

West Bengal State Council of Technical &
Vocational Education and Skill
Development
(Technical Education Division)



Syllabus
of
Diploma in Mechanical Engineering [ME]

Part-III (6th Semester)

2023

**CURRICULUM STRUCTURE FOR PART-III (SEMESTER 6) OF THE
FULL-TIME DIPLOMA COURSES IN MECHANICAL ENGINEERING**

BRANCH: MECHANICAL ENGINEERING				SEMESTER 6						
SL No	Category	Code No	Course Title	L	P	Total Class per week	Credit	Full marks	Internal Marks	ESE Marks
1	Program Core	MEPC302	Design of Machine Elements	3		3	3	100	40	60
2	Program Core	MEPC304	Work, Organization & Management	3		3	3	100	40	60
3	Program Elective	MEPE302	Program Elective (with Lab)	2		2	2	100	40	60
4	Humanities and Social Science	HS302	Entrepreneurship and Start-ups	3		3	3	100	40	60
5	Open Elective	MEOE302	Open Elective (Compulsory)	3		3	3	100	40	60
6	Open Elective	MEOE304	Open Elective	3		3	3	100	40	60
7	Program Elective	MEPE304	Program Elective Lab		2	2	1	100	60	40
8	Major Project	PR302	Major Project		6	6	3	100	60	40
9	Seminar	SE302	Seminar	1		1	1	100	100	0
Total				18	8	26	22	900	460	440
STUDENT CONTACT HOURS PER WEEK: 26hours (Lecture-18 hours; Practical-8 hours) Theory and Practical Period of 60 minutes each. FULL MARKS-900 (Internal Marks-460; ESE Marks-440) L-Lecture, P-Practical, ESE- End Semester Examination										

Credit Distribution	Credit
Program Core	6
Program Elective	3
Open Elective	6
Project + Seminar	4
Humanities and Social Science	3
Total	22

Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately in each subject.

Sl. No.	Program Elective (with Lab)	Credit
1.	Mechatronics (Sub code: MEPE302/1)	Any one 2
2.	Oil Hydraulics & Pneumatics (Sub code: MEPE302/2)	

Sl. No.	Open Elective	Credit
1.	Engineering Economics & Project Management (Compulsory for all Branches) [Sub code: MEOE302]	3
2.	Electrical Machines& Controls(Sub code: MEOE304/1)	Any one 3
3.	Environment Engineering & Science(Sub code: MEOE304/2)	



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“Karigori Bhavan”, 4th Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

Name of the Course: Diploma in Mechanical Engineering	
Category: Programme Core	Semester : Sixth
Code No. : MEPC302	Full Marks : 100
Course Title : Design of Machine Elements	Examination Scheme : (i) External Assessment : 60 marks (End Semester Examination) (ii) Internal Assessment: 40 marks [Class test : 20 marks Assignment / viva voce : 10 marks Class attendance : 10 marks]
Duration : 17 weeks (total hours per week = 3)	
Total lecture class/week : 3	
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course outcomes (COs):

After completion of this course, the student will be able to -

- Analyze the various modes of failure of simple machine parts under different load patterns.
- Design simple machine parts and prepare part and assembly drawings as per the designed dimensions.
- Use design data books and different IS codes of design for the selection of materials for given applications.
- Calculate weight and various costs of different items such as pattern, casted parts, machined parts, forged parts etc.

2. Theory Components:

The following topics/subtopics should be taught and assessed in order for achieving the course outcomes to attain the identified competency.

Unit	Topics & Sub-topics	Teaching Hour
UNIT 1: Introduction to Machine Design	1.1. General considerations in machine design, Aesthetic considerations regarding shape, size, colour & surface finish. 1.2. Fatigue, Endurance Limit, Creep and creep curve. 1.3. Factor of safety and its selection criteria. 1.4. Stress concentration, its causes and remedies. 1.5. Use of design data books, Use of standards in design. 1.6. Types of failures.	06
UNIT 2: Design of Simple Machine Parts	2.1. Socket & Spigot type Cotter joint. 2.2. Knuckle Joint. Design of Bolt: 2.3. Basic types of screw fastening. 2.4. Stresses in screwed fasteners.	08

	2.5. Bolts of Uniform Strength. 2.6. Design of Eyebolt.	
UNIT 3: Design of Shafts, Keys, Couplings & Flat Belt Pulleys	<i>Design Of Shafts:</i> 3.1 Types of shafts, Shaft materials, Standard sizes. 3.2 Design of solid shaft and hollow shaft on strength basis and torsional rigidity basis. <i>Design of Keys:</i> 3.3 Types of keys & Applications, design of Saddle key and Sunk key. 3.4 Effect of keyways on strength of shaft. <i>Design of Couplings:</i> 3.5 Types of coupling and applications, design of rigid type flange coupling. Design of Pulley: 3.6 Types of pulleys and applications, design of Flat belt C.I. pulley.	10
UNIT 4: Design of Welded Joints	<i>Design of Welded Joints:</i> 4.1. Types of fillet joints. 4.2. Strength of parallel fillet welds. 4.3. Strength of transverse fillet welds. 4.4. Axially loaded symmetrical section welded joints. 4.5. Merits and demerits of threaded joints, riveted joints and welded joints.	06
UNIT 5: Antifriction Bearings	5.1 Classification and applications of bearings, comparison of sliding contact & rolling contact bearings, bearing materials. 5.2 Terminology of ball bearings-Load-Life relationship, Static load carrying capacity and Dynamic load carrying capacity, Equivalent-limiting load, limiting speed. 5.3 Selection of ball bearings using manufacturer's catalogue. 5.4 Bearing failure –causes & remedies.	06
UNIT 6: Estimating & Costing	6.1 Introduction to estimating& costing, Elements of costing. 6.2 Determination of weight of various parts such as simple bush, flanged pipe, lathe centre, rivet, bolt head, ring, cotter and knuckle pin. 6.3 Estimation of selling price of simple engineering parts. 6.4 Estimation of fabricated jobs such as simple cylindrical tank & cuboidal tank.	09
Sub Total : Total Lecture Classes		45
No. of classes required for conducting Internal Assessment examination		6
Grand Total:		51

3. Suggested Home Assignments/Students' Activities: (any four)

- Assignment on the selection of materials for given applications using design data book. Also, list the mechanical properties of material selected.
- Problems on design of simple machine parts like Cotter Joint / Knuckle Joint with free hand sketches of all types of failure of each component.
- Problems on design Flange Coupling / Flat belt C.I. pulley with free hand sketches of all types of failure of each component.

- d) ASME Code for shaft design (in case of line shaft carrying a pulley supported between bearings or one overhung pulley).
- e) Problems on design of welded joints with parallel fillet welds /transverse fillet welds / combination of them, axially loaded symmetrical section welded joints.
- f) Prepare a chart for various types of antifriction bearings along with their materials & applications, causes of failure of bearing and their remedies.
- g) Problems on weight and cost calculation of different parts such as flanged pipe, lathe centre, rivets, bolts & nuts, wooden pattern of flange etc.
- h) Problems on overhead cost calculation, selling price calculation.

4. Suggested scheme for question paper design for conducting internal assessment examination: (Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test - 1	4	8	8	20
Class Test - 2	4	8	8	20

Suggested scheme for End Semester Examination: [Duration 2.5 hours]

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1 & 2	09	20	20 x 01 = 20
	3 & 4	09		
	5 & 6	07		
Total:		25	20	20
Subjective Type Questions(Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1, 2, 3	04	05 (At least two from each group))	05 x 08 = 40
C	4, 5 & 6	05		
Sub Total: (B + C):		09	05	40
Total [A+B+C]:				60

6. Rubrics for the Assessment of Students Activity: (20 marks)

Sl. No.	Performance Indicators	Weightage in %	
1	In time submission of home assignment/micro-project/internet search on specific topic, preparation of chart, creation of innovative model etc.		40
2	Viva voce		60
2a	Communication skill	10	
2b	Technical interpretation skill	10	
2c	Answering / Conclusion with justification	40	
Total:			100

7. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1	Introduction to Machine Design	V.B. Bhandari	Tata Mc-Graw Hill
2	Machine Design	Sharma & Agarwal	S.K. Kataria& Sons
3	Machine Design	R. S. Khurmi	S. Chand & Co.
4	Machine Design	R. K. Jain	Khanna Publication
5	Machine Design, Drawing, Estimating & Costing	A.R. Basu	Dhanpat Rai
6	Design Data Book	V.B. Bhandari	Tata Mc-Graw Hill
7	Hand Book of Properties of Engineering Materials & Design Data for Machine Elements	Abdulla Shariff	Dhanpat Rai & Sons



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Name of the Course: Diploma in Mechanical Engineering							
Course Title : Work, Organization & Management				Semester : Sixth			
Category: Programme Core				Full Marks: 100			
Code No. : MEPC304				Examination Scheme:			
Duration : 17 weeks				External Assessment			
				End Semester Examination			60
				Internal Assessment			
Teaching Scheme				Class Test :		20	40
L	T	Total	Credit	Assignment/Student activity		10	
3		3	3	Class attendance		10	
				Total			100
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.							
Assignment / Student Activity: Submission of Home assignment, submission of report after conducting site visit/ industry visit/ micro-project / market survey / internet search on specific topic, preparation of chart, creation of innovative model or present seminar on specific topic which is suitable for the given subject as per instruction of subject teacher.							

1. Course Outcomes:

Students will be able to:

- Understand the concept of management and organizational structure.
- Gain knowledge on work-study and workplace designs and evaluate standard time.
- Analyze the strategic issues and strategies required to select, develop and train work force.
- Understand the importance of Production planning & control and what is required for quality inspection.
- Apply various purchasing method, inventory control techniques in practice.

2. Theory Components:

Unit	Topics	Teaching Hours
Unit: 1 Management Process	<ul style="list-style-type: none"> -Concept of Business and management - Introduction to types of business – Service, Manufacturing , Trading - Introduction to types of Industry – Engineering Industry (Heavy & Light Engineering Industries), Process Industry , - Resources of management, primary and Secondary objectives of management -Introduction to types of management according to nature of Organization - 	08

	<p>Industrial Management, Hotel management , Sports management, Transport management , Event management etc. (types only)</p> <p>-Introduction to types functional areas of management -- Human resources management , Materials management, Financial management, Production management</p> <p>- Principles of Scientific management by F.W.Taylor</p> <p>- Principles of Management (14 principles of Henry Fayol)</p> <p>- Functions of Management -Planning, Organizing, Directing, Controlling</p>	
Unit: 2 Organizational Management	<p>-Definition</p> <p>- Types of organization – Line, Line & staff, Functional, Project</p> <p>-Authority & Responsibility, Span of Control</p>	03
Unit: 3 Human Resource Management	<p>-Objectives & Functions of Human resource Management</p> <p>-Recruitment & selection - process; Training & Development - Types of training – Induction, Skill Enhancement; Performance appraisal, Merit rating.</p> <p>Leadership & Motivation - Styles of Leadership; Qualities of a good leader; Motivation; Maslow's Theory of Motivation, Factors for motivation;</p> <p>Safety Management- Causes of accident, Safety precautions;</p> <p>Fire Safety - Fire triangle, classification of fire, Different extinguishing Modes;</p>	06
Unit: 4 Materials Management and inventory control	<p>-Objectives & Functions of materials Management</p> <p>Purchase procedure – steps involved in purchasing</p> <p>Stores Management – Functions, BIN card</p> <p>- objectives of inventory control</p> <p>Maximum & Minimum Stock, Lead Time, Reorder Level- Economic Order Quantity</p> <p>ABC analysis and VED analysis of Inventory,</p> <p>Break Even analysis,</p>	06
Unit: 5 Work Study	<p>Work Study-</p> <p>Method Study- Objectives, Selection of work ; Basic procedure for conduct of Method study, Flow process chart(Names only) Flow Process chart symbols, Work Measurement -</p> <p>Objectives, steps involved in work measurement, Time study, procedure of Time Study, Time Study Equipment. Standard Time, Allowances, PMTS.</p>	05
Unit: 6 Plant location, Plant layout	<p>Plant Location - Factors affecting Site Selection,</p> <p>Plant Layout – Objectives & principles of good plant lay out,</p> <p>Types of plant lay out based on types of production - Job production, Batch Production, Mass production,</p> <p>Productivity and types.</p> <p>Material handling – Need and Types of material handling devices.</p>	05
Unit: 7 Introduction to Production Planning and Control	<p>Production planning – Definition of planning, sequencing, Routing, Scheduling, loading, dispatching, follow up, Inspection, corrective action.</p>	04
Unit:8 Introduction to Plant Maintenance	<p>Importance of plant and machinery maintenance, Types of maintenance-breakdown, scheduled, Preventive & Predictive maintenance</p>	04

Unit : 9 Inspection and Introduction to Quality Control	Purpose of inspection, Inspection of – incoming materials- in-process – Finished goods Concept Quality, quality Control, Brief introduction of Total quality Management (TQM), Quality circle, Concept of ISO series, Benefits of ISO	04
Sub Total : Total Lecture Classes		45
No. of classes required for conducting Internal Assessment		06
Grand Total :		51

3. Suggested Home Assignments/Students' Activities: (any four)

- Preparation of chart to show the different types of organization.
- Preparation of chart for fire safety.
- Preparation of chart for personal, Tools & Equipment and products safety.
- Preparation of chart showing layout of material handling system for a given application (coal handling system in power plant / Ash handling system / manufacturing industry / foundry shop / etc.)
- Preparation of a flow process chart and operation process chart.
- Preparation of EOQ model
- Prepare charts for showing steps of recruitment, types of training and performance appraisal & merit rating
- Preparation of chart of maintenance of machinery used in an engineering industry
- Prepare a report on types of inspection and Total Quality Management.

4. Suggested scheme for question paper design for conducting internal assessment examination:

(Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1(Remember)	Level 2(understand)	Level3 (Apply &above)	Total
Class Test -1	4	8	8	20
Class Test -2	4	8	8	20

f. Suggested Scheme for End Semester Examination [Duration3 hours]

A: Multiple Choice Type Questions(Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1, 2 & 3	08	20	20x01=20
	4, 5 & 6	10		
	7, 8 & 9	07		
Total:		25	20	20
B: Subjective Type Questions (Carrying 08 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1, 2, 3 & 4	04	05 (taking at least one from each group)	05 x 08=40
C	5, 6, 7, 8 & 9	05		
Total:(B + C)		09	05	40
Total[A+B + C]:				60

6. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1.	Industrial Engineering and Management	O.P. Khanna	Dhanpat Rai & Sons
2	Production & Operations Management	Kanishka Bedi	Oxford University Press
3	Essentials of Management	Joseph L. Massie,	Prentice-Hall of India, New Delhi 2004.
4	Industrial Engineering & Management	S. C. Sharma,	Khanna Book Publishing Co. (P) Ltd., Delhi
5	Management Principles, Processes & Practices	A.Bhattacharya & A.Kumar	Oxford University Press
6	Production & Operation Management	M.T.Telsang	S.Chand



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Name of the Course: Diploma in Mechanical Engineering	
Category: Program Elective	Semester : Sixth
Code No.: MEPE 302/1	Full Marks : 100
Course Title: Mechatronics	Examination Scheme: (i) External Assessment: 60 marks (End Semester Examination) (ii) Internal Assessment: 40 marks [Class Test : 20 marks Assignment/ viva voce: 10 marks Class attendance : 10 marks]
Duration : 17 weeks (Total class hour/week = 2)	
Total lecture class/week: 2	
Credit : 2	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course Outcomes (COs):

After completion of this course, the students should be able to:

- Understand and demonstrate the basic concept of Mechatronics.
- Demonstrate the application of Mechatronics in Manufacturing.
- Identify different components, interpret their function and demonstrate the working of a given Mechatronics System.
- Understand the basic concept and application of CNC machines, Part Programming and Industrial Robotics.

2. Theory Components:

The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes.

Unit	Topics and Sub-topics	Teaching Hours
Unit: 1 Introduction to Mechatronics	1.1. Definition of mechatronics. 1.2. Mechatronics in manufacturing, products and design.	2
Unit 2 Elements in Mechatronics	2.1. Basic working principle and applications of data conversion devices, sensors (Displacement, Position and Proximity Sensors, Velocity and Motion Sensors, Force Sensors, Fluid Pressure Sensors, Flow Sensors, Liquid Level Sensors, Temperature Sensors and Light Sensors), micro-sensors, transducers, signal processing devices and timers.	6
Unit: 3 Processors and Controllers	3.1. Basic working principle and applications of Microprocessors and Microcontrollers. 3.2. Basic working principle and applications of PID Controllers and PLCs.	4
Unit: 4	4.1. Basic working principle and applications of stepper motors and servo	6

Drives and Mechanisms of an Automated System	drives. 4.2. Basic working principle and applications of ball screws, linear motion bearings and cams. 4.3. Basic concept and application of systems controlled by camshafts and electronic cams. 4.4. Basic concept and application of tool magazines and indexing mechanisms.	
Unit: 5 Hydraulic Systems	5.1. Components, their symbol and functions of Hydraulic Systems: Pumps, Control Valves (Pressure Control Valves, Flow Control Valves and Direction Control Valves) and Actuators (Linear Actuators and Rotary Actuators). 5.2. Design of hydraulic circuits (Meter in, Meter out circuits and Sequencing circuit) 5.3. Application of hydraulic systems.	5
Unit: 6 Pneumatic System:	6.1. Components, their symbol and functions of Pneumatic Systems: Compressors, Control Valves (Pressure Control Valves, Flow Control Valves and Direction Control Valves), Actuators (Linear Actuators and Rotary Actuators), FRL Unit and Silencers. 6.2. Production, distribution and conditioning of compressed air. 6.3. Design of pneumatic circuits (Meter in, Meter out circuits and Sequencing circuit). 6.4. Application of pneumatic systems.	5
Unit: 7 CNC Technology and Robotics:	7.1. Basic concept and application of CNC machines and part programming. 7.2. Basic concept and application of Industrial Robotics.	2
Total Lecture Classes (Sub Total):		30
No. of classes required for conducting Internal Assessment:		04
Grand Total :		34

3. Suggested Home Assignments / Student Activities: (Any Four)

Other than classroom and laboratory learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in the course:

Note:

A suggested list of home assignments / student activities is given here. Similar home assignments / student activities could be added by the concerned faculty member also. **Four (04)** home assignments / student activities are to be undertaken by an individual student that needs to be assigned to him / her by the concern faculty member during the course. Students should prepare and submit report for each of their assignment / activity.

- Prepare a chart of sensors and transducers showing their functions and applications.
- Prepare a comparative study on Microprocessors and Microcontrollers for demonstration purpose.
- Prepare a comparative study on of PID Controllers and PLCs for demonstration purpose.
- With a flow diagram show the basic components, state their functions and overall working of a mechatronics system.
- Prepare a report on application of mechatronics in manufacturing.
- With a suitable diagram explain the working of a re-circulating ball screw nut mechanism.
- Prepare a chart showing the symbols and stating the function of different components of a hydraulic system.
- Prepare a chart showing the symbols and stating the function of different components of a pneumatic system.
- Prepare a comparative study on hydraulic & pneumatic systems for demonstration purpose.

- j) Identify different components, interpret their function and demonstrate the working of a given sequencing hydraulic circuit as assigned by the concern teacher.
- k) Develop, draw and explain a suitable hydraulic / pneumatic circuit which may be used for speed controlling a hydraulic / pneumatic actuator.
- l) Prepare a chart containing the labelled diagram of a CNC Machine showing all of its components and their functions.
- m) Prepare a Part Programming for CNC Turning Centre (CNC Lathe) using different codes for a specific job as assigned by the subject teacher.
- n) Prepare a Part Programming for CNC Machining Centre (CNC Milling) using different codes for a specific job as assigned by the subject teacher.

**4. Suggested Scheme for Question Paper Design for Conducting Internal Assessment:
(Duration: 45 Minutes)**

Questions to be set as per following Bloom's Taxonomy				
Internal Assessment	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test: 1	4	8	8	20
Class Test: 2	4	8	8	20

5. Suggested Scheme for End Semester Examination: (Duration: 2.5 hours)

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1, 2, 3 & 4	15	20	20 x 01 = 20
	5, 6 & 7	10		
Sub-Total [A]:		25	20	20
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1, 2, 3 & 4	05	05 (At least two from each group)	05 x 08 = 40
C	5, 6 & 7	04		
Sub-Total [B+C]:		09	05	40
Total [A+B+C]:				60

6. Rubrics for the assessment of students' activity:

Sl. No.	Performance Indicators
1	Originality of completing the Assigned task / micro-project work
2	Presentation Skill
3	In time submission of assignment work / micro-project work
4	Viva voce

7. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
01	Mechatronics - Electronic Control Systems in Mechanical and Electrical Engineering	Bolton W.	Pearson Education Ltd.
02	Introduction to Mechatronics and Measurement Systems	Histand B.H. and Alciatore D.G.	Tata McGraw Hill
03	Programmable Logic Controllers	John W. Webb and Ronald Reis	Prentice Hall of India
04	Programmable Logic Control – Principles and Applications	NIIT	Prentice Hall of India
05	Programmable Logic Controller & Industrial Automation	Mitra & Sengupta	Penram International Publishing (India) Pvt. Ltd.
06	Sensors for Mechatronics	Paul P.L. Regtien	Elsevier
07	Introduction to Mechatronics	Appu Kuttan K.K.	Oxford
08	Process Control Principles & Applications	Surekha Bhanot	Oxford
09	Mechatronics Systems Design	Kolk R.A. and Shetty D.	Vikas Publishing, New Delhi
10	Mechatronics Principles, Concepts and Applications	Mahalik N.P.	Tata McGraw Hill
11	A Text book of Mechatronics	R.K.Rajput	S. Chand
12	Mechatronics	H.M.T.	Tata McGraw Hill
13	Mechatronics	Ramachandran	Wiley



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Name of the Course: Diploma in Mechanical Engineering	
Category: Program Elective	Semester : Sixth
Code No.: MEPE 302/2	Full Marks : 100
Course Title: Oil Hydraulics and Pneumatics	Examination Scheme: (iii) External Assessment: 60 marks (End Semester Examination) (iv) Internal Assessment:40 marks [Class Test : 20 marks Assignment/ viva voce: 10 marks Class attendance : 10 marks]
Duration : 17 weeks (Total class hour/week = 2)	
Total lecture class/week: 2	
Credit : 2	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course Outcomes (COs):

After completion of this course, the Students should be able to:

- Understand the basic concept, advantages, limitations and applications of Fluid Power Systems (Oil Hydraulic and Pneumatic Systems).
- Identify and understand the function of various components of Oil Hydraulic & Pneumatic Systems.
- Understand and demonstrate the working principle of various components used for Oil Hydraulic & Pneumatic Systems.
- Develop simple Oil Hydraulic and Pneumatic Circuits for specific requirement.

2. Theory Components:

The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcomes.

Unit	Topics and Sub-topics	Teaching Hours
Unit: 1 Introduction to Oil Hydraulic and Pneumatic Systems	1.1. Basic concept of fluid power systems. 1.2. Practical applications, advantages and limitations of fluid power systems. 1.3. Classification of fluid power system. 1.4. General layout, basic components, their functions and applications of oil hydraulic system. 1.5. General layout, basic components, their functions and applications of pneumatic system. 1.6. Comparison of oil hydraulic & pneumatic systems.	05
Unit: 2 Components of Oil Hydraulic Systems	2.1. Classification, function and symbols of oil hydraulic pumps. 2.2. Working principle and construction of vane pumps, gear pumps and piston pumps. 2.3. Types, symbols and working of pressure control valves (pressure relief valve, pressure-reducing valve, unloading valve and sequence valve).	10

	2.4. Types, symbols and working of direction control valves—check valve, poppet type DCV and spool type DCV (spool positions of 3/2, 4/2, & 4/3). Method of actuation of DCV. 2.5. Types, symbols and working of flow control valves - pressure compensated and non-pressure compensated flow control valve. 2.6. Types, symbols and working of oil hydraulic actuators (rotary and linear actuators). 2.7. Function and symbols of oil hydraulic accessories (oil filter, intensifier and accumulator).	
Unit: 3 Oil Hydraulic Circuits	3.1. Control circuits of single acting / double acting linear hydraulic actuators / hydraulic motor. 3.2. Meter in, Meter out circuits, bleed off circuit. 3.3. Pump unloading circuit. 3.4. Motion synchronization circuit. 3.5. Sequencing circuit. 3.6. Accumulator Circuits.	07
Unit: 4 Components of Pneumatic System	4.1. Types, function and symbols of compressors and air receiver. 4.2. Working principle and construction of reciprocating compressors and rotary compressors (Screw compressor and vane compressor only). 4.3. Types, symbols and working of pneumatic pressure control valves, flow control valves and direction control valves (3/2, 4/3, 5/2). Working principle of poppet type 3/2 DCV. 4.4. Types, symbols and functions of pneumatic actuators (rotary and linear actuators). 4.5. Functions and symbols of pneumatic accessories (FRL unit& silencer).	05
Unit: 5 Pneumatic Circuits	5.1. Control circuits of single acting / double acting linear pneumatic actuators / Air motor 5.2. Meter in& Meter out circuits. 5.3. Sequencing circuits.	03
Total Lecture Classes (Sub Total):		30
No. of classes required for conducting Internal Assessment:		04
Grand Total :		34

3. Suggested Home Assignments / Student Activities: (Any Four)

Other than classroom and laboratory learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in the course:

Note:

A suggested list of home assignments / student activities is given here. Similar home assignments / student activities could be added by the concerned faculty member also. Four (04) home assignments / student activities are to be undertaken by an individual student that needs to be assigned to him / her by the concern faculty member during the course. Students should prepare and submit report for each of their assignment / activity.

- Prepare a report on unique features and applications of fluid power systems for demonstration purpose.
- Prepare an extensive comparative study on oil hydraulic & pneumatic systems for demonstration purpose.
- Prepare a comparative study on positive displacement pump and non-positive displacement pump for demonstration purpose.
- Deduce the expression of volumetric displacement and discharge of an external gear pump and / or an unbalance vane pump and / or a bent axis type piston pump from its setting and geometry (assume all required information).
- Prepare a chart explaining the spool positions of 3/2 and 4/3 spool type DCV for demonstration purpose.
- Prepare a chart showing the symbols of different types of pumps / compressors, control valves and actuators used in oil hydraulic and pneumatic systems.
- Prepare a report on purpose of mandatory mountings and accessories generally installed in an air receiver.

- h) Prepare a report on conditioning of working fluid generally implemented in oil hydraulic and pneumatic systems.
- i) Prepare a comparative study on meter-in and meter-out hydraulic circuits for demonstration purpose.
- j) Develop, draw and explain a suitable speed control circuit of hydraulic motor which may be used for driving the arbor of a hydraulic horizontal milling machine.
- k) Develop, draw and explain a suitable sequencing hydraulic circuit which may be used for sequential operation of two double acting linear actuators.
- l) With suitable circuit diagrams explain the purpose of using accumulator in oil hydraulic system.
- m) Develop, draw and explain a suitable intensifier circuit which may be used for driving a hydraulic punching press.

4. Suggested Scheme for Question Paper Design for Conducting Internal Assessment:

(Duration: 45 Minutes)

Questions to be set as per following Bloom's Taxonomy				
Internal Assessment	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test: 1	4	8	8	20
Class Test: 2	4	8	8	20

5. Suggested Scheme for End Semester Examination: (Duration: 2.5 hours)

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1, 2 & 3	18	20	20 x 01 = 20
	4 & 5	07		
Sub-Total [A]:		25	20	20
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	05	05 (At least two from each group)	05 x 08 = 40
C	3, 4 & 5	04		
Sub-Total [B+C]:		09	05	40
Total [A+B + C]:				60

6. Rubrics for the assessment of students' activity:

Sl. No.	Performance Indicators
1	Originality of completing the Assigned task / micro-project work
2	Presentation Skill
3	In time submission of assignment work / micro-project work
4	Viva voce

7. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
01	Fluid Power with Application	A. Esposito	Pearson
02	Oil Hydraulic System- Principle and Maintenance	S.R. Majumdar	Tata McGraw Hill
03	Pneumatics Systems- Principles and Maintenance	S.R. Majumdar	Tata McGraw Hill
04	Hydraulic and Pneumatic Control	K. Shanmuga Sundaram	S. Chand
05	Hydraulics and Pneumatics, A technician's and engineer's guide	Andrew Parr	Butterworth-Heinemann
06	Fluid Power Generation, Transmission & Control	Jagadeesha T., Thammaiah Gowda	Wiley
07	Pneumatic Controls	P. Joji	Wiley
08	Introduction to Hydraulics and Pneumatics	Ilango & Soundararajan	Prentice Hall India
09	Hydraulics and Pneumatics	Stewart	Taraporewala Publication
10	Hydraulic System & Maintenance	Farel Bradbury	ILIFFE Books, London
11	Industrial Fluid Power	Charles Hedges	Womack Educational Publications
12	Industrial Hydraulic Control	Peter Rhoner	Prentice Hall India
13	Industrial Hydraulics	Hicks Pippenger	McGraw Hill International



WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT

[A Statutory Body under West Bengal Act XXVI of 2013]

(Formerly West Bengal State Council of Technical Education)

"Karigori Bhavan", 4th Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

Name of the Course: Diploma in Mechanical Engineering	
Category: HS	Semester : Sixth
Code No.: HS302	Full Marks : 100
Course Title: Entrepreneurship and Start-ups	Examination Scheme: (v) External Assessment: 60 marks (End Semester Examination) (vi) Internal Assessment:40 marks [Class Test : 20 marks Assignment/ viva voce: 10 marks Class attendance : 10 marks]
Duration : 17 weeks (Total class hour/week = 3)	
Total lecture class/week: 3	
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course Learning Objectives

- To raise awareness, knowledge and understanding of enterprise/ entrepreneurship.
- To motivate and inspire students toward an entrepreneurial career.
- To understand venture creation process and to develop generic entrepreneurial competences.
- To introduce students to the basic steps required for planning, starting and running a business.
- To familiarise students with the different exit strategies available to entrepreneurs.

2. Course Outcomes (COs):

After completing the course students will able to:

CO 1	Identify qualities of entrepreneurs, develop awareness about entrepreneurial skill and mindset and express knowledge about the suitable forms of ownership for small business
CO 2	Comprehend the basics of Business idea, Business plan, Feasibility Study report, Project Report and Project Proposal
CO 3	Understand the concept of start-up business and recognise its challenges within legal framework and compliance issues related to business.
CO 4	Make a growth plan and pitch it to all stakeholders and compare the various sources of funds available for start-up businesses

3. Theory Components:

Unit	Name of the Topic	Hours
Unit 1: Entrepreneurship: Introduction and Process	<ul style="list-style-type: none"> • Concept, Competencies, Functions and Risks of entrepreneurship • Entrepreneurial Values& Attitudes and Skills • Mind set of an employee/manager and an entrepreneur • Types of Ownership for Small Businesses <ul style="list-style-type: none"> ○ Sole proprietorship ○ Partnerships ○ Joint Stock company- public limited and private limited companies 	10

	<ul style="list-style-type: none"> Difference between entrepreneur and Intrapreneur 	
Unit 2: Preparation For Entrepreneurial Ventures	<ul style="list-style-type: none"> Business Idea- Concept, Characteristics of a Promising Business Idea, Uniqueness of the product or service and its competitive advantage over peers. Feasibility Study – Concept, Location, Economic, Technical and Environmental Feasibility. Structure and Contents of a standard Feasibility Study Report Business Plan – Concept, rationale for developing a Business Plan, Structure and Contents of a typical Business Plan Project Report- Concept, its features and components Basic components of Financial Statements- Revenue, Expenses (Revenue & capital expense), Gross Profit, Net Profit, Asset, Liability, Cash Flow, working capital, Inventory. Funding Methods-Equity or Debt. <p>Students are just expected to know about the features and key inclusions under, Business Plan and Project Report. <u>They may not be asked to prepare a Business Plan/ Project Report/ Project Feasibility Report in the End of Semester Examination.</u></p>	20
Unit 3: Establishing Small Enterprises	<ul style="list-style-type: none"> Legal Requirements and Compliances needed for establishing a New Unit- <ul style="list-style-type: none"> NOC from Local body Registration of business in DIC Statutory license or clearance Tax compliances 	03
Unit 4: Start-Up Ventures	<ul style="list-style-type: none"> Concept & Features Mobilisation of resources by start-ups: Financial, Human, Intellectual and Physical Problems and challenges faced by start-ups. Start-up ventures in India – Contemporary Success Stories and Case Studies to be discussed in the class. <p>Case studies have been included in the syllabus to motivate and inspire students toward an entrepreneurial career from the success stories. <u>No questions are to be set from the case studies.</u></p>	04
Unit 5: Financing Start- Up Ventures In India	<ul style="list-style-type: none"> Communication of Ideas to potential investors – Investor Pitch Equity Funding, Debt funding – by Angel Investors, Venture Capital Funds, Bank loans to start-ups Govt. Initiatives including incubation centre to boost start-up ventures MSME Registration for Start-ups –its benefits. 	06
Unit 6: Exit Strategies For Entrepreneurs	<ul style="list-style-type: none"> Merger and acquisition exit, Initial Public Offering (IPO), Liquidation, Bankruptcy – <u>Basic Concept only.</u> 	02
Sub Total : Total Lecture Classes		45
No. of classes required for conducting Internal Assessment examination		6
Grand Total:		51

4. Suggested Scheme for Question Paper Design for Conducting Internal Assessment:

(Duration: 45 Minutes)

Questions to be set as per following Bloom's Taxonomy				
Internal Assessment	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test: 1	4	8	8	20
Class Test: 2	4	8	8	20

5. Suggested Scheme for End Semester Examination: (Duration: 2.5 hours)

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1, 2 & 3	18	20	20 x 01 = 20
	4, 5 & 6	07		
Sub-Total [A]:		25	20	20
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	05	05 (At least two from each group)	05 x 08 = 40
C	3, 4, 5 & 6	04		
Sub-Total [B+C]:		09	05	40
Total [A+B + C]:				60

6. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1.	Entrepreneurship Development	Sangeeta Sharma	Prentice Hall of India Learning Private Ltd
2.	Entrepreneurship Development	S. Anil Kumar	New Age International
3.	Fundamentals of Entrepreneurship	Sangram Keshari Mohanty	Prentice Hall of India Learning Private Ltd
4.	Fundamentals of Entrepreneurship	Dr. G.K. Varshney	Sahitya Bhawan Publication
5.	Managing New Ventures: Concepts and Cases on Entrepreneurship	Anjan Rai Chaudhuri	Prentice Hall of India Learning Private Ltd
6.	How to Start a Business in India	Simon Daniel	Buooks, Chennai
7.	Entrepreneurship and Small Business Management	S.S. Khanka	S. Chand & Sons, New Delhi
8.	Entrepreneurship Development and Business Ethics	Abhik Kumar Mukherjee & Shaunak Roy	Oxford University Press
9.	Entrepreneurship Development and Business Ethics	Dr B Chandra & Dr B Biswas	Tee Dee Publications
10.	Entrepreneurship Development Small Business Entrepreneurship	Poornima Charantimath	Pearson Education India



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Name of the Course: Diploma in Mechanical Engineering	
Category: Open Elective (Compulsory)	Semester : Sixth
Code No.: OE302	Full Marks : 100
Course Title: Engineering Economics & Project Management	Examination Scheme: (i) External Assessment: 60 marks (End Semester Examination) (ii) Internal Assessment: 40 marks [Class Test : 20 marks Assignment/ viva voce: 10 marks Class attendance : 10 marks]
Duration : 17 weeks (Total class hour/week = 3)	
Total lecture class/week: 3	
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course Outcomes (COs):

After completing the course students will able to:

CO 1	To acquire knowledge of basic economics to facilitate the process of economic decision making.
CO 2	To acquire knowledge on basic financial management aspects
CO 3	To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved
CO 4	To develop an understanding of key project management skills and strategies

2. Theory Components:

Unit	Name of the Topic	Hours
Unit 1: Introduction, Theory of Demand & Supply	1.1 Introduction to Engineering Economics, the relationship between Engineering and Economics. 1.2 Resources, scarcity of resources, and efficient utilization of resources. 1.3 Opportunity cost, rationality costs, and benefits. 1.4 Theory of Demand: the law of demand, different types of demand, determinants of demand, demand function, price elasticity of demand. 1.5 Theory of Supply: determinants of supply, supply function. 1.6 Market mechanism: Equilibrium, basic comparative static analysis (Numerical problems)	9
Unit 2: Theory of Production & Costs	2.1 Concept of production (goods & services), Different factors of production (fixed and variable factors), Short-run Production function (Graphical illustration), and Long run production function (returns to scale). 2.2 Theory of Cost: Short-run and long-run cost curves with graphical illustration, basic concept on total cost, fixed cost, variable cost, marginal cost, average cost etc.	10

	2.3 Economic concept of profit, profit maximization (numerical problems)	
Unit 3: Different Types of Market and Role of Government	3.1 Perfect Competition: Features of Perfectly Competitive Market. 3.2 Imperfect Competition: Monopoly, Monopolistic Competition, and Oligopoly. 3.3 Role of government in Socialist, Capitalist and Mixed Economy structure with example.	04
Unit 4: Concept of Project	2.1 Definition and classification of projects). 2.2 Importance of Project Management. 2.3 Project life Cycle -[Conceptualization → Planning → Execution → Termination]	04
Unit 5: Feasibility Analysis of a Project	5.1 Economic and Market analysis. 5.2 Financial analysis: Basic techniques in capital budgeting– Payback period method, Net Present Value method, Internal Rate of Return method. 5.3 Environmental Impact study–adverse impact of the project on the environment. 5.4 Project risk and uncertainty: Technical, economical, socio-political, and environmental risks. 5.5 Evaluation of the financial health of a project–Understanding the basic concept of Fixed & Working Capital, Debt & Equity, Shares, Debentures etc., and different financial ratios like Liquidity Ratios, Activity Ratios, Debt-equity ratio & Profitability Ratio (Basic concept only). <i><u>N.B: Knowledge of financial statements is not required; for the estimation of ratios the values of the relevant variables will be provided.</u></i>	10
Unit 6: Project Administration	6.1 Gantt Chart– a system of bar charts for scheduling and reporting the progress of a project (basic concept only). 6.2 Concept of Project Evaluation and Review Technique (PERT) and Critical Path method (CPM): basic concept and application with real-life examples.	08
Sub Total : Total Lecture Classes		45
No. of classes required for conducting Internal Assessment examination		6
Grand Total:		51

3. Suggested Home Assignments / Student Activities:

Guideline for Assignment -

Students should be instructed to prepare a report on a project (preferably the Major Project they prepare in 6th Semester), using a popular project management software in IT/ Computer Laboratory, under the guidance of the Lecturer in Computer Science & Technology and Lecturer in Humanities.

4. Suggested Scheme for Question Paper Design for Conducting Internal Assessment:

(Duration: 45 Minutes)

Questions to be set as per following Bloom's Taxonomy				
Internal Assessment	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test: 1	4	8	8	20
Class Test: 2	4	8	8	20

3. Suggested Scheme for End Semester Examination: (Duration: 2.5 hours)

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1, 2 & 3	13	20	20 x 01 = 20
	4, 5 & 6	12		
Sub-Total [A]:		25	20	20
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1, 2 & 3	05	05 (At least two from each group)	05 x 08 = 40
C	4, 5 & 6	04		
Sub-Total [B+C]:		09	05	40
Total [A+B +C]:				60

6. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1.	Principles of Economics	Case and Fair	Pearson Education Publication
2.	Principles of Economics	Mankiw	Cengage Learning
3.	Project planning, analysis, selection, implementation and review	Prasanna chandra	Tata McGraw Hill.
4.	Project Management	Gopala Krishnan	McMillan India Ltd



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Name of the Course: Diploma in Mechanical Engineering	
Category: Open Elective	Semester : Sixth
Code No.: OE304/1	Full Marks : 100
Course Title: Electrical Machines & Controls	Examination Scheme: (i) External Assessment: 60 marks (End Semester Examination) (ii) Internal Assessment: 40 marks [Class Test : 20 marks Assignment/ viva voce: 10 marks Class attendance : 10 marks]
Duration : 17 weeks (Total class hour/week = 3)	
Total lecture class/week: 3	
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course Outcomes (COs):

After completing the course students will able to:

CO 1	Identify suitable transformer & DC motors for an intended application.
CO 2	Analyze the input and output characteristics curves of a motor to determine its aptness for an application.
CO 3	Recommend suitable fractional kW motor for a planned project.
CO 4	Obtain an accurate yet compact mathematical model of a dynamical system.
CO 5	Determine a suitable control algorithm for an intended application.

2. Theory Components:

The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcome.

Unit	Topics and Sub-topics		Hours
Unit 1: DC Machines & Transformers	1.1	Mechanism of Electro – Mechanical Energy Conversion	11
	1.2	Basics of DC Machines: <ul style="list-style-type: none"> Identify the different parts with functions Working/ Operating principles of Motor & Generator Types of DCMachines General circuit diagram / representation of DC Motor Applications of different types of DC Motors in industrial sector 	

	1.2	Brief concept of DC Motors: <ul style="list-style-type: none"> • Back – EMF – concept and necessity for starting • DC starter – necessity and types (only names) • Speed & Torque equation. (only expression) • Numerical on torque – speed equation 	
	1.3	. Basic concept of Transformers: <ul style="list-style-type: none"> • Identify main constructional parts with their functions • Types of transformers • Operating principle of Transformer • EMF equation and Transformation Ratio (expressions only) • Simple numerical on EMF equation & Transformation ratio 	
	1.4	Various losses in transformer, OC and SC Test of transformer for finding the parameters.	
	1.5	Basic concept of Auto – transformer: <ul style="list-style-type: none"> • Working concept • Volt – Amperes relationship • Application in industrial sector 	
Unit 2: A C Machines	A: Induction Motor		11
	2.A.1	Basics of Induction Motor: <ul style="list-style-type: none"> • Identify the constructional parts with their functions • Outline the constructional differences between SQIM & Wound rotor 	
	2.A.2	Terminology and expressions related to Induction Motor: <ul style="list-style-type: none"> • Synchronous Speed & Rotor Speed • Slip • Stator & Rotor frequency 	
	2.A.3	Working principle of an Induction Motor (Brief idea).	
	2.A.4	Expression of Torque developed in an Induction Motor (only equation). Simple numerical on torque equation.	
	2.A.5	Characteristics of Induction Motor: <ul style="list-style-type: none"> • Speed – Torque Characteristics • Slip – Torque Characteristics 	
	2.A.6	Control of Induction Motor: <ul style="list-style-type: none"> • Reversal of rotation • Voltage & frequency control method (comprehensive) • Stator & Rotor resistance control method (brief idea) • Pole changing control method (brief idea) 	
	2.A.7	Concept of different types of Braking method of Induction Motor.	
	2.A.8	Industrial applications of Squirrel Cage & Wound – Rotor type Induction Motors.	

	B: Synchronous Machines		
	2.B.1	Basics of Synchronous Machines: <ul style="list-style-type: none"> Identify main constructional parts with their functions Operating principle of Synchronous Motor 	
	2.B.2	Terminology related to Synchronous Motor: <ul style="list-style-type: none"> Concept of starting Hunting Damper winding 	
	2.B.3	Applications of Synchronous Motor.	
Unit 3: Fractional kW Motors	3.1	Basics of Permanent Magnet Synchronous Motor (PMSM) <ul style="list-style-type: none"> Identify different constructional parts Describe operating principle Control of PMSM Applications 	07
	3.2	Basics of Brushless DC Motor (BLDC) <ul style="list-style-type: none"> Define the constructional parts Describe operating principle Closed loop Control of BLDC Applications 	
	3.3	Brief concept and applications: <ul style="list-style-type: none"> Stepper Motor Universal Motor Single phase Induction Motors 	
Unit 4: Introduction to Control System	4.1	Introduction to control system, Classification of control system.	09
	4.2	Control system components: Synchro, D.C Servomotor, A.C Servo motor, AC Tachometer (only basic operating principle & construction and diagram. (no deduction)	
	4.3	Concept of transfer function, poles and zeroes, transfer function of first & second order system. (no deduction)	
	4.4	Signals (unit step, unit ramp, unit impulse) and their mathematical representation and characteristics.	
	4.5	Modelling of mechanical systems, force-voltage and force-current analogy.	
	4.6	Block Diagram Representation of control system, Transfer function from Block diagram reduction technique, State space representation of continuous time systems, State equations, Transfer function from State Variable representation.	
Unit 5:	5.1	Time response characteristics of first and second order system to unit step excitation (no deduction).	07

Time response analysis, Stability and Process control	5.2	Stability concept: characteristic equation, Deciding stability from pole zero concept, Routh Hurwitz criteria (Numerical), Applications and limitations.	
	5.3	Control action of a system with ON/OFF, P, PI, PD, PID controller, Practical application of these controllers (with block diagram only).	
Total Lecture Classes (Sub Total):			45
No. of classes required for conducting Internal Assessment:			06
Grand Total :			51

3. Suggested Home Assignments/ Student Activities: (Any Four)

- Visit a small motor manufacturing industry and make a report based on their observation.
- Prepare a Power – Point Presentation on the working of DC Motors, Induction Motors, Transformers, Synchronous Motor, PMSM and BLDC.
- Prepare a Power – Point Presentation on the parts of DC Motors, Induction Motors, Transformers, Synchronous Motor, PMSM and BLDC.
- Make a market survey and submit a report on the basis of the following:
 - Types of Machines,
 - Manufacturer,
 - Name Plate details,
 - Applications.
- Visit a Transformer manufacturing factory and observe the various routine tests on Transformers and submit a report.
- Make a model or simulation type project using BLDC and PMSM.
- Deduce mathematical modelling of different mechanical and electrical systems.
- Make a power point presentation on block diagram reduction technique.
- Make a power point presentation on different controllers.
- Prepare a power point presentation on Programmable Logic Controllers.

4. Suggested Scheme for Question Paper Design for Conducting Internal Assessment: (Duration:45 Minutes)

Questions to be set as per Bloom's Taxonomy				
Internal Assessment	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test – 1	4	4	12	20
Class Test – 2	4	4	12	20

5. Suggested Scheme for End Semester Examination: (Duration: 2 hrs. 30 minutes.)

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be set	To be Answered	Total Marks
A	1 & 2	12	20	20 X 1 = 20
	3	03		
	4 & 5	10		
Total:		25	20	20
Long Answer Type Questions (Carrying 5 mark each)				
Group	Unit	To be set	To be Answered	Total Marks
B	1 & 2	04	05 (At least two from each group)	05 X 08 = 40
C	3, 4 & 5	05		
Total: (B + C)		09	05	40
Sub – Total (A) Marks:				20
Sub – Total (B+C) Marks:				40
Total (A+B+C) Marks for End Semester:				60

6. Rubrics for the Assessment of Student's Activity:

Sl. No.	Performance Indicators	Weightage in %
01.	Originality of completing the Assigned task / micro-project work.	50
02.	Presentation Skill.	30
03.	In time submission of assignment work / micro- project work.	10
04.	Viva voce	10
Total:		100

7. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
01.	Principle of Electrical Machines	V. K. Mehta Rohit Mehta	S. Chand & Co. Pvt. Ltd., New Delhi
02.	Electrical Technology Vol – II	B. L. Thereja A. K. Thereja	BPB Publication, New Delhi
03.	Electrical Machinery	P. S. Bimbhara	Khanna Publishers, New Delhi



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Name of the Course: Diploma in Mechanical Engineering	
Category: Open Elective	Semester : Sixth
Code No.: OE304/2	Full Marks : 100
Course Title: Environment Engineering & Science	Examination Scheme: (iii) External Assessment: 60 marks (End Semester Examination) (iv) Internal Assessment: 40 marks [Class Test : 20 marks Assignment/ viva voce: 10 marks Class attendance : 10 marks]
Duration : 17 weeks (Total class hour/week = 3)	
Total lecture class/week: 3	
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course Outcomes (COs):

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

CO 1	Recognize the relevance and the concept of Environmental Science and Engineering and different world-wide activities on this area.
CO 2	Illuminate the different types of environmental pollutant, their effects and their sustainable solutions.
CO 3	Discuss the environmental regulations act. and standards.
CO 4	Gather basic idea about conventional and non-conventional energy resources.
CO 5	Demonstrate the broad perspective of Environmental Science practices by utilizing engineering knowledge and principles

2. Theory Components:

Unit	Name of the Topic	Hours
Unit 1: Environment and Ecology	1.1 Classification of Environment 1.2 Environmental descriptors 1.3 Environmental quality and descriptive parameters 1.4 Ecology: Definition and classification 1.5 Environmental impact on ecology	08
Unit 2: Water pollution and pollutants (Natural and Anthropogenic)	2.1 Ground water: Sources and quality analysis 2.2 Surface water: Sources and quality analysis 2.3 Quality parameters in water treatment along with flow-sheets 2.4 Basic processes for potable water supply (Detailed technology not necessary) 2.5 Water pollution: Surface and ground water pollution, types of pollutants 2.6 Mode of water pollution 2.7 Parameters to be assessed for water pollution (Turbidity, pH, total suspended solids, total solids, BOD and COD: Definition, calculation) 2.8 Chemistry aspect for water pollution	11

	2.9 Control of water pollution (Description only) 2.10 Fundamental of water treatment techniques.	
Unit 3: Air quality, Air Pollution and Control, Noise Pollution	3.1 Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler) 3.2 Air Pollutants: Types, Units of air pollutants 3.3 Atmospheric physics for air pollution 3.4 Particulate Pollutants: Effects and control strategies (Bag filter, Cyclone separator, Electrostatic Precipitator) 3.5 Advanced air pollution control methods 3.6 Noise pollution: sources of pollution, measurement of noise pollution 3.7 Noise measuring devices and their demonstration.	10
Unit 4: Solid waste and Soil pollution	4.1 Definition of solid waste 4.2 Classification of solid waste 4.3 Overview on municipal, industrial, hazardous, hospital, plastic, E-waste. etc. 4.4 Solid waste management and disposal process. 4.5 Soil pollution, Poor Fertility, Septicity, Concentration of Infecting Agents in Soil 4.6 Leaching and its impact on soil pollution.	06
Unit 5: Renewable sources of Energy	5.1 Energy Resources: Energy scenario, national and international status. 5.2 Solar Photovoltaic: Solar radiation and types, basic working principle of solar PV, solar cells and types, water pumping and applications of solar PV. 5.3 Solar Thermal system: basic working principle and applications of solar thermal energy, solar water heater and types, solar cooking, solar pond, Solar still etc. 5.4 Wind energy systems: basic principle, types of wind turbines, application of wind energy, 5.5 Bio-energy systems: bio thermal and chemical basic principle, gasifier and digesters. 5.6 Hydro energy systems: small and micro hydro systems and its basic working. 5.7 Geothermal energy: Basic working principle, types and application of geothermal energy. 5.8 Ocean & Tidal Energy: Basic working principle, applications and types of different types of energy generation through ocean and tidal systems.	08
Unit 6: Environment Legislation system and Rules	6.1 Environmental protection rules 6.2 Sustainable environmental management.	02
Sub Total : Total Lecture Classes		45
No. of classes required for conducting Internal Assessment examination		6
Grand Total:		51

3. Suggested Scheme for Question Paper Design for Conducting Internal Assessment:

(Duration: 45 Minutes)

Questions to be set as per following Bloom's Taxonomy				
Internal Assessment	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test: 1	4	8	8	20
Class Test: 2	4	8	8	20

4. Suggested Scheme for End Semester Examination: (Duration: 2.5 hours)

Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1, 2 & 3	17	20	20 x 01 = 20
	4, 5 & 6	8		
Sub-Total [A]:		25	20	20
Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1, 2 & 3	06	05 (At least two from each group)	05 x 08 = 40
C	4, 5 & 6	03		
Sub-Total [B+C]:		09	05	40
Total [A+B+C]:				60

5. Suggested Learning Resources:Text Books:

1. Environmental Studies- By N.N. Basak
2. Environmental Studies-By D .Srivastava
3. Introduction to Environmental Engineering— By Dr. Manindra Nath Patra.
4. Environmental Engineering- By A.K. Jain

Reference Books:

1. Environmental Engineering---By G.Killy
2. Environmental Engineering--- By Peavy, Rowe
3. Water and Waste Water Engineering— By S.Garg
4. Waste Water Engineering--By -Panmia
5. Non-conventional Energy Sources-4th Edition, By Prasad Rajesh K and Ojha
6. Non-conventional Energy Resources—By Chauhan and Srevastava
7. Non-conventional Energy Sources---By G.D.Rai (Khanna Publisher)
8. Ecology --By -Odum
9. Ecology---By -Das & Das
10. Environmental Law ---By -Gurdip Sing
11. Environmental Law----By Jaiswal Jaiswal Jaiswal
12. Environmental Law in India ---By -P. Leela Krishnan
13. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
14. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
15. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications- Rating System, TERI Publications - GRIHA Rating System.



WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT

[A Statutory Body under West Bengal Act XXVI of 2013]

(Formerly West Bengal State Council of Technical Education)

"Karigori Bhavan", 4th Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

Name of the Course: Diploma in Mechanical Engineering			
Category: Program Elective	Semester: Sixth		
Code No.: MEPE 304/1	Full Marks: 100		
Course Title: Mechatronics Lab	Sessional Examination Scheme:		
	External Assessment (End Semester Sessional Examination)		
	Assignment on the day of Viva Voce:	20	40 marks
Duration : 17 weeks (2 hours per week)	Viva Voce (before Board of Examiners):	20	
	Internal Assessment		
	Continuous assessment of class performance and in time submission of Assignments:	30	60 marks
Total practical classes / week: 2	Viva Voce:	20	
	Class Attendance:	10	
Credit: 1	Total Marks:		100
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.			
Pre-requisite: Knowledge of Mechatronics [Code No.: MEPE 302/1].			

1. Course Outcomes (COs):

The theory and practical experiences associated with this subject are to be taught and implemented, so that the student demonstrates the following industry oriented course outcomes:

- The Students should be able to identify and understand the function of various components of a Mechatronics Systems.
- The Students should be able to demonstrate the working of a given Mechatronics System.
- The Students should be able to understand the basic concept of CNC machines and Part Programming.

2. Suggested Assignments / Practical for Continuous Assessment:

The list of practical to be completed by the students towards attainment of the required competency:

Sl. No.	List of Practical
01	Identification, demonstration of working principle and application of different sensors and transducers.
02	Verification or calibration or measurement different mechanical quantity with suitable setup comprising of different sensor(s) and / or transducer(s): (Any two of the following) <ol style="list-style-type: none"> Measurement of strain by using a basic strain gauge and determination of the stress induced. Measurement of velocity of compressible fluid across a duct using Anemometer. Speed Measurement by using Stroboscope / Magnetic / Inductive Pick Up. Measurement of flow of fluid by using Rotameter. Calibration of given LVDT. Temperature control using Thermal Reed switch & Bimetal switch. Temperature measurement using Thermocouple. Measurement of force & weight by using a load cell. Liquid Level Measurement by using floats/ differential pressure cell system.

	x. Verify characteristics of photo transducer & photo diode.
03	Demonstration of basic working principle and application of various digital to analog and analog to digital converters.
04	Simulation or design and develop program using PLC / Microcontroller for the following purpose: (Any two) <ul style="list-style-type: none"> i. Measurement of speed of a motor. ii. Motor start and stop by using two different sensors. iii. Simulation of a pedestrian traffic controller. iv. Simulation of four-road junction traffic controller. v. Lift / elevator control. vi. Washing machine control. vii. Tank level control. viii. Soft drink vending machine control. ix. Speed control of servo motor / DC motor x. Temperature & humidity measurement and control xi. Measurement of distance using suitable sensor
05	Identification of different components, interpretation of their function and demonstration of working of a given hydraulic system as assigned by the concern teacher.
06	Identification of different components, interpretation of their function and demonstration of working of a given pneumatic system as assigned by the concern teacher.
07	Design and demonstration of Meter-in and Meter-out Circuits.
08	Design and demonstrate a suitable sequencing Circuit for sequential operation two actuators.
09	Identification of different components, interpretation of their function and demonstration of working of a CNC machine as specified by concern teacher.
10	Preparation of a chart containing commonly used word address codes, G-codes, M-codes and their interpretation as used in manual part programming of CNC machine tool.
11	Prepare a Part Program by using different codes for a specific job as assigned by the concern teacher, which is to be digitally manufactured or manufactured in CNC Turning Centre (CNC Lathe).
12	Prepare a Part Program by using different codes for a specific job as assigned by the concern teacher, which is to be digitally manufactured or manufactured in CNC Machining Centre (CNC Milling).

Note:

A suggested list of Practical is given in the above table. The concerned faculty member may add similar Practical Assignment also. **Any five (05)** practical are needed to be performed during the course, so that the student achieves the desired level of competency as generally required by the industry.

3. Suggested Scheme for Internal Assessment: [Total Marks: 60]

Involvement	Total Marks
Continuous assessment of class performance and in time submission of Assignments.	30
Viva Voce on to the Laboratory Practice at the end of the semester.	20
Class attendance.	10
Total Internal Assessment:	60
Pass criterion for Internal Assessment = 24 Marks [Minimum]	

4. Suggested Scheme for End Semester Examination: [Total Marks: 40]

Involvement	Total Marks
Assignment on the day of End Semester Exam.	20
Viva Voce on to the Laboratory Practice on the day of End Semester Exam.	20
Total External Assessment:	40
Pass criterion for Internal Assessment = 16 Marks [Minimum]	

During conducting such Practical (laboratory / field based) work, the following social Skills / attitudes which are to be developed through the experiences:

- Follow the safety practices.
- Practice good housekeeping.
- Demonstrate working as a leader / team member.
- Maintain tools and equipment in good working condition.
- Follow ethical practice.

5. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
01	Mechatronics - Electronic Control Systems in Mechanical and Electrical Engineering	Bolton W.	Pearson Education Ltd.
02	Introduction to Mechatronics and Measurement Systems	Histand B.H. and Alciatore D.G.	Tata McGraw Hill
03	Programmable Logic Controllers	John W. Webb and Ronald Reis	Prentice Hall of India
04	Programmable Logic Control – Principles and Applications	NIIT	Prentice Hall of India
05	Programmable Logic Controller & Industrial Automation	Mitra & Sengupta	Penram International Publishing (India) Pvt. Ltd.
06	Sensors for Mechatronics	Paul P.L. Regtien	Elsevier
07	Introduction to Mechatronics	Appu Kuttan K.K.	Oxford
08	Process Control Principles & Applications	Surekha Bhanot	Oxford
09	Mechatronics Systems Design	Kolk R.A. and Shetty D.	Vikas Publishing, New Delhi
10	Mechatronics Principles, Concepts and Applications	Mahalik N.P.	Tata McGraw Hill
11	A Text book of Mechatronics	R.K.Rajput	S. Chand
12	Mechatronics	H.M.T.	Tata McGraw Hill
13	Mechatronics	Ramachandran	Wiley



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Name of the Course: Diploma in Mechanical Engineering			
Category: Program Elective	Semester: Sixth		
Code No.: MEPE304/2	Full Marks: 100		
Course Title: Oil Hydraulics and Pneumatics Lab	Sessional Examination Scheme:		
	External Assessment (End Semester Sessional Examination)		
	Assignment on the day of Viva Voce:	20	40 marks
Duration : 17 weeks (2 hours per week)	Viva Voce (before Board of Examiners):	20	
	Internal Assessment		
	Continuous assessment of class performance and in time submission of Assignments:	30	60 marks
Total practical classes/week: 2	Viva Voce:	20	
	Class Attendance:	10	
Credit: 1	Total Marks:		100
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.			
Pre-requisite: Knowledge of Oil Hydraulics and Pneumatics [Code No.: MEPE 302/2].			

1. Course Outcomes (COs):

The theory and practical experiences associated with this subject are to be taught and implemented, so that the student demonstrates the following industry oriented course outcomes:

- The Students should be able to identify and understand the function of various components of Oil Hydraulic & Pneumatic Systems.
- The Students should be able to understand and demonstrate the working principle of various components used for Oil Hydraulic & Pneumatic Systems.
- The Students should be able to develop simple Oil Hydraulic and Pneumatic Circuits for specific requirement.

2. Suggested Assignments / Practical for Continuous Assessment:

The list of practical to be completed by the students towards attainment of the required competency:

Sl. No.	List of Practical	Unit No. with Subject Code
01	Study of external gear pump and / or an unbalance vane pump and / or a bent axis type piston pump generally used in oil hydraulic systems and prepare report with suitable diagrams explaining its working principle and applications.	02 [MEPE 302/2]
02	Study of receiver mounted reciprocating air compressor generally used in pneumatic systems and prepare report with suitable diagrams explaining its working principle and function of its mandatory mountings and accessories.	04 [MEPE 302/2]
03	Study of rotary compressor (screw and / or vane compressor) generally used in pneumatic systems and prepare report with suitable diagrams explaining its working principle and applications.	04 [MEPE 302/2]
04	Study of pressure control valves generally used in oil hydraulic / pneumatic system and prepare report on its type, working principle, symbol and application.	02 & 04 [MEPE 302/2]

05	Study of flow control valves generally used in oil hydraulic / pneumatic system and prepare report on its type, working principle, symbol and application.	02 & 04 [MEPE 302/2]
06	Study of direction control valves generally used in oil hydraulic / pneumatic System and prepare report on its type, working principle, types of actuation, specification, symbol and application.	02 & 04 [MEPE 302/2]
07	Examine the cut-section model of check valve and needle valve and prepare report with suitable diagrams explaining its working principle and applications.	02 [MEPE 302/2]
08	Study of rotary / linier (single /double acting) actuators generally used in oil hydraulic / pneumatic system and prepare report on its working principle, symbol and application.	02 & 04 [MEPE 302/2]
09	Study of FRL Unit used in pneumatic system and prepare a report with suitable diagrams on working principle and function of its individual components.	04 [MEPE 302/2]
10	Identify and operate different components of oil hydraulic trainer system and prepare a report comprising list of components, function with symbol of each components and overall utility of the system.	02 & 03 [MEPE 302/2]
11	Identify and operate different components of pneumatic trainer system and prepare a report comprising list of components, function with symbol of each components and overall utility of the system.	04 & 05 [MEPE 302/2]
12	Prepare and operate an oil hydraulic circuit as specified by the concern teacher in a hydraulic trainer system. Observe, record pressure gauge readings at different stages of operation and prepare a report on working and setting of safety equipment(s) of hydraulic trainer system.	02 & 03 [MEPE 302/2]
13	Design, prepare, operate and submit a report on Control circuits of single acting and double acting linear actuators.	03 & 05 [MEPE 302/2]
14	Design, prepare, operate and submit a report on Meter-in and Meter-out Circuits.	03 & 05 [MEPE 302/2]
15	Design, prepare, operate and submit a report on Sequencing Circuit.	03 & 05 [MEPE 302/2]
16	Design, prepare, operate and submit a report on a suitable oil hydraulic Circuit which may be used to drive a shaping machine.	03 [MEPE 302/2]
17	Design, prepare, operate and submit a report on a suitable pneumatic circuit for Speed Control of pneumatic motor which may be used to drive pneumatic drill machine.	05 [MEPE 302/2]

Note:

A suggested list of Practical is given in the above table. The concerned faculty member may add similar Practical Assignment also. Any five (05) practical are needed to be performed during the course, so that the student achieves the desired level of competency as generally required by the industry.

3. Suggested Scheme for Internal Assessment: [Total Marks: 60]

Involvement	Total Marks
Continuous assessment of class performance and in time submission of Assignments.	30
Viva Voce on to the Laboratory Practice at the end of the semester.	20
Class attendance.	10
Total Internal Assessment:	60
Pass criterion for Internal Assessment = 24 Marks [Minimum]	

4. Suggested Scheme for End Semester Examination: [Total Marks: 40]

Involvement	Total Marks
Assignment on the day of End Semester Exam.	20
Viva Voce on to the Laboratory Practice on the day of End Semester Exam.	20
Total External Assessment:	40
Pass criterion for Internal Assessment = 16 Marks [Minimum]	

During conducting such Practical (laboratory / field based) work, the following social Skills / attitudes which are to be developed through the experiences:

- f) Follow the safety practices.
- g) Practice good housekeeping.
- h) Demonstrate working as a leader / team member.
- i) Maintain tools and equipment in good working condition.
- j) Follow ethical practice.

5. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
01	Fluid Power with Application	A. Esposito	Pearson
02	Oil Hydraulic System- Principle and Maintenance	S.R. Majumdar	Tata McGraw Hill
03	Pneumatics Systems- Principles and Maintenance	S.R. Majumdar	Tata McGraw Hill
04	Hydraulic and Pneumatic Control	K. Shanmuga Sundaram	S. Chand
05	Hydraulics and Pneumatics, A technician's and engineer's guide	Andrew Parr	Butterworth-Heinemann
06	Fluid Power Generation, Transmission & Control	Jagadeesha T., Thammaiah Gowda	Wiley
07	Pneumatic Controls	P. Joji	Wiley
08	Introduction to Hydraulics and Pneumatics	Ilango & Soundararajan	Prentice Hall India
09	Hydraulics and Pneumatics	Stewart	Taraporewala Publication
10	Hydraulic System & Maintenance	Farel Bradbury	ILIFFE Books, London
11	Industrial Fluid Power	Charles Hedges	Womack Educational Publications
12	Industrial Hydraulic Control	Peter Rhoner	Prentice Hall India
13	Industrial Hydraulics	Hicks Pippenger	McGraw Hill International



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Name of the Course: Diploma in Mechanical Engineering			
Category: Major Project	Semester: Sixth		
CodeNo.:PR302	FullMarks:100		
Course Title: Major Project	Sessional Examination Scheme:		
Duration:17weeks(total hours per week=6)	External Assessment (End Semester Sessional Examination)		
	Evaluation of final report of the major project	20	40 marks
	Viva voce (before Board of Examiner(s))	20	
	Internal Assessment		
Total Practical class / week: 6	Continuous assessment of class Performance and in time submission of final report of the major project	30	60 marks
	Seminar presentation and viva voce	20	
	Credit:3	Class attendance	
	Total marks		100
Pass Criterion: Students must obtain at least 40 % marks (pass marks) in both the internal assessment and end semester examination separately.			
Note: Most of the departmental faculties / teaching staff (as per availability) have to be involved to conduct number of different Major Projects by grouping the students of Semester 5 / Semester 6.			

1. Course Outcomes (COs):

Depending upon the nature of the projects undertaken, some of the following major course outcomes can be attained:

After completion of the project, the students will be able to:

- Implement the planned activity individually and / or as team.
- Select, collect and use required information / knowledge to solve the identified problem.
- Take appropriate decisions based on collected and analyzed information.
- Communicate effectively and confidently as a member and leader of team.
- Prepare project report following proper guidelines using appropriate tools (if any).

2. Course details:

At the end of 5th semester 'progress report' was submitted by the student based on the progress of project work done by him / her. The project work started in 5th semester is to be continued in 6th semester to attain the course outcomes as mentioned above. Such major project work must be completed in 6th semester and a 'Final report' is to be prepared based on the project work executed by the students. At the end of 6th semester, each student must present a 'Seminar' presentation (in ppt format) in presence of the faculties and students of the respective department.

This Seminar presentation will be entirely based on the project work done and the 'Final Report' prepared by the student. Evaluation of 'viva voce' part will be based on the question-answer part at the end of the seminar presentation. The questions may be asked by any faculty or students.

3. Suggested contents of the project Final Report:

- a) Title page (Containing Project Title along with Polytechnic name and Logo (if any), names of team members and guide teacher(s)).
- b) Certificate (in the format given in this document as Annexure- A).
- c) Acknowledgement
- d) Abstract (within 200 to 250 words)
- e) Content (Introduction, Objective of the project, Methodology / Procedure Followed, Results and Discussions, Conclusions, Appendix if any, and References)
- f) Abbreviations (if any)

4. Suggested Scheme for End Semester External Assessment: [Total Marks: 40]

Involvement	Total Marks
Evaluation of Final report on the day of End Semester External Exam.	20
Viva Voce on to the major project work (done by the student) on the Day of End Semester External Exam.	20
Total External Assessment:	40
Pass criterion for Internal Assessment = 16 Marks[Minimum]	

5. Suggested Scheme for Internal Assessment: [Total Marks: 60]

Involvement	Total Marks
Continuous assessment of performance, contribution and in time submission of Final report of the major project.	30
Seminar Presentation and Viva Voce on to the projects work at the end of the semester.	20
Class attendance	10
Total Internal Assessment:	60
Pass criterion for Internal Assessment = 24 Marks [Minimum]	

CERTIFICATE

This is to certify that the project work entitled "***(Title of the project work)***" being submitted by (*Student's name*) to (*Polytechnic name*) for the award of the degree of Diploma in Mechanical Engineering is a record of his project work carried out under my supervision and guidance. The student is fully responsible for the results and discussion presented in this report.

This work, in my opinion, has reached the standard of fulfilling the requirements for the award of the degree of Diploma in Mechanical Engineering.

Name and signature of the Project Guide(s)

Name and signature of the HOD,
Mechanical Engineering Dept.

Name and signature of the
Principal/Principal-in-Charge



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Name of the Course: Diploma in Mechanical Engineering				
Category: Seminar	Semester: Sixth			
Code No.: SE302	Full Marks: 100			
Course Title: Seminar	Sessional Examination Scheme:			
	External Assessment (End Semester Sessional Examination)			
	Final presentation of Seminar	30	40 marks	
Duration : 17 weeks (1 hour per week)	Viva Voce (before Board of Examiners / fellow students):	10		
	Internal Assessment			
	Continuous assessment of class performance and in time submission of report	30	60 marks	
	Total classes/week: 1	Viva Voce:		
	Class Attendance:	10		
Credit: 1	Total Marks:			100
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.				
Pre-requisite: Knowledge of project work / emerging field of Mechanical Engineering etc.				
Note: Most of the departmental faculties (as per availability) have to be involved to act as mentor / guide for presenting seminar by each student.				

1. Course Outcomes (COs):

- CO1 - Establish motivation for any topic of interest and develop a thought process for technical presentation.
- CO2 - Organize a detailed literature survey and build a document with respect to technical publications.
- CO3 - Analysis and comprehension of proof of concept and related data.
- CO4 - Effective presentation and improve soft skills.
- CO5 - Make use of new and recent technology for creating technical reports

2. Suggested activities for effective presentation:

This one credit point course is meant to make ready the students for Effective presentation in front of the scientific audience and improve soft skills and to explore topics in detail. The students will be allowed to opt a seminar topic in the beginning of the session (Semester – 6) based on their departmental subjects / Assigned major project / emergent field etc.

During practice, to prepare himself / herself as a speaker, each student will have to receive feedback from the fellow students and the mentor faculty (s).

Students will research topics and organize presentations on the topic before an internal committee constituted by the concerned department of the institute and other students. Each student will have to give 10-15 minute presentations on seminar topic.

On the final seminar date (s), attendance of all students enrolled is mandatory. It is expected that students will actively participate by asking questions to the speaker. The effort by students to meet these expectations will be considered in the determination of their final grade. Before due date of seminar, students have to submit a detailed outline of their presentation and also a brief abstract describing their

presentation to his or her mentor. Abstracts should be concise well written and free of grammatical and typographical errors. The abstract will also serve as an announcement and should include the time, date, and location of the seminar

Students may choose to use PowerPoint to present their seminar, or the chalkboard is also acceptable media for visual aids. It is the responsibility of the students to arrange for any additional equipment he or she feels required to present seminar. Visual aids should look professional and be readable in the entire room.

Proposal Seminar Format:

- Introduce the advisor/mentor and committee members present in the seminar hall.
- Give an introduction and background information on your topic.
- Clearly state the objectives to choose the topic.
- Describe the seminar topic thoroughly.
- Questioner session

The final grade of the students will be determined for seminar as per following criteria.

Sl. No.	Criteria for evaluation of students for seminar
1	Quality of content presented
2	Proper planning for presentation
3	Effectiveness of presentation
4	Quality of the report
5	Depth of knowledge and presentation skill
6	Viva – voce / Questioner session

3. Suggested Scheme for Internal Assessment: [Total Marks: 60]

Involvement	Total Marks
Continuous assessment of class performance and in time submission of report.	30
Viva Voce	20
Class attendance	10
Total Internal Assessment:	60
Pass criterion for Internal Assessment = 24 Marks [Minimum]	

4. Suggested Scheme for End Semester Examination: [Total Marks: 40]

Involvement	Total Marks
Final Presentation of Seminar topic	30
Viva Voce on the day of final presentation	10
Total External Assessment:	40
Pass criterion for Internal Assessment = 16 Marks [Minimum]	

West Bengal State Council of Technical &
Vocational Education and Skill
Development
(Technical Education Division)



Syllabus
of
Compulsory Subjects & Open Electives as
per New Syllabus [OE]
Part-III (6th Semester)

2023

List of Compulsory Subjects & Open Electives as per New Syllabus 2022

Compulsory Subject		
Subject Code	Name of the Subject	Page Number
HS 302	Entrepreneurship & Start-ups	3-6
Open Elective - I		
Subject Code	Name of the Subject	Page Number
OE 302	Engineering Economics & Project Management	7-10
Open Elective - II		
Subject Code	Name of the Subject	Page Number
OE 304/1	Electric Vehicle Technology	11-13
OE 304/2	Industrial Management	14-17
OE 304/3	Industrial Safety	18-23
OE 304/4	Disaster Management	24-26
OE 304/5	Environmental Science & Engineering	27-30
OE 304/6	Renewable Energy	31-33
OE 304/7	Mechatronics	34-36
OE 304/8	Internet of Things	37-38
OE 304/9	Sustainable Development	39-41
OE 304/10	Medical Electronics	42-43
OE 304/11	Occupational Health & Safety Engineering	44-50
OE 304/12	Industrial Hazards & Modern Waste Management	51-55
OE 304/13	Export & Import Management	56-61
OE 304/14	Industrial Management and Safety	62-67
OE 304/15	Electrical Machines & Control	68-74
OE 304/16	Artificial Intelligence	75-76
OE 304/17	Operations Research	77-78
OE 304/18	Soft Computing Techniques	79-80
OE 304/19	Construction Management	81-83
OE 304/20	Solid Waste Management	84-86
OE 304/21	Sustainable Architecture	87-88
OE 304/22	Machine Learning	89-91
OE 304/23	Web Designing	92-95
OE 304/24	Energy & Environment Control in Metallurgical Industries	96-98
OE 304/25	Network Security Management and Administration	99-102
OE 304/26	Internet of Things (for CFS)	103-104
OE 304/27	Network Security Management and Administration Lab (for CFS)	105-106
OE 304/28	Internet of Things Lab (for CFS)	107
OE 304/29	Economic Policies in India	108-109

Course Title	Entrepreneurship and Start-ups
Course Code	HS 302
Number of Credits	3
Pre Requisites	None
Total Contact Hours	3(L: 2; T: 1)/week = 45 hrs
Course Category	HS

Course Learning Objectives

1. To raise awareness, knowledge and understanding of enterprise/ entrepreneurship.
2. To motivate and inspire students toward an entrepreneurial career.
3. To understand venture creation process and to develop generic entrepreneurial competences.
4. To introduce students to the basic steps required for planning, starting and running a business.
5. To familiarise students with the different exit strategies available to entrepreneurs.

Course Outcomes:

After completing the course students will able to:

CO 1	Identify qualities of entrepreneurs, develop awareness about entrepreneurial skill and mindset and express knowledge about the suitable forms of ownership for small business
CO 2	Comprehend the basics of Business idea, Business plan, Feasibility Study report, Project Report and Project Proposal
CO 3	Understand the concept of start-up business and recognise its challenges within legal framework and compliance issues related to business.
CO 4	Make a Growth Plan and pitch it to all stakeholders and compare the various sources of funds available for start-up businesses

Detailed Course Content

Unit	Name of the Topic	Hours
1.	ENTREPRENEURSHIP – INTRODUCTION AND PROCESS <ul style="list-style-type: none"> • Concept, Competencies, Functions and Risks of entrepreneurship • Entrepreneurial Values& Attitudes and Skills • Mindset of an employee/manager and an entrepreneur • Types of Ownership for Small Businesses <ul style="list-style-type: none"> ○ Sole proprietorship ○ Partnerships ○ Joint Stock company- public limited and private limited 	10

	<p>companies</p> <ul style="list-style-type: none"> • Difference between entrepreneur and Intrapreneur 	
2.	<p>PREPARATION FOR ENTREPRENEURIAL VENTURES</p> <ul style="list-style-type: none"> • Business Idea- Concept, Characteristics of a Promising Business Idea, Uniqueness of the product or service and its competitive advantage over peers. • Feasibility Study – Concept – Locational, Economic, Technical and Environmental Feasibility. Structure and Contents of a standard Feasibility Study Report • Business Plan – Concept, rationale for developing a Business Plan, Structure and Contents of a typical Business Plan • Project Report- Concept, its features and components • Basic components of Financial Statements- Revenue, Expenses (Revenue & capital exp), Gross Profit, Net Profit, Asset, Liability, Cash Flow, working capital, Inventory. Funding Methods-Equity or Debt. <p>Students are just expected to know about the features and key inclusions under, Business Plan and Project Report. <u>They may not be asked to prepare a Business Plan/ Project Report/ Project Feasibility Report in the End of Semester Examination.</u></p>	20
3.	<p>ESTABLISHING SMALL ENTERPRISES</p> <ul style="list-style-type: none"> • Legal Requirements and Compliances needed for establishing a New Unit- <ul style="list-style-type: none"> ○ NOC from Local body ○ Registration of business in DIC ○ Statutory license or clearance ○ Tax compliances 	03
4.	<p>START-UP VENTURES</p> <ul style="list-style-type: none"> • Concept & Features • Mobilisation of resources by start-ups: Financial, Human, Intellectual and Physical • Problems and challenges faced by start-ups. • Start-up Ventures in India – Contemporary Success Stories and Case Studies to be discussed in the class. <p>Case studies have been included in the syllabus to motivate and inspire students toward an entrepreneurial career from the success stories. <u>No questions are to be set from the case studies.</u></p>	04

5.	FINANCING START-UP VENTURES IN INDIA <ul style="list-style-type: none"> • Communication of Ideas to potential investors – Investor Pitch • Equity Funding, Debt funding – by Angel Investors, Venture Capital Funds, Bank loans to start-ups • Govt Initiatives including incubation centre to boost start-up ventures • MSME Registration for Start-ups –its benefits 	06
6.	EXIT STRATEGIES FOR ENTREPRENEURS <ul style="list-style-type: none"> • Merger and acquisition exit, Initial Public Offering (IPO), Liquidation, Bankruptcy – <u>Basic Concept only</u> 	02

Examination Scheme

❖ End Semester Examination: 60 marks

Suggested Question Paper Scheme for End Semester Examination

Group A: 20marks

Question Type	Number of questions to be set	Number of questions to be answered
MCQ, Fill in the blanks, True or False (Carrying 1 mark each)	25	20

Group B: 40marks

Question Type	Number of questions to be set	Number of questions to be answered
Subjective Type questions (Carrying 8 marks each)	10	5

❖ Internal Assessment: 40 marks

- Class test : 20 marks
- Assignment: 10 marks
- Class attendance: 10 marks

Suggested Learning Resources

Sl. No.	Title of Book	Author	Publication
1.	Entrepreneurship Development	Sangeeta Sharma	Prentice Hall of India Learning Private Ltd
2.	Entrepreneurship Development	S. Anil Kumar	New Age International
3.	Fundamentals of Entrepreneurship	Sangram Keshari Mohanty	Prentice Hall of India Learning Private Ltd
4.	Fundamentals of Entrepreneurship	Dr. G.K. Varshney	Sahitya Bhawan Publication
5.	Managing New Ventures: Concepts and Cases on Entrepreneurship	Anjan Raichaudhuri	Prentice Hall of India Learning Private Ltd
6.	How to Start a Business in India	Simon Daniel	Buuku, Chennai
7.	Entrepreneurship and Small Business Management	S.S. Khanka	S. Chand & Sons, New Delhi
8.	Entrepreneurship Development and Business Ethics	Abhik Kumar Mukherjee & Shaunak Roy	Oxford University Press
9.	Entrepreneurship Development and Business Ethics	Dr B Chandra & Dr B Biswas	Tee Dee Publications
10.	Entrepreneurship Development Small Business Entrepreneurship	Poornima Charantimath	Pearson Education India

Syllabus of Engineering Economics & Project Management

Course Code:	OE302
Course Title:	Engineering Economics & Project Management
No. of Credits:	3 (L: 3, T: 0, P: 0)
Prerequisites:	NIL
Course Category:	Open Elective (Compulsory for all branches)

Course Objectives:

- To acquire knowledge of basic economics to facilitate the process of economic decision making.
- To acquire knowledge on basic financial management aspects.
- To develop the idea of project plan, from defining and confirming the project goals and objectives, identifying tasks and how goals will be achieved.
- To develop an understanding of key project management skills and strategies.

Group-A

Unit-I (INTRODUCTION, THEORY OF DEMAND & SUPPLY) [9 hours]

1.1 Introduction to Engineering Economics, the relationship between Engineering and Economics

1.2 Resources, scarcity of resources, and efficient utilization of resources.

1.3 Opportunity cost, Rational Choice Theory

1.4 Theory of Demand:

- The law of demand
- Different types of demand (Individual demand & Market demand)
- Determinants of demand
- Demand function
- Change in demand (Shift of demand curve) and the change in quantity demanded.
- Definition and types of Elasticity of demand (price, income & cross price elasticity) with mathematical derivation, Concept of elastic and inelastic goods, Measurement of price elasticity of demand (Point elasticity and Arc elasticity), Variation of price elasticity on different points of a linear demand curve, ranging from zero to infinity, Relationship between price, total revenue and price elasticity of demand (mathematical derivation).

1.5 Theory of Supply:

- Definition of supply
- Determinants of supply
- Supply function
- Supply curve and shift of supply curve.

1.6 Market mechanism:

- Definition of Market
- Price mechanism: determination of equilibrium price and quantity demand & supply (Numerical examples with graphical illustration).
- Stability of equilibrium.
- Basic comparative static analysis: Change in equilibrium due shift of demand & supply curve (Numerical problems with graphical illustration).

Unit-II (THEORY OF PRODUCTION & COSTS) [10 hours]

2.1: Theory of Production: Concept of production (goods & services), Different factors of production (fixed and variable factors), Short-run Production function (Graphical illustration), law of return (graphical and mathematical derivation), and Long run production function (returns to scale).

2.2: Theory of Cost: Short-run and long-run cost curves with graphical illustration, basic concept on total cost, fixed cost, variable cost, marginal cost, average cost etc. with the diagrammatic concept., Relationship between AC AND MC.

2.3: Economic concept of profit, profit maximization (numerical problems)

UNIT-III (DIFFERENT TYPES OF MARKET AND ROLE OF GOVERNMENT) [4 hours]

3.1: Perfect Competition: Features of Perfectly Competitive Market.

3.2: Imperfect Competition: Monopoly, Monopolistic Competition, and Oligopoly.

3.3: Role of government in Socialist, Capitalist and Mixed Economy structure with example.

Group-B

Unit-I (CONCEPT OF PROJECT) [4 hours]

1.1: Definition and classification of projects

1.2: Importance of Project Management.

1.3: Project life Cycle [Conceptualization→Planning→Execution→Termination]

Unit-II (FEASIBILITY ANALYSIS OF A PROJECT) [10 hours]

2.1: Economic and Market analysis.

2.2: Financial analysis: Basic techniques in capital budgeting – Payback period method, Net Present Value method, Internal Rate of Return method.

2.3: Environmental Impact study – adverse impact of the project on the environment.

2.4: Project risk and uncertainty: Technical, economical, socio-political, and environmental risks.

2.5: Evaluation of the financial health of a project – Understanding the basic concept of Fixed & Working Capital, Debt & Equity, Shares, Debentures etc., and different financial ratios like Liquidity Ratios, Activity Ratios, Debt-equity ratio & Profitability Ratio (Basic concept only).

N.B: Knowledge of financial statements is not required; for the estimation of ratios the values of the relevant variables will be provided.

Unit-III (PROJECT ADMINISTRATION) [8 hours]

3.1: **Gantt Chart** – a system of bar charts for scheduling and reporting the progress of a project (basic concept).

3.2: **Concept of Project Evaluation and Review Technique (PERT) and Critical Path method (CPM)**: basic concept and application with real-life examples.

Examination Scheme:

A. Semester Examination pattern of 60 marks:

1. Objective type Question (MCQ, Fill in the blanks, and Very Short question-1 mark each): At least five questions from each unit. [Total marks: 20]

2. Subjective questions: Five questions to be answered taking at least two from each group. [Total marks: 5x8=40]

B. Assignment (10 Marks)

Guideline for Assignment (10 Marks)

Students may be instructed to prepare a report on a project (preferably the based on the Major Project in 6th Semester), using a popular project management software in IT/Computer Laboratory, under the guidance of the Lecturer in Computer Science & Technology and Lecturer in Humanities.

C. Class Test: Two examinations 20 marks each. Take best of two.

D. Attendance: 10 Marks

Suggested reference books:

- 1. Principles of Economics – Case and Fair, Pearson Education Publication*
- 2. Principles of Economics – Mankiw, Cengage Learning*
- 3. Project planning, analysis, selection, implementation and review – Prasannachandra – Tata McGraw Hill.*
- 4. Project Management – Gopala krishnan – Mcmillan India Ltd*

Proposed Syllabus for Electric Vehicle Technology

Course Code	OE II
Course Title	Electric Vehicle Technology
Number of Credits and L-T-P	3 [L – 2, T – 1, P - 0]
Course Category	PC
Prerequisites	Basic Electrical and Electronics Engineering Mechanics Strength of Materials

Course objectives: -

After completing this course, the students will be able

- To understand the basics of electric vehicle history and components.
- To understand properties of batteries.
- To understand the electrical machine properties and classifications.
- To understand the properties of electric vehicle drive systems
- To understand the concepts of hybrid electric vehicles.

Unit	Contents	No of Classes
1	Introduction 1.1 History of Hybrid and Electric Vehicles; 1.2 Social and Environmental importance of Hybrid and Electric Vehicles; 1.3 Basic Components, 1.4 Vehicle mechanics: 1.4.1 Roadway fundamentals, 1.4.2 Vehicle kinetics, 1.4.3 Dynamics of vehicle motion; Propulsion System Design.	6
2	Battery: 2.1 Introduction to Energy Storage – Cell and Battery fundamentals, Battery capacity, Open circuit voltage and Terminal voltage, Charge/Discharge rate, State of charge/discharge, Depth of discharge, Battery energy density & Specific energy, Battery power density & Specific power, Battery efficiency. 2.2 Different traction batteries – Lead Acid battery, Nickel based batteries, Sodium based batteries and Lithium based batteries – Li-ion & Li-poly. 2.3 Battery Management System – Definition, Parts: Power Module, Battery, DC/DC Converter, Load, Communication channel, Battery Pack Safety 2.4 Troubleshooting of EV Batteries.	10

3	DC Electrical Machines: 3.1 Basic concept of DC Electric motors, Types, Power & torque generation, Power-flow diagram and braking in motors. 3.2 DC Motors 3.2.1 Basic Construction & Principle of Operation, Brushless & Brushed DC Motor 3.2.2 Torque equation and Torque-speed characteristic of a DC motor 3.2.3 Regenerative braking of a DC motor 3.2.3 Permanent Magnet Brushless DC Motor(Basic concept only) 3.3 Advantages & disadvantages of DC Electrical Machines 3.4.Applications in connection to EVs 3.5 Troubleshooting of DC Electrical Machines	8
4	AC Electrical Machines: 4.1 Three phase AC Induction Motor 4.1.1 Basic Construction & Principle of Operation 4.1.2 Synchronous speed, Slip, Simplified Torque expression and Torque-slip Characteristics 4.1.3 Per-phase equivalent circuit of an Induction Motor 4.1.4. Speed control methods 4.1.5. Regenerative braking of an Induction motor 4.2 Permanent Magnet Synchronous Motor(Basic concept only) 4.3 Switched Reluctance motor(Basic concept only) 4.4 Advantages & disadvantages of AC Electrical Machines 4.5 Applications in connection to EVs 4.6 Troubleshooting of AC Electrical Machines	8
5	Electric Vehicle Drive Train: 5.1 Transmission configuration; Components: Gears, Differential, Clutch, Brakes; Regenerative braking, Motor sizing; Fuel efficiency analysis.	4
6	Hybrid Electric Vehicles: 6.1 Types: Parallel, Series, Parallel and Series configurations; 6.2 Drive train; Sizing of components; 6.3 Basics of Micro, Mild, Mini, Plug-in and Fully hybrid.	6
Total Classes		42

Weightage distribution

Group Name	Unit Number	Weightage (%)
A	1	10
	2	20
B	3	25
	4	25
C	5	10
	6	10

Course Outcome:

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

CO1	Understand the basics of electrical vehicle history and components.
CO2	To understand properties of batteries as energy storage device for Electric Vehicles.
CO3	To understand working and properties of different electrical motors in connection to their applications in Electric Vehicles.
CO4	Understand the properties of electrical vehicle drive systems.
CO5	Understand the concepts of hybrid electric vehicles.

Reference Books:

1. Electric & Hybrid Vehicles – A.K. Babu, Khanna Publishing House, New Delhi, 2018
2. Electric & Hybrid Vehicles – Design Fundamentals - Iqbal Hussain, Second Edition, CRC Press, 2011.
3. Electric Vehicle Technology Explained - James Larminie, John Wiley & Sons, 2003.
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals - MehrdadEhsani, YiminGao, Ali Emadi, CRC Press, 2010.
5. Electric Vehicle Battery Systems - Sandeep Dhameja, Newnes, 2000.
6. Electric and hybrid vehicles technologies, modeling and control - amirkhajepour / saberfallah / avestagoodarzi

e-References

1. <https://www.primecom.tech/blogs/news/what-types-of-motors-are-used-in-electric-vehicles>

Theoretical Paper:

Name of the Course: Open Elective for All disciplines except Mechanical Engineering						
Course Title : Industrial Management				Semester : Sixth		
Category: Open Elective				Full Marks: 100		
Code no. : OE				Examination Scheme:		
Duration : 17 weeks				External Assessment		
				End Semester Examination		60
				Internal Assessment		
Teaching Scheme				Class Test :	20	40
L	T	Total	Credit	Assignment/Student activity	10	
3			3	Class attendance	10	
				Total		
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.						
Assignment / Student Activity: Submission of Home assignment, submission of report after conducting site visit/ industry visit/ micro-project / market survey / internet search on specific topic, preparation of chart, creation of innovative model or present seminar on specific topic which is suitable for the given subject as per instruction of subject teacher.						

1. Course Outcomes:

1. Explain the importance of management process in Business.
2. Understand different types of organization, Objectives and functions of management.
3. Understand the functional areas of management relating human resources, Materials, Finance.
4. Apply various rules and regulations concerned with Business & Social Responsibilities of the Technician
5. Identify various components of management
6. Find the economic order quantity (EOQ) for given situation.
7. Apply break even analysis for optimum production
8. Apply principles of safety in industrial activities.

2. Theory Components:

Unit	Topics	Teaching Hours
Unit: 1 Overview Of Business	1.1. Types of Business -Service -Manufacturing -Trade 1.2. Industrial sectors Introduction to: -Engineering industry -Process industry -Textile industry -Chemical industry -Agro industry 1.3 Globalization Introduction - Advantages & disadvantages w.r.t. India	04

	1.4 Intellectual Property Rights (I.P.R.)	
Unit: 2 Management Process	2.1 What is Management? -Evolution - Various definitions - Concept of management -Management is the combination of art and science - Levels of management -Administration & management - Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management -Planning -Organizing -Directing -Controlling 2.4 Social responsibility and Environmental dimension of management.	05
Unit: 3 Organizational Management	3.1 Organization :- - Definition -Steps in organization 3.2 Types of organization - Line - Line & staff - Functional - Project 3.3 Departmentation - Centralized & Decentralized -Authority & Responsibility - Span of Control 3.4 Forms of ownership - Proprietorship -Partnership - Joint stock - Co-operative Society - Govt. Sector	06
Unit: 4 Human Resource Management	4.1 Personnel Management - Introduction - Definition -Objectives -Functions 4.2 Staffing - Introduction to HR Planning -Recruitment Procedure 4.3 Personnel– Training & Development - Types of training - Induction -Skill Enhancement 4.4 Grievance handling 4.5 Leadership, Leadership quality, Leadership style -Motivation - Maslow’s Theory of Motivation 4.6 Introduction to -ESI Act -Workmen Compensation Act	08

Unit: 5 Financial Management	5.1. Financial Management - Objectives & Functions 5.2. Break Even Analysis -Introduction -Graphical representation -Significance -Limitations 5.3. Introduction to – -Excise Tax - Income Tax -GST -Custom Duty	06
Unit: 6 Materials Management	6.1 Objectives and function of Materials Management 6.2. Purchase Procedure - Objects of Purchasing - Functions of Purchase Dept. - Steps in Purchasing 6.2 Economic Order Quantity(EOQ) - Introduction & Graphical Representation 6.3 Inventory Management. -Meaning & Objectives 6.4 ABC Analysis, VED Analysis 6.5 Stores function, -BIN card, -Pricing of materials -Store verifications	08
Unit: 7 Sales and Marketing Management	7.1 Introduction 7.2 Difference between Selling and Marketing 7.3 Functions of Marketing 7.4 Market Survey 7.5 Sales promotions 7.6 Recent trends	04
Unit: 8 Safety Engineering	8.1 Accidents -causes of accidents 8.2 Need for safety 8.3 Organization for safety 8.4 Safety committee 8.5 Safety programmes 8.6 Safety measures	04
Sub Total :	Total Lecture Classes	45
No. of classes required for conducting Internal Assessment		06
Grand Total :		51

Assignments: (any five)-

1. Preparation of chart for fire safety.
3. Preparation of chart for personal, Tools & Equipment and products safety.
4. Preparation of chart to avoid accident.
5. Preparation of chart to show the different financial ratios.
6. Preparation of chart to show the different types of organization.
7. **Preparation of EOQ model.**
8. **Preparation of beak even analysis model**
9. **Prepare charts for showing steps of recruitment, training and performance appraisal**

Suggested scheme for question paper design for conducting internal assessment examination:
(Duration:45minus)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1(Remember)	Level 2(understand)	Level3 (Apply &above)	Total
Class Test -1	4	8	8	20
Class Test -2	4	8	8	20

4. Suggested Scheme for End Semester Examination[duration: 2 hours 30 minutes]

A: Multiple Choice Type Questions(Carrying 1mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A1	1 & 2	07	20	20x01=20
A2	3,4 &5	10		
A3	6,7 & 8	08		
Total:		25	20	20
B: Subjective Type Questions (Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B1	1 & 2	02	05	08x05=40
B2	3,4 &5	04		
B3	6,7 & 8	03		
Total:		09	05	40
Sub-Total[A]:				20
Total[A+B]:				60

6. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1.	Industrial Engineering and Management	O.P. Khanna	Dhanpat Rai & Sons
2	Management Principles, Processes & Practices	A.Bhattacharya & A.Kumar	Oxford University Press
3	The process of Management	W.H. Newman E.Kirby Warren Andrew R. McGill	Prentice-Hall of India, New Delhi 2004.
4	Industrial Engineering & Management,	V.Arun Viswanath, Anoop. S. Nair, S.L.Sabu	SCITECH Publication(s) Pvt. Ltd
5	Industrial Management	Rustom S. Davar	Khanna Publication
6.	Industrial Engg & Management	N V S Raju	Cengage
7.	Industrial Management	Jhamb & Bokil	Everest Publication , Pune



WEST BENGAL STATE COUNCIL OF TECHNICAL & VOCATIONAL EDUCATION AND SKILL DEVELOPMENT

[A Statutory Body under West Bengal Act XXVI of 2013]

(Formerly West Bengal State Council of Technical Education)

"Karigori Bhavan", 4th Floor, Plot No. B/7, Action Area-III, New Town, Rajarhat, Kolkata-700160

Name of the Course: Diploma in Engineering	
Category: Open Elective	Semester : Sixth
Code no. :	Theory : 100 Marks
Course Title : Industrial Safety	Examination Scheme : (i) External Assessment : 60 marks (End Semester Examination) (ii) Internal Assessment: 40 marks [Class test : 20 marks Assignment, viva voce : 10 marks Class attendance : 10 marks]
Duration :16 weeks	
Total lecture class/week : 3	
Credit : 3	
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	

1. Course outcomes (COs):

By the end of this course, a student should be able to:

1. Understand the various basic concepts of Hazard, Risk, and Accidents in various industries and their management.
2. Understand the various effects of physical hazards on human health and the various control measures to rectify the same.
3. Understand and identify various hazards in industries and the impact of damages in these areas.
4. Understand the various fire prevention techniques to be followed in various industries.
5. Evaluate workplace to determine the existence of occupational safety and health hazards.
6. Explain important legislations related to Health, Safety and Environment
7. Understand and implement statutory requirements mentioned in factories act for the prevention of accidents.

Besides the above this course would equip the students to effectively employ hazard analysis techniques in Industry and helpful to prevent the accidents in Industry.

2. Theory Components:

The following topics/subtopics should be taught and assessed for achieving the course outcomes to attain the identified competency.

UNIT	Topics & Sub-topics	Teaching Hour
UNIT 1 INTRODUCTION TO INDUSTRIAL SAFETY	History and Development of Safety Movement, Importance of Safety, Safety Policy: Safety Organization and Its Responsibilities, Accident Sequence Theory, Causes of Accidents, Accident Prevention and Control Techniques Including Near Misses. Risk, Hazards and Dangerous Occurrences. First Aid. Financial Costs-Direct And Indirect	4

	Costs of Accidents.	
UNIT 2 INDUSTRIAL HYGIENE	Industrial Hygiene – Principles and its Control Measures. Permissible Limits. Stress, Exposure to Heat, Heat Balance, Effects of Heat Stress, Chemical Agents, Flammables, Explosives- Types, Water Sensitive Chemicals, Oxidants, Gases Under Pressure, Chemicals Causing Health Hazards: Irritants, Asphyxiates, Anaesthetics, Poisons and Carcinogens. Air Sampling, Types of Airborne Contaminants and Their Evaluation Methods, Housekeeping and its Importance.	6
UNIT 3 WORKPLACE HAZARDS AND ITS CONTROL	<p>Physical Hazards</p> <p>Illumination - Principles and Purpose of Good Illumination. Standards of Illumination.</p> <p>Ventilation – Principle and Purpose of Ventilation. Classification of Ventilation (Natural and Artificial), Heat Stress – Various Indexes, Different Controls (Including Air Conditioning), Vibration and its Control, Noise Pollution and its Control, Noise Mapping, Personal Protective Aids. Safe Weight Lifting Procedure. Safe Start Up, Shut Down and Emergency Shut Down Procedures. Permit to Work System.</p> <p>Chemical Hazards</p> <p>Hazardous Chemicals – Classification and its Properties, Common Hazard and Precautions for Each Class. Safety in Transportation and Bulk Storage of Hazardous Materials. Corrosion Prevention and Preventive Maintenance of Vulnerable Equipment. Safe Entry Into Confined Spaces. Permit to Work System.</p> <p>Electrical Hazards</p> <p>Dangers from Electricity. Safe Limits of Voltage and Amperage. Safe Distance from LT and HT Lines. Means of Cutting of Power Overload and Short Circuit Protection. Methods and Importance of Earthing. Earth Fault Protection. Earth Insulation and Continuity Tests. Protection Against Overvoltage.</p> <p>Lighting Arrester, Flame Proof and Intrinsic Electrical Equipment, Precautions in Their Selection, Installation, Maintenance and Use. Control of Hazards due to Static Electricity. Permit to Work System.</p> <p>Fire Hazards</p> <p>Chemistry of Fire, Classification of Fire. Common Causes of Industrial Fire. Statutory Provisions Regarding Fire Safety, Factors Contributing Towards Fire.</p> <p>Determination of Fire Load. Fire Resistance of Building Materials. Design of Industrial Plant for Fire Safety.</p>	16

	<p>Prevention of Fire: Portable Extinguishers- Water Type Extinguisher, Carbon dioxide Type Extinguisher, Foam Type Extinguisher, Dry Chemical Type Extinguisher. Sprinkle Systems, CO₂ Flooding System Foam Flooding System. Industrial Fire Detection and Alarms. Special Precautionary Measures in Handling/Processing Flammable Liquids, Gases, Vapours, Mists and Dusts. Emergency Action Plan.</p> <p>Construction Hazards</p> <p>Safe Operating Procedure (SOP) and Code of Practice (COP) for Various Civil Works, Works at Heights and Various Safe Conditions Including Fall Protection and Preventive Measures. Personal Protective Aids for Working at Construction Site. Permit to Work System.</p> <p>Mining Hazards</p> <p>Mine Rules and Regulations (CMR 2017 and MMR 1961), Specific Statutory Provisions from DGMS Circulars, Mine Act, Bye Laws for Safe Mining. Permit to Work System.</p>	
<p>UNIT 4</p> <p>OCCUPATIONAL HEALTH</p>	<p>History of Occupational Health, Concept of Occupational Health, Occupational and Work Related Diseases, Levels of Prevention, Health Examination (Initial and Periodic), Essentials of Occupational Health Services (OHS), Personal Protective Equipment (Respiratory and Non-Respiratory), Ergonomic Controls, Risk Assessment, Risk Management and Risk Tolerance.</p>	6
<p>UNIT 5</p> <p>INDUSTRIAL SAFETY LEGISLATIONS</p>	<p>The Factories Rules, Functions of Safety Management, Legislative Measures in Industrial Safety: Factories Act, 1948, Workmen's Compensation Act, 1948, Employees State Insurance Act, 1948. Water (Prevention and Control) Pollution Act, 1974, Boiler Vessels Act. Child Labour and Women Employee Act.</p> <p>ILO Convention and Recommendations in the Furtherance of Safety, Health and Welfare.</p> <p>Occupational Safety, Health and Environment Management: Bureau of Indian Standards on Safety and Health 14489 - 1998 and 15001 – 2000 OSHA (Occupational Safety and Health Administration).</p>	5
<p>UNIT 6</p> <p>INDUSTRIAL SAFETY MANAGEMENT</p>	<p>Industrial Safety: History of Safety Movement in India and Abroad. Accident-Nature & Size. Need for Safety, Legal, Humanitarian, Economic and Social Considerations. Total Loss Control Concept, Introduction to Productivity, Quality, Reliability, and Safety (PQRS) Theory.</p> <p>Safety Management- Principles & Practices With Case Studies, Role of Management in Industrial Safety. Process Safety</p>	5

	Management (PSM). Safety Organization: Role of Safety Committee and its Formation, Safety Awareness Programme: Motivation, Education and Training, Appraisal of Industrial Safety and Measurement of Safety Performance.	
Sub Total : Total Lecture Classes		42
No. of classes required for conducting Internal Assessment examination		6
Grand Total :		48

3. Suggested Home Assignments/Students' Activities: (any Five)

- What do you understand by safety, risks and hazards? Differentiate between risks and hazards.
- What are the various causes of dangerous occurrences arising due to dust, fire and chemicals refereeing different types of industries?
- Can you measure some control measures to limit the degree of hazards for factories highlighting the "permissible limits" of different pollutants?
- Draw charts to impose upon safety in chemical/power/construction/mining or any other heavy industries (any two types of industries). While doing these, highlight the role of top and middle management of these organization.
- Draw an emergency response action plan in case of fire in any heavy industry.
- Draw schematic diagram of any fixed firefighting system (sprinkler/CO2 total flooding/foam flooding system) and describe it.
- Draw the labelled schematic diagram of portable fire extinguishers (showing all internal components) of DCP type, water type, CO2 type and foamtype.
- Classify hazardous chemical and describe the hazards associated with them.
- Draw a labelled diagram of lighting arrester fitted on a multi-storied building and describe its functional procedure.
- Briefly describe Factories Act, 1948 and Employees State Insurance Act, 1948.

4. Suggested scheme for question paper design for conducting internal assessment examination:(Duration: 45 minutes)

Questions to be set as per Bloom's Taxonomy				
	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (understand)	Level 3 (Apply & above)	Total
Class Test - 1	04	08	08	20
Class Test - 2	04	08	08	20

5. Suggested Scheme for End Semester Examination [duration 2.5 hours]

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be Set	To be Answered	Total Marks
A	1& 2	07	20	20 x 01 = 20
	3	10		
	4, 5 & 6	08		
Total:		25	20	20
E: Subjective Type Questions(Carrying 8 marks each)				
Group	Unit	To be Set	To be Answered	Total Marks
B	1 & 2	2	05	08 x 05 = 40
	3	4		
	4, 5 & 6	3		
Total:		09	05	40
Total [A+B]:				60

6. Rubrics for the Assessment of Students Activity: (20 marks)

Sl. No.	Performance Indicators	Weightage in %	
1	In time submission of home assignment or submission of report after conducting site visit/ industry visit/ micro-project / market survey / internet search on specific topic, preparation of chart, creation of innovative model etc.		40
2	Viva voce or present seminar on submitted report.		60
2a	Communication skill	10	
2b	Technical interpretation skill	10	
2c	Answering / Conclusion with justification	40	
Total:			100

7. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
1	Industrial Safety, Health and Environment Management Systems	R. K. Jain and Sunil S. Rao	Khanna Publishers
2	A Handbook On Industrial Safety and Fire Management	Ravi Kant Pandey	Chetan Prakashan
3	Principles of Industrial Safety Management	Akhil Kumar Das	PHI Learning Pvt Ltd

4	Industrial Safety Management	L M Deshmukh	McGraw Hill Education
5	Industrial Safety & Environment	Anupama Prashar	S.K. Kataria& Sons
6	Fundamentals of Occupational Safety and Health	Mark A. Friend and James P. Kohn	Government Institutes An imprint of The Scarecrow Press, Inc.
7	Safety in Industry	Brij Mohan Bansal	Woodhead Publishing India Pvt. Ltd.

Name of the Course	Diploma in Engineering	Course duration	6 semester
Course Title	Disaster Management	Course Code	OE
Subject offered in Semester	Sixth	Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL	Course Category	OE
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Learning Objectives:

Following are the objectives of this course:

- To learn about various types of natural and man-made disasters.
- To know pre- and post-disaster management for some of the disasters.
- To know about various information and organisations in disaster management in India and Legal framework of disaster management.
- To get exposed to technological tools and their role in disaster management.

Module/ Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/ Group A	Unit I and II
Module B/ Group B	Unit III and V
Module C/ Group C	Unit IV

Course Content

Unit – I: Understanding Disaster

Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management.

Unit – II: Types, Trends, Causes, Consequences and Control of Disasters

Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire);

Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters, health disaster) Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters.

Unit- III: Disaster Management Cycle and Framework

Disaster Management Cycle – Paradigm Shift in Disaster Management.

Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness.

During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, addressing Residual issues, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Strategy, Hyogo Framework of Action (HFA).

Unit- IV: Disaster Management in India and Legal framework of disaster management

Disaster Profile of India – Mega Disasters of India and Lessons Learnt.

Disaster Management Act 2005 – Institutional and Financial Mechanism

National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and Inter Governmental Agencies

Refugee Camps and Settlements: Water Supply and Sanitation in Emergency: *Introduction-* Human rights, international humanitarian law and refugee conventions, water and sanitation, refugee camp planning.

Settlement planning- Environmental health risks in emergencies – needs and standards – public health approach to water supply and sanitation in emergencies – partners in the humanitarian response – working with disaster affected people – social diversity – local context Emergency settlements, site selection and planning – introduction – physical planning of emergency settlement – settlement location and physical layout: implications for water supply and sanitation.

Water supply – planning and implementation – water sources – treatment – pumping – tinkering – storage – distribution – collection and use – testing. Waste water – storm water – community involvement.

Waste Management- Phased response – organizational options – staffing needs – monitoring latrine programmers – technical options – options for problem sites- Health risk of solid waste from health centers – dead bodies disposal

Unit- V: Applications of Science and Technology for Disaster Management

Geo-informatics in Disaster Management (RS, GIS and GPS).

Disaster Communication System (Early Warning and Its Dissemination).

Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters

S & T Institutions for Disaster Management in India

References:

1. Publications of National Disaster Management Authority (NDMA) on Various Templates and Guidelines for Disaster Management
2. Bhandani, R. K., An overview on natural & man-made disasters and their reduction, CSIR, New Delhi
3. Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries, Daya Publishers, Delhi
4. Alexander, David, Natural Disasters, Kluwer Academic London
5. Ghosh, G. K., Disaster Management, A P H Publishing Corporation
6. Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.
7. Singh Jagbir, Disaster Management-Future Challenges and Opportunities, IK International Publishing House Pvt. Ltd.

8. Gupta, Harsh K., Disaster Management, Universities Press (India) Pvt. Ltd.

9. Harvey, P.A., Baghri, S. and Reed, R.A. (2002) **Emergency Sanitation: Assessment and programme design**, WEDC, Loughborough University, UK.

Course outcomes:

After completing this course, student will be:

- Acquainted with basic information on various types of disasters
- Knowing the precautions and awareness regarding various disasters
- Decide first action to be taken under various disasters
- Familiarized with organization in India which are dealing with disasters and Legal framework of disaster management
- Able to select IT tools to help in disaster management

PROPOSED SYLLABUS FOR ENVIRONMENTAL SCIENCE & ENGINEERING

Course Code	OE
Course Name	ENVIRONMENTAL SCIENCE & ENGINEERING
Number of Credits and L-T-P	3 [L – 3, T – 0, P – 0]
Course Category	OE
Prerequisites	NA

Course Objectives:

After completing this course, the students will be able

1. To increase the awareness towards Environmental Science and Engineering.
2. To recognize and apply the role of technology towards Environmental Science and Engineering.
3. To know the method and tools used for Environmental Science and Engineering.
4. To know about the environmental pollution management act.

Course Contents:

Unit No.	Description of Topic	Contact Hrs.
01	Environment and Ecology 1.1 Classification of Environment 1.2 Environmental descriptors 1.3 Environmental quality and descriptive parameters 1.4 Ecology: Definition and classification 1.5 Environmental impact on ecology	08
02	Water pollution and pollutants (Natural and Anthropogenic) 2.1 Ground water: Sources and quality analysis 2.2 Surface water: Sources and quality analysis 2.3 Quality parameters in water treatment along with flow-sheets 2.4 Basic processes for potable water supply (Detailed technology not necessary) 2.5 Water pollution: Surface and ground water pollution, types of pollutants 2.6 Mode of water pollution 2.7 Parameters to be assessed for water pollution (Turbidity, pH, total suspended solids, total solids, BOD and COD:	10

	Definition, calculation) 2.8 Chemistry aspect for water pollution 2.9 Control of water pollution (Description only) 2.10 Fundamental of water treatment techniques.	
03	Air quality, Air Pollution and Control, Noise Pollution 3.1 Definition of pollution and pollutant, Natural and manmade sources of air pollution (Refrigerants, I.C., Boiler) 3.2 Air Pollutants: Types, Units of air pollutants 3.3 Atmospheric physics for air pollution 3.4 Particulate Pollutants: Effects and control strategies (Bag filter, Cyclone separator, Electrostatic Precipitator) 3.5 Advanced air pollution control methods 3.6 Noise pollution: sources of pollution, measurement of noise pollution 3.7 Noise measuring devices and their demonstration	10
04	Solid waste and Soil pollution 4.1 Definition of solid waste 4.2 Classification of solid waste 4.3 Overview on municipal, industrial, hazardous, hospital, plastic, E-waste.etc. 4.4 Solid waste management and disposal process. 4.5 Soil pollution ,Poor Fertility, Septicity, Concentration of Infecting Agents in Soil 4.6 Leaching and its impact on soil pollution.	06
05	Renewable sources of Energy 5.1 Energy Resources: Energy scenario, national and international status. 5.2 Solar Photovoltaics: Solar radiation and types, basic working principle of solar PV, solar cells and types, water pumping and applications of solar PV. 5.3 Solar Thermal system: basic working principle and applications of solar thermal energy, solar water	06

	heater and types, solar cooking, solar pond, Solar still etc. 5.4 Wind energy systems: basic principle, types of wind turbines, application of wind energy, 5.5 Bio-energy systems: bio thermal and chemical basic principle, gasifier and digesters. 5.6 Hydro energy systems: small and micro hydro systems and its basic working. 5.7 Geothermal energy: Basic working principle, types and application of geothermal energy. 5.8 Ocean & Tidal Energy: Basic working principle, applications and types of different types of energy generation through ocean and tidal systems	
06	Environment Legislation system and Rules 6.1 Environmental protection rules 6.2 Sustainable environmental management	02
Total Hours		42

Weightage distribution in both objective, short and broad answer type questions:

Group	Unit Number	Weightage (%)
A	1 & 2	50
B	3 & 4	30
C	5 & 6	20

Course Outcomes:

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

C01	Recognize the relevance and the concept of Environmental Science and Engineering and different world-wide activities on this area.
C02	Illuminate the different types of environmental pollutant, their effects and their sustainable solutions.
C03	Discuss the environmental regulations act. and standards
C04	Gather basic idea about conventional and non-conventional energy resources
C05	Demonstrate the broad perspective of Environmental Science practices by utilizing engineering knowledge and principles

Text Books:

1. Environmental Studies- By N.N.Basak
2. Environmental Studies-By D .Srivastava
3. Introduction to Environmental Engineering— By Dr.Manindra Nath Patra.
4. Environmental Engineering- By A.K.Jain

Reference Books:

1. Environmental Engineering---By G.Killy
2. Environmental Engineering--- By Peavy, Rowe
3. Water and Waste Water Engineering— By S.Garg
4. Waste Water Engineering--By -Panmia
5. Non-conventional Energy Sources-4th Edition, By Prasad Rajesh K and Ojha
6. Non-conventional Energy Resources—By Chauhan and Srevastava
7. Non-conventional Energy Sources---By G.D.Rai (Khanna Publisher)
8. Ecology --By -Odum
9. Ecology---By -Das & Das
10. Environmental Law ---By -Gurdip Sing
11. Environmental Law----By Jaiswal Jaiswal Jaiswal
12. Environmental Law in India ---By -P.Leela Krishnan
13. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
14. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
15. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System

Semester	:	VI	
Course Code	:	OE	
Course Title	:	Renewable Energy	
Number of Credits	:	3 (L: 3, T: 0, P: 0)	
Prerequisite	:	NIL	
Course Category	:	OE	
Course Objective			
Following are the objectives of this course			
	To provide basic knowledge of different sources of renewable energy and Renewable energy plants		
Course Content		Hrs/Unit	
Module 1	Unit 1	Introduction	6
		1.1 Classification of energy: Primary and secondary energy, Commercial and non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy. 1.2 Advantage of Renewable energy 1.3 Sources of Renewable Energy: Solar Energy, Wind Energy, Biomass Energy, Hydro Energy, Geothermal Energy, Tidel and Ocean energy (only brief idea on all these)	
	Unit II	Solar energy	9
		2.1 Units of solar power and solar energy 2.2 Essential subsystem in solar energy plant: Solar collector or concentrator, energy transport medium, energy storage, energy conversion plant, power conditioning control and protection system, alternative or standby power supply. 2.3 Solar Electric System: Solar water Heater, Solar lighting system, Solar cooker, Electric vehicle charging station (Working principle only) 2.4 Idea on Photovoltaic Technology	
Module 2	Unit III	Bioenergy	7
		3.1 Introduction on Biogas, Sources of Bioenergy 3.2 Different forms of Biomass, their composition & fuel properties 3.3 Production of Biogas: working principle of fixed-dome type and floating gas holder type biogas plant 3.4 Idea of gasifier, digester 3.5 Use of Biogas	
	Unit IV	Wind Energy	6
		4.1 Basic working principle of Wind energy production	

		4.2 Speed and power relation, Average power of the wind 4.3 System components of wind Energy (e.g. Tower, Turbine, Blades etc). 4.4 Control of rotor speed	
Module 3	Unit V	Hydropower	5
		5.1 How hydropower plant works 5.2 Main components of Hydropower plant: Gate, penstock, surge tank, turbine, transformer etc. 5.3 Types of hydropower: Run-of-River power plant (no active storage), Plant with significance storage, Pumped storage, Tidal plant (Only basic idea)	
	Unit VI	Measuring Instruments	9
		6.1 Basic principle of Pyranometer for solar radiation measurement. 6.2 Idea on different instrument used in Hydroelectric power plant, Solar thermal plant, Wind power plant, Biogas plant (name of instruments and where to use in that plant.)	

Suggested Learning resources

Title	Author	Publisher
Non-Conventional Energy	ShobhNath Singh	Pearson
Renewable and Efficient Electric Power Systems	Gilbert M. Masters	Wiley
Alternative Energy Systems & Applications	B.K.Hodge	Wiley
Renewable Energy Technologies,	J.C.Sabonnadiere,	Wiley
Introduction to Renewable Energy	Vaughn Nelson	CRC Press
Renewable Energy: Power for a Sustainable Future	Godfrey Boyle	
Renewable Energy Technology	Jha, Sen, Tiwari, Kothari	New Age International
Renewable Energy Technology	Chetan Singh Solanki	PHI
Non-Conventional Energy Resources	S.H.Saeed, D.K.Sharma	S.K.Kataria& Sons
Energy Techonology: Nonconventional, Renewable & conventional	Rao, Parulekar	Khanna Publisher
Non-conventional Energy Sources	G.D. Rai	Khanna Publisher
Non-Conventional Energy Resources	B. H. Khan	McGraw Hill Publications.
Solar Energy – Principles of Thermal Collection and Storage	S. P. Sukhatme, J.K. Nayak	Tata McGraw-Hill, New Delhi
Solar Energy, Fundamentals and Applications	Garg, Prakash	Pearson
Solar energy	A.M. Rehman	Scitech

		Publications(India) Pvt. Ltd
Introduction to solar principles	Thomas E. Kissell	Pearson
Biogas Systems, Principle and	Mital KM.	New Age International Ltd.
Course Outcome		
At the end of the course student will be able to:	<ul style="list-style-type: none"> ➤ Classify different energy sources ➤ Understand basics on solar energy, bioenergy, wind energy, and hydropower. ➤ Identify different parts of solar energy plant. ➤ Know various sources of biomass, and construction of biogas production plant ➤ Understand concepts of wind energy, components and functions of it ➤ Grow critical thinking and problem-solving skills to overcome obstacles to use renewable energy system. ➤ Identify different measuring instruments related to specific renewable energy plant. 	

Semester : VI	
Course Code : OE	
Course Title : Mechatronics	
Number of Credit: 3 (L- 3; T- 0; P- 0)	
Prerequisite: Nil	
Course Category: OE	
Course Objectives: <ol style="list-style-type: none"> 1. To learn the architecture of the mechatronics system design. 2. To study the characteristics of the mechanical and electrical actuators and their selection for mechatronic systems. 3. To develop process plan and templates for design of mechatronic systems. 4. To know different system models and applications of mechatronic systems. 	
Course Contents (Theory):	
Unit : 1	1. Introduction to Mechatronics: <ol style="list-style-type: none"> 1.1 Introduction. 1.2 Advantages of Mechatronics. 1.3 Basic building blocks of Mechatronic systems. 1.4 Measurement systems of Mechatronics. 1.5 Control systems and their types. 1.6 Closed-loop control System, Multi input multi output system, 1.7 Measurement System terminology: <ol style="list-style-type: none"> a) Displacement, Position & Proximity Sensors. b) Velocity and Motion Sensors. c) Fluid Pressure Sensors. d) Force Sensors. e) Flow Sensors. f) Temperature Sensors. g) Liquid Level Sensors. h) Light Sensors. 1.8 Selection of Sensors and their specifications.
Unit : 2	2.1 Mechanical Actuation Systems: <ol style="list-style-type: none"> 2.1.1 Types of motion. 2.1.2 Advantage and limitations 2.1.3 Loading, Gear Trains, Pawl & Ratchet, Belt & Chain drives, Bearings Selection, Ball & Roller bearings. 2.1.4 Mechanical aspects of motor selection. 2.2 Electrical Actuation Systems: <ol style="list-style-type: none"> 2.2.1 Switches & Relays, Solenoids. 2.2.2 D.C Motors, A.C. Motors.

	<p>2.2.3 Stepper Motors: Specifications and Control of stepper motors.</p> <p>2.2.4 D.C Servomotor and A.C Servomotor, Specifications and Control of servo motors.</p> <p>2.2.5 AC & DC position control system.</p> <p>2.2.6 A/D & D/A converter.</p> <p>2.3 Pneumatic & Hydraulic Systems:</p> <p>2.3.1 Power supplies.</p> <p>2.3.2 Applications of Directional Control Valve (DCV). Pneumatic Control Valve, Cylinders, Rotary actuators.</p>
Unit : 3	<p>3. Mathematical Model:</p> <p>3.1 Introduction to Mathematical model.</p> <p>3.2 Mechanical System building blocks.</p> <p>3.3 Electrical System building blocks.</p> <p>3.4 Fluid System building blocks.</p> <p>3.5 Thermal System building blocks.</p> <p>3.6 System Model:</p> <p>Engineering Systems: Rotational, Translational Systems, Electro-Mechanical System, Hydro-Mechanical System.</p> <p>3.7 Input/Output Systems:</p> <p>3.7.1 Interfacing system, Input/output ports,</p> <p>3.7.2 Buffers, Handshaking, Polling and interrupts, Serial interfacing, Introduction to PIA, Serial communications interface,</p> <p>3.7.3 Example of interfacing of a seven-segment display with a decoder.</p>
Unit : 4	<p>4. Programmable Logic Controller (PLC):</p> <p>4.1 Function of PLC in Mechatronics.</p> <p>4.2 Basic block diagram and components of PLC.</p> <p>4.3 Function of Input & Output module.</p> <p>4.4 PLC Programming steps, Ladder diagram, logic functions, Latching and Sequencing, Timers, Internal relays and Counters, Shift registers, Master and Jump Controls.</p> <p>4.5 Data handling, Analog input/output.</p> <p>4.6 Selection criteria of PLC.</p> <p>4.7 Applications of PI, PD, PID controller.</p>
Unit : 5	<p>5. Applications in Mechatronics:</p> <p>5.1 Design process stages,</p> <p>5.2 Case studies of Mechatronics systems:</p> <p>a) A pick-and-place robot.</p> <p>b) Car parking.</p> <p>c) Automatic water level measurement.</p> <p>d) Sequential control of washing machine.</p>

	e) Automatic Camera.		
Text / Reference Books:			
Sl. No.	Titles of Book	Name of Author	Name of Publisher
1.	Mechatronics	W. Bolton	Pearson Education India.
2.	Mechatronics	M.D. Singh& Joshi	Prentice Hall of India
3.	Mechatronics System	Devadas Shetty	PWS Publishing
4.	A Text Book on Mechatronics	R.K.Rajput	S.Chand & Co, New Delhi
5.	Exploring Programmable Logic Controllers with applications	Pradeep Kumar Srivatsava	BPB Publications
Course Outcomes:			
At the end of the course, the student will be able to:			
1. Know the architecture of the mechatronics system design.			
2. Interpret the characteristics of the mechanical and electrical actuators and select for mechatronic systems.			
3. Propose process plan and templates for design of mechatronic systems.			
4. Learn use of PLC in mechatronic systems.			
5. Know different system models of mechatronic systems and apply them for specific use.			

Semester : VI	
Course Code : OE	
Course Title : Internet of Things	
Number of Credit: 3 (L- 3; T- 0; P- 0)	
Prerequisite: Nil	
Course Category: OE	
Course Objectives: <ol style="list-style-type: none"> 1. To learn the concept of IOT. 2. To know IOT standards for applications. 3. To implement IOT in different fields of applications. 	
Course Contents (Theory):	
Unit : 1	1. Introduction to Internet of Things: <ol style="list-style-type: none"> 1.1 Define the term “Internet of Things” 1.2 Technological trends that led to evolution of IOT 1.3 IOT in everyday life.
Unit : 2	2. Design consideration of IOT: <ol style="list-style-type: none"> 2.1 Describe the components of an embedded system. 2.2 Describe the interactions of embedded systems with the physical world. 2.3 Name the core hardware components most commonly used in IOT devices. 2.4 IOT and SCADA. 2.5 IOT handling Big Data.
Unit : 3	3. Interfacing by IOT devices: <ol style="list-style-type: none"> 3.1 Describe the interaction between software and hardware in an IOT device. 3.2 Explain the use of networking and basic networking hardware. 3.3 Different components used for Internet. 3.4 Describe the structure of the Internet.
Unit : 4	4. IOT Standards: <ol style="list-style-type: none"> 4.1 Requirement of international standard (case study) 4.2 IOT standards in practice. 4.3 Operating platforms /systems.
Unit : 5	5. IOT Applications & Challenges: <ol style="list-style-type: none"> 5.1 Lighting as a service (case study). 5.2 Intelligent Traffic systems (case study). 5.3 Smart car Parking system (case study). 5.4 Smart water management (case study). 5.5 Challenges in IOT implementation.

Text / Reference Books:

Sl. No.	Titles of Book	Name of Author	Name of Publisher
1.	Internet of Things	Raj Kamal	McGraw Hill Education; First edition (10 March 2017)
2.	Internet of Things: A Hands- On Approach	Arsheep Bahge and Vijay Madiseti	Orient Blackswan Private Limited - New Delhi; First edition (2015) ISBN : 978-8173719547

SUGGESTED SOFTWARE/LEARNING WEBSITES:

1. <https://www.raspberrypi.org/blog/getting-started-with-iot/>
2. <https://www.arduino.cc/en/IoT/HomePage>
3. <https://www.microchip.com/design-centers/internet-of-things>
4. <https://learn.adafruit.com/category/internet-of-things-iot>
5. <http://esp32.net/>

Course Outcomes:

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

1. Learn IOT concepts and Standards of IOT.
2. Know components of IOT System.
3. Know IOT applications in different fields.
4. Interpret challenges in IOT implementation.

Proposed Syllabus of Sustainable Development

Course Code	OE6XX
Course Name	Sustainable Development
Number of Credits and L-T-P	3 [L – 3, T – 0, P - 0]
Course Category	OE
Prerequisites	NA

Course Objectives:

After completing this course, the students will be able

1. To increase the awareness towards sustainability.
2. To recognize and apply the role of technology towards sustainable development.
3. To know the method and tools used for sustainability.
4. To know about the environmental pollution management act.

Course Contents:

Module No.	Description of Topic	Contact Hrs.
01	Sustainability 1.1 Sustainability – introduction – concept – application of this concept 1.2 Social, Economical and environmental Sustainability (Concept only) 1.3 Relation between Technology and Sustainable development 1.4 Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs)- 17 th goals of sustainable development by UN. (Name and concept) 1.5 REACH (Registration, evaluation, authorization and restriction of chemicals) – Definition – Application – Aim 1.6 Clean Development Mechanism (CDM) 1.7 National Action Plan on Climate Change (NAPCC)	12
02	Environmental Pollution 2.1. Introduction of environment- basic elements of environment, 2.2. Environmental pollution – Type of Environment pollution (definition and concept) 2.1. Air Pollution and its sources and effects, - reducing process 2.2. Water pollution and its sources and effect, - reducing process 2.3. Soil pollution – cause –effect – reducing process	10

	2.4.Noise pollution – causes –effect- reducing process 2.5. Radioactive Pollution- cause –effect and controlling mechanism 2.6.Solid waste and its causes and effect - Zero waste concept and 3 R concepts in solid waste management; 2.7.Greenhouse effect, Global warming, Climate change, Ozone layer depletion, Carbon credits, carbon trading, carbon foot print, water footprint, legal provisions for environmental protection.	
03	Environmental pollution management 3.1.ISO 14001:2015 frame work and benefits, Scope and goal of Life Cycle Analysis (LCA), 3.2. Circular economy, Bio-mimicking, Environment Impact Assessment (EIA), 3.3. Industrial ecology and industrial symbiosis.	08
04	Non-conventional resource management 4.1. Basic concepts of Renewable energy sources 4.2. Working principle, advantages, disadvantages about solar photovoltaic, solar thermal energy, bio-energy, Fuel cells, Wind energy, hydro energy, geothermal energy, ocean and tidal energy 4.3. Worldwide and national progress in renewable energy. 4.4. Environmental aspects of renewable energy projects	06
05	Sustainability practices 5.1. Basic concept of sustainable habitat, Methods for increasing energy efficiency in buildings, 5.2. Green Engineering, Sustainable Urbanization, Sustainable cities, Sustainable transport and other sustainable concepts based on technology upgradation	06
Total Hours		42 Hrs

Weightage distribution in both objective, short and broad answer type questions:

Group	Module Number	Weightage (%)
A	1 & 2	50
B	3 & 4	30
C	5	20

Course Outcomes:

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

C01	Recognize the relevance and the concept of sustainability and different world-
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	wide activities on this direction.
C02	Illuminate the different types of environmental pollutant, their effects and their sustainable solutions
C03	Discuss the environmental regulations act. and standards
C04	Gather basic idea about conventional and non-conventional energy resources
C05	Demonstrate the broad perspective of sustainable practices by utilizing engineering knowledge and principles

Text Books:

1. M.C. Dash, Concepts of Environmental Management for Sustainable Development, Dreamtech Press
2. Deb Prasanna Choudhury, Sustainability Management, Zorba Books

Reference Books:

3. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
4. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning
5. Environment Impact Assessment Guidelines, Notification of Government of India, 2006
6. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998
7. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System
8. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.
9. Twidell, J. W. and Weir, A. D., Renewable Energy Resources, English Language Book Society (ELBS).
10. Purohit, S. S., Green Technology - An approach for sustainable environment, Agrobios Publication

MEDICAL ELECTRONICS

(Open Elective)

Credit-3

L- 3 hrs./Week

Objective:

1. Acquire the knowledge of bio-electric potential.
2. To be familiar with bio-medical Instrumentation.
3. Introduce to the electronic devices and theory of operation in the medical area.
4. Apply knowledge of engineering and science to understand the principle of electronic of the Biomedical Instruments & Machineries.
5. Introduce the student to the electronic devices for medical imaging.

Unit	Course content	Cont. Hrs
1	Bio-potential: Introduction to cell, Structure of cell membrane, excitable cells, definition of Bio-potential, Membrane potential, Resting membrane potential, Cause of Resting membrane potential, Nernst equation for Equilibrium electric potential, Goldman equation for membrane potential, Action potential, Different phenomenon of action potential, action potential wave form, Propagation of action potential. Bio-medical signals: Non-electric bio-medical signal and introduction to bio-electric signals & their sources. Introduction to ECG, EEG, EMG, ERG.	5
2	Basic Concept of Bio-medical Instrumentation: Different types of bio-medical instrument, Generalized bio-medical instrumentation system - Basic block diagram, different functional units such as electrodes, transducer/ sensor, bio-amplifier, filter, display, recorder, alarm, controlling system, memory.	4
3	ECG: Definition of ECG, Electro-physiology of heart, ECG amplifier, ECG electrodes and its placement, ECG leads, Basic block diagram of ECG machine, HR measurement,	6
4	Blood pressure measurement: definition of blood pressure, arterial blood pressure, Systolic pressure, Diastolic pressure, pulse pressure, mean pressure, Indirect BP measurement method, Principle of Auscultatory method, Working of Electronic BP instrument, Working principle of Direct BP measurement.	5
5	Medical Laboratory Instrument: Introduction to photometry, Beer-Lambert's law. Working, block diagram, application of Colorimeter, Clinical Bio-chemistry analyzer, Cell counter	4
6	Cardiac Pacemaker and Defibrillator: Pacemaker & its necessity, Working principle of Synchronous and Asynchronous pacemaker with block diagram, Implantable Pacemaker. Defibrillator, Working principle of Defibrillator with block diagram. Application of Defibrillator.	4
7	Patient Monitoring System: Introduction to ICU, Working of bed side patient, different clinical parameter, Centralized patient Monitoring system.	3
8	Electro-surgery Machine: Working principle of electro-surgery machine, Cutting & coagulation mode, Electro-surgery circuit, electro-surgery Safety.	2
9	Electrical safety: Introduction to Electric shock hazard in electro-medical Instrument, Macro shock, micro shock, Physiological effects of Electric Shock, Leakage current, Earth leakage current, Enclosure leakage current, Patient Leakage current, Patient safety precaution.	4
10	Medical imaging: X-ray, Working of X-ray machine with block diagram, Computed radiography (CR) system, Digital radiography (DR), Ultrasound, Working principle of Ultrasound imaging system, Different modes of Ultrasound. Principle of CT image formation, Principle of MRI.	5
11	Introduction to bio-telemetry: Definition of bio-telemetry, Wireless bio-telemetry, Single channel bio-telemetry, Multi-channel Bio-telemetry,	3
	Total:	45

Course Outcome (CO)

CO	<i>After completion of the course, students would be able to</i>
CO1	Describe the bio-potential, resting membrane potential, Nernst equation, Goldman equation, Action potential.
CO2	Explain the working principle of ECG machine, blood pressure instrument, photometry, Clinical Bio-chemistry analyzer, Cell counter, Cardiac pacemaker, defibrillator, patient monitor, electro surgery machine.
CO3	State the electrical shock hazards in medical equipment/machinery, Physiological effects of Electric Shock, Leakage current & its types, Patient safety precaution.
CO4	Demonstrate working principle of Medical imaging modalities – X-ray, CR, ultrasonography, CT scan MRI and working principle of bio-telemetry.

Note: CO may be changed as per the concern subject teacher.

Books:

Sl No	Book	Author	Publisher
1	Handbook of Biomedical Instrumentation	R.S. Khandpur	McGraw Hill Education
2	Biomedical Instrumentation and Measurements	Cromwell	Pearson
3	Handbook of analytical Instrumentation	R.S. Khandpur	McGraw Hill Education
4	A Text Book of Medical Instruments.	S. Ananthi	New Age International Private Limited
5	Medical Instrument	J. G. Webster	Wiley

Course Code	:	OE II
Course Title	:	OCCUPATIONAL HEALTH & SAFETY ENGINEERING
Course Category	:	Open Elective II
Number of Credits	:	3
Contact	:	3 lecture/week, 1hr/lecture, Total 45 lecture
Offered to	:	6 th Semester students
Pre Requisite	:	Elementary knowledge on Safety Engineering at Industries
Course Objectives		
<p>FWT OE II OCCUPATIONAL HEALTH AND SAFETY ENGINEERING The course aims at providing exposure to make the students</p> <ul style="list-style-type: none"> To learn about the basics of hazard, risk and accidents in various industries and their management; To learn about the principles of Industrial hygiene their permissible limits and controlling measures; To learn about the various hazards in industries and the impact of damages in these areas; To understand the safety procedures involved in the footwear and allied industries; To learn about the statutory requirements mentioned in factories act for prevention of accidents. 		
Course Content		
UNIT I	OCCUPATIONAL HEALTH <ul style="list-style-type: none"> History of occupational health; Concept of occupational health; Occupational and work related diseases; Levels of prevention; Health examination (Initial & Periodic); Essentials of occupational health services (OHS); Personal protective equipment (PPE-Respiratory & Non-Respiratory); Ergonomic Controls; Risk Assessment; Risk Management & Risk Tolerance. 	Duration: 05 Periods (L: 5.0)
UNIT II	INTRODUCTION TO INDUSTRIAL SAFETY <ul style="list-style-type: none"> History and development of Safety movement; Importance of safety and safety consciousness in Indian Footwear and allied Industries; 	Duration: 05 Periods (L: 5.0)

	<ul style="list-style-type: none"> • Safety policy; • Safety organizations and its responsibilities; • Industrial Accidents; • Accidents sequence theory; • Causes of accidents; • Identification of vulnerable areas of accidents; • Accident prevention and control techniques including near misses, risk, hazards and dangerous occurrences; • First Aid; • Financial Cost – Direct & Indirect cost of accidents.
UNIT III	<p>INDUSTRIAL HYGIENE <i>Duration: 05 Periods (L: 5.0)</i></p> <ul style="list-style-type: none"> • Principles and its control measures; • Permissible limits; • Stress; • Exposure to Heat; • Heat balance; • Effects of heat stress; • Chemical agents; • Flammables; • Explosives – Types, Water Sensitive chemicals, Oxidants, Gases under pressure; • Chemicals causing Health Hazards – Irritants, Asphyxiates, Anaesthetics, Poisons and Carcinogens. • Air Sampling. • Types of Air Borne contaminants and their evaluation methods. • House keeping and its importance.
UNIT IV	<p>WORKPLACE HAZARDS AND ITS CONTROL <i>Duration: 10 Periods (L:10.0)</i></p> <ul style="list-style-type: none"> • <i>Physical Hazards</i> <ul style="list-style-type: none"> ➤ Illumination - Principles and Purpose of good illumination, Standards of Illumination; ➤ Ventilation – Principle and Purpose of ventilation, Classification of ventilation (Natural & Artificial); ➤ Thermal Stress – Various indexes, its impact & control (including air conditioning);

- Impact & Control of Vibration;
- Noise Pollution, its impact and control;
- Impact & control of radiation;
- Personal Protective Aids;
- Safe weight lifting procedure;
- Safe Start Up;
- Shut down and emergency shut down procedures;
- Permit to work system.

- **Chemical Hazards**

- Definition of various chemical hazards, properties and preventive measures;
- Routes of entry of chemicals into human body;
- Concentration & type of exposure in the industry;
- General toxic effects of chemicals for the environment;
- Common safety in transportation and bulk storage of hazardous materials;
- Corrosion prevention and preventive maintenance of vulnerable equipment;
- Safe entry into confined spaces;
- Permit to work system;

- **Electrical Hazards**

- Dangers from electricity;
- Safe limits of voltage and amperage;
- Safe distance from LT and HT Lines;
- Means of cutting of Power overload and short circuit protection;
- Methods and importance of Earthing, earth fault protection, earth insulation and continuity tests;
- Control of hazards due to Static electricity permit to work system.

- **Fire Hazards**

- Chemistry of fire;
- Classification of fire;
- Common causes of industrial fire statutory;

	<ul style="list-style-type: none"> ➤ Provisions regarding fire safety; ➤ Factors contributing towards fire; ➤ Determination of Fire Load; ➤ Fire resistance of building materials; ➤ Design of Industrial Plant for Safety; ➤ Prevention of Fire - Portable Fire extinguishers –Water/Carbon di-oxide/Foam/Dry Chemical; ➤ Fire Prevention System – Sprinkle/CO₂ Flooding/ Foam System; ➤ Industrial Fire Detection and Alarms; ➤ Special precautionary measures in handling/Processing flammable liquids, Gases, Vapours, Mists and Dusts; ➤ Emergency Action Plan. <ul style="list-style-type: none"> • Biological Hazards <ul style="list-style-type: none"> ➤ Description of bacterial agents; ➤ Description of viral agents; ➤ Explanation the transmission and prevention of water borne diseases; ➤ Outline vector borne diseases; ➤ Explanation of vector control in the factory.
UNIT V	POLLUTION Duration: 03 Periods (L: 3.0) <ul style="list-style-type: none"> • Atmospheric pollution; • Waste and dust; • Toxic materials and gases; • Environmental pollution by Footwear Industry.
UNIT VI	IDENTIFICATION OF RISK ASSESSMENT AND HAZARD PREVENTION IN FOOTWEAR INDUSTRY Duration: 07 Periods (L: 7.0) <ul style="list-style-type: none"> • Explanation of Associated Hazards and Its Effects in <ul style="list-style-type: none"> ➤ Raw material handling; ➤ Logistics; ➤ R & D and Quality Control; ➤ Rubber Section; ➤ Leather Section; ➤ Assembly Section; ➤ Engineering; ➤ Packing and handling of finished products;

	<ul style="list-style-type: none"> ➤ HR Administration and Accounts; ➤ Stores & Purchases; ➤ Projects; ➤ Environment, Health, Safety & Fire. <ul style="list-style-type: none"> • Effective steps to implement safety procedures of the associated hazard and its effect; • Periodic inspection and preventive maintenance of Footwear machines & equipments.
UNIT VII	<p>SAFETY MANAGEMENT IN FOOTWEAR INDUSTRY</p> <p style="text-align: right;"><i>Duration: 05 Periods (L: 5.0)</i></p> <ul style="list-style-type: none"> • Principles of safety management; • Safety policy; • Benefits of zero incident safety policy; • Importance of incident free working environment; • Incident investigation; • Root cause analysis; • Medical evaluation; • Preventive action; • Safety awareness programme at workplace; <ul style="list-style-type: none"> ➤ Motivation; ➤ Education; ➤ Training at various levels of production & operation. ➤ Appraisal of Industrial Safety; ➤ Measurement of Safety performance; • Machineries safety; • Standard operating procedures (SOP) of modern equipment's; • Personal protection equipment's (PPE); • PPE Compliance; • Emergency drill for worker; • Effective communication; • Safety Standards; • Role of Government, Management & Trade Unions in promoting industrial safety; • Safety Organisation – Role of safety Committee and its formation.

UNIT VIII	INDUSTRIAL SAFETY REGULATIONS			Duration: 05 Periods (L: 5.0)
	<ul style="list-style-type: none">• The Factory Rules;• Functions of Safety Management;• Legislative Measures in Industrial Safety: Factory Act 1948, Workmen’s Compensation Act 1943, Employees Sattate Insurance Act 1948; Water (Prevention & Control) Pollution Act 1974, Boiler Vessels Act, Child Labour and Women Employee Act;• ILO Convention and Recommendations in the furtherance of Safety, Health & Welfare;• Occupational Safety;• Health & Environment Mangement: Bereau of Indian Standards on Safety Health 14489 – 1998 and 15001 – 2000 OSHA (Occupational Safety and Health Administration).			
Suggested Students Assignment (Any One)				
Each student should do any one of the following assignment or any other similar assignment related to the course and before conducting, gets it approved from concerned Teachers and HOD. <ul style="list-style-type: none">➤ Draw an emergency response action plan case of fire broke out at Footwear industry.➤ Briefly describe Factories Act, 1948 and Employees State Insurance Act, 1948.➤ Briefly describe about the various types of hazardous risks associated with footwear industry and therby suggest the possible remedial measures.				
Expert Lecture				
It is mandatory to organize an Expert Lecture on the aforesaid subject by inviting resource persons from the domain specific i.e Footwear Industry.				
Evaluation Scheme				
THEORY (100 MARKS)				
External Assessment (60 Marks)		Internal Assessment (40 Marks)		
End Semester Examination	Mid Semester Test	Quizzes/ Viva voce/ Assignment	Class Attendance	
60	20	10	10	
Pass Criterion: Students have to obtain at least 40% marks (Pass marks) in both Internal Assessment and External Assessment separately.				
References/Suggested Learning Resources				
<ol style="list-style-type: none">1. Industrial Safety Handbook (2nd Edition) by William Handley-McGraw Hill Book Company, 1969.2. Industrial Safety (3rd Edition) by R.P Blaka-Prentice Hall inc., New Jersey, 1963.3. Industrial Safety, Health and Environment Management System by R.K Jain and Sunil S. Rao-Kanna Publishers.4. Principles of industrial Safety Management by Akhil Kumar Das-PHI Learning Pvt. Ltd.5. Industrial Safety Management by LM Deshmukh-McGraw Hill Education.6. Fundamentals of Occupational Safety & Health By Mark A Friend and James P Kohn-Government Institutes An imprint of the Scarecrow Press Inc.				

7. Safety in Industry by Brij Mohan Bansal-Woodhead Publishing India Pvt. Ltd.	
8. Physical and Biological Hazards in the Workplacein the Workplace by Wald, Peter and Gregg M. Steve-New York, NY:Van Nostrand Reinhold, 2001.	
Suggested E-Learning Resources	
1. https://youtu.be/8nbOI-0U9Co 2. http://youtu.be/55p7hJqb13s 3. http://youtu.be/rxVzm)ixNtY 4. http://youtu.be/y3dQj1mYIOw 5. http://youtu.be/VhOTDJVC8uM 6. http://youtu.be/vb9QFjkEmAU	
Course Outcomes	
At the successful completion of this course, students will be able to	
CO I	Identify the components needed to provide a safe and healthful work environment through case studies and review of injury statistics provided in the course.
CO II	Analyze safety and health issues resulting from worker complaints or OSHA violations and suggest potential remedies.
CO III	Identify potential workplace safety and health hazards and determine how to mitigate the hazards through engineering controle, administrative controls and personal protective equipment.
CO IV	Conduct basic safety inspections using strategies that they have developed through hazard identification and job hazard analysis.
CO V	Review the principles for developing and implementing a successful occupational health and safety program and evaluation of a work site.

Course Code	:	OE II
Course Title	:	INDUSTRIAL HAZARDS AND MODERN WASTE MANAGEMENT
Course Category	:	Open Elective II
Number of Credits	:	3
Contact	:	2 lecture/week, 1hr/lecture, Total 45 lecture
Offered to	:	6th Semester students
Pre Requisite	:	Basic knowledge about the various types of Environmental Pollutants

Course Objectives

FWTOE II INDUSTRIAL HAZARDS AND MODERN WASTE MANAGEMENT The course aims at providing exposure to the students

- To learn about the sources, categories, composition and general methods of disposal and management of solid waste;
- To provide comprehensive overview of solid and hazardous waste management;
- To provide knowledge on solid waste management design aspects;
- To learn about the different methods of solid waste management.

Course Content

UNIT I	WASTE GENERATION & DISPOSAL <i>Duration: 08 Periods (L: 8.0)</i> <ul style="list-style-type: none"> • Introduction; • Sources and Categories of waste; • Bio Degradable and Non Bio Degradable waste; • Solid wastes and their classification; • Chemical composition of solid wastes; • General methods of Disposal and Management of Solid waste;
UNIT II	INDUSTRIAL WASTE <i>Duration: 08 Periods (L:8.0)</i> <ul style="list-style-type: none"> • Introduction; • Types of Industrial waste; • Identification of Industrial waste; • Hazardous waste management sites in India; • Route of industrial hazard entry into human body-Inhalation;
UNIT III	SOLID WASTE GENERATION IN FOOTWEAR AND LEATHER PRODUCTS INDUSTRY <i>Duration: 08 Periods (L: 8.0)</i> <ul style="list-style-type: none"> • Introduction; • Generation <ul style="list-style-type: none"> ➤ Leather cut-off; ➤ Natural Rubber/Poly-Isoprene waste;

	<ul style="list-style-type: none"> ➤ Reaction Injection Moulded (RIM); ➤ Polyurethane (PU) blends; ➤ Poly Vinyl Chloride (PVC) and blends; ➤ Ethyl Vinyl Acetate (EVA) and blends; ➤ Styrene butadiene rubber (SBR) wastes; ➤ Thermoplastic Polyurethane (PU) waste; ➤ Thermoplastic Rubber (TR); ➤ Textiles; ➤ Cotton excess; ➤ Polyester; ➤ Nylon; <ul style="list-style-type: none"> • Materials used in Assembling Operations: Adhesive, Solvent, Finishing materials etc.
UNIT IV	<p>SOLID WASTE GENERATION IN LEATHER INDUSTRY</p> <p style="text-align: right;"><i>Duration: 08 Periods (L: 8.0)</i></p> <ul style="list-style-type: none"> • Introduction; • Generation <ul style="list-style-type: none"> ➤ Skin Collagen waste; ➤ Fleshing waste; ➤ Wet Blue; ➤ Trimming; ➤ Buffing; ➤ Chrome shaving; ➤ Chrome Split; ➤ Trimming from crust and finished leather; • Description on possible utilization of the leather wastes.
UNIT V	<p>SOLID WASTE MANAGEMENT OF FOOTWEAR INDUSTRIES.</p> <p style="text-align: right;"><i>Duration: 06 Periods (L: 6.0)</i></p> <p><i>A. STORAGE, COLLECTION AND TRANSPORTATION OF FOOTWEAR INDUSTRY WASTE</i></p> <ul style="list-style-type: none"> • Collection; • Engineering classification; • Characterization; • Generation and Quantification. • Transportation

	<ul style="list-style-type: none"> ➤ Collection systems; ➤ Collection equipments; ➤ Transfer stations; ➤ Collection route optimization; <p>B. TREATMENT METHODS</p> <ul style="list-style-type: none"> • Various methods of refuse processing; • Recovery, Recycle & Reuse; • Composting <ul style="list-style-type: none"> ➤ Concept, Principles and Factors affecting the composting process; ➤ Methods of composting – Aerobic and Anaerobic, Incineration, Pyrolysis, Energy recovery, Bangalore and Indore model etc. • Disposal methods <ul style="list-style-type: none"> ➤ Impact of Open dumping; ➤ Site Selection; ➤ Sanitary land filling – Design criteria and design examples; ➤ Leachate and Gas collection systems; ➤ Leachate treatment. • Hazardous & Non-Hazardous Waste Management <ul style="list-style-type: none"> ➤ Introduction; ➤ Sources; ➤ Classification; ➤ Physico-chemical, Chemical and Biological treatment; ➤ Regulations; ➤ Procedure for the management of hazardous and other industrial waste; ➤ Procedure for the management of Non-Hazardous Industrial waste. • Thermal Treatment <ul style="list-style-type: none"> ➤ Incineration and Pyrolysis; • Soil contamination and site remediation – Bioremediation processes, monitoring of disposal sites.
UNIT VI	<p>ADVANCED WASTE MANAGEMENT METHOD</p> <p>A. Removal of Refractory Organic Compounds</p>

Duration: 07 Periods (L: 7.0)

- Advanced Oxidation Process
 - Photocatalytic treatment;
 - Membrane separation;
 - Homogeneous catalysis system;
 - Heterocatalytic systems;

B. Removal of Inorganic Compounds

- Electro dialysis;
- Reverse Osmosis;
- Multiple effect evaporator;
- Ion-exchange;

Suggested Students Assignment

Each student should do any one of the following assignment or any other similar assignment related to the course and before conducting, gets it approved from concerned Teachers and HOD.

- Write a short essay on possible utilization of Waste generated from Leather Industry.
- Briefly describe about the various types of solid waste generated from a footwear manufacturing industry.
- Describe in brief about the various solid waste management techniques associated with hazardous and non-hazardous industry wastes.

Evaluation Scheme

**THEORY
(100 MARKS)**

External Assessment (60 Marks)	Internal Assessment (40 Marks)		
End Semester Examination	Mid Semester Test	Quizzes/ Viva voce/ Assignment	Class Attendance
60	20	10	10

Pass Criterion: Students have to obtain at least **40% marks (Pass marks)** in both Internal Assessment and External Assessment separately.

References/Suggested Learning Resources

1. Elements of Solid Hazardous Waste Management by O.P Gupta-Khanna Book Publishing Co.
2. Solid Waste Management by A. Bhide - Indian national Scientific Documentation Centre, New Delhi.
3. Solid Waste by George Tchobanoglous, Keith Frank – McGraw Hill Publication, New Delhi.
4. Solid Waste Engineering by A. Vesilind – Thompson Books.
5. The Treatment of Industrial Waste 92nd edi.) by B.E Bessellieve and M. Schwartz- McGraw Hill.
6. Hazardous Waste (Management and Handling) Rules, 2001.

Suggested E-Learning Resources

1. <https://youtu.be/aS-U8xsvZ-4>
2. <http://youtu.be/GjKXTjLs020>
3. <http://youtu.be/rAbCMM0WjLi>
4. <http://youtu.be/BbLIJPwMBKQ>
5. <http://youtu.be/hj3w4UUElal>
6. <http://youtu.be/PJBRgespiOA>
7. <http://youtu.be/Had2dwmyhE>

8. http://youtu.be/qsfr_HNdHZo

Course Outcomes

At the successful completion of this course, students will be able to

CO I	Explore their knowledge on Industrial of various treatment options for solid waste management;
CO II	Learn adverse impact of industrial hazard on the environment as well as on human body;
CO III	Evaluate the regulations of industrial wastes and to be able to recognize the environmentally friendly utilization methods;
CO IV	Convert footwear solid waste into valuable product;
CO V	Explore utilization benefits of tannery wastes.

Name of the Course: Diploma in Engineering		
Course Title: Export Import Management	Course code : OE	
Number of Credit: 3	Semester: SIXTH	
Teaching Scheme	Examination Scheme	
Duration: 15 weeks	Maximum Marks: 100	
Theory : - 3 hrs/week	Mid. Sem. Tests	20 Marks
Tutorial: -NIL	Quizzes, Viva-voce, Assignments	10 Marks
Practical: NIL	Class Attendance	10 Marks
Total Contact Hours: 45 Hours	End Semester Examination	60 Marks
Prerequisite:		
Aim: The aim of the course is to acquaint the students with the export-import procedures, documentation and logistics and to familiarize students with the role of merchandiser in exports and buying Industry.		
Course Objective:		
1) To explain the meaning & nature of imports & exports; 2) To know the facets of foreign trade policy; 3) To develop a conceptual understanding of the regulatory framework for exports in India; 4) To highlight the main characteristics of the global trade environment; 5) To provide an exposure regarding export –import management and documentation procedures.		
Course Content :		
Content (Theory)		Module
Unit:1	Introduction to Export & Import: Export: Meaning & Importance Import: Meaning & Importance Export Vs. Import Basic Planning for Export &Import Registration for Exporters Registration for Importers Export License Import License General provisions regarding Export & Import	Module-1
Unit:2	Regulatory Framework Governing Exports and	

	<p>Imports:</p> <p>Laws governing India's export-import (general provisions):</p> <ul style="list-style-type: none"> • Foreign trade (Development and Regulation) Act, 1992 • Foreign trade (Development and Regulation) Amendment Bill, 2010 • The Customs Act • GST Act <p>Government/Semi-government agencies in export-import promotion:</p> <ul style="list-style-type: none"> • Ministry of Commerce and Industry • Director General of Foreign Trade(DGFT) • Export Promotion Council (EPC) • Export Inspection Council (EIC) • Export Credit Guarantee Corporation (ECGC) • Directorate General of Commercial Intelligence and Statistics ((DGCI&S) • EXIM Bank • State Trading Corporation of India Ltd.(STC) • Central Board of Indirect Taxes & Customs (CBIC) <p>Overview of Foreign Trade Policy (2015-2020)</p> <ul style="list-style-type: none"> • Legal basis and duration of FTP • Handbook of Procedures (HBP) • e-IEC & e-BRC • Reduction in mandatory documents required for Export and Import • Electronic Data Interchange (EDI) • Self-Assessment of Customs Duty • Time Release Study (TRS) • Towns of Export Excellence (TEE) • Special provision for import of Hides Skins and semi-finished goods • Free Exports • Bonded Warehouses for imports & exports • Import & Export of Samples • Export Promotion Councils (EPC) • Merchandise Exports from India Scheme (MEIS) • Service Exports from India Scheme (SEIS) 		
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Unit:3	<p>Export Documentation:</p> <p>Export Documentation in India:</p> <ul style="list-style-type: none"> • Aligned Documentation System (ADS) – Meaning & Advantages • Paper Size and Specifications • Export documents: Commercial documents & Regulatory documents • Classification of Commercial and Regulatory Documents: <p>Documents related to goods: Proforma Invoice, Commercial Invoice, Consular Invoice, Legalized Invoice, Customs Invoice, Packing Note and Packing List, Certificate of Origin</p> <p>Documents related to shipment: Shipping Bill, Mate's Receipt, Cart Ticket, Certificate of Measurement, Bill of Lading, Airway Bill, Marine Insurance Policy Certificate, Shipping advice</p> <p>Documents related to payment: L/C, Bill of Exchange, Trust Receipt, Bank Certificate of Payment</p> <p>Documents related to inspection: Certificate of Inspection</p> <p>Documents related to excisable goods: GP Forms (GP-I/GP-II), Form C, ARE-1 Form</p> <p>Documents related to foreign exchange regulations:</p> <p>GR/SDF Form, PP Form, VP/COD Form, SOFTEX Form</p>	<p>Module-2</p>	<p>13</p>
Unit:4	<p>Export procedure:</p> <ul style="list-style-type: none"> • Preliminary Stage : Export Licensing, Inquiry and Offer, Examination of Terms & Conditions of Export, Export Contract and Confirmation of Acceptance • Pre-shipment Stage : Pre-shipment Finance, Production and Procurement of Goods, Shipping Space, Packing and Marking, Quality Control and Pre-Shipment Inspection, Central Excise Clearance, Appointment of Clearing and 		

	<p>Forwarding agents, Insurance Cover (ECGC & Marine Policy)</p> <ul style="list-style-type: none"> • Shipment Stage: Documentary Examination at Customs House, Obtaining 'Carting Order' and Customs Physical Examination, Loading cargo on Vessel, Exchange Control Formalities • Post-shipment Stage: Presentation of Documents to the Bank, Export Incentives • How to export raw hides, skins and leather? <p>Export clearance formalities to export articles of leather, saddler, harness, travel goods, handbags</p>		
Unit-5	<p>Import Procedure & Documentation:</p> <p>Import Procedure:</p> <ul style="list-style-type: none"> • Obtaining Import Export Code (IEC) • Ensuring legal compliance under different trade laws • Procuring import licenses • Filing Bill of Entry & documents to conclude the customs clearance formalities • Determining the import duties to clear goods • Receiving permission to import goods <p>Import Documentation: IEC Number, Import License , Bill of Entry, Commercial Invoice Commercial invoice cum packing list, Bill of Lading or Airway Bill, , Certificate of Insurance, Purchase Order or Letter of Credit (L/C), Technical Write-up or Literature (Only required for specific goods), Industrial License (for specific goods), Test Report (If any), Registration cum Membership Certificate (RCMC), GATT/DGFT declaration, DEEC/DEPB/ECGC License for duty benefits</p>	Module-3	13
Unit-6	<p>INCO Terms & different Methods of Payments in International Trade:</p> <p>INCO Terms : EXW, FCA, CPT, CIP , DAP , DPU , DDP ,FAS, FOB, CFR, CIF</p> <p>Methods of Payments: Advance Payment, Letter of credit, Documents against Payments - D.A.P or D/P basis, Documents against Acceptance (D/A)</p>		

Unit-7	Impact of GST Rates, HSN Codes on Leather Goods Industry: <ul style="list-style-type: none"> • GST Rates : Meaning of GST Rates, Types of GST Rates and GST Rate structure in India • HSN Codes : Meaning & Importance • GST Rate & HSN Code for Raw hides and skins (other than furskins) and leather – Chapter 41 • GST Rate & HSN Code for Articles of leather; saddlery and harness; travel goods, handbags and similar containers; articles of animal gut (other than silkworm gut) - Chapter42 		
Assignment	<ul style="list-style-type: none"> • Students can visit exporters and importers and understanding the practical processes and formalities involved. • Students can also simulate an export order and create a detailed process involving all documentation and procedural aspects. 		6

Total	45
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Examination Scheme of ESE (End Semester Examination)

	Question Type	Question to be set	Questions to be answered	Marks
Theoretical	MCQ-type questions are carrying one mark.	15	10	10
	Short answer-type questions carrying one mark.	15	10	10
	Subjective-type questions carrying two marks.	10	6	12
	Subjective-type questions carrying six marks.	9 (3 each from each of 3 modules)	3	18

TOTAL	60
Pass Criterion: Students have to obtain at least 40% marks individually both in Internal assessment and end semester exams to pass.	
References: <ol style="list-style-type: none"> 1. Export Marketing- TAS Balagopal, Himalaya Publishing House, Mumbai 2. Export Management- D.C. Kapoor, Vikas Publishing House, New Delhi. 3. Handbook of Import-Export Procedures – Ministry of Commerce, Govt. of India. 4. Export Documentation and procedures – Nabhi Publications, New Delhi. 5. Import – Do it Yourself, M.I. Mahajan, Snow White Publications, New Delhi. 	
Course outcomes:	
<p>Upon completion of this course, students should be able to:</p> <ol style="list-style-type: none"> 1) Identify and evaluate export or import opportunities in Leather Goods Sector. 2) Discuss the insights of procedure to set up an international trading company. 3) Understand the meaning, eligibility and procedure to get IEC Number for export-import business in India. 4) Understand documents involved in export-import activities & custom procedures for export & import in India. 5) Simulate an export / import order and create a detailed process involving all documentation and procedural aspects. 	

Name of the Course: Diploma in Engineering			
Course Title: Industrial Management and Safety		Course code : OE	
Number of Credit: 3		Semester: SIXTH	
Teaching Scheme		Examination Scheme	
Duration: 15 weeks		Maximum Marks: 100	
Theory : - 3 hrs/week		Mid. Sem. Tests	20 Marks
Tutorial: -NIL		Quizzes, Viva-voce, Assignments	10 Marks
Practical: NIL		Class Attendance	10 Marks
Total Contact Hours: 45 Hours		End Semester Examination	60 Marks
Prerequisite:			
Aim :			
Course Objective:			
<ol style="list-style-type: none"> 1. Introduce students about the role of managements 2. To understand organizational behavior 3. To understand the role of HRM, Industrial Management 4. To understand the various basic concepts of Hazard, Risk, and Accidents in various industries and their management. 5. To understand the various effects of physical hazards on human health and the various control measures to rectify the same. 6. To understand and identify various hazards in industries and the impact of damages in these areas. 7. To understand the various fire prevention techniques to be followed in leather industries. 8. To evaluate workplace to determine the existence of occupational safety and health hazards. 9. To explain important legislations related to Health, Safety and Environment 			
Course Content:			
UNIT	Topics & Sub-topics	Module	Teaching Hour
➤ Unit:1 INTRODUCTION TO MANAGEMENT SCIENCE	Principles and function of Management- Contribution of different Management Writers(Henry Fayol, F.W. Taylor, Max Weber) in the field of Management Science. ➤ ORGANISATIONAL BEHAVIOR	Module	6

	<ul style="list-style-type: none"> Behavior-Motivation-Motivational Theories-Morale-Leadership-Communication. 	1	
<p>➤ Unit: 2 HUMAN RESOURCE MANAGEMENT</p>	<ul style="list-style-type: none"> Human Resource Management-Concept and Definition-Function-Recruitment-Training, Performance Appraisal-Industrial Safety. <p>INTRODUCTION TO INDUSTRIAL ENGINEERING (Basic Idea), PRINCIPLES OF SHOPFLOOR SUPERVISION WITH EMPHASIS ON 5S, SAFETY AND MOTIVATION.</p>		10
<p>UNIT 3 INTRODUCTION TO INDUSTRIAL SAFETY and INDUSTRIAL HYGIENE</p>	<p>History and Development of Safety Movement, Importance of Safety, Safety Policy: Safety Organization and Its Responsibilities, Accident Sequence Theory, Causes of Accidents, Accident Prevention and Control Techniques Including Near Misses. Risk, Hazards and Dangerous Occurrences. First Aid. Financial Costs-Direct And Indirect Costs of Accidents.</p> <p>Industrial Hygiene – Principles and its Control Measures. Permissible Limits. Stress, Exposures to Heat, Heat Balance, Effects of Heat Stress, Chemical Agents, Flammables, Explosives - Types, Water Sensitive Chemicals, Oxidants, Gases Under Pressure, Chemicals Causing Health Hazards: Irritants,</p>		6
<p>UNIT 4 WORKPLACE HAZARDS AND ITS CONTROL</p>	<p>Physical Hazards</p> <p>Illumination - Principles and Purpose of Good Illumination. Standards of Illumination.</p> <p>Ventilation – Principle and Purpose of Ventilation. Classification of Ventilation (Natural and Artificial), Heat Stress – Various Indexes, Different Controls (Including Air Conditioning), Vibration and its Control, Noise Pollution and its Control, Noise Mapping, Personal Protective Aids. Safe Weight Lifting Procedure. Safe Start Up, Shut Down and Emergency Shut Down Procedures. Permit to Work System.</p>		10

	<p>Chemical Hazards Hazardous Chemicals – Classification and its Properties, Common Hazard and Precautions for Each Class. Safety in Transportation and Bulk Storage of Hazardous Materials. Corrosion Prevention and Preventive Maintenance of Vulnerable Equipment. Safe Entry Into Confined Spaces. Permit to Work System.</p> <p>Electrical Hazards Dangers from Electricity. Safe Limits of Voltage and Amperage. Safe Distance from LT and HT Lines. Means of Cutting of Power Overload and Short Circuit Protection. Methods and Importance of Earthing. Earth Fault Protection. Earth Insulation and Continuity Tests. Protection Against Overvoltage. Lighting Arrester, Flame Proof and Intrinsic Electrical Equipment, Precautions in Their Selection, Installation, Maintenance and Use. Control of Hazards due to Static Electricity. Permit to Work System.</p> <p>Fire Hazards Chemistry of Fire, Classification of Fire. Common Causes of Industrial Fire. Statutory Provisions Regarding Fire Safety, Factors Contributing Towards Fire. Determination of Fire Load. Fire Resistance of Building Materials. Design of Industrial Plant for Fire Safety. Prevention of Fire: Portable Extinguishers- Water Type Extinguisher, Carbon dioxide TypeExtinguisher, Foam Type Extinguisher, Dry Chemical Type Extinguisher. Sprinkle Systems, CO₂ Flooding System FoamFlooding System. Industrial Fire Detection and Alarms. Special Precautionary Measures in Handling/Processing Flammable Liquids, Gases, Vapours, Mists and</p>		
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	Dusts. Emergency Action Plan.		
UNIT 5 OCCUPATIONAL HEALTH	History of Occupational Health, Concept of Occupational Health, Occupational and Work Related Diseases, Levels of Prevention, Health Examination (Initial and Periodic), Essentials of Occupational Health Services (OHS), Personal Protective Equipment (Respiratory and Non-Respiratory), Ergonomic Controls, Risk Assessment, Risk Management and Risk Tolerance.		5
UNIT 6 INDUSTRIAL SAFETY LEGISLATIONS	<p>The Factories Rules, Functions of Safety Management, Legislative Measures in Industrial Safety: Factories Act, 1948, Workmen's Compensation Act, 1943, Employees State Insurance Act, 1948. Water (Prevention and Control) Pollution Act, 1974, Boiler Vessels Act. Child Labour and Women Employee Act.</p> <p>ILO Convention and Recommendations in the Furtherance of Safety, Health and Welfare.</p> <p>Occupational Safety, Health and Environment Management: Bureau of Indian Standards on Safety and Health 14489 - 1998 and 15001 – 2000 OSHA (Occupational Safety and Health Administration).</p>		5
	Total		42
Suggested Home Assignments/Students' Activities: (any Five)	<ul style="list-style-type: none"> i. What do you understand by safety, risks and hazards? Differentiate between risks and hazards. ii. What are the various causes of dangerous occurrences arising due to dust, fire and chemicals refereeing different types of industries? iii. Can you measure some control measures to limit the degree of hazards for factories highlighting the "permissible limits" of different pollutants? 		

	iv. Draw schematic diagram of any fixed firefighting system (sprinkler/CO2 total flooding/foam flooding system) and describe it. v. Draw the labelled schematic diagram of portable fire extinguishers (showing all internal components) of DCP type, water type, CO2 type and foam type. vi. Classify hazardous chemical and describe the hazards associated with them. vii. Draw a labelled diagram of lighting arrester fitted on a multi-storied building and describe its functional procedure. viii. Briefly describe Factories Act, 1948 and Employees State Insurance Act, 1948.		

Examination Scheme of ESE (End Semester Examination)

Theoretical	Question Type	Question to be set	Questions to be answered	Marks
	MCQ-type questions are carrying one mark.	15	10	10
	Short answer-type questions carrying one mark.	15	10	10
	Subjective-type questions carrying two marks.	10	6	12
	Subjective-type questions carrying six marks.	9 (3 each from each of 3 modules)	3	18
TOTAL				60
Pass Criterion: Students have to obtain at least 40% marks individually both in Internal assessment and end semester exams to pass.				

References:

- 1“Industrial Engineering and Management” by Dr. Ravi Shankar. Galgotia Publications
2. Industrial Safety, Health and Environment Management Systems, R. K. Jain and Sunil S. Rao, Khanna Publishers
- 3 A Handbook On Industrial Safety and Fire Management, Ravi Kant Pandey, Chetan Prakashan
- 4 Principles of Industrial Safety Management, Akhil Kumar Das, PHI Learning Pvt Ltd
- 5 Industrial Safety Management, L M Deshmukh, McGraw Hill Education
- 6 Industrial Safety & Environment, Anupama Prashar, S.K. Kataria & Sons
- 7 Fundamentals of Occupational Safety and Health, Mark A. Friend and James P. Kohn, Government Institutes An imprint of The Scarecrow Press, Inc.
- 8 Safety in Industry, Brij Mohan Bansal, Woodhead Publishing India Pvt. Ltd.

Course outcomes:

At the end of this course, a student should be able to

1. Understand the role of managements in industry
2. Understand the importance of organizational behavior
3. Understand the role of HRM, Industrial Management
4. Understand the various basic concepts of Hazard, Risk, and Accidents in various industries and their management.
5. Understand the various effects of physical hazards on human health and the various control measures to rectify the same.
6. Understand and identify various hazards in industries and the impact of damages in these areas.
7. Understand the various fire prevention techniques to be followed in leather industries.
8. Evaluate workplace to determine the existence of occupational safety and health hazards.
9. Explain important legislations related to Health, Safety and Environment

Besides the above this course would equip the students to effectively employ hazard analysis techniques in Industry and helpful to prevent the accidents in Industry.

Name of the Course: Diploma in Engineering			
Category: Open Elective - II	Semester: Sixth		
Code No.: OE II	Theory: 100 Marks		
Course Title: Electrical Machines & Control	Examination Scheme		
Duration: 17 weeks (Total Class hour/Week = 3)	External Assessment		
	End Semester Examination		60
	Internal Assessment		
Total Lecturer Class / Week = 3	Class Test	20	40
	Assignments & Viva – Voce	10	
	Class Attendance	10	
Credit: 3	Total Marks		100
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.			

1. Course Outcomes (COs):

CO1: Identify suitable transformer & DC motors for an intended application.

CO2: Analyse the input and output characteristics curves of a motor to determine its aptness for an application.

CO3: Recommend suitable fractional kW motor for a planned project.

CO4: Obtain an accurate yet compact mathematical model of a dynamical systems.

CO5: Determine a suitable control algorithm for an intended application.

2. Theory Components:

The following topics / subtopics should be taught and assessed in order to develop unit outcomes for achieving the identified course outcome.

Unit (s)	Topics and Sub – topics		Teaching Hours
Unit – 01 DC Machines & Transformers	1.1	Mechanism of Electro – Mechanical Energy Conversion	11
	1.2	Basics of DC Machines: <ul style="list-style-type: none"> Identify the different parts with functions Working / Operating principles of Motor & Generator Types of DC Machines General circuit diagram / representation of DC Motor Applications of different types of DC Motors in industrial sector 	

	1.3	Brief concept of DC Motors: <ul style="list-style-type: none"> • Back – EMF – concept and necessity for starting • DC starter – necessity and types (only names) • Speed & Torque equation. (only expression) • Numerical on torque – speed equation 	
	1.4	Basic concept of Transformers: <ul style="list-style-type: none"> • Identify main constructional parts with their functions • Types of transformers • Operating principle of Transformer • EMF equation and Transformation Ratio (expressions only) • Simple numerical on EMF equation & Transformation ratio 	
	1.5	Various losses in transformer, OC and SC Test of transformer for finding the parameters.	
	1.6	Basic concept of Auto – transformer: <ul style="list-style-type: none"> • Working concept • Volt – Ampere relationship • Application in industrial sector 	
Unit – 02 AC Machines	A: Induction Motor		11
	2.A.1	Basics of Induction Motor: <ul style="list-style-type: none"> • Identify the constructional parts with their functions • Outline the constructional differences between SQIM & Wound rotor 	
	2.A.2	Terminology and expressions related to Induction Motor: <ul style="list-style-type: none"> • Synchronous Speed & Rotor Speed • Slip • Stator & Rotor frequency 	
	2.A.3	Working principle of an Induction Motor. (Brief idea)	
	2.A.4	Expression of Torque developed in an Induction Motor. (only equation) Simple numerical on torque equation.	
	2.A.5	Characteristics of Induction Motor: <ul style="list-style-type: none"> • Speed – Torque Characteristics • Slip – Torque Characteristics 	
	2.A.6	Control of Induction Motor: <ul style="list-style-type: none"> • Reversal of rotation • Voltage & frequency control method (comprehensive) • Stator & Rotor resistance control method (brief idea) • Pole changing control method (brief idea) 	
	2.A.7	Concept of different types of Braking method of Induction Motor.	
	2.A.8	Industrial applications of Squirrel Cage & Wound – Rotor type Induction Motors.	

	B: Synchronous Machines		
	2.B.1	Basics of Synchronous Machines: <ul style="list-style-type: none"> Identify main constructional parts with their functions Operating principle of Synchronous Motor 	
	2.B.2	Terminology related to Synchronous Motor: <ul style="list-style-type: none"> Concept of starting Hunting Damper winding 	
	2.B.3	Applications of Synchronous Motor.	
Unit – 03 Fractional kW Motors	3.1	Basics of Permanent Magnet Synchronous Motor (PMSM) <ul style="list-style-type: none"> Identify different constructional parts Describe operating principle Control of PMSM Applications 	07
	3.2	Basics of Brushless DC Motor (BLDC) <ul style="list-style-type: none"> Define the constructional parts Describe operating principle Closed loop Control of BLDC Applications 	
	3.3	Brief concept and applications: <ul style="list-style-type: none"> Stepper Motor Universal Motor Single phase Induction Motors 	
Unit – 04 Introduction to Control System	4.1	Introduction to control system, Classification of control system.	09
	4.2	Control system components: Synchro, D.C Servomotor, AC Servo motor, AC Tachometer (only basic operating principle & construction and diagram. (no deduction)	
	4.3	Concept of transfer function, poles and zeroes, transfer function of first & second order system. (no deduction)	
	4.4	Signals (Unit step, unit ramp, unit impulse) and their mathematical representation and characteristics.	
	4.5	Modelling of mechanical systems, force-voltage and force-current analogy.	
	4.6	Block Diagram Representation of control system, Transfer function from Block diagram reduction technique, State space representation of continuous time systems, State equations, Transfer function from State Variable representation.	
Unit – 05	5.1	Time response characteristics of first and second order system to unit step excitation (no deduction).	07

Time response analysis, Stability and Process control	5.2	Stability concept: characteristic equation, Deciding stability from pole zero concept, Routh Hurwitz criteria (Numerical), Applications and limitations.	
	5.3	Control action of a system with ON/OFF, P, PI, PD, PID controller, Practical application of these controllers (with block diagram only).	
Total Lecture Classes (Sub Total):			45
No. of classes required for conducting Internal Assessment:			06
Grand Total :			51

3. Suggested Home Assignments/ Student Activities:

- Visit a small motor manufacturing industry and make a report based on their observation.
- Prepare a Power – Point Presentation on the working of DC Motors, Induction Motors, Transformers, Synchronous Motor, PMSM and BLDC.
- Prepare a Power – Point Presentation on the parts of DC Motors, Induction Motors, Transformers, Synchronous Motor, PMSM and BLDC.
- Make a market survey and submit a report on the basis of the following:
 - Types of Machines
 - Manufacturer
 - Name Plate details
 - Applications
- Visit a Transformer manufacturing factory and observe the various routine tests on Transformers and submit a report.
- Make a model or simulation type project using BLDC and PMSM.
- Deduce mathematical modeling of different mechanical and electrical systems.
- Make a power point presentation on block diagram reduction technique.
- Make a power point presentation on different controllers.
- Prepare a power point presentation on Programmable Logic Controllers.

4. Suggested Scheme for Question Paper Design for Conducting Internal Assessment:(Duration: 45 Minutes)

Questions to be set as per Bloom's Taxonomy				
Internal Assessment	Distribution of Theory Marks			
	Level 1 (Remember)	Level 2 (Understand)	Level 3 (Apply & above)	Total
Class Test – 1	4	4	12	20
Class Test – 2	4	4	12	20

5. Suggested Scheme for End Semester Examination :(Duration: 2 hrs. 30 mins.)

A: Multiple Choice Type Questions (Carrying 1 mark each)				
Group	Unit	To be set	To be Answered	Total Marks
A (01)	01 & 02	07	10	10 X 01 = 10
	03	03		
	04 & 05	05		
(Question Number : 01) – Total:		15	10	10

B: Fill-in the Blank Type Questions (Carrying 1 mark each)				
Group	Unit	To be set	To be Answered	Total Marks
A (02)	01 & 02	07	10	10 X 01 = 10
	03	03		
	04 & 05	05		
(Question Number : 02) – Total:		15	10	10
C: Long Answer Type Questions (Carrying 5 mark each)				
Group	Unit	To be set	To be Answered	Total Marks
B	01 & 02	04	05	05 X 08 = 40
C	03	02		
D	04 & 05	03		
(Question Number : 03 to 11) – Total:		09	05	40
Allotment of Sub – Total (A+B) Marks:				20
Allotment of Sub – Total (C) Marks:				40
Allotment of Total (A+B+C) Marks for END Semester:				60

6. Rubrics for the Assessment of Student's Activity:

Sl. No.	Performance Indicators	Weightage in %
01.	Originality of completing the Assigned task / micro-project work.	50
02.	Presentation Skill.	30
03.	In time submission of assignment work / micro-project work.	10
04.	Viva voce	10
Total:		100

7. Suggested Learning Resources:

Sl. No.	Title of Book	Author	Publication
01.	Principle of Electrical Machines	V. K. Mehta Rohit Mehta	S. Chand & Co. Pvt. Ltd., New Delhi
02.	Electrical Technology Vol – II	B. L. Thereja A. K. Thereja	BPB Publication, New Delhi
03.	Electrical Machinery	P. S. Bimbhara	Khanna Publishers, New Delhi

04.	Theory & Performance of Electrical Machines	J. B. Gupta	S. K. Kataria & sons
05.	Modern Control Engineering	K. Ogata	Pearson
06.	Control System Engineering	P. Ramesh Babu	Scitech Publication
07.	Control System Engineering	D. P. Kothari & I. J. Nagrath	New Age International Publishers
08.	Electrical Machines & Control	Navani J.P. & Sapra Sonal	S. Chand Publication, New Delhi
09.	Automatic Control System	Benjamin C. Kuo Farid Golnaraghi	Wiley

8. Suggested e-Learning Resources:

Sl. No.	Topic Description	e - Learning Resources
01.	DC Machines	a) https://www.youtube.com/watch?v=D4RFFnzRdKk&list=PL425060D3C78350E1&index=22 b) https://www.youtube.com/watch?v=89XcdUNFU90&list=PL425060D3C78350E1&index=23 c) https://www.youtube.com/watch?v=0Owe848XA3k d) https://www.youtube.com/watch?v=2SBzRVwFeA8
02.	Transformer	a) https://www.youtube.com/watch?v=n1r4cOF2zW4&list=PLs5_Rtf2P2r5YY5b23uDGrtpo42ezMmGp&index=11 b) https://www.youtube.com/watch?v=3zpzzpEH940&list=PLs5_Rtf2P2r5YY5b23uDGrtpo42ezMmGp&index=12 c) https://www.youtube.com/watch?v=pOkxh0EH1qo&list=PLs5_Rtf2P2r5YY5b23uDGrtpo42ezMmGp&index=32
03.	Induction Motor	a) https://www.youtube.com/watch?v=dZyO5gcWP-o&list=PL425060D3C78350E1&index=35 b) https://www.youtube.com/watch?v=ze8LY4yq9Wk&list=PL425060D3C78350E1&index=36 c) https://www.youtube.com/watch?v=FrbxxqNHn2l&list=PL425060D3C78350E1&index=37 d) https://www.youtube.com/watch?v=GayRzjl_imk&list=PL425060D3C78350E1&index=38
04.	Synchronous Machine	a) https://www.youtube.com/watch?v=b24jORRoxEc&list=PL425060D3C78350E1&index=39
05.	Fractional kW Motors	a) https://www.youtube.com/watch?v=EcXlXNf-4Ws&list=PLJpKI3Fm4KzzxxDzhkObVrU_iaL1cm4u_&index=1 (PMSM) b) https://www.youtube.com/watch?v=O6XiVD_2AUg&list=PLJpKI3Fm4KzzxxDzhkObVrU_iaL1cm4u_&index=3 (BLDC) c) https://www.youtube.com/watch?v=bhYjz7Yv5gs&list=PLJpKI3Fm4KzzxxDzhkObVrU_iaL1cm4u_&index=2 (BLDC) d) https://www.youtube.com/watch?v=Tp724MqrosA (Stepper Motor) e) https://www.youtube.com/watch?v=1T_SQIO-1Xg (Universal Motor) f) https://youtube.com/playlist?list=PL_mruginuVd9gEWorBnZul_fQQyQdC9p3 (Single Phase IM)

06.	Introduction to Control System	a) https://www.youtube.com/watch?v=vVFDm_CdQw&list=PLA74601484F6994D8&index=1 b) https://www.youtube.com/watch?v=u6kYU3qcR3c&list=PLA74601484F6994D8&index=2 c) https://www.youtube.com/watch?v=oTmpeck2M6M&list=PLA74601484F6994D8&index=3 d) https://www.youtube.com/watch?v=2c2y35EleZY&list=PLA74601484F6994D8&index=10 e) https://www.youtube.com/watch?v=RavWF_T0zL8&list=PLA74601484F6994D8&index=12 f) https://www.youtube.com/watch?v=BoY_SKtA_qg&list=PLA74601484F6994D8&index=13 g) https://www.youtube.com/watch?v=CrXOMBIYFp0 h) https://www.youtube.com/watch?v=9Ea-Qq3Lmnl
07.	Time response analysis, Stability and Process control	a) https://www.youtube.com/watch?v=cJRIUGDtS-0&list=PLA74601484F6994D8&index=23 b) https://www.youtube.com/watch?v=QdT-leoeyoc&list=PLA74601484F6994D8&index=24 c) https://www.youtube.com/watch?v=sGSz4PaLWPo&list=PLA74601484F6994D8&index=25 d) https://www.youtube.com/watch?v=f4WGCQXqfnw

Name of the Course : Diploma in Engineering			
Course Title: OPEN ELECTIVE II Artificial Intelligence		Course code : OE	
Number of Credit : 3		Semester : SIXTH	
Teaching Scheme		Examination Scheme	
Duration : 15 weeks		Maximum Marks : 100	
Theory : - 3 hrs/week		Continuous Internal Assessment	20 Marks
Tutorial: - NIL		Attendance	10 Marks
Practical : NIL		Assignment/Presentation/Quiz	10 Marks
Total Contact Hours: 45 Hours		End Semester Examination	60 Marks
Prerequisite: Having fundamental knowledge of Computers programming and elementary mathematical or logical operations.			
Aim <ol style="list-style-type: none"> To study the core concepts of Artificial Intelligence. To study different applications of Artificial Intelligence 			
Course Objective:			
To impart an exposure on Artificial Intelligence and its applications in GIS using powerful features of AI which involves			
1. To understand the various characteristics of Intelligent agents			
2. To learn the different search strategies in AI			
3. To learn to represent knowledge in solving AI problems			
4. To understand the different ways of designing software agents			
5. To know about the various applications of AI.			
Course Content :			
Content (Theory)		Module	Hrs./Unit
Unit:1	INTRODUCTION 1.1 Introduction–Definition 1.2 Future of Artificial Intelligence 1.3 Characteristics of Intelligent Agents 1.4 Typical Intelligent Agents 1.5 Problem Solving Approach to Typical AI problems.	Module 1	9
Unit: 2	PROBLEM SOLVING METHODS 2.1 Problem solving Method 2.2 Search Strategies- Uninformed - Informed – Heuristics 2.3 Local Search Algorithms and Optimization Problems - Searching with Partial Observations 2.4 Constraint Satisfaction Problems – Constraint Propagation 2.5 Backtracking Search - Game Playing - Optimal		9
Unit: 3	KNOWLEDGE REPRESENTATION 3.1 First Order Predicate Logic 3.2 Prolog Programming – Unification 3.3 Forward Chaining 3.4 Backward Chaining 3.5 Resolution 3.6 Knowledge Representation 3.7 Ontological Engineering-Categories and Objects 3.8 Events - Mental Events and Mental Objects 3.9 Reasoning Systems for Categories – Reasoning with Default Information	Module 2	9

Unit-4	SOFTWARE AGENTS		
	4.1 Architecture for Intelligent Agents		
	4.2 Agent communication		
	4.3 Negotiation and Bargaining		
	4.4 Argumentation among Agents		
	4.5 Trust and Reputation in Multi-agent systems		
UNIT-5	APPLICATIONS		
	5.1 All applications		
	5.2 Optical character recognition.		
	5.3 Handwriting recognition.		
	5.4 Speech recognition.		
	5.5 Face recognition.		
	5.6 Artificial creativity.		
	5.7 Computer vision.		
	5.8 Virtual reality.		
	5.9 Image processing		
Total			45

Examination Scheme of ESE (End Semester Examination)

	Question Type	Question to be set	Questions to be answered	Marks
Theoretical	MCQ type questions carrying 1 mark.	15	10	10
	Fill in the blanks type questions carrying 1 mark.	15	10	10
	Subjective type questions carrying 5 marks.	10 (At least 3 questions from each of 3 modules)	8	40
	TOTAL			60

Text Books:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Pearson, Fourth Edition.
2. I. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc..

References:

1. M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, 2008
2. Nils J. Nilsson, —The Quest for Artificial Intelligence, Cambridge University Press.
3. William F. Clocksin and Christopher S. Mellish, Programming in Prolog: Using the ISO Standard, Fifth Edition, Springer..
4. Gerhard Weiss, —Multi Agent Systems, Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, —Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press.
- 6.

Course Outcomes:

Upon completion of the course, the students will be able to:

- Use appropriate search algorithms for any AI problem
- Represent a problem using first order and predicate logic
- Provide the apt agent strategy to solve a given problem
- Design software agents to solve a problem
- Design applications for NLP that use Artificial Intelligence.

Semester: VI	
Course Code: OE	
Course Title: Operations Research	
Number of Credit: 3 (L - 3; T - 0; P - 0)	
Prerequisite: Nil	
Course Category: OE	
Course Objectives: <ol style="list-style-type: none"> 1. To understand and analyze managerial problems in industry so that they are able to use resources (capitals, materials, staffing, and machines) more effectively. 2. To acquire knowledge of formulating mathematical models for quantitative analysis of managerial problems in industry. 	
Course Contents (Theory):	
Unit : 1	1.Development: 1.1 Definition, Characteristics and phase of Scientific Method, Types of models. 1.2 General methods for solving operations research models.
Unit : 2	2. Allocation: 2.1 Introduction to linear programming formulation, 2.2 Graphical solution, Simplex Method, Artificial variable technique, Duality principle. Sensitivity analysis.
Unit : 3	3. Transportation Problem: 3.1 Formulation. 3.2 Optimal solution. 3.3 Unbalanced Transportation problems. 3.4 Degeneracy. 3.5 Assignment problem: Formulation, Optimal solution.
Unit : 4	4. Sequencing: 4.1 Introduction. 4.2 Terminology. 4.3 Notations and Assumptions. 4.4 Problems with n-jobs and two machines. 4.5 Optimal sequence algorithm. 4.6 Problems with n-jobs and three machines.
Unit : 5	5. Theory of games: 5.1 Introduction; 5.2 Two-person zero-sum games; 5.3 The Maximum–Minimax principle; 5.4 Games without saddle points; 5.5 Mixed Strategies; 2 x n and m x 2 Games; 5.6 Graphical solutions;

	5.7 Dominance property; 5.8 Use of L.P. to games.		
Text / Reference Books:			
Sl. No.	Titles of Book	Name of Author	Name of Publisher
1.	Operations Research: Principles and Applications	G. Srinivasan,	PHI Learning Private Limited.
2.	Operations Research: An Introduction -	Hamdy A. Taha	Pearson.
3.	Operations Research: Concepts and Cases	Hillier and Liberman	McGraw-Hill
Course Outcomes:			
At the end of the course, the student will be able to:			
1. Recognize the importance and value of Operations Research and mathematical modeling in solving practical problems in industry.			
2. Formulate a managerial decision problem into a mathematical model.			
3. Understand Operations Research models and apply them to real-life problems.			
4. Understand and implement the Transportation Models and Assignment Models at workplace.			
5. Understand the characteristics of different types of decisions.			



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Course Title: SOFT COMPUTING TECHNIQUES		
Course Code	OE###	
Number of Credits :3	3 (L: 3, T: 0, P: 0)	
Prerequisites	Knowledge Statistics & Probability, Algorithm , C/C++/Java and MATLAB	
Course Category	OE	
Course code: ###	Semester: #####	
Duration: 15 weeks	Maximum Marks: 100	
Teaching Scheme	Examination Scheme	
Theory: 3 hrs/week Total Contact Hours: 45 Hours	Continuous Internal Assessment: 20 Marks Attendance: 10 Marks Viva/Presentation/Assignment/Quiz etc: 10 Marks End Semester Examination: 60 Marks	
Course Objectives		
<ul style="list-style-type: none">➤ To learn Fuzzy logic and its applications.➤ To learn artificial neural networks and its applications.➤ To solving single-objective optimization problems using GAs.➤ To solving multi-objective optimization problems using Evolutionary algorithms (MOEAs).➤ Applications of soft computing to solve problems in varieties of application domains.		
Course Content:		
Contents (Theory)	Hrs./Unit	Module
UNIT 1: Problem Solving Methods and Tools of AI	9	A
Problem Space, Problem solving, State space, Algorithm’s performance and complexity, Search Algorithms, Depth first search method, Breadth first search methods their comparison, A*, AO*, p type, Np complete and Np Hard problems(concept only).		
UNIT 2: Advances in Soft Computing Tools	7	B
Fuzzy Logic, Theory and applications, Fuzzy Neural networks, Concept of Pattern Recognition, Data Mining Concepts.		
UNIT 3: Artificial Neural Networks	10	B
Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture: single layer and multilayer feed forward networks, recurrent networks. Back propagation algorithm, factors affecting back propagation training, applications.		
UNIT 4: Evolutionary Computing Methods & GA	10	C



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Evolutionary Computing Methods: **Principles of Evolutionary Processes and genetics, A history of Evolutionary computation and introduction to evolutionary algorithms, Genetic algorithms, Evolutionary strategy, Evolutionary programming, Genetic programming.**

Genetic Algorithm and Genetic Programming: **Basic concepts, working principle, procedures of GA, flow chart of GA, Genetic representations, (encoding) Initialization and selection, Genetic operators, Crossover, Mutation, Convergence of GA, Bit wise operation in GA , applications.**

UNIT 5: Swarm Optimization & Application

9

C

Swarm Optimization: **Introduction to Swarm intelligence, Ant colony optimization (ACO), Particle swarm optimization (PSO).**

Application: Production, Distribution and Transportation (or field related to the branch of study in the form of Design, control and optimization).

Course outcomes

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

- **CO1: Classify and differentiate problem solving methods and tools.**
- **CO2: Apply A*, AO*, Branch and Bound search techniques for problem solving.**
- **CO3: Formulate an optimization problem to solve using evolutionary computing methods.**
- **CO4: Design and implement GA, PSO and ACO algorithms for optimization problems in Mechanical Engineering.**
- **CO5: Apply soft computing techniques for design, control and optimization of Manufacturing systems.**

Reference Books

1. **Principles of Soft Computing, Sivanandam, Deepa, Wiley**
2. **Introduction to Soft Computing Neuro-Fuzzy and Genetic Algorithm, Samir Roy and Udit Chakraborty, Pearson**
3. **Tettamanzi Andrea, Tomassini and Marco, Soft Computing Integrating Evolutionary, Neural and Fuzzy Systems, Springer, 2001.**
4. **Elaine Rich, Artificial Intelligence, McGraw Hill, 2/e, 1990.**
5. **Kalyanmoy Deb, Multi-objective Optimization using Evolutionary Algorithms, John Wiley and Sons, 2001.**

Name of the Course	Diploma in Engineering	Course duration	6 semester
Course Title	Construction Management	Course Code	OE
Subject offered in Semester	Sixth	Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL	Course Category	OE
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives:

Following are the objectives of this course:

- To understand the contract management and associated labour laws.
- To prepare and understand the principles involved in site layout.
- To know the procedure for scheduling of various activities in construction project.
- To understand the labour laws, procedure for arbitration, settlements.
- To know different safety measures in construction projects.

Module/ Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/ Group A	Unit I and II
Module B/ Group B	Unit III
Module C/ Group C	Unit IV and V

Course Content

Unit – I Construction industry and management

- Organization-objectives, principles of organization, types of organization: government/public and private construction industry, Role of various personnel in construction organization
- Agencies associated with construction work- owner, promoter, builder, designer, architects.
- Role of consultant for various activities: Preparation of Detailed Project Report (DPR), monitoring of progress and quality, settlement of disputes, documentation of incidents and solutions adopted at site. SWOT analysis in construction.
- Cost effective Construction

Unit – II Site Layout

- Principles governing site layout.
- Factors affecting site layout.
- Preparation of site layout.
- Land acquisition procedures and providing compensation.

Unit- III Planning and scheduling

- Identifying broad activities in construction work & allotting time to it, Methods of Scheduling, Development of bar charts, Merits & limitations of bar chart.

- Elements of Network: Event, activity, dummy activities, Precautions in drawing Network, Numbering the events.
- CPM networks, activity time estimate, Event Times by forward & backward pass calculation, start and finish time of activity, project duration. Floats: Types of Floats-Free, independent and total floats, critical activities and critical path,
- Purpose of crashing a network, Normal Time and Cost, Crash Time and Cost, Cost slope, Optimization of cost and duration.
- Material Management- Ordering cost, inventory carrying cost, Economic Order Quantity
- Store management, various records related to store management, inventory control by ABC technique, Introduction to material procurement through portals (e.g. www.inampro.nic.in)

Unit IV Construction Contracts and Specifications

- Types of Construction contracts
- Contract documents, specifications, general special conditions
- Contract Management, procedures involved in arbitration and settlement (Introduction only)

Unit- V Safety in Construction and Labour Laws

- Safety in Construction Industry—Causes of Accidents, Remedial and Preventive Measures.
- Labour Laws and Acts pertaining to Civil construction activities (Introduction only)

Suggested learning resources

1. Sharma S C and Deodhar S V, Construction Engineering and Management, Khanna Book Publishing, New Delhi
2. Gahlot, P.S. and Dhir, B.M Construction planning and management New Age International (P) Ltd. Publishers, New Delhi.
3. Shrivastava, U.K., Construction planning and management, Galgotia Publication Pvt Ltd. New Delhi
4. Mantri, S., The A To Z of Practical Building Construction and its Management, Satya Prakashan New Delhi
5. Khanna, O.P., Industrial Engineering and management, Dhanpat Rai New Delhi
6. Punmia, B.C. and Khandelwal, K.K., Project Planning and Controlling with PERT And CPM, Laxmi Publications (P)Ltd.
7. Sengupta, B., Guha H., Construction Management and Planning, Tata-McGraw Hill.
8. Harpal, Singh, Construction Management and accounts, Mc-Graw Hill.
9. Sharma, S.C., Industrial Engineering and Management, Khanna Publications, New Delhi
10. Nagarajan, K., Project Management, New Age International Pvt. Ltd.
11. Chitkara, K.K., Construction Project Management- Planning, Scheduling and Controlling, Tata-McGraw Hill, New Delhi
12. Jha, Kumar Neeraj, Construction Project Management, Pearson Publication.
13. Barrie D.S., Professional Construction Management, McGraw Hill, New York.

Course outcomes:

After completing this course, student will be able to:

- Understand the contract management and associated labour laws.
- Prepare and understand the nuances of executing the site layout.

- Prepare networks and bar charts for the given construction project.
- Understand the intricacies of disputes, related arbitration and settlement laws.
- Apply safety measures at construction projects.

Name of the Course	Diploma in Engineering	Course duration	6 semester
Course Title	Solid Waste Management	Course Code	
Subject offered in Semester	Sixth	Number of Credits	3 (L:3, T: 0, P: 0)
Prerequisites	NIL	Course Category	OE
Question distribution	As per standing norms of WBSCT&VE&SD	Marks distribution	As per standing norms of WBSCT&VE&SD

Course Objectives:

Following are the objectives of this course:

- To know various sources of solid.
- To learn techniques of collection and transportation of solid waste.
- To know various methods of disposal of solid waste.
- To understand and identify different biomedical and E-waste and their subsequent disposal techniques.

Module /Group [as per directives from WBSCT&VE&SD in framing questions of end semester]	Distribution of unit
Module A/Group A	Unit I and II
Module B/Group B	Unit III and V
Module C /Group C	Unit IV

Course Content:

Unit – I Introduction

- Definition of solid waste, different solid waste – domestic Waste, commercial waste, industrial waste, market waste, agricultural waste, biomedical waste, E-waste, hazardous waste, institutional waste, etc.

- Sources of solid waste, Classification of solid waste – hazardous and non- hazardous waste.
- Composition of municipal solid waste.

Unit- II Storage, Collection and Transportation of Municipal Solid Waste

- Collection, segregation, storage and transportation of solid waste.
- Tools and Equipment-Litter Bin, Broom, Shovels, Handcarts, Mechanical road sweepers, Community bin - like movable and stationary bin.
- Transportation vehicles with their working capacity -Animal carts, Auto vehicles, Tractors or Trailers, Trucks, Dumpers, Compactor vehicles. Transfer station- meaning, necessity, location.
- Role of rag pickers and their utility for society.

Unit- III Composting of Solid Waste

- Concept of composting of waste, Principles of composting process. Factors affecting the composting process.
- Methods of composting – Manual Composting – Bangalore method, Indore Method, Mechanical Composting – Dano Process, Vermi composting.

Unit IV Techniques for Disposal of Solid Waste

- Solid waste management techniques – solid waste management hierarchy, waste prevention, waste reduction, reusing, recycling and materials recovery techniques (Only introduction)
- Land filling technique, Factors to be considered for site selection, Land filling methods-Area method, Trench method and Ramp method, Leachate and its control, Biogas from landfill, Advantages and disadvantages of landfill method, Recycling of municipal solid waste, Ill effects of unplanned solid waste dumping
- Incineration of waste: Introduction of incineration process, Types of incinerators – Flash, Multiple chamber Incinerators, Products of incineration process with their use, Pyrolysis of waste – Definition, Methods
 - Energy generation from Waste (elementary idea)

Unit- V Biomedical and E-waste management

- Definition of Bio medical Waste.
- Sources and generation of Biomedical Waste and its classification
- Bio medical waste Management technologies.
- Definition, varieties and ill effects of E- waste,
- Recycling and disposal of E- waste.

Suggested learning resources:

1. Gupta O.P, Elements of Solid Hazardous Waste Management, Khanna Book Publishing Co., Delhi Ed. 2018
2. Bhide, A. D., Solid Waste Management, Indian National Scientific Documentation Centre, New Delhi.
3. George Tchobanoglous, Kreith, Frank., Solid Waste, McGraw Hill Publication, New Delhi.
4. Sasikumar, K., Solid Waste Management, PHI learning, Delhi.
5. Hosetti, B.B., Prospect and Perspectives of Solid Waste Management, New Age International Publisher.
6. V. Rajaram, F.Z. Siddiqui, S. Agarwal, M. E. Khan, Solid and Liquid Waste Management, PHI learning, Delhi.

Course outcomes: After completing this course, student will be able to:

- Identify the sources of solid waste.
- Select the relevant method of collection and transportation of solid waste.
- Suggest an action plan for composting of solid waste.
- Devise suitable disposal technique for solid waste
- Use the relevant method for disposal of Bio-medical and E-waste.

Course Code	:	OE (OPEN ELECTIVE-II)
Course Title	:	Sustainable Architecture
Number of Classes	:	3(L-3,T-0,P-0)
Number of Credit	:	3
Prerequisites	:	NIL
Course offered in	:	6 th Semester
Course Duration	:	17 weeks
Course Category	:	OE
Full Marks	:	100
Students can choose any one subject for Open Elective-II from the list		

Course Objectives

- (i) develop energy conscious architectural design, strategies and built form
- (ii) understand futuristic vision of urban habitat

MODULAR DIVISION OF THE SYLLABUS

Module	Topic	Lecture
1	INTRODUCTION TO CONCEPTS OF SUSTAINABILITY	08
2	SUSTAINABLE ARCHITECTURE TECHNIQUES	16
3	GREEN BUILDINGS	15
4	GREEN BUILDING COUNCIL & RATING SYSTEMS	06
CONTACT PERIODS: 45 INTERNAL ASSESSMENTS: 4 TOTAL PERIODS: 51		

SEMESTER EXAMINATIONS SCHEME

MOD ULE	OBJECTIVE QUESTIONS				SUBJECTIVE QUESTIONS							
	PART A				PART B				PART C			
	TO BE SET	TO BE ANSWERE D	MARKS PER QUESTIO N	TOTAL MARK S	TO BE SE T	TO BE ANSWER ED	MARKS PER QUESTIO N	TOTA L MARK S	TO BE SE T	TO BE ANSWER ED	MARKS PER QUESTIO N	TOTA L MARK S
1	10	AnyTHIRTY	1	1x30=30	3	Any SIX	2	2x6=12	1	Any THREE	6	6x3=18
2	15				2				1			
3	10				3				2			
4	10				1				2			
MARKS ALLOTMENT												
SL.NO	INTERNAL ASSESSMENT						SEMESTER EXAM					
	TYPE				MARKS		QUESTION TYPE		MARKS			
1	Mid Semester Tests				20		Part 1		1x30=30			
2	Quizzes, Viva-voce,Assignments				10		Part 2		2X6=12			
3	ClassAttendance				10		Part 3		6X3=18			
Total Marks: 100												

SL.NO	INTERNAL ASSESSMENT		SEMESTER EXAM	
	TYPE	MARKS	QUESTION TYPE	MARKS
1	Mid Semester Tests	20	Part 1	1x30=30
2	Quizzes,Viva-voce,Assignments	10	Part 2	2X6=12
3	ClassAttendance	10	Part 3	6X3=18
Total Marks: 100				

DETAIL COURSE CONTENT

MODULE NO.	TOPIC	CONTENTS	CONTACT PERIODS
Module1	INTRODUCTION TO CONCEPTS OF SUSTAINABILITY	DEFINITION OF SUSTAINABILITY AND SUSTAINABLE ARCHITECTURE — THE NEED FOR SUSTAINABLE ARCHITECTURE: environmental, economic, and health and community THE PRINCIPLES OF SUSTAINABLE ARCHITECTURE: energy efficiency, waste management and environment friendly building materials and practices	08
Module2	SUSTAINABLE ARCHITECTURE TECHNIQUES	ELEMENTS OF SUSTAINABLE DESIGN: SITE PLANNING – building orientation and day lighting, BUILDING FORM – wind effects and ventilation, stack ventilation, wind tower, earth air tunnel, active and passive heating and cooling techniques, courtyard planning BUILDING ENVELOPE – double external wall skins, rat trap brick bonding, Trombe walls LANDSCAPING – green awnings, green roofs, grass paver tiles RENEWABLE ENERGY – solar panels, wind turbines, grey water recycling, rainwater harvesting, sustainable materials – bamboo, straw, wool brick, sustainable concrete, glazed windows (DEFINITIONS, USES AND EXAMPLES)	16
Module3	GREEN BUILDINGS	DEFINITION OF GREEN BUILDINGS – BENEFITS OF GREEN BUILDINGS – Environmental, Economic and Social (efficiency of structural design, energy, water, materials, and waste reduction) GREEN BUILDINGS IN INDIA – Shorabji Godrej Building Hyderabad, ITC Green Center Gurgaon, Infinity Benchmark Salt Lake Kolkata, Suzlon One Earth Pune, Biodiversity Conservation India Ltd Bangalore	15
Module 4	GREEN BUILDING COUNCIL & RATING SYSTEMS	INTERNATIONAL GREEN BUILDING RATING SYSTEM – LEED GREEN BUILDING RATING SYSTEMS IN INDIA – IGBC, GRIHA, ECBC (SCOPE AND SALIENT FEATURES)	06

REFERENCE BOOKS

1. Green from the Ground Up/ David Johnston and Scott Gibson
2. Green Building Illustrated/ Francis D.K. Ching and Ian M. Shapiro
3. Green Building Guidance : The Ultimate Guide for IGBC Accredited Professional Examination/ Karthik Karuppu
4. Natural Design, Organic Architecture: Lessons for Building Green/ Frank Lloyd Wright



West Bengal State Council of Technical & Vocational Education and Skill Development (Technical Education Division)

Course Title: Machine Learning		
Course Code	OE	
Number of Credits: 3 - L: 3, T: 0, P: 0		
Prerequisites	Concept of AI	
Course Category	PC	
Course code: CST	Semester: Sixth	
Duration: 15 weeks	Maximum Marks: 100	
Teaching Scheme	Examination Scheme	
Theory: 3 hrs./week Total Contact Hours: 45 Hours	Continuous Internal Assessment: 20 Marks Attendance: 10 Marks Viva/Presentation/Assignment/Quiz etc.: 10 Marks End Semester Examination: 60 Marks	
Aim of the Course		
This course will introduce the concept of Machine Learning through different learning methods.		
Course Objectives		
<ul style="list-style-type: none">• To learn the concept of how to learn patterns and concepts from data without being explicitly programmed• To design and analyze various machine learning algorithms and techniques with a modern outlook focusing on recent advances.• Explore supervised and unsupervised learning paradigms of machine learning.• To explore Neural Network and Genetic Algorithm.		
Course Content:		
Contents (Theory)	Hrs./Unit	Marks
Unit 1: Supervised Learning (Regression & Classification)	15	20
<ul style="list-style-type: none">❖ Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes❖ Linear models: Linear Regression, Logistic Regression, Generalized Linear Models❖ Introduction to Support Vector Machines, Nonlinearity and Kernel Methods		
Unit 2: Unsupervised Learning	7	10
<ul style="list-style-type: none">• Clustering: K-means/Kernel K-means• Dimensionality Reduction: PCA and kernel PCA• Matrix Factorization and Matrix Completion		



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UNIT 3: Artificial Neural Network	8	10	
<ul style="list-style-type: none">❖ Neural network representation❖ Perception❖ Multilayer Network and Back Propagation Algorithm❖ Illustrative Example: Face recognition			
UNIT 4: Genetic Algorithm	8	10	
<ul style="list-style-type: none">❖ Representing Hypotheses❖ Genetic Operators❖ Fitness Function and Selection❖ Hypothesis space search❖ Genetic Programming			
UNIT 5: Reinforcement Learning	7	10	
<ul style="list-style-type: none">❖ Introduction❖ The Learning Task❖ Q Learning❖ Temporal Difference Learning			
<ul style="list-style-type: none">❖ Note: Implementation of Machine Learning Algorithm by using suitable software can be done in Project work. Also seminar can be presented on topics of this subject.			
Course outcomes			
Student should be able to			
Sl. No.	Description	Bloom's Taxonomy Level	
1	Understand the concept of machine learning.	Knowledge, Understand	
2	Identify the regression and classification problem.	Analyze	
3	Relate the supervised, unsupervised learning in the real life problem.	Analyze	
4	Evaluate the machine learning models with respect to the performance parameters.	Analyze	
5	Design and implement various machine learning algorithms in the range of real world problems.	Design	
Reference Books:			
Name of Authors	Title of the Book	Edition	Name of the publisher
Tom M. Mitchell	Machine Learning	-	Mc Graw Hill
Christopher Bishop	Pattern Recognition and Machine Learning	-	Springer
Rajiv Chopra	Machine Learning	-	Khanna Publishing House
Christopher M. Bishop	Pattern Recognition and Machine	-	Springer



West Bengal State Council of Technical & Vocational Education and Skill Development (Technical Education Division)

	Learning		
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West Bengal State Council of Technical & Vocational Education and Skill Development (Technical Education Division)

Course Title: Web Designing			
Course Code	OE		
Number of Credits: 3 - L: 3, T: 0, P: 0			
Prerequisites	NIL		
Course Category	PC		
Course code: CST	Semester: Sixth		
Duration: 15 weeks	Maximum Marks: 100		
Teaching Scheme	Examination Scheme		
Theory: 3 hrs./week Total Contact Hours: 45 Hours	Continuous Internal Assessment: 20 Marks Attendance: 10 Marks Viva/Presentation/Assignment/Quiz etc.: 10 Marks End Semester Examination: 60 Marks		
Aim of the Course			
This course will introduce the concepts of PHP frameworks, which gives a complete description about the principles, used, architectures, applications, design and implementation of web development concepts. After the completion of course, students will get hands on experience on various techniques of web development and will be able to design and develop a complete website.			
Course Objectives			
The objective of this course is to provide the necessary knowledge to design and develop dynamic, database-driven web applications using PHP version 5. Students will learn how to connect to any ODBC-compliant database, and perform hands on practice with a MySQL database to create database-driven HTML forms and reports etc. Students also learn how to configure PHP and Apache Web Server. Comprehensive lab exercises provide facilitated hands on practice crucial to develop competence web sites.			
Course Content:			
Contents (Theory)	Hrs./Unit	Marks	Module
UNIT 1:	7	12	A
<ul style="list-style-type: none">➤ Overview of PHP➤ Static vs. Dynamic Web Sites➤ Dynamic Content from Databases➤ Developing Dynamic Internet Applications➤ Client-Side Scripting vs. Server-Side Scripting➤ Overview of PHP Advantages and Capabilities➤ Configuring PHP.INI➤ PHP vs. ASP➤ Basic PHP➤ echo and print Statements➤ Comments in PHP➤ PHP Case Sensitivity➤ Defining variable and constant➤ PHP Data Types➤ PHP Operators			



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➤ Looping Constructs - while, do...while, for, for each			
UNIT 2:	5	10	A
<ul style="list-style-type: none">➤ Introduction to the Apache Web Server - What is Apache? - The main benefits / advantages - Apache Installation - Apache Virtual Host - Name-based Virtual Hosts - IP-based Virtual Hosts➤ PHP Functions - Introduction to Functions - User Defined Functions - Passing Arguments to Functions - Variable scope - Local and Global Scope - Passing Arguments by Reference - Returning Values from a Function - Using Include Files - The Require Statement - Dynamic Function Calls - Recursive Functions - Predefined PHP Functions➤ PHP Arrays - What is an Array? - Why do we use arrays? - Indexed Arrays - Associative Arrays - Multidimensional Arrays - Sorting Arrays in PHP - Array Functions➤ PHP MySQL Database and Forms			
UNIT 3:	10	10	B
<ul style="list-style-type: none">➤ What is MySQL? - Queries - PHP's Database APIs - Configuring PHP for Database Support - MySQL vs. Access - MySQL vs. SQL Server - Forms and Program - Insert Data Into - Insert Multiple Records Into MySQL - HTTP GET, POST, And Request methods - Insert Data From a Form Into a Database - PHP MySQL Select (Retrieving Data from Forms) - PHP MySQL The Where Clause - PHP MySQL Order By Keyword - PHP MySQL Update - PHP MySQL Delete - Looping through database - PHP Functions Specific to MySQL➤ Using Cookies with PHP - What is a Cookie? - How to Create a Cookie? - How to Retrieve a Cookie Value? - How to Delete a Cookie?➤ PHP Sessions - What is a PHP Session - Starting a PHP Session - Storing and Retrieve Session Variable - Session Unset - Destroy A PHP Session➤ Miscellaneous PHP Tasks - Error Logging - Using Environment Variables - PHP Redirect To Another URL - Getting IP Addresses from Visitors - PHP - Function preg_match()			
UNIT 4:	6	8	B
<ul style="list-style-type: none">➤ PHP File Handling - String Functions➤ E-Commerce Site - What is E-Commerce - E-commerce platforms on the market➤ SQL Injection - Introduction➤ PDO - Introduction➤ Introduction to Frameworks➤ Introduction to CMS (Content Management System) - WordPress➤ AJAX➤ Introduction to open Source CMF (Content management framework) - Codeigniter			
UNIT 5:	17	20	C
<ul style="list-style-type: none">➤ Introduction to Codeigniter - What is a PHP Framework - MVC Pattern - Why Should we use a PHP Framework? - When to use a PHP Framework? - What are the Best PHP Frameworks Available? - Codeigniter Overview - CodeIgniter Features - CodeIgniter Basic Concepts and Application Architecture - Installing Codeigniter - Basic Configuration Options - Database Configuration - CodeIgniter - Application Architecture - Directory Structure - CodeIgniter - MVC Framework - Application URL Structure			



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- Controller Introduction - Calling a Controller - Creating & Calling Constructor Method - Controller function - Interacting with views
- Views - Views- Introduction - Loading the View - Working with configuration layout - Creating custom layout - Controller variables and parameters - CodeIgniter URLs - Passing argument through url - Redirection - Form and Getting post data
- Models - Model Introduction - Creating Model Class - User defined function in model - Connecting to a Database - Automatic Connecting - Manual Connecting - Inserting Data to Database - Fetching data - Deleting data - Updating data
- Helpers - Helpers – Introduction - Array Helper, Cookie Helper, Date Helper, URL Helper, etc.. - Loading a Helper - Auto load Configuration
- Session Management - Initializing a Session - Add Session Data - To retrieve all session data - To remove all session data - Flashdata - Retrieve Flashdata
- Cookie Management

Course outcomes

Student should be able to

Sl. No.	Description	Bloom's Taxonomy Level
1	Understand the functionality of the various PHP syntax	Knowledge, Understand
2	Appreciate the strengths and limitations of PHP Frame Work	Apply, Create
3	Explain the analyzing techniques of CodeIgniter	Analyze
4	Describe different methodologies used in web Designing.	Analyze
5	Compare different approaches of web designing with various technologies. Develop different type of Web Application in 6 th Semester Project work.	Evaluating

Note: Development of Web-page can be done as Project work. Also seminar can be presented on topics of this subject.

Reference Books:

Name of Authors	Title of the Book	Edition	Name of the publisher
Ullman	PHP for the Web: Visual Quick-Start Guide	5th Edition	Pearson
Thomas Myer	Professional CodeIgniter		John Wiley & Sons
Welling	PHP and MySQL Web Development	5th Edition	Pearson
Robin Nixon	Learning Php, MySQL & JavaScript: A Step-By-Step Guide to Creating Dynamic Websites	Second 6 th Edition	SPD
Ray Harris	Murach's PHP & MySQL		SPD
Michael Morrison, Lynn Beighley	Head First PHP & MySQL		SPD



West Bengal State Council of Technical & Vocational Education and Skill Development (Technical Education Division)

	A Brain-Friendly Guide		
Dr. Poornima G. Naik, Dr. Girish R. Naik	PHP Coding with CodeIgniter - Hands-on Experience with CodeIgniter		Educreation Publishing

Unit No.	Unit Title	Group	Distribution of Theory Marks			
			R Level	U Level	A Level	Total
1.	Unit 1	A	4	6	2	12
2.	Unit 2	A	4	4	2	10
3.	Unit 3	B	4	2	4	10
4.	Unit 4	B	4	2	2	8
5.	Unit 5	C	4	6	10	20
	Total		20	20	20	60

Legends: R = Remember; U = Understand; A = Apply and above levels(Bloom's revised taxonomy)

COURSE: Energy and Environment Control in Metallurgical Industries

Course Code	OE II
Course Title	Energy and Environment Control in Metallurgical Industries
Number of Credits	2
Course offered in	Part - III, 6 th . Semester
Course Category	Open Elective – II
Hours / Week	2 (Lecture – 1 : Tutorial : 1) ; Total 15 weeks / Sem
Full Marks	100

Marks Distribution: Full Marks =100

Sl No	Internal assessment		End Semester Exam	
	Type	Marks	Question Type	Marks
1	Mid Semester Tests (Two best out of three)	20	Objective type questions carrying 1 mark for 20 questions(Qs) out of 25 Qs throughout the syllabus	1x20=20
2	Quizzes, viva-voce, Assignments	10	Question carrying 8 marks for 5 Qs out of 9 Qs .	8 x 5=40
3	Class Attendance	10		
	Total	40		60

Course Objectives:

Students will acquire knowledge, skill and attitude to have following attributes.

1. Gather concept about energy control and its importance
2. Understand about different energy considerations in metallurgical industries
3. Gather knowledge about energy audit
4. State about different processes of energy conservation and recovery

Course Outcomes (COs):**Subject: Energy and Environment Control in Metallurgical Industries****After successful completion of this course, the students will be able to:**

Course	Statement
MTPC304.1	Describe energy control and its importance
MTPC304.2	Explain different energy considerations in metallurgical industries
MTPC304.3	Describe energy audit and its importance.
MTPC304.4	Explain different processes of energy conservation and recovery.

UNIT WISE DIVISION OF THE SYLLABUS

UNIT	TOPIC	CONTACT PERIODS
1	Introduction	3
2	Energy consideration in metallurgical industries	9
3	Energy conservation and recovery	9
4	Energy audit	9
	Total =	30

Reference Books: -

1. Energy Management in Iron & Steel works - The Iron & Steel Institute, 1988.
2. New Energy Saving Technologies Operation Experience – I.I.S.I.
3. Statistics on Energy in Steel Industry – I.I.S.I.
4. Steel & Energy -- I.I.S.I.
5. National Seminar on Energy for Steel Industry, 23-29 Sep 1977, Rourkela, IIM.
6. National Seminar on Specific Energy Consumption in the Iron & Steel Industry, 10-12 Dec. 1982, Jamshedpur, IIM.
7. Seminar on Energy Conservation in Steel Industry, 14, Dec, 1991, :Bhilai IIM.
8. Symposium on Exploring - Alternative Source of Energy Conservation in Steel Industry, 14-15 Dec, 1984, Bhadravati, IIM.

DETAIL COURSE CONTENT

1.0 Introduction : 3 PERIODS

- 1.1 Concept of Energy control and auditing
- 1.2 Its importance in industries under present scenario, cost control
- 1.3 Concept of energy management

2.0 Energy consideration in metallurgical industries : 9 PERIODS

- 2.1 Energy consumption in Metallurgical Industries
- 2.2 Application of thermodynamic principles and energy balance
- 2.3 Different types of Fuels and their utility
- 2.4 Energy consumption in electrometallurgical extraction processes, Rolling mill, Forging shop, Blast furnace, Arc furnace, L-D furnace, Induction furnace, Cupola, Heat treatment furnace etc.

3.0 Energy conservation and recovery : 9 PERIODS

- 3.1 Concept of energy conservation
- 3.2 Different types & utility
- 3.3 Recovery processes

4.0 Energy audit : 9 PERIODS

- 4.1 Theory & concept of Energy audit & its management
- 4.2 Conventional and non-conventional energy sources, their utility

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Syllabus Network Security Management and Administration (Theory)

Course Title	Network Security Management and Administration (Open Elective-2)
Course Code:OE2	Semester: Sixth
Duration: Six Months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 48	Class Attendance: 10 Marks
Credit: 2.5	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	
Pre-Requisites: Familiarization with Network components such as Router, Switch, LAN, Firewall etc.) and Computer networking.	

Course Objectives:

- ❖ Introduction to network management and Administration.
- ❖ Introduction to network faults and troubleshooting.

Course Outcomes: The students will be able to –

- ❖ Describe the different types of network directory services.
- ❖ Know the network management and administration.
- ❖ Apply the different types of network technologies for internet connection.
- ❖ Troubleshoot and repair the network faults.

Course Content

Unit-1

5 hours

1. Introduction

1.1 Duties of the System Administrator Linux as well as other OS Administrator, Steps of Installing and Configuring Servers.

1.2 Planning the Network – describing the Topologies, planning and Implementing the Security.

Unit-2

20 hours

2. Network Services

- 2.1. Configuring Printer
- 2.2. TCP/IP Networking – Understanding Network Class, Configuring the Network, Exploring Directory Services and Remote Network Access.
- 2.3. The Network File System – NFS overview, Configure an NFS Server, Configure an NFS Client, NFS Security.
- 2.4. Network Related Jobs – Network Administrator, Network Engineer, Network Architecture / Designer, Other Network Related Jobs.
- 2.5. Directory Services - Define Directory Services, Definition of Novelle Directory, Windows NT domains, Microsoft's Active Directory, X500 Directory Access Protocol, Lightweight Directory Access Protocol, Forests, Trees, Roots and Leaves. Configuring Samba Server
- 2.6. Active Directory Architecture – Object Types, Object Naming, Canonical Names, LDAP Notation, Globally unique identifiers, User Principle Names, Domain, Trees & Forests.
- 2.7. Remote Network Access – Need of Remote Network Access, Public Switched Telephone Network, Integrated Services Digital Network, Digital Subscriber Line, CATV.
- 2.8. Virtual Private Network – VPN Protocols, Types of VPNs, VPN Clients, SSL VPNs

Unit-3

15 hours

3. Network Connection and Printing Services

- 3.1 Dynamic Host Configuration Protocol (DHCP) – DHCP Origins, Reverse Address Resolution Protocol (RARP), The Bootstrap Protocol (BOOTP), DHCP Objectives, IP Address Assignment, DHCP Architecture.
- 3.2 Introduction to Domain Name System(DNS) - DNS Objectives, Domain Naming, Top Level Domains, Second Level Domains, Sub domains, DNS Functions, Resource Records, DNS Name Resolution, Resolves, DNS Requests, Root Name Servers, Resolving a Domain Name, DNS Name Registration.
- 3.3 Understand Network Printing Concepts - Understand Network Printing Concepts, locally connected print devices, setting up local print devices, Shared print devices, Sharing Locally Attached Print Devices, Describe Windows Network Printing, and Add Print Wizard

Unit-4

9 hours

4. Implementation of Network

4.1 Designing Network – Accessing Network Needs, Applications, Users, Network Services, Security and Safety, Growth and Capacity Planning, Meeting Network, Needs – Choosing Network Type, Choosing Network Structure, Choosing Servers.

4.2 Configuring a Database Server

4.3 Creating VNC Server

4.4 Providing Additional Network Services – Configuring a Time Server, Providing a Caching Proxy Server.

4.5 Optimizing Network Services

Unit-5

9 hours

5. Administering Windows and Linux Server (The Basics)

5.1 Working with User Accounts - Adding a User, Modifying User Account, Deleting or Disabling a User Account.

5.2 Working with Windows Security Groups – Creating Group, Maintaining Group Membership.

5.3 Working with Shares – Understanding Share Security, Creating Shares, Mapping Drives

5.4 Administering Printer Shares – Setting up Network Printer,

Unit-6

6 hours

7. Troubleshooting and security of Network

7.1 Understanding the Problem – Troubleshooting, Segmenting the Problem, Isolating the Problem, Setting Priorities.

7.2 Troubleshooting Tools – Hardware Tools, Software Tools, Monitoring and Troubleshooting Tools

7.3 Internal Security – Account Security, File and Directory permissions, Practices and user education.

7.4 External Threats – Front Door threats, Back Door threats, Denial services threats, Viruses, worms and other Malicious codes

Text books:

Windows Portion:

1. Windows Server Security. A Technical Reference. Roberta Bragg. Addison-Wesley

Linux Portion:

2. Linux Administration Handbook. Second Edition. Evi Nemeth, Garth Snyder, Trent R. Hein. Prentice Hall

Reference Links:

- National Security Agency: <http://www.nsa.gov/>
- NIST, Computer Security Division, Computer Security Resource Center: <http://csrc.nist.gov/>
- Common Criteria for Information Technology Security Evaluation:
<http://www.commoncriteriaportal.org/>
- U.S. Department of Homeland Security: <http://www.dhs.gov/>
- ITU (International Telecommunication Union: <http://www.itu.int/>
- Internet Society (ISOC): <http://www.isoc.org/>
- The Internet Engineering Task Force (IETF): <http://www.ietf.org/>
- Internet Architecture Board (IAB): <http://www.iab.org/>
- International Organization for Standardization (ISO): <http://www.iso.org>
- IEEE Computer Society: <http://www.computer.org>
- Association for Computing Machinery (ACM): <http://www.acm.org/>
- USENIX: The Advanced Computing Systems Association: <http://www.usenix.org/>

Syllabus for Internet of Things (Theory)

Course Title	Internet of Things (Open Elective – 2)
Course Code: OE2- CFS 310	Semester: sixth
Duration: Six Months	Maximum Marks:100
Teaching Scheme	Examination Scheme
Theory: 3 hrs./week	Mid Semester Test: 20 Marks, Quizzes, Viva-voce, Assignment: 10 Marks
Total hours: 48	Class Attendance: 10 Marks
Credit: 2.5	End Semester Exam.: 60 Marks
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both internal assessment and end semester examination separately.	
Pre-Requisites: Networking and Communication Protocols	

Course Objectives:

- ❖ Internet of Things (IoT) is presently an important technology with wide ranging interest from Government, academia and industry. IoT cuts across different application domain verticals ranging from civilian to defence sectors which includes agriculture, space, health care, manufacturing, construction, water, mining, etc. Today it is possible to build different IoT solutions such as shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

Course Outcomes: After completion of the course students will be able to learn the following major themes:

- ❖ Gain a good understanding of various aspect of IoT.
- ❖ Gain detailed knowledge of some IoT tools.
- ❖ Develop basic implementation skills of IoT.
- ❖ Understand how connected devices work together to update other applications.
- ❖ Acquire knowledge to interface sensors and actuators with microcontroller based Arduino platform.
- ❖ Writing C programs in Arduino IDE .

Course Content

Unit-1

10 hours

1. Introduction to IoT

- 1.1. Fundamentals
- 1.2. Sensing
- 1.3. Actuation

Unit-2

10 hours

2. Networking

- 2.1 Basics of IoT Networking
- 2.2 Communication Protocols
- 2.3 Sensor networks

Unit-3

10 hours

3. Arduino Programming

- 3.1 Introduction to Arduino programming
- 3.2 Integration of Sensors/Actuators to Arduino

Unit-4

10 hours

4. Implementation

- 4.1 Implementation of IoT with Raspberry Pi
- 4.2 Data Handling Analytics

Unit-5

8 hours

5. Case Studies

- 5.1 Agriculture
- 5.2 Healthcare
- 5.3 Activity Monitoring

Text books:

1. Pethuru Raj and Anupama C. Raman, “The Internet of Things: Enabling Technologies, Platforms, and Use Cases”, CRC Press.
2. Dr. Jeeva Jose, “Internet of Things”, 2017, Khanna Publishing House.

Reference books:

1. Arshdeep Bahga and Vijay Madisetti, “Internet of Things: A Hands-on Approach” Universities Press.
2. Raj Kamal, “Internet of Things: Architecture and Design Principles”, McGraw Hill Education.

List of open Source software/learning Websites:

- https://nptel.ac.in/noc/individual_course.php?id=noc17-cs22.

Syllabus Network Security Management and Administration (Practical)

Course Title	Network Security Management and Administration Lab (Open Elective-2)				
Course Code: OE2-CFS320	Semester: Sixth				
Duration: Six Months	Maximum Marks:100				
Teaching Scheme	Continuous Assessment-60			End Semester Assessment-40	
Practical: 3 hrs./week Total hours: 48	Assignments (to be allotted)	Class Performance	Class Attendance	Assignment on the day of Viva-voce	Viva-voce (Before Board of Examiners)
Credit: 1.5	30	20	10	20	20
Pass Criterion: Students have to obtain at least 40% marks(pass marks) in both continuous assessment and end semester Assessment separately.					
Pre-Requisites: Familiarization with Network components such as Router, Switch, LAN, Firewall etc.) and Computer networking.					

List of Practical:

Installation: 10 Hours

1. Creating Windows Server/Linux Boot Disk
2. Installing Windows Server/Linux
3. Installing Active Directory
4. Create new Users & give the Permission
 - a) User and group administration
 - b) Creating and deleting users from the system
 - c) Modifying user's profile
 - d) Creating and deleting groups
 - e) Important system files related to user administration

Configuration 26 Hours

1. Configuring Linux as DHCP server
2. Configuring various clients for DHCP server (Windows & Linux)
3. Configure Network File Sharing Server
4. Mounting NFS exports on NFS clients
5. Configuring Apache Web Server
6. Configuring Apache for multiple sites using IP-based, port-based and name-based virtual hosting
7. Configuring FTP Server
8. Configuring SMTP services

9. Configuring POP3/IMAP service on Linux
10. Configuring samba to act as member server for Windows Network
11. Configuring samba service for file sharing with windows systems
12. Creating AD Objects
13. Setting up Local Print Device
14. Installing and Configuring a Network – Capable Print Device

Maintaining and Automation

8 Hours

1. Configure Backup and Disaster Recovery.
 - a. Introduction to various types of backup media
 - b. Backup and restoring data using dump / restore commands
 - c. Backup and restoring using tar and CPIO commands
2. Configure Logging and Monitoring
3. Automating Administrative Tasks

Project:

4 Hours

1. Group of four students prepare a mini report on Latest Networking Technology

Syllabus Internet of Things (Practical)

Course Title	Internet of Things Lab (Open Elective-2)				
Course Code: OE2-CFS322	Semester: Sixth				
Duration: Six months	Maximum Marks:100				
Teaching Scheme	Continuous Assessment-60			End Semester Assessment-40	
Practical: 3 hrs./week Total hours: 48	Assignments (to be allotted)	Class Performance	Class Attendance	Assignment on the day of Viva-voce	Viva-voce (Before Board of Examiners)
Credit: 1.5	30	20	10	20	20
Pass Criterion: Students have to obtain at least 40% marks (pass marks) in both continuous assessment and end semester Assessment separately.					
Pre-Requisites: Networking and Communication Protocols, Operating Systems, Concepts of Web Applications.					

Skills to be developed:

After completing the module, the learner will be able to:

- Understand how connected devices work together to update other applications.
- Acquire knowledge to interface sensors and actuators with microcontroller based Arduino platform.
- Writing C programs in Arduino IDE
- Understand the Communication between microcontroller and PC using serial communication.
- Build IoT based applications and understand how data flows between things.

List of Laboratory Experiments:

LAB-I:	Experiments based on Arduino Programming	12 Hours
LAB-II:	Experiments based on Raspberry Pi.	12 Hours
LAB-III:	Networking for Raspberry Pi	12 Hours
LAB-IV:	Mini projects (using Arduino/Raspberry Pi) on topics like: Earthquake detector, RGB color mixer, LED controller, Smoke detection with MQ-2 detector, Home automation, Water monitoring system, Voice controller air purifier, Contactless IoT doorbell, IoT temperature and mask scan entry etc.	12 Hours

Open Elective		
Name of the Subject : ECONOMIC POLICIES IN INDIA		
Course Code: OE II	Semester: Sixth	
Duration:: Seventeen weeks	Marks:100	
Theory: 3 hrs./week	Mid Semester Exam.: 20	
Tutorial: Nil hr./week	Attendance & Teacher’s Assessment: 10 +10	
Practical: Nil hrs./week	End Semester Exam.: 60	
Credit: 3		
Course Learning Objectives: The objective of this course is to familiarize the students of different streams with the basic concepts, structure, problems and issues concerning Indian economy.		
Course Outcomes: CO1: Understand Indian economics policy, planning strategies CO2:It will enable to students to comprehend theoretical and empirical development across countries and region for policy purposes CO3: Development Economics as a discipline encompasses different approaches to the problems of unemployment, poverty, income generation, industrialization from different perspectives CO4: Able to identify the problems and capable to decide the application for future development CO5: Analyze economic issues and find solutions to complex economic problems and take correct economic judgment		
Detail Course Content		
Unit:1 Basic features and problems of Indian Economy	<ul style="list-style-type: none">▪ Economic History of India▪ Nature of Indian Economy,▪ Planned Economy, Mixed Economy (changes since 1991)▪ Demographic features and Human Development Index▪ Problems of Poverty▪ Unemployment,▪ Inflation,▪ Income inequality▪ Black money in India.	Periods:10
Unit:2 Agriculture	<ul style="list-style-type: none">▪ Issues in Agriculture sector in India▪ Components of Green Revolutions▪ Impact of Green Revolutions▪ Food Management(Minimum Support Price, Procurement Price, Issue Price, Farm Subsidies)▪ PDS & Food Subsidy▪ Agricultural Credits and it’s impact on Farmers	Periods:10
Unit : 3 Industrial Policies	<ul style="list-style-type: none">▪ A brief review of Industrial Policies up to 1980▪ New Industrial Policy 1991▪ Disinvestment, Types of Disinvestment, Current Disinvestment Policy▪ FDI Policy Measures▪ Make in India.	Periods:10

Unit : 4 Recent trends in Fiscal and Monetary Policies in India	<ul style="list-style-type: none"> ▪ What is Monetary Policy? What is Fiscal Policy? Difference between Monetary & Fiscal Policy. ▪ Recent trends in Fiscal and Monetary Policies in India 	Periods:5
Unit : 5 External sector in India	<ul style="list-style-type: none"> ▪ Description ▪ Forex Reserves ▪ External Debt ▪ Fixed Currency Regime ▪ Floating Currency Regime ▪ Foreign Exchange Market ▪ Trade Balance, BOP ▪ India's External Performance 	Periods:5
Unit : 6 Service Sector	<ul style="list-style-type: none"> ▪ Importance of Service Sector ▪ Manufacturing Vs. Service ▪ Trade in Service ▪ Different types of services <ul style="list-style-type: none"> - Consultancy Services - Space Services - R&D Services 	Periods:5
Contact Periods : 45 Internal Assessment : 6 Total Periods : 51		

Reference Books:

1. Dutt Rudder and K.P.M Sunderam (2017). Indian Economy. S Chand & Co. Ltd. New Delhi.
2. Mishra S.K & V.K Puri (2017). Indian Economy and –Its Development Experience. Himalaya Publishing House.
3. Singh, Ramesh, (2016): Indian Economy, Tata-McGraw Hill Publications, New Delhi.
4. Dhingra, I.C., (2017): March of the Indian Economy, Heed Publications Pvt. Ltd.
5. Karam Singh Gill, (1978): Evolution of the Indian Economy, NCERT, New Delhi
6. Kaushik Basu (2007): The Oxford Companion to Economics of India, Oxford University Press.