and the knowledge of metering tools to troubleshoot mechanical, electrical, and electromechanical systems.
CO-6	<b>Identify</b> the friction, wear and lubrication properties at mating parts of machines and its tribological characteristics

**List of Open Source Software/learning website:**

1. <http://nptel.ac.in/>

(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**  
**Subject Code: ME1310**  
**Subject Name: 3-D Printing**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course:** Open Elective

**Prerequisite:** Basics of Engineering Graphics, Computer Aided Design

**Rationale:** The objective of this course is to impart knowledge/fundamentals of various 3D Printing Techniques for different application as per industrial needs.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Introduction:</b> Introduction to Design, Prototyping fundamentals. Introduction to 3D printing, its historical development, advantages. Commonly used terms, process chain, 3D modelling, Data Conversion, and transmission, Checking and preparing, Building, Post processing, RP data formats, Classification of 3D printing process, Applications to various fields	<b>08</b>
<b>2</b>	<b>Stereo lithography apparatus (SLA):</b> Models and specifications, process, working principle, photopolymers, photo polymerization, layering technology, laser and laser scanning, applications, advantages and disadvantages, case studies.	<b>05</b>
<b>3</b>	<b>Solid Ground Curing (SGC):</b> Models and specifications, process, working, principle, applications, advantages and disadvantages, case studies.	<b>05</b>
<b>SECTION-B</b>		
<b>4</b>	<b>Laminated object manufacturing (LOM):</b> Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies.	<b>05</b>
<b>5</b>	<b>Fused Deposition Modeling (FDM):</b> Models and specifications, Process, Working principle, Applications, Advantages and disadvantages, Case studies, practical demonstration.	<b>05</b>

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**Diploma of Engineering**  
**Subject Code: ME1310**  
**Subject Name: 3-D Printing**

<b>6</b>	<p><b>Selective laser sintering (SLS):</b>          Models and specifications, process, working principle, applications, advantages and disadvantages, case studies.          Three dimensional printing (3DP): Models and specification, process, working principle, applications, advantages and disadvantages, case studies.</p>	<b>08</b>
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**Reference Books:**

1. Chua C.K., Leong K.F. and LIM C.S Rapid prototyping: Principles an Applications, World Scientific publications, 3rdEd., 2010
2. D.T. Pham and S.S. Dimov, “Rapid Manufacturing”, Springer, 2001
3. Paul F. Jacobs, “ Rapid Prototyping and Manufacturing”–, ASME Press, 1996
4. Ian Gibson, Davin Rosen, Brent Stucker “Additive Manufacturing Technologies, Springer, 2nd Ed, 2014.
5. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.
6. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press.
7. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
8. Kamrani A K, Nasr E A, Rapid Prototyping: Theory and practice, Springer,

**List of Practical/ tutorials: NA**

**Course Outcomes:**

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	<b>Discuss</b> how technology shifts throughout history have made 3D printing possible.
CO-2	<b>Describe</b> the advantages and limitations of each 3D printing technology.
CO-3	<b>Analyse</b> various 3D printing technologies and materials and select appropriately for a given application.
CO-4	<b>Use</b> software tools for 3D printing.
CO-5	<b>Explain</b> the manufacturing procedure of a prototype using SLA, SGC, LOM, FDM, SLS technique.
CO-6	<b>Identify</b> opportunities to apply 3D printing technology for time and cost savings.

**List of Open Source Software/learning website:**

- <http://nptel.ac.in>



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**Diploma of Engineering**  
**Subject Code: MH1301**  
**Subject Name: Indian Constitution**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - V**

**Type of course:** Mandatory course

**Prerequisite:** Zeal to learn the Constitution

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	2	50		0	0	50

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Introduction to Constitution:</b> Meaning and importance of the Constitution, History of Indian Constitution, salient features of Indian Constitution. Preamble of the Constitution.	3
2	<b>Fundamental Rights:</b> Fundamental rights – meaning and limitations, Right to equality, Right against exploitation, Right of freedom of religion Cultural and educational rights, Right to property, Directive principles of state policy.	7
3	<b>Fundamental Duties:</b> Fundamental duties -their enforcement and their relevance.	3
4	<b>Union Government:</b> Union Executive- President, Vice-president, Prime Minister, Council of Ministers. Union Legislature- Parliament and Parliamentary proceedings. Union Judiciary-Supreme Court of India – composition and powers and functions.	5

**(Established under Gujarat Private Universities Act, 2009)**

**Diploma of Engineering**  
**Subject Code: MH1301**  
**Subject Name: Indian Constitution**

<b>5</b>	<p><b>State Government:</b></p> <p>State Executive- Governor, Chief Minister, Council of Ministers. State Legislature-State Legislative Assembly and State Legislative Council. State Judiciary-High court.</p>	<b>5</b>
<b>6</b>	<p><b>Election provisions, Emergency provisions, Amendment of the constitution</b></p> <p>Election Commission of India-composition, powers and functions and electoral process. Types of emergency-grounds, procedure, duration and effects. Amendment of the constitution- meaning, procedure and limitations.</p>	<b>5</b>

**Total L - 28 Hours**

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>30</b>	<b>35</b>	<b>25</b>	<b>5</b>	<b>5</b>	<b>0</b>

**Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)**

**Course Outcomes:**

At the end of the course the student should be able to:

CO 1	Understand and explain the significance of Indian Constitution as the fundamental law of the land.
CO 2	Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.
CO 3	To Understand the Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsibilities.
CO 4	Analyse the Indian political system, the powers and functions of the Union Governments in detail.

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**Diploma of Engineering**  
**Subject Code: MH1301**  
**Subject Name: Indian Constitution**

CO 5	Analyse the Indian political system, the powers and functions of the State and Local Governments in detail
CO 6	Understand Electoral Process, Emergency provisions and Amendment procedure.

**Textbooks**

1. M.V.Pylee, “Introduction to the Constitution of India”, 4th Edition, Vikas publication, 2005.
2. Durga Das Basu ( DD Basu) , “Introduction to the constitution of India”, (Student Edition), 19th edition, Prentice-Hall EEE, 2008.
3. Constitution of India. D. D. Basu. (Prantice Hall of India Pvt. Ltd., New Delhi) 4. Constitution of India. D. K. Singh. (Eastern Book Company, Lucknow) 5. Constitution of India (P M Baxi)
6. Constitutional Law of India, Dr. J.N. Pandey, Central Law Agency
7. Introduction to the Consitution of India, Durga Das Basu, LexisNexis.
8. Indian Constitutional Law, M.P. Jain, LexisNexis
9. V.N.Shukla’s Constitution of India, Mahndra Pal Singh, Eastern Book Company 10. Constitutional Law – I Structure, Udai Raj Rai, Eastern Book Company

**Reference Book**

1. Merunandan, “Multiple Choice Questions on Constitution of India”, 2 nd Edition, Meraga publication, 2007.

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**Diploma of Engineering**  
Subject Code: ME 1312  
Subject Name: Design of Machine Element

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course:** Program Core Course

**Prerequisite:** Nil

**Rationale:** Objective of Machine Design is to create new and better machine components to improve the existing one. A mechanical engineer should have thorough knowledge of design of machine elements to avoid the failure of machines or components.

### Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

### Content:

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Introduction to Design:</b> Design philosophy and Procedures, General Considerations in Machine Design, Fundamentals: Types of loads, concepts of stress, Strain, Stress – Strain Diagram for Ductile and Brittle Materials, Types of Stresses, Bearing pressure Intensity, Crushing, Bending and Torsion, Standardization and preferred numbers.	04
2	<b>Design of simple machine parts:</b> Cotter Joint, Knuckle Joint, Design of Levers, Hand/Foot Lever & Bell Crank Lever, Design of C-Clamp.	05
3	<b>Antifriction Bearings:</b> Classification of Bearings; Sliding contact & Rolling contact, Terminology of Ball bearings: Life Load relationship, Selection of ball bearings using manufacturer's catalogue.	03
<b>SECTION-B</b>		
4	<b>Pressure Vessels:</b> Types of pressure vessels used in process industries, design of thick cylinders and design of thin cylinders.	04
5	<b>Design of springs:</b> Classification and Applications of Springs, Spring terminology, Materials and Specifications, Stresses in springs, Wahl's correction factor, Deflection of springs, Energy stored in springs, Design of Helical and Compression springs subjected to uniform applied loads.	04

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**Diploma of Engineering**

**Subject Code: ME 1312**

**Subject Name: Design of Machine Element**

<b>6</b>	<b>Ergonomics &amp; Aesthetic consideration in design:</b> Ergonomics of Design: Man–Machine relationship; Design of Equipment for control, environment & safety; Aesthetic considerations regarding shape, size, colour & surface finish.	<b>04</b>
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**Text Books:**

1. Machine Design – Sadhu Singh, Khanna Book Publishing Co., Delhi
2. Introduction to Machine Design – V.B.Bhandari, Tata Mc- Graw Hill, New Delhi.
3. Machine design – Pandya & Shah, Dhanpat Rai & Son, New Delhi.
4. Machine design – R.K.Jain, Khanna Publication, New Delhi.
5. Design Data Book – PSG Coimbtore, PSG Coimbtore.
6. Design Data Book – V.B.Bhandari, Tata Mc- Graw Hill, New Delhi.

**Reference Books:**

1. Mechanical Engineering Design – Joseph Edward Shigley, Tata Mc- Graw Hill, New Delhi.

**List of Practical:**

1. Study of preferred numbers series and its application.
2. Design of Cotter Joint and Knuckle Joint.
3. Design of Lever and C-clamp.
4. Study of antifriction bearing and Life Load relationship of rolling contact bearing.
5. Study and design of thin and thick pressure vessel.
6. Design of Helical and Compression springs subjected to uniform applied loads.
7. Study of Man–Machine relationship using concept of Ergonomics & Aesthetic.

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	<b>Understand</b> the basic fundamentals of Machine Design.
CO-2	<b>Calculate</b> and design of simple machine parts.



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**Diploma of Engineering**  
**Subject Code: ME 1312**  
**Subject Name: Design of Machine Element**

CO-3	<b>Define</b> the type of bearing use on its load-life relationship using design databook.
CO-4	<b>Rectify</b> the boiler failure on the basis of design.
CO-5	<b>Illustrate</b> the design of spring.
CO-6	<b>Role-play</b> of Ergonomics & Aesthetic consideration in design.

**List of Open Source Software/learning website:**

1. <http://nptel.ac.in/>

**(Established under Gujarat Private Universities Act, 2009)**

**Diploma of Engineering**

**Subject Code: ME1313**

**Subject Name: Production & operations management**

Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course: Program core course**

**Prerequisite:** Knowledge of Basic mechanical operations, workshop and various tools associated with manufacturing and fabrication work.

**Rationale:** One of the most critical areas for success in any business enterprise is how Production and Operations are managed. The knowledge of statistics, economics, finance, organizational behavior and strategy into a consolidated production, operation related decisions, criteria for location decision, quality management and their tools are of utmost importance.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
2	0	0	2	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Process Planning and Process Engineering</b> Introduction, Function, Pre-requisites and steps in process planning, Factors affecting process planning, Make or buy decision, plant capacity and machine capacity, Preliminary Part Print Analysis: Introduction, Establishing the General Characteristics of work piece, determining the principal Process,	<b>05</b>

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<b>2</b>	<b>Production Forecasting</b> Introduction of production forecasting, The strategic role of forecasting in supply chain, Time frame, Demand behavior, Forecasting methods- Qualitative and Quantitative, Forecast accuracy.	<b>05</b>
<b>3</b>	<b>Scheduling</b> Introduction, Objectives in scheduling, Loading, Sequencing, Monitoring, Theory of Constraints, Employee scheduling.	<b>02</b>
<b>SECTION-B</b>		
<b>4</b>	<b>Break-Even Analysis</b> Introduction, Break-even analysis charts, Breakeven analysis for process, plant and equipment selection. Introduction to Aggregate Operations Planning, Demand management,	<b>04</b>
<b>5</b>	<b>Assembly Line Balancing</b> Assembly lines, Assembly line balancing, Splitting tasks, Flexible and U-shaped line layouts, Mixed model line balancing, Basics of Computerized assembly line balancing.	<b>04</b>
<b>6</b>	<b>Material Management</b> Introduction, Importance and objectives of material management, Purchasing and Stores: policies and procedures, Vendor development, selection process, analysis and rating.	<b>04</b>

**Text Books:**

1. Production and Operations Management – K.Aswathappa, K.Shridhara Bhat, Himalaya Publishing House, 2014.

**Reference Books:**

1. Production and Operations Management – Shailendra Kale, McGraw Hill Educations (India) Private Limited, 2013.
2. Production and Operations Management – R.Paneerselvam, PHI Learning Private Limited, 2013.



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**Subject Name: Production & operations management**

3. Operations Management – Joseph Monk, TMH Publishers, New Delhi, 2004.
4. Modern Production /Operations Management – Buffa Elwood S, John Wiley Publishers, Singapore, 2002.

**List of Practical/ tutorials: NIL**

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	Define operations management and explain its relationship to productivity. And, also understand tools and techniques of process planning and process engineering.
CO-2	Describe the importance of forecasting and explain the effective application of the different forecasting approaches and methods.
CO-3	Solve simple problems on the process of scheduling
CO-4	Apply break-even analysis for selection of process and/or equipment's
CO-5	Explain layout strategy and how operations managers determine facility arrangements and size.
CO-6	Understand make-or-buy decisions, and the selection and integration of suppliers. And how much to order and when to order.

**List of Open Source Software/learning website:**

- <http://nptel.ac.in>

(Established under Gujarat Private Universities Act, 2009)

Diploma of Engineering

Subject Code: ME1314

Subject Name: Refrigeration and Air-conditioning

## Shroff S.R. Rotary Institute of Chemical Technology

Semester: - VI

**Type of course:** Programme Core course

**Prerequisite:** Fundamental knowledge of thermal engineering

**Rationale:** The course is designed to give fundamental knowledge of types of refrigeration, refrigeration cycles, refrigerants and their behavior under various conditions, air conditioning load calculation and designing of components of air distribution system.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<p><b>Introduction:</b> Brief history and need of refrigeration and air conditioning, methods of producing cooling, ton of refrigeration, coefficient of performance, types and application of refrigeration and air conditioning systems</p> <p><b>Refrigerant:</b> Recapitulation of desirable properties of refrigerants, secondary refrigerants, designation of refrigerants, need of new refrigerants and future industrial refrigerants</p>	03
2	<p><b>Air refrigeration:</b> Aircraft refrigeration, working and analysis of Simple, Bootstrap, Reduced ambient and Regenerative air refrigeration systems, simple examples</p>	03
3	<p><b>Vapour compression/absorption refrigeration system:</b> Simple, standard vapour compression cycle and its analysis on P-h chart, Calculations of refrigerating effect, work done and C.O.P., vapour absorption refrigeration system, Electrolux refrigeration system</p>	06
<b>SECTION-B</b>		

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**Diploma of Engineering**

**Subject Code: ME1314**

**Subject Name: Refrigeration and Air-conditioning**

<b>4</b>	<b>Psychrometry:</b> Properties of moist air, temperature and humidity measuring instruments, psychrometric chart, psychrometric processes such as sensible heating and cooling, heating and humidification cooling and dehumidification, chemical dehumidification, adiabatic saturation	<b>06</b>
<b>5</b>	<b>Human comfort:</b> Selection of inside design conditions, thermal comfort, heat balance equation for a human being, factors affecting thermal comfort, Effective temperature, comfort chart and factors governing effective temperature, selection of outside design conditions	<b>03</b>
<b>6</b>	<b>Air-conditioning systems:</b> Classification, system components, all air, all water, and air-water systems, room air conditioners, packaged air conditioning plant, central air conditioning systems, split air conditioning systems	<b>03</b>

**Text Books:**

1. Refrigeration and Air Conditioning by R S Khurmi and J K Gupta, S. Chand Publishing
2. Modern refrigeration and Air conditioning for Engineers by Prof. P S Desai, Khanna Publishers
3. Refrigeration and Air Conditioning by Manohar Prasad, New Age International Publisher.

**Reference Books:**

1. Refrigeration and Air Conditioning by C P Arora, McGraw-Hill India Publishing Ltd.
2. Refrigeration and Air-conditioning by Ramesh Arora, Prentice Hall of India

**List of Practical:**

1. To understand different components of VCR system and to determine its COP
2. To understand working of Electrolux refrigerator and to determine its COP.
3. To analyze NH<sub>3</sub>-H<sub>2</sub>O system for specific application.
4. To understand various tools used for refrigeration tubing and to perform various operations like flaring, swaging, bending, brazing etc.

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**Diploma of Engineering**

**Subject Code: ME1314**

**Subject Name: Refrigeration and Air-conditioning**

5. To study different psychrometric processes and analyze the same using psychrometric chart
6. To understand construction and working of window air-conditioner/ split air-conditioner and to determine its capacity.
7. To determine COP and apparatus dew point of an air conditioning test rig.

**Course Outcomes:**

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Understand the basic concepts of refrigeration and air conditioning systems with different types of refrigerants
CO-2	Analyze different Air refrigeration systems
CO-3	Apply fundamentals of vapour compression and absorption refrigeration systems
CO-4	Enumerate basics of psychometric properties and process
CO-5	Study factors affecting human comfort and selection criteria of inside & outside design conditions
CO-6	Select proper air-conditioning system for various applications

**List of Open Source Software/learning website:**

- <https://nptel.ac.in>

(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**  
**Subject Code: ME 1315**  
**Subject Name: Power Plant Engineering**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course:** Programme Elective course

**Prerequisite:** Knowledge of Basic Engineering Thermodynamics, Fluid Mechanics, and Heat Transfer

**Rationale:** Economic growth of the nation essentially results into growth in power sector. This course is designed to give fundamental knowledge of components & operation of various types of conventional power plants such as Steam, Gas, Hydro, Nuclear etc.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Introduction to Power Plant Engineering:</b> Need, Scope & importance of Power Plant Engineering in industries. Knowledge & skill required for application of PPE, Sources of energy, Power plants-concept, types and energy conversion in each type. Central and captive power plants, Layout & Basic elements of various power plants, Technical data of basic elements of different power plants and over all specifications of power plant.	<b>04</b>

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**Diploma of Engineering**

**Subject Code: ME 1315**

**Subject Name: Power Plant Engineering**

2	<p><b>Steam Power Plant:</b> Main elements and working of steam power plant, Schematic diagram and Various circuits of modern thermal power plant, High pressure boilers such as Lamont boiler, Benson boiler, Loeffler boiler, Schmidt Hartman boiler. Super heaters, air pre heaters, Boiler furnaces, Pulverised fuel system, Different types of draft system in boilers, Parameters related to power plant performance. Maintenance as well as safety measure of components of steam power plant.</p>	04
3	<p><b>Diesel And Gas Turbine Power Plant :</b> Essential elements and working of diesel power plant and their function, Advantages and disadvantages of diesel engine as a prime mover, Explanation of various systems of diesel power plant. Important components of gas turbine power plant and their functions, Advantages of gas turbine over diesel engine as prime mover, Methods of improving performance of gas turbine plant, Essential auxiliaries of gas turbine power plant, Governing system.</p>	04
<b>SECTION-B</b>		
4	<p><b>Nuclear Power Plant:</b> Fundamentals of nuclear power generation, Nuclear fuels, Basic elements of a nuclear reactor, Classification of nuclear reactor, Schematic diagrams and working and comparison of pressurized water reactor, Boiling water reactor, CANDU type reactor, Criteria for location of nuclear power plant, Comparison of nuclear plant with steam power plant, Units of radiation, Safe dose of radiation recommended by physicists, Effect of radiation, Disposal of nuclear waste, Technical details of nuclear power plants in India.</p>	04
5	<p><b>Hydel Power Plant:</b> Purpose of multi-purpose hydro project, Advantages and disadvantages of hydro power station considering the economic factor, Basic elements of hydro power plant, Classification of Hydro-electric power plant, Water turbine used in Hydro power plant, Factors for selecting hydraulic turbines, Auxiliaries attached with Hydro-power plant, Governing of water turbine, Stages of starting and stopping of turbine of hydro-electric power station.</p>	04
6	<p><b>Power Plant Economics :</b> Cost of power, Economics of power generation and distribution. Economics in plant selection.</p>	04

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**Diploma of Engineering**

**Subject Code: ME 1315**

**Subject Name: Power Plant Engineering**

**Reference Books:**

1. A course in power plant engineering – S. C. Arora, S. Domkundwar, Dhanpatrai & sons, New Delhi.
2. Power Plant Engineering, P.K. Nag, McGraw Hill Education .
3. Power Plant Technology, M.M. El-Wakil, McGraw Hill Education
4. Power plant engineering, P.C.Sharma, S.K.Kataria & sons, New Delhi.
5. Power plant Technology- G.D.Rai, Khanna publisher, New Delhi.

**List of Practical/ tutorials:**

1. Study of Modern Steam Power Plant.
2. Study of Steam Turbines. (Impulse, Reaction and governing).
3. Study of Gas and Steam Turbine Combined Cycles.
4. Study of Nuclear Power Plant.
5. Study of various draught system.
6. Study of different feed water treatment plants.
7. Study of different types of steam nozzle and design a nozzle
8. Comparative study of different types of high pressure boilers
9. Study of Coal and Ash handling system.
10. Study of condenser and cooling tower.

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	<b>Know and identify</b> the different power generation methods and global energy situation
CO-2	<b>Analyze</b> thermodynamic cycles of steam power plant and understand construction, working and significance of its various systems
CO-3	<b>Understand</b> and <b>Analyze</b> thermodynamic cycles of Diesel and gas turbine power plant
CO-4	<b>Identify</b> and <b>Analyze</b> components of nuclear power plant and its working.
CO-5	<b>Understand</b> the elements and working of hydel power plant and <b>select</b> the hydraulic turbines
CO-6	<b>Estimate</b> economic parameters of power plant



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**Diploma of Engineering**  
**Subject Code: ME 1315**  
**Subject Name: Power Plant Engineering**

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**List of Open Source Software/learning website:**

1. <http://nptel.ac.in/>



(Established under Gujarat Private Universities Act, 2009)

**Diploma Engineering**  
**Subject Code: ME1316**  
**Subject Name: Hybrid Vehicles**

## Shroff S.R. Rotary Institute of Chemical Technology

### Semester: - VI

**Type of course:** Program Elective Course

**Prerequisite:** Zeal to learn the subject

**Rationale:** Vehicle is an unavoidable machine for the industry, individual and government. The fuel consumptions have led the nations to be dependent on electric vehicles and needs a major change in the operation in context to energy saving. The electric vehicle has drawn attention of the designers, researchers and manufacturers for the skilled persons needed in this era. The energy saving concept has led to hybrid electric vehicle in all the concepts for the transportation.

### Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	2	3	70	30	30	20	150

### Content:

Sr No	Content	Total Hrs.
<b>SECTION-A</b>		
1	History & Importance of Electrical Vehicles: History of Electric Vehicles, Development towards the 21st Century, Types of Electric Vehicles in use today – Battery Electric Vehicle, Hybrid (ICE & others), Fuel Cell EV and Solar Powered Vehicles.	03
2	Induction to Hybrid Electric Vehicle: Social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies. Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid Drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.	04
3	Electric Drive Trains: Basic concept of electric traction, introduction to various electric drive- train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis. Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles,	05

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**Diploma Engineering**  
**Subject Code: ME1316**  
**Subject Name: Hybrid Vehicles**

	Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switched Reluctance Motor drives, drive system efficiency.	
<b>SECTION-B</b>		
4	Storage Systems: Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.	05
5	Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Introduction to various charging techniques and schematic of charging stations.	04
6	Indian & Global Scenarios in Electric: Vehicles Technology Scenario, Market Scenario, Policies & Regulations, Payback & Commercial Model, Policies in India.	03

**Text book:**

1. Electric and Hybrid Vehicles: Design Fundamentals by Iqbal Hussein, CRC Press, 2003.

**Reference Books:**

1. Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design by Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, CRC Press, 2004.
2. Electric Vehicle Technology by James Larminie, John Lowry, Wiley, 2003.
3. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals, Theory, and Design by M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, CRC Press, 2004.
4. Hybrid Electric Vehicles: Energy Management Strategies by S. Onori, L. Serrao and G. Rizzoni, Springer, 2015.

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**Diploma Engineering**  
**Subject Code: ME1316**  
**Subject Name: Hybrid Vehicles**

**List of Practical:**

1. Study of different types of Electric & Hybrid vehicles.
2. Study of various Electric Drive-train topologies.
3. Study of various Hybrid Drive-train topologies.
4. Study of various charging techniques and schematic of charging stations.
5. Calculate & Compare brake power, torque and mechanical efficiency of I.C. engine & Electrical Motor of same configuration.
6. Case Study: Tesla Model X.
7. Case Study: Tata Nexon.
8. Case Study: BRTS Electric Bus & Charging Infrastructure
9. Case Study: Vehicles Technology Scenario in India.
10. Case Study: Policies & Regulations for Hybrid vehicles in India.

**Course Outcomes:**

Sr. No.	CO statement
CO-1	Understand the history and importance of Electrical Vehicles.
CO-2	Analyze the power and energy need of the various hybrid and electric vehicle.
CO-3	Evaluate energy efficiency of the vehicle for its drive trains.
CO-4	Enlist and understand various storage requirements for electric vehicles.
CO-5	Measure and Estimate the energy consumption of the hybrid Vehicles.
CO-6	Check ongoing scenario at world and national level in hybrid and electric vehicle market.

**List of Open Source Software/learning website:**

- <https://nptel.ac.in>

(Established under Gujarat Private Universities Act, 2009)

Diploma of Engineering

Subject Code: ME1317

Subject Name: Computer Aided Design & Manufacturing

Shroff S.R. Rotary Institute of Chemical Technology

Semester: - VI

Type of course: Programme Elective

Prerequisite: Nil

**Rationale:** Computer Aided Design & Manufacturing is highly demanded area now a day. Computer Aided Design & Manufacturing deals with Design of components to manufacturing and also includes Planning and controlling the processes. Industries widely use CNC and FMS now a day. Students will be familiar with its hardware and software and also able to write programs for machining.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Fundamentals of CAD/CAM:</b> Automation; Design process; Application of computers for design; Benefits of CAD; Computer configuration for CAD applications; Design workstation; Graphic terminal; CAD Software: Definition of system software and application software; CAD database and structure.	4
2	<b>Geometric Modeling:</b> 3D-Wire frame modeling; Wire frame entities and their definitions; Interpolation and Approximation of curves; Concept of Parametric and Non-parametric representation of curves; Curve fitting techniques.	6
3	<b>Surface Modeling:</b> Algebraic and Geometric form; Parametric space of surface; Blending functions; Parametrization of surface patch; Subdividing; Cylindrical surface; Ruled surface; Surface of revolution; Spherical surface; Composite surface; Bezier surface; Solid Modelling: Definition of cell composition and spatial occupancy enumeration; Sweep representation; Constructive solid geometry; Boundary representations.	8
<b>SECTION-B</b>		
4	<b>NC Control Production Systems:</b> Numerical control; Elements of NC system; NC part programming; Methods of NC part programming; Manual part programming, Computer assisted part programming; Post processor; Computerized part program.	8

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**Diploma of Engineering**

**Subject Code: ME1317**

**Subject Name: Computer Aided Design & Manufacturing**

<b>5</b>	<b>Group Technology:</b> Part families; Parts classification and coding; Production analysis; Machine cell design; Computer aided process planning; Retrieval type and Generative type; Machinability data systems; MRP and its Benefits.	<b>5</b>
<b>6</b>	<b>Flexible manufacturing system:</b> F.M.S equipment; Layouts; Analysis methods and benefits; Computer aided quality control; Automated inspection: Off-line, On-line, Contact, Non-contact; Coordinate measuring machines; Machine vision; CIM system and Benefits.	<b>5</b>

**Text Books:**

1. CAD/CAM Principles and Applications, P.N.Rao, Tata McGraw Hill, 2007
2. Computer Aided Design and Manufacturing, Groover M.P. & Zimmers Jr, Prentice hall of India.

**Reference Books:**

1. CAD/CAM/CIM, RadhaKrishna P. & Subramanyam, Wiley Eastern Ltd.
2. CAD/CAM, Introduction, -Ibrahim Zeid, Tata McGraw Hill, 2007
3. Automation, Production Systems and Computer Integrated Manufacturing by Mikell P Groover, Pearson Education.

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	Describe CAD-CAM based manufacturing process and explain various application of it in manufacturing industries.
CO-2	Understand geometric transformation techniques in CAD.
CO-3	Develop mathematical models to represent curves and surfaces and Model engineering components using solid modeling techniques.
CO-4	Write the programs for CNC to manufacture industrial components.
CO-5	Identify scope of concept of GT with automation and interpret various coding system
CO-6	Utilize Flexible manufacturing system tools.

**List of Open Source Software/learning website:**

- [nptel.ac.in](http://nptel.ac.in)

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**Diploma of Engineering**  
**Subject Code: ME1318**  
**Subject Name: Product Design**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course:** Open Elective

**Prerequisite:** NIL

**Rationale:** The product development through engineering aspects is always remains challenges to engineers. The aim of present course is to introduce the students about the basic product design process based on mechanical aspects applying innovative thinking and fundamentals of mechanical engineering.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Introduction:</b> Definition of a product, Types of product, Levels of product, Product-market mix, New product development (NPD) process, Idea generation methods, Creativity, Creative attitude, Creative design process, Morphological analysis, Analysis of interconnected decision areas, Brain storming.	<b>04</b>
<b>2</b>	<b>Product Development:</b> Product life cycle, The challenges of Product development, Product analysis, Product characteristics, Economic considerations, Production and Marketing aspects, Characteristics of successful Product development, Phases of a generic product development process, Product development practices and industry-product strategies.	<b>08</b>
<b>3</b>	<b>Identifying customer need:</b> Types of customer needs, Customer need models. Gathering Customer needs: Need Gathering Methods, Conducting Interviews: Like Dislike Method, Articulated-Use Method, Product feel and Industrial Design. Organizing and Prioritizing Needs: Grouping Interpreted needs, Affinity	<b>06</b>

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**Diploma of Engineering**  
**Subject Code: ME1318**  
**Subject Name: Product Design**

	Diagram, Determining need Importance, Customer use patterns, Customers need Documentation.	
<b>SECTION-B</b>		
<b>4</b>	<b>Product design:</b> Design by evolution, Design by innovation, Design by imitation, Factors affecting product design, Standards of performance and environmental factors, Decision making and iteration, Morphology of design (different phases), Role of aesthetics in design.	<b>05</b>
<b>5</b>	<b>Product Analysis and Material Selection:</b> Tools and charts used for product analysis like bill of materials, gozinto chart, performance characteristics of materials, material selection process, sources of information on material properties, economics of materials, evaluation methods for material selection	<b>05</b>
<b>6</b>	<b>Introduction to Optimization in Design:</b> Economic factors in design, Design for safety and reliability, Role of computers in design, Modeling and Simulation, The role of models in engineering design, Mathematical modeling, Similitude and scale models, Concurrent design, Six sigma and design for six sigma, Introduction to optimization in design, Economic factors and financial feasibility in design, Design for manufacturing, Rapid Prototyping (RP), Application of RP in product design, Product Development versus Design.	<b>08</b>

**Text Books:**

1. Product design and development, by K.T. Ulrich and S.D. Eppinger, Tata McGraw Hill.
2. Engineering Design –George E. Dieter
3. Product design & process Engineering by Niebel & deeper, McGraw hill
4. Merie Crawford : New Product management, McGraw-Hill Irwin.
5. Chitale A K and Gupta R C, “Product Design and Manufacturing”, Prentice Hall of India
6. An Introduction to Engineering Design methods Vijay Gupta.

**Reference Books:**

1. Product Design, by Kevin Otto, Kristin wood, Pearson Education Inc.
2. Kevin Otto and Kristin Wood, Product Design, Techniques in Reverse Engineering and New

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**Diploma of Engineering**  
**Subject Code: ME1318**  
**Subject Name: Product Design**

3. Product Development, Pearson education. Engineering Design Process, by Yousef Haik, T M M Shahin, Cengage Learning

**List of Practical/ tutorials: NA**

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	<b>Describe</b> the basic concepts of product design and development process
CO-2	<b>Illustrate</b> the methods to define the customer needs.
CO-3	<b>Explain</b> an engineering design and development process.
CO-4	<b>Identify</b> appropriate methods for selection of material based on product analysis.
CO-5	<b>Propose</b> the intuitive and advanced methods used to develop and evaluate a concept.
CO-6	<b>Apply</b> modelling and embodiment principles in product design and development process.

**List of Open Source Software/learning website:**

- NPTEL <http://nptel.ac.in>



(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**

**Subject Code: ME1319**

**Subject Name: Farm Equipment & Farm Machinery**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course:** Programme Elective

**Prerequisite:** Zeal to learn the subject

**Rationale:** Students will be equipped with sufficient practical skills on farm power sources, handling of tractors, power tillers and various implements used in land preparation, sowing, inter cultivation and agro energy.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	00	00	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Introduction to Farm Machinery:</b> Introduction to farm mechanization, Classification of farm machines. Unit operations in crop production, Identification and selection of machines for various operations on the farm. Hitching systems and controls of farm machinery.	06
2	<b>Earth Moving Equipment:</b> Calculation of field capacities and field efficiency, Calculations for economics of machinery usage, comparison of ownership with hiring of machines. Introduction to seed-bed preparation and its classification, Familiarization with land reclamation and earth moving equipment.	05
3	<b>Tillage Machinery:</b> Introduction to machines used for primary tillage, secondary tillage, rotary tillage, deep tillage and minimum tillage, Measurement of draft of tillage tools and calculations for power requirement for the tillage	07

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**Diploma of Engineering**

**Subject Code: ME1319**

**Subject Name: Farm Equipment & Farm Machinery**

	machines, Introduction to tillage machines like mould-board plough, disc plough, chisel plough, sub-soiler, harrows, puddler, cultivators, identification of major functional components, Attachments with tillage machinery.	
<b>SECTION-B</b>		
<b>4</b>	<b>Seeding Methods:</b> Introduction to sowing, planting & transplanting equipment. Introduction to seed drills, no-till drills, and strip-till drills, Introduction to planters, bed planters and other planting equipment like sugarcane, potato. Study of types of furrow openers and metering systems in drills and planters, Calibration of seed-drills/ planters, Adjustments during operation.	<b>05</b>
<b>5</b>	<b>Transplanting Methods:</b> Introduction to materials used in construction of farm machines, Heat treatment processes and their requirement in farm machines, Properties of materials used for critical and functional components of agricultural machines, Introduction to steels and alloys for agricultural application. Identification of heat treatment processes specially for the agricultural machinery components.	<b>06</b>
<b>6</b>	<b>Agro Energy:</b> Energy requirement in agricultural operations - Solar (Thermal and Photovoltaic), Wind mills, Bio- gas energy and their utilization in agriculture, Gasification of biomass for IC Engines, Energy efficient cooking stoves and alternative cooking fuels, agricultural waste and their utilization.	<b>07</b>

**Text Books:**

- 1) Farm Machinery and equipment, C. P. Nakra, Dhanpat Rai and Sons.
- 2) Elements of Agricultural Engineering, Jagdishwar Sahay, Standard Publishers and Distributors.

**Reference Books:**

- 1) Principles of farm machinery, Kepner, R. A., Roy Bainer, and Barger, B. L., CBS publishers and Distributors.
- 2) Agricultural Machines. Klenin, N.I., Popov, I.F., and Sakun, V. A., Amerind publishing Co. Pvt. Ltd.

**(Established under Gujarat Private Universities Act, 2009)**

**Diploma of Engineering**

**Subject Code: ME1319**

**Subject Name: Farm Equipment & Farm Machinery**

- 3) Principles of Agricultural Engineering, Vol. I, Michal, A. M., and Ojha, T. P., Jain Brothers.
- 4) Farm Machinery - An Approach, Jain, S. C., Standard Publishers and Distributors.

**Course Outcomes:**

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	Describe the objectives of Farm mechanization.
CO-2	Find the field efficiency and capacities to calculate the economics of machinery.
CO-3	Select the machines usages for different tillage, and its power requirement calculations.
CO-4	Summarise the calibration, constructional features and working of sowing equipment based on crop.
CO-5	Understand machinery materials and heat effects for different farm machinery equipment.
CO-6	Study of energy requirement in agricultural operations.

**List of Open-Source Software/learning website:**

- <https://archive.nptel.ac.in>

(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**

**Subject Code: ME1320**

**Subject Name: Economics Policies in India**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course:** Open Elective

**Prerequisite:** Nothing

**Rationale:** This subject is designed to acquaint the students in a comprehensive manner with different aspects of Indian economy. The policy issues and measure to understand economic initiatives for improving economic development and growth, agriculture and industry, planning of the different sectors of the economy and the place of Indian economy in the international level particularly after economic reforms and covered. This will sharpen the analytical faculty of the students to understand the whole system of Economic Policy in India

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Economic Development and Growth Policies :</b> Economic Development & Social Opportunity - Development, Freedom and Opportunity on education & health, the government, the state & the market.	<b>04</b>
<b>2</b>	<b>Human Development:</b> <b>Essential Components of Human development</b> - Indexing Human Development in India- indicators, scaling and composition <b>Recasting Planning in terms of Human Development</b> - Human Poverty, entitlement, capability approach; Public Action and Social Inequality - public, its role, reach of inequalities, Social inequalities and economic reforms, basic equality and social security and Health care, local governance & social reforms.	<b>07</b>

**(Established under Gujarat Private Universities Act, 2009)**

**Diploma of Engineering**

**Subject Code: ME1320**

**Subject Name: Economics Policies in India**

<b>3</b>	<b>Agriculture and Industrial Sectors of the Indian economy :</b> Agriculture Growth and Industrial Performance in Indian - Salient features of industrial and agriculture growth, links between agriculture and industry - production linkages, demand linkages, savings & investment linkages, Planning for Agriculture - 21st Century perspective, Indian agriculture - emerging perspectives and policy issues. Industrial growth in 80's - some issues; Government Policy Towards Public Sector Since 1991; Paradigm shift in Industrial Policy; Jobless Growth in Indian manufacturing in 2000s.	<b>07</b>
<b>SECTION-B</b>		
<b>4</b>	<b>Indian Planning:</b> Objectives & strategy of Planning in India; Regional Planning Policy in India - regional imbalances in India and policy measures to remove regional imbalances, critical review of Regional Planning in India, Economic Growth and Social Attainment - the role of Development Strategy, Parallel Economy - causes and remedies, current status of the Black Money - Graying of India's Political economy.	<b>07</b>
<b>5</b>	<b>Economic Reforms &amp; External Sector:</b> Growth & Macro Economic Imbalances in India-linkages between growth & fiscal & external balances, trends in fiscal & external deficits; Critical Appraisal of Economic Reforms; WTO - Uruguay Round of Final Act & its Implication for India, Impact of WTO on various aspects of Indian Economy, India's Role at Doha Ministerial Conference, Geneva Frame Work and update on Trade Negotiations	<b>07</b>
<b>6</b>	<b>Foreign Trade Policy:</b> Import - Export Policy in pre-reform period, New Trade Policy - The Reform Period, Foreign Trade Policy 2009-14; FDI in Multi-brand Trade & Safe Guards.	<b>04</b>

**Reference Books:**

1. Economic Development and Policy in India by T R Jain , VK Global Publications
2. Economic Development in India (Policies, Reforms and Liberalisation) 3rd Edition by AV Balakrishnan, G K Publication
3. Indians Economic Policy by Bimal Jalan, Penguin Books Publication
4. Indian Economic Policy and Development by P T Bauer , Routledge publication
5. Economic Policies In India by Navratan Sharma

(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**

**Subject Code: ME1320**

**Subject Name: Economics Policies in India**

**Course Outcomes:**

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	<b>Know</b> basics of Indian economy and development stages.
CO-2	<b>Identify</b> the key factors contributing towards human development.
CO-3	<b>Understand</b> the importance of agriculture and industrial development in Indian economy.
CO-4	<b>Recognize</b> the objectives and strategy of planning in India.
CO-5	<b>Apprehend</b> the concept of economic reforms and effect of external sectors.
CO-6	<b>Get</b> the insides about foreign trade policy.

**List of Open Source Software/learning website:**

(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**  
**Subject Code: ME1321**  
**Subject Name: Disaster Management**

## Shroff S.R. Rotary Institute of Chemical Technology

### Semester: VI

**Type of course:** Open Elective

**Prerequisite:** Nil

**Rationale:** The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	PA (I)	ESE (V)	
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Introduction on Disaster</b> Understanding Disasters Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and Disaster management.	<b>04</b>
<b>2</b>	<b>Different Types of Disaster</b> A) Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc B) Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures(Building and Bridge), War & Terrorism etc. Causes, effects and practical examples for all disasters.	<b>07</b>
<b>3</b>	<b>Risk and Vulnerability Analysis</b> 1. Risk : Its concept and analysis 2. Risk Reduction 3. Vulnerability : Its concept and analysis 4. Strategic Development for Vulnerability Reduction	<b>07</b>

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**Diploma of Engineering**  
**Subject Code: ME1321**  
**Subject Name: Disaster Management**

<b>SECTION-B</b>		
<b>4</b>	<p><b>Disaster Preparedness</b></p> <ol style="list-style-type: none"> <li>1. Disaster Preparedness: Concept and Nature</li> <li>2. Disaster Preparedness Plan</li> <li>3. Prediction, Early Warnings and Safety Measures of Disaster.</li> <li>4. Role of Information, Education, Communication, and Training,</li> <li>5. Role of Government, International and NGO Bodies.</li> <li>6. Role of IT in Disaster Preparedness</li> <li>7. Role of Engineers on Disaster Management.</li> </ol>	<b>04</b>
<b>5</b>	<p><b>Disaster Response</b></p> <ol style="list-style-type: none"> <li>1. Disaster Response : Introduction</li> <li>2. Disaster Response Plan</li> <li>3. Communication, Participation, and Activation of Emergency Preparedness Plan</li> <li>4. Search, Rescue, Evacuation and Logistic Management</li> <li>5. Role of Government, International and NGO Bodies</li> <li>6. Psychological Response and Management (Trauma, Stress, Rumor and Panic)</li> <li>7. Relief and Recovery</li> <li>8. Medical Health Response to Different Disasters</li> </ol>	<b>07</b>
<b>6</b>	<p><b>Rehabilitation, Reconstruction and Recovery</b></p> <ol style="list-style-type: none"> <li>1. Reconstruction and Rehabilitation as a Means of Development.</li> <li>2. Damage Assessment</li> <li>3. Post Disaster effects and Remedial Measures.</li> <li>4. Creation of Long-term Job Opportunities and Livelihood Options,</li> <li>5. Disaster Resistant House Construction</li> <li>6. Sanitation and Hygiene</li> <li>7. Education and Awareness,</li> <li>8. Dealing with Victims' Psychology,</li> <li>9. Long-term Counter Disaster Planning</li> <li>10. Role of Educational Institute.</li> </ol>	<b>07</b>



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**Diploma of Engineering**  
**Subject Code: ME1321**  
**Subject Name: Disaster Management**

**Text Books:**

1. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction Programme (2009-2012).
2. Disaster Management, J. P. Singhal, Laxmi Publications.
3. Sphere Project (2011). Humanitarian Charter and Minimum Standards in Disaster Response.
4. Geneva: Sphere Project. <http://www.sphereproject.org/handbook>

**Reference Books:**

1. Disaster Medical Systems Guidelines. Emergency Medical Services Authority,
2. State of California, EMSA no.214, June 2003.
3. Guerisse P. 2005 Basic Principles of Disaster Medical Management. Act Anaesth. Belg; 56:395-401.
4. Aim and Scope of Disaster Management. Study Guide prepared by Sharman and Hansen. UW-DMC, University of Washington.

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	<b>Collect</b> the basic terminology and various information of Disaster Management.
CO-2	<b>Explain</b> types, trends, causes consequences and control of disaster.
CO-3	<b>Analyze</b> the risk and vulnerability of disaster.
CO-4	<b>Understand</b> the concept and nature of disaster preparedness.
CO-5	<b>Create</b> the awareness about disaster response plan.
CO-6	<b>Study</b> the Rehabilitation, Reconstruction and Recovery in the event of Disaster.

**List of Open Source Software/learning website:**

[www.nptel.ac.in](http://www.nptel.ac.in)

(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**

**Subject Code: ME1322**

**Subject Name: Introduction of E-Governance**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course:** Open Elective

**Prerequisite:** Nil

**Rationale:** To cover the concepts of e-Governance and to understand how technologies and business models shape the contours of government for improving citizen services and bringing in transparency.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		C	Theory Marks		Practical Marks	
					ESE (E)	PA (M)	ESE (V)	PA (I)
3	0	0	3	70	30	0	0	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	Exposure to emerging trends in ICT for development, Understanding of design and implementation of e-Government projects, e-governance lifecycle.	04
2	Need for Government Process Re-engineering (GPR), National e-Governance Plan (NeGP) for India.	07
3	Architecture and models of e-Governance, including Public Private Partnership (PPP), Need for Innovation and Change Management in eGovernance, Critical Success Factors, Major issue including corruption, resistance for change, e-Security and Cyber laws.	07
<b>SECTION-B</b>		
4	Focusing on Indian initiatives and their impact on citizens, Sharing of case studies to highlight best practices in managing e-Governance projects in Indian context. Visits to local e-governance sites (CSC, eSeva, Post Office, Passport Seva Kendra, etc) as part of Tutorials.	07
5	SMART Governments & Thumb Rules, Critical Success Factors, Major	07

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**Diploma of Engineering**

**Subject Code: ME1322**

**Subject Name: Introduction of E-Governance**

	issue Thumb Rules.	
<b>6</b>	Mini Projects by students in groups, primarily evaluation of various e-governance projects.	<b>04</b>

**Reference Books:**

1. Managing Transformation Objectives to Outcomes. J Satyanarayana, Prentice Hall India.
2. The State, IT and Development. Kenneth Kenniston, RK Bagga and Rohit Raj Mathur, Sage Publications India Pvt Ltd.
3. E-Government -The Science of the Possible. J Satyanarayana, Prentice Hall, India.

**Course Outcomes:**

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

<b>Sr. No.</b>	<b>CO statement</b>
CO-1	<b>Understanding</b> the design and implementation of e-Government projects and lifecycle.
CO-2	<b>Explain</b> the knowledge of the Process Re-engineering (GPR); National e-Governance Plan (NeGP) for India.
CO-3	<b>Acquire</b> the knowledge in Public Private Partnership (PPP), e-Security and Cyber laws.
CO-4	<b>Prepare</b> an practical knowledge of e-Governance projects Focusing on Indian initiatives and their impact on citizens.
CO-5	<b>Outline</b> the knowledge in SMART Governments & Thumb Rules.
CO-6	<b>Evaluation</b> of various e-governance projects.

**List of Open Source Software/learning website:**

[www.nptel.ac.in](http://www.nptel.ac.in)

(Established under Gujarat Private Universities Act, 2009)

**Diploma of Engineering**

**Subject Code: MH1303**

**Subject Name: Project**

## Shroff S.R. Rotary Institute of Chemical Technology

**Semester: - VI**

**Type of course:** Engineering

**Prerequisite:** Knowledge of Basic mechanical operations, workshop and various tools associated with manufacturing and fabrication work.

**Rationale:** This course enables the students to exercise some of the knowledge and/or skills developed during the programme to new situation or problem for which there are number of engineering solutions. This course include planning of the tasks which are to be completed within the time allocated, and in turn, helps to develop ability to plan, use, monitor and control resources optimally and economically. By studying this course abilities like creativity, imitativeness and performance qualities are also developed in students. Leadership development and supervision skills are also integrated objectives of learning this course.

**Teaching and Examination Scheme:**

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
0	0	18	9	00	00	100	100	200

**Content:**

Student will select a topic for project work in consultation with the guiding teacher and/or expert from industries. The student will have to do literature survey & experimental work on that topic. At the end of the semester he/she will have to submit a report on his/her works. The student will present his/her topic in front of experts and staff. His/her performance will be assessed on the basis of his/her project report and presentation.

**Course Outcomes:**

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

Sr. No.	CO statement
CO-1	<b>Plan</b> and <b>identify</b> materials, processes and other resources optimally.
CO-2	<b>Develop</b> innovative and creative ideas.
CO-3	<b>Cultivate</b> leadership, interpersonal skill and team work.



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**Diploma of Engineering**

**Subject Code: MH1303**

**Subject Name: Project**

CO-4	<b>Support</b> sense of environmental responsibility.
CO-5	<b>Purchase</b> raw material/standard parts.
CO-6	<b>Interpret</b> the drawings, manufacture, assemble, inspect & if necessary modify the parts/unit/assembly of the project work.

**List of Open Source Software/learning website:**

- <http://nptel.iitm.ac.in>
- World Wide Web
- Google Search Engine etc.