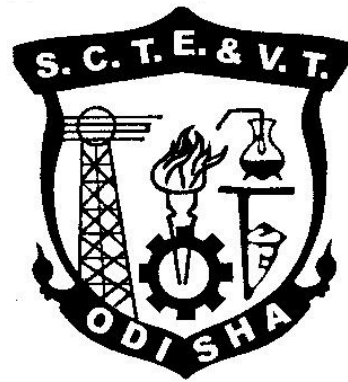


CURRICULLUM OF 5TH SEMESTER

For

DIPLOMA IN MECHANICAL ENGINEERING

(Effective FROM 2020-21 Sessions)



STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING,

ODISHA, BHUBANESWAR

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 5th Semester (Mechanical.) (wef 2020-21)									
Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Entrepreneurship and Management & Smart Technology	4		-	20	80	3	100
Th.2		Design of Machine elements	4		-	20	80	3	100
Th.3		Hydraulic Machines & Industrial Fluid Power	4		-	20	80	3	100
Th.4		Mechatronics	4			20	80	3	100
Th.5		Refrigeration and air-conditioning	4			20	80	3	100
		<i>Total</i>	20			100	400	-	500
		Practical							
Pr.1		Refrigeration and Air conditioning lab	-	-	4	25	50	3	75
Pr.2		Hydraulic machines & Industrial Fluid power lab	-	-	4	25	50	3	75
Pr.3		CAD/CAM LAB	-	-	4	25	50	3	75
Pr.4		Project Work Phase -I		-	4	25	-	-	25
		Student Centered Activities (SCA)			3				
		<i>Total</i>	-	-	19	100	150	-	250
		Grand Total	20	-	19	200	550	-	750
Abbreviations: L-Lecturer, T-Tutorial, P-Practical. Each class is of minimum 55 minutes duration									
Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%									
SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.									
There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester									

Th1. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY

(Common to All Branches)

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	TOTAL	60

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0

In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.

OBJECTIVES

After undergoing this course, the students will be able to :

- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies
- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

DETAILED CONTENTS

1. **Entrepreneurship**
 - Concept /Meaning of Entrepreneurship
 - Need of Entrepreneurship
 - Characteristics, Qualities and Types of entrepreneur, Functions
 - Barriers in entrepreneurship
 - Entrepreneurs vrs. Manager
 - Forms of Business Ownership: Sole proprietorship, partnership forms and others
 - Types of Industries, Concept of Start-ups
 - Entrepreneurial support agencies at National, State, District Level(Sources): DIC, NSIC,OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
 - Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks
2. **Market Survey and Opportunity Identification (Business Planning)**
 - Business Planning
 - SSI, Ancillary Units, Tiny Units, Service sector Units
 - Time schedule Plan, Agencies to be contacted for Project Implementation
 - Assessment of Demand and supply and Potential areas of Growth
 - Identifying Business Opportunity
 - Final Product selection
3. **Project report Preparation**
 - Preliminary project report
 - Detailed project report, Techno economic Feasibility
 - Project Viability
4. **Management Principles**
 - Definitions of management
 - Principles of management
 - Functions of management (planning, organising, staffing, directing and controlling etc.)
 - Level of Management in an Organisation
5. **Functional Areas of Management**
 - a) Production management
 - Functions, Activities
 - Productivity
 - Quality control
 - Production Planning and control
 - b) Inventory Management
 - Need for Inventory management
 - Models/Techniques of Inventory management
 - c) Financial Management
 - Functions of Financial management
 - Management of Working capital
 - Costing (only concept)
 - Break even Analysis
 - Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)
 - d) Marketing Management
 - Concept of Marketing and Marketing Management
 - Marketing Techniques (only concepts)
 - Concept of 4P s (Price, Place, Product, Promotion)
 - e) Human Resource Management
 - Functions of Personnel Management
 - Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages
6. **Leadership and Motivation**
 - a) Leadership

- Definition and Need/Importance
- Qualities and functions of a leader
- Manager Vs Leader
- Style of Leadership (Autocratic, Democratic, Participative)

b) **Motivation**

- Definition and characteristics
- Importance of motivation
- Factors affecting motivation
- Theories of motivation (Maslow)
- Methods of Improving Motivation
- Importance of Communication in Business
- Types and Barriers of Communication

7. **Work Culture, TQM & Safety**

- Human relationship and Performance in Organization
- Relations with Peers, Superiors and Subordinates
- TQM concepts: Quality Policy, Quality Management, Quality system
- Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)

8. **Legislation**

- Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
- Features of Factories Act 1948 with Amendment (only salient points)
- Features of Payment of Wages Act 1936 (only salient points)

9. **Smart Technology**

- Concept of IOT, How IOT works
- Components of IOT, Characteristics of IOT, Categories of IOT
- Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

Syllabus to be covered before IA: Chapter 1,2,3,4

RECOMMENDED BOOKS

- Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
- Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
- Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
- Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
- Industrial Engineering and Management by Banga and Sharma, Khanna Publications
- Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
- Online Resource on Startups and other concepts
- <https://www.fundable.com/learn/resources/guides/startup>

TH.2 DESIGN OF MACHINE ELEMENTS

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	5 th
Total Period:	60	Examination	3 hrs.
Theory periods:	4 P/W	I.A:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Machine design is the art of planning or devising new or improved machines to accomplish specific purposes. Idea of design is helpful in visualizing, specifying and selection of parts and components which constitute a machine. Hence all mechanical engineers should be conversant with the subject.

B. COURSE OBJECTIVES

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

1. Understanding the behaviours of material and their uses.
2. Understanding the design of various fastening elements and their industrial uses.
3. Understanding the different failures of design elements.
4. Understanding the change of design to accomplish the different field of applications.
5. Design shafts, keys, couplings required for power transmission.
6. Design closed coil helical spring

C. CHAPTER WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods
01	INTRODUCTION	12
02	DESIGN OF FASTENING ELEMENTS	12
03	DESIGN OF SHAFT AND KEYS	12
04	DESIGN OF COUPLING	12
05	DESIGN OF CLOSED COIL HELICAL SPRING	12
TOTAL		60

D. COURSE CONTENTS

1.0 Introduction:

- 1.1 Introduction to Machine Design and Classify it.
- 1.2 Different mechanical engineering materials used in design with their uses and their mechanical and physical properties.
- 1.3 Define working stress, yield stress, ultimate stress & factor of safety and stress –strain curve for M.S & C.I.
- 1.4 Modes of Failure (By elastic deflection, general yielding & fracture)
- 1.5 State the factors governing the design of machine elements.
- 1.6 Describe design procedure.

2.0 Design of fastening elements:

- 2.1 Joints and their classification.
- 2.2 State types of welded joints .
- 2.3 State advantages of welded joints over other joints.
- 2.4 Design of welded joints for eccentric loads.
- 2.5 State types of riveted joints and types of rivets.
- 2.6 Describe failure of riveted joints.
- 2.7 Determine strength & efficiency of riveted joints.
- 2.8 Design riveted joints for pressure vessel.
- 2.9 Solve numerical on Welded Joint and Riveted Joints.

3.0 Design of shafts and Keys:

- 3.1 State function of shafts.
- 3.2 State materials for shafts.
- 3.3 Design solid & hollow shafts to transmit a given power at given rpm based on
 - a) Strength: (i) Shear stress, (ii) Combined bending tension;
 - b) Rigidity: (i) Angle of twist, (ii) Deflection, (iii) Modulus of rigidity
- 3.4 State standard size of shaft as per I.S.
- 3.5 State function of keys, types of keys & material of keys.
- 3.6 Describe failure of key, effect of key way.
- 3.7 Design rectangular sunk key considering its failure against shear & crushing.
- 3.8 Design rectangular sunk key by using empirical relation for given diameter of shaft.
- 3.9 State specification of parallel key, gib-head key, taper key as per I.S.
- 3.10 Solve numerical on Design of Shaft and keys.

4.0 Design of Coupling:

- 4.1 Design of Shaft Coupling
- 4.2 Requirements of a good shaft coupling
- 4.3 Types of Coupling.
- 4.4 Design of Sleeve or Muff-Coupling.
- 4.5 Design of Clamp or Compression Coupling.
- 4.6 Solve simple numerical on above.

5.0 Design a closed coil helical spring:

- 5.1 Materials used for helical spring.
- 5.2 Standard size spring wire. (SWG).
- 5.3 Terms used in compression spring.
- 5.4 Stress in helical spring of a circular wire.
- 5.5 Deflection of helical spring of circular wire.
- 5.6 Surge in spring.
- 5.7 Solve numerical on design of closed coil helical compression spring.

Syllabus covered up to I.A-Chapters 1,2 &3

LEARNING RESOURCES

SL.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER
01	PANDYA AND SHAH	MACHINE DESIGN	CHAROTAR PP
02	R.S.KHURMI &J.K.GOPTA	A TEXT BOOK OF MACHINE DESIGN	S.CHAND
03	P.C.SHARMA &D.K AGRAWAL	A TEXT BOOK OF MACHINE DESIGN	S.K.KATARIYA
04	V.B.BHANDARI	DESIGN OF MACHINE ELEMENTS	TMH
05	S.MD.JALAUDEEN	DESIGN DATA BOOK	ANURADHA PUBLICATION

TH.3 HYDRAULIC MACHINES & INDUSTRIAL FLUID POWER

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	5 TH
Total Period:	60	Examination	3 hrs.
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Use of fluids can be realized by a group of machines called hydraulic machine and use of hydraulic control and pneumatic control system in automation and in earth movers.

B. COURSE OBJECTIVES:

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

1. Distinguish the working principle of pumps and turbines
2. Explain the working of centrifugal pumps and gear pumps.
3. Compare pneumatic system with hydraulic system.
4. Draw pneumatic circuits for industrial application.
5. State the properties of hydraulic system.
6. Develop hydraulic circuit for machine tool operation.

C. CHAPTERWISE DISTRIBUTION OF PERIODS.

SL.NO	TOPICS	PERIODS
01	HYDRAULIC TURBINES	15
02	CENTRIFUGAL PUMPS	05
03	PNEUMATIC SYSTEM	20
04	HYDRAULIC SYSTEM	20
	TOTAL	60

D. COURSE CONTENTS

1.0 HYDRAULIC TURBINES.

- 1.1 Definition and classification of hydraulic turbines
- 1.2 Construction and working principle of impulse turbine.
- 1.3 Velocity diagram of moving blades, work done and derivation of various efficiencies of impulse turbine.
- 1.4 Velocity diagram of moving blades, work done and derivation of various efficiencies of Francis turbine.
- 1.5 Velocity diagram of moving blades, work done and derivation of various efficiencies of Kaplan turbine

- 1.6 Numerical on above
- 1.7 Distinguish between impulse turbine and reaction turbine.

2.0 CENTRIFUGAL PUMPS

- 2.1 Construction and working principle of centrifugal pumps
- 2.2 work done and derivation of various efficiencies of centrifugal pumps.
- 2.3 Numerical on above

3.0 RECIPROCATING PUMPS

-
- 3.1 Describe construction & working of single acting reciprocating pump.
- 3.2 Describe construction & working of double acting reciprocating pump.
- 3.3 Derive the formula for power required to drive the pump (Single acting & double acting)
- 3.5 Define slip.
- 3.5 State positive & negative slip & establish relation between slip & coefficient of discharge.
- 3.6 Solve numerical on above

4.0 PNEUMATIC CONTROL SYSTEM

- 4.1 Elements –filter-regulator-lubrication unit
- 4.2 Pressure control valves

- 4.2.1 Pressure relief valves
- 4.2.2 Pressure regulation valves

- 4.3 Direction control valves

- 4.3.1 3/2DCV, 5/2 DCV, 5/3DCV
- 4.3.2 Flow control valves
- 4.3.3. Throttle valves

- 4.4 ISO Symbols of pneumatic components

- 4.5. Pneumatic circuits

- 4.5.1 Direct control of single acting cylinder
- 4.5.2 Operation of double acting cylinder
- 4.5.3 Operation of double acting cylinder with metering in and metering out control

5.0 HYDRAULIC CONTROL SYSTEM

- 5.1 Hydraulic system, its merit and demerits

- 5.2 Hydraulic accumulators

- 5.3.1 Pressure control valves
- 5.3.2 Pressure relief valves
- 5.3.3 Pressure regulation valves

- 5.3 Direction control valves

- 5.3.1 3/2DCV, 5/2 DCV, 5/3DCV
- 5.3.2 Flow control valves
- 5.3.3 Throttle valves

5.4 Fluid power pumps

5.4.1 External and internal gear pumps

5.4.2 Vane pump

5.4.3 Radial piston pumps

5.5 ISO Symbols for hydraulic components.

5.6 Actuators

5.7 Hydraulic circuits

5.7.1 Direct control of single acting cylinder

5.7.2 Operation of double acting cylinder

5.7.3 Operation of double acting cylinder with metering in and metering out control

5.8 Comparison of hydraulic and pneumatic system

Syllabus to be covered up to I.A –CHAPTER 1.,2, &3

LEARNING RESOURCES

SL.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER
01	DR.JAGDISH LAL	HYDRAULIC MACHINES	METROPOLITAN BOOK CO
02	ANDREW	HYDRAULICS	
03	K SHANMUGA, SUNDARAM	HYDRAULIC &PNEUMATIC CONTROL	S.CHAND
04	MAJUMDAR	HYDRAULIC &PNEUMATIC CONTROL	TMH
05	J.F. BLACKBURN, G.REETHOF &J.L SHEARER	FLUID POWER CONTROL	

TH.4 MECHATRONICS

Name of the Course: Diploma in Mechanical Engg.			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs.
Theory periods:	4 P/W	I.A:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Day by day, engineering and technology experiences a tremendous growth. Mechatronics plays a major role in developing engineering and technology. It can be defined as the applications of electronics and computer technology to control the motions of mechanical systems. With the help of microelectronics and sensor technology, mechatronics systems are providing high levels of precision and reliability.

B. COURSE OBJECTIVES:

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

1. To study the definition and elements of mechatronics system.
2. To learn how to apply the principle of mechatronics for the development of productive systems.
3. To learn the CNC technology and applications of mechatronics in manufacturing automation.
4. Define different type of system and Sensors and solve the simple problems.
5. Explain the concept of Mechanical actuation, Electrical actuation and solve the simple problems.
6. Find out the various types of System Models & Input /Output parts and solve the problems.
7. Describe the programmable Logic Controller and develop programme in PLC.
8. To learn the Industrial robotics

C. CHAPTERWISE DISTRIBUTION OF PERIODS

Sl No.	Topic	Periods
01	Introduction to Mechatronics	05
02	Sensors and Transducers	10
03	Actuators-Mechanical, Electrical	10
04	Programmable logic controllers	15
05	Elements of CNC Machines	15
06	Robotics	05

D.COURSE CONTENTS

1.0 INTRODUCTION TO MECHATRONICS

- 1.1 Definition of Mechatronics
- 1.2 Advantages & disadvantages of Mechatronics
- 1.3 Application of Mechatronics
- 1.4 Scope of Mechatronics in Industrial Sector
- 1.5 Components of a Mechatronics System
- 1.6 Importance of mechatronics in automation

2.0 SENSORS AND TRANSDUCERS

- 2.1 Definition of Transducers
- 2.2 Classification of Transducers
- 2.3 Electromechanical Transducers
- 2.4 Transducers Actuating Mechanisms
- 2.5 Displacement & Positions Sensors
- 2.6 Velocity, motion, force and pressure sensors.
- 2.7 Temperature and light sensors.

3.0 ACTUATORS-MECHANICAL, ELECTRICAL

- 3.1 Mechanical Actuators
 - 3.1.1 Machine, Kinematic Link, Kinematic Pair
 - 3.1.2 Mechanism, Slider crank Mechanism
 - 3.1.3 Gear Drive, Spur gear, Bevel gear, Helical gear, worm gear
 - 3.1.4 Belt & Belt drive
 - 3.1.5 Bearings
- 3.2 Electrical Actuator
 - 3.2.1 Switches and relay
 - 3.2.2 Solenoid
 - 3.2.3 D.C Motors
 - 3.2.4 A.C Motors
 - 3.2.5 Stepper Motors
 - 3.2.6 Specification and control of stepper motors
 - 3.2.7 Servo Motors D.C & A.C

4.0 PROGRAMMABLE LOGIC CONTROLLERS(PLC)

- 4.1 Introduction
- 4.2 Advantages of PLC
- 4.3 Selection and uses of PLC
- 4.4 Architecture basic internal structures
- 4.5 Input/output Processing and Programming
- 4.6 Mnemonics
- 4.7 Master and Jump Controllers

5.0 ELEMENTS OF CNC MACHINES

5.1 Introduction to Numerical Control of machines and CAD/CAM

5.1.1 NC machines

5.1.2 CNC machines

5.1.3.CAD/CAM

5.1.3.1 CAD

5.1.3.2 CAM

5.1.3.3 Software and hardware for CAD/CAM

5.1.3.4 Functioning of CAD/CAM system

5.1.3.4 Features and characteristics of CAD/CAM system

5.1.3.5 Application areas for CAD/CAM

5.2 elements of CNC machines

5.2.1 Introduction

5.2.2 Machine Structure

5.2.3 Guideways/Slide ways

5.2.3.1 Introduction and Types of Guideways

5.2.3.2 Factors of design of guideways

5.2.4 Drives

5.2.4.1 Spindle drives

5.2.4.2 Feed drive

5.2.5 Spindle and Spindle Bearings

6.0 ROBOTICS

6.1 Definition, Function and laws of robotics

6.2Types of industrial robots

6.3 Robotic systems

6.4 Advantages and Disadvantages of robots

Syllabus to be covered up to 1st I.A : Chapters 1,2,3 & 4

LEARNING RESOURCES:

SL.NO.	AUTHOR	TITLE OF THE BOOK	PUBLISHER
1	W. Bolton	Mechatronics	Pearson Education India
2	R.K Rajput	Text book of Mechatronics	S. Chand
3	R. RADHAKRISHNA, S,SUBRAMANIAN	CAD/CAM/CIM	NEW AGE INTERNATIONAL PVT.LTD
4	MIKELL GROVER	CAD/CAM	

Th.5 REFRIGERATION AND AIR CONDITIONING

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	5 th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	I.A:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Food Preservation is the basic need of food industry to improve effective utilization of food. Hence the study of Refrigeration and Air-conditioning is essential. Comfort is the basic requirement of customers and machines through air conditioning & hence learning the concept of air-conditioning and methods of air-conditioning facilities quality design of air conditioning.

B. COURSE OBJECTIVE:

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

- 1.Explain the working of open & closed air system of air refrigeration system
- 2.Describe the working and construction of compressor, Condenser, evaporator, expansion valve used for air conditioning and refrigeration.
- 3.Explain Vapor Compression refrigeration system.
- 4.Explain Vapor Absorption refrigeration system.
- 5.Compare different refrigerants properties.
- 6.Describe equipment for air conditioning.
- 7.Explain the cooling load for the given requirement.

C. CHAPTER WISE DISTRIBUTION OF PERIODS

Sl.No.	Topic	Periods
01	AIR REFRIGERATION CYCLE	05
02	SIMPLE VAPOUR COMPRESSION REFRIGERATION SYSTEM	10
03	VAPOUR ABSORPTION REFRIGERATION SYSTEM	07
04	REFRIGERATION EQUIPMENTS	08
05	REFRIGERANT FLOW CONTROLS, REFRIGERANTS & APPLICATION OF REFRIGERANTS	10
06	PSYCHOMETRICS & COMFORT AIR CONDITIONING SYSTEMS	10
07	AIR CONDITIONING SYSTEMS	10
	TOTAL	60

D.COURSE CONTENTS

1.0 AIR REFRIGERATION CYCLE.

- 1.1 Definition of refrigeration and unit of refrigeration.
- 1.2 Definition of COP, Refrigerating effect (R.E)
- 1.3 Principle of working of open and closed air system of refrigeration.
 - 1.3.1 Calculation of COP of Bell-Coleman cycle and numerical on it.

2.0 SIMPLE VAPOUR COMPRESSION REFRIGERATION SYSTEM

- 2.1 schematic diagram of simple vapors compression refrigeration system'
- 2.2 Types
 - 2.2.1 Cycle with dry saturated vapors after compression.
 - 2.2.2 Cycle with wet vapors after compression.
 - 2.2.3 Cycle with superheated vapors after compression.
 - 2.2.4 Cycle with superheated vapors before compression.
 - 2.2.5 Cycle with sub cooling of refrigerant
- 2.2.6 Representation of above cycle on temperature entropy and pressure enthalpy diagram
- 2.2.7 Numerical on above (determination of COP, mass flow)

3.0 VAPOUR ABSORPTION REFRIGERATION SYSTEM

- 3.1 Simple vapor absorption refrigeration system
- 3.2 Practical vapor absorption refrigeration system
- 3.3 COP of an ideal vapor absorption refrigeration system
- 3.4. Numerical on COP.

4.0 REFRIGERATION EQUIPMENTS

4.1 REFRIGERANT COMPRESSORS

- 4.1.1 Principle of working and constructional details of reciprocating and rotary compressors.
- 4.1.2 Centrifugal compressor only theory
- 4.1.3 Important terms.
- 4.1.4 Hermetically and semi hermetically sealed compressor.

4.2 CONDENSERS

- 4.2.1 Principle of working and constructional details of air cooled and water cooled condenser
- 4.2.2 Heat rejection ratio.
- 4.2.3 Cooling tower and spray pond.

4.3 EVAPORATORS

- 1.6.1 Principle of working and constructional details of an evaporator.
- 1.6.2 Types of evaporator.
- 1.6.3 Bare tube coil evaporator, finned evaporator, shell and tube evaporator.

5.0 REFRIGERANT FLOW CONTROLS, REFRIGERANTS & APPLICATION OF REFRIGERANTS

5.1 EXPANSION VALVES

- 5.1.1 Capillary tube
- 5.1.2 Automatic expansion valve
- 5.1.3 Thermostatic expansion valve

5.2 REFRIGERANTS

- 5.2.1 Classification of refrigerants
- 5.2.2 Desirable properties of an ideal refrigerant.
- 5.2.3 Designation of refrigerant.
- 5.2.4 Thermodynamic Properties of Refrigerants.
- 5.2.5 Chemical properties of refrigerants.
- 5.2.6 commonly used refrigerants, R-11, R-12, R-22, R-134a, R-717
- 5.2.7 Substitute for CFC
- 5.3 Applications of refrigeration
 - 5.3.1 cold storage
 - 5.3.2 dairy refrigeration
 - 5.3.3 ice plant
 - 5.3.4 water cooler
 - 5.3.5 frost free refrigerator

6.0 PSYCHOMETRICS & COMFORT AIR CONDITIONING SYSTEMS

- 6.1 Psychometric terms
- 6.2 Adiabatic saturation of air by evaporation of water
- 6.3 Psychometric chart and uses.
- 6.4 Psychometric processes
 - 6.4.1 Sensible heating and Cooling
 - 6.4.2 Cooling and Dehumidification
 - 6.4.3 Heating and Humidification
 - 6.4.4 Adiabatic cooling with humidification
 - 6.4.5 Total heating of a cooling process
 - 6.4.6 SHF, BPF,
 - 6.4.7 Adiabatic mixing
 - 6.4.8 Problems on above.
- 6.5 Effective temperature and Comfort chart

7.0 AIR CONDITIONING SYSTEMS

- 7.1 Factors affecting comfort air conditioning. .
- 7.2 Equipment used in an air-conditioning.
- 7.3 Classification of air-conditioning system
- 7.4 Winter Air Conditioning System
- 7.5 Summer air-conditioning system.
- 7.6 Numerical on above

Syllabus to be covered up to I.A- Chapters 1.2&3.

LEARNING RESOURCES

SL.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHER
01	C.P ARRORA	REFRIGERATION AND AIR CONDITIONING	TMH
02	R.S.KHURMI &J.K.GOPTA	REFRIGERATION AND AIR CONDITIONING	S.CHAND
03	P.L BALLANY	REFRIGERATION AND AIR CONDITIONING	KHANNA PUBLISHER
04	DOMKUNDRA AND ARORA	REFRIGERATION AND AIR CONDITIONING	DHANPAT RAY AND SONS

Pr.1 REFRIGERATION AND AIR CONDITIONING LAB

Name of the Course: Diploma in Mechanical Engg.			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Sessional:	25
Maximum marks:	100	End Semester Examination:	50

COURSE OBJECTIVES

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

1. Study the construction features of Domestic Refrigerator, water cooler, Window Air Conditioner, Split Air Conditioner
2. Determining the capacity, COP, of Refrigerator Test Rig, Window air Conditioner, Split Air Conditioner, Water cooler.
3. Evacuating the entire system
4. Locating the leakage in refrigerating system
5. Charging of the refrigerating system

List of Practicals

1. Study the construction features of Domestic Refrigerator.
2. Study the construction features of water cooler.
3. Study the construction features of window air conditioner
4. Study the construction features of split air conditioner
5. Determine the capacity and cop of vapour compression Refrigerator test rig
6. Determine the capacity and cop of water cooler
7. Determine the capacity and cop of window air conditioner
8. Determine the capacity and cop of split air conditioner
9. Determine the capacity and cop of vapour absorption Refrigerator test rig.
10. Complete charging of a domestic refrigerator and its leak test.

Pr 2. HYDRAULIC MACHINES & INDUSTRIAL FLUID POWER LAB

Name of the Course: Diploma in Mechanical Engg.			
Course code:		Semester	5th
Total Period:	60	Examination	3 hrs.
Theory periods:	4 P/W	Sessional:	25
Maximum marks:	100	End Semester Examination:	50

COURSE OBJECTIVES

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

- 1.0 Conducting performance test on impulse and reaction turbine
- 2.0 Conducting performance test on centrifugal pump
- 3.0 Designing & operating pneumatic circuits
- 4.0 Designing & operating industrial fluid power circuits

List of Practicals

- 1.0 Performance test on impulse turbine and to find out the efficiency
- 2.0 Performance test on Kaplan turbine and to find out the efficiency
- 3.0 Performance test on Francis turbine and to find out the efficiency
- 4.0 Performance test on centrifugal pump and to find out the characteristic curves
- 5.0 Direct operation of single & double acting pneumatic cylinder.
- 6.0 Operating double acting pneumatic cylinder with quick exhaust valve
- 7.0 Speed control double acting pneumatic cylinder using metering in and metering out circuits.
- 8.0 Direct operation of single & double acting hydraulic cylinder
- 9.0 Direct operation of hydraulic motor
- 10.0 Speed control double acting hydraulic cylinder using metering in & metering out circuits.

Pr.3 CAD/CAM LAB

Name of the Course: Diploma in Mechanical Engg.			
Course code:		Semester	5th
Total Period:	60	Examination	3 Hrs
Theory periods:	4 P/W	Sessional:	25
Maximum marks:	75	End Semester Examination:	50

OBJECTIVES

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

- 1.To understand the fundamentals and use of CAD.
- 2.To conceptualize drafting and modelling in CAD.
- 3.To interpret the various features in the menu of solid modelling package.
- 4.To synthesize various parts or components in an assembly.
- 5.Toprepare CNC programmes for various jobs

COURSE CONTENTS

PART-A.

INTRODUCTION:

Part modelling, Datum plane, Datum plane; constraint; dimensioning; extrude; revolve; sweep; protrusion; extrusion; rib; shell; hole; round; chamfer; copy; mirror; assembly; align; orient.

EXERCISES:

2D Drawings of Rectangle, circle, polygon and its dimensioning

3D Drawings of;

- 1.Gib and cutter joint
- 2.Screw Jack;
- 3.Connecting Rod;
- 4.Bearing Block.

Print the orthographic view from the above assembled 3Ddrawing

PART-B.

CNC Programming and Machining

INTRODUCTION;

- 1.Study of CNC lathe, milling;
- 2.Study of international codes; G-Codes and M –Codes
- 3.Format –Dimensioning methods;
- 4.Programme writing –Turning Simulator-Milling simulator IS practice-commands menus
- 5.Editing the programme in the CNC MACHINES;
- 6.Execute the programme in the CNC machines;

Exercise;

1. Print the programme and make the component in the CNC machine;
- 2.Using canned cycle-create a part programme for thread cutting, grooving and produce component in the CNC Turning Machine
- 3.Using Linear interpolation and Circular Interpolation-Create a part programme for grooving and produce component in the CNC Milling Machine

Pr 4. PROJECT WORK (Phase-I)

Course code:		Semester	5 th
Total Period:	60	Examination :	-
Theory periods:	4P / week	Sessional Marks	25
		TOTAL Marks	25

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of mechanical engineering practices in real life situations, so as to participate and manage a large mechanical engineering projects in future.

Entire Project shall spread over 5th and 6th Semester. Part of the Project covered in 5th Semester shall be named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real life working environment, preferably in an industrial environment.
- Develop working models or applications and implement these for the actual needs of the community/industry.
- Explain the working of industrial environment and its work ethics.
- Explain what entrepreneurship is and how to become an entrepreneur.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- Find latest ideas on robotics, automation and mechatronics based projects.

General Guidelines

The individual students have different aptitudes and strengths and also areas of interest. Project work, therefore, should match the strengths and interest of the students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester). Students should be allotted a problem of interest to him/her as a project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. Preferably there should not be more than 5 students, if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

Following are the broad suggestive areas of project work

- ✓ Automobile based projects.
- ✓ Refrigeration based & Air conditioning based projects.
- ✓ Hydraulic control & Pneumatic control based automation projects
- ✓ Fabrication based projects.
- ✓ Wind mill
- ✓ Solar energy based projects.
- ✓ Thermal power plant using steam.
- ✓ Hydel power dam.
- ✓ Cooling tower.

- ✓ Solenoid based hammer.
- ✓ Unmanned railway crossing.
- ✓ Engine based air compressor.
- ✓ Mobile all round year air conditioner
- ✓ Driverless car.
- ✓ Hybrid motorbike.
- ✓ Any other areas found suitable.
- ✓ Torque testing machine.
- ✓ Spring testing machine.
- ✓ Mechanical sanitizer.
- ✓ Solar powered refrigerator.
- ✓ Door opener.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9.	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations to such an exhibition.

Project Phase-I and Phase-II

The Project work duration shall cover 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5th sem under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work upto Design of the system have to be complete in Phase-I. Execution of work may begin in Phase-I depending on the Project. Project Milestones are to be set so that progress can be tracked . In Phase-II Execution of work and Documentation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-I in 5th semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

EQUIPMENT LIST

REFRIGERATION AND AIR –CONDITIONING LAB

SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	Domestic Refrigerator test rig	01 no
02	water cooler test rig	01 no
03	Window Air Conditioner test rig	01 no
04	Split Air Conditioner test rig	01 no
05	Vacuum pump set with accessories	01 no
06	Charging cylinder with accessories	02 nos
07	Halide torch or any leak tester	02 nos
08	Vapour absorption test rig	01

HYDRAULIC MACHINES & INDUSTRIAL FLUID POWER LAB

SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	Impulse turbine(PELTON WHEEL) Test Rig with arrangements to find efficiency	01no
02	Kaplan turbine Test Rig with arrangements to find efficiency	01no
03	Francis turbine Test Rig with arrangements to find efficiency	01no
04	Centrifugal pump Test Rig with arrangements to find efficiency	01no
05	Pneumatic Trainer Kit with accessories	02nos
06	Hydraulic Trainer Kit with accessories	01no
07	Manual or Digital Tachometer	05nos

CAD/CAM LAB

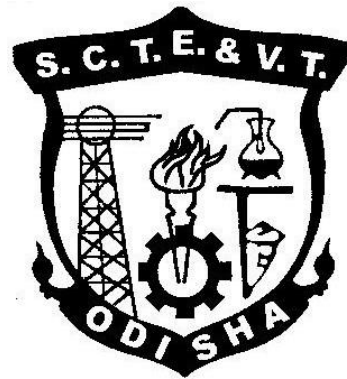
SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	DESKTOP COMPUTER with UPS	30 no
02	AUTOCAD SOFTWARE 2D/3D	01 each
03	CNC TURNING MACHINE	01 no
04	CNC MILLING MACHINE	01 no
05	PRINTER	02 nos

CURRICULLUM OF 6TH SEMESTER

For

DIPLOMA IN MECHANICAL ENGINEERING

(Effective FROM 2020-21 Sessions)



**STATE COUNCIL FOR TECHNICAL EDUCATION & VOCATIONAL TRAINING,
ODISHA, BHUBANESWAR**

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA									
TEACHING AND EVALUATION SCHEME FOR 6th Semester (Mechanical Engg.) (wef 2020-21)									
Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		INDUSTRIAL ENGINEERING & MANAGEMENT	4		-	20	80	3	100
Th.2		AUTOMOBILE ENGINEERING AND HYBRID VEHICLES	4		-	20	80	3	100
Th.3		POWER STATION ENGINEERING	4		-	20	80	3	100
Th.4		ELECTIVE (any One)	4			20	80	3	100
Th.4(a)		COMPOSITE MATERIALS							
Th.4(b)		ADVANCE MANUFACTURING PROCESSES							
Th.4(c)		INDUSTRIAL ROBOTICS & AUTOMATION							
		<i>Total</i>	16			80	320	-	400
		Practical							
Pr.1		AUTOMOBILE ENGINEERING LAB	-	-	4	50	50	3	100
Pr.2		POWER STATION ENGINEERING LAB	-	-	4	25	50	3	75
Pr.3		PROJECT WORK PHASE -II		-	10	50	100	3	150
Pr.4		LIFE SKILL	-	-	2	25	-	-	25
		STUDENT CENTERED ACTIVITIES (SCA)			3				
		<i>Total</i>	-	-	23	150	200	-	350
		Grand Total	16	-	23	230	520	-	750
Abbreviations: L-Lecturer, T-Tutorial, P-Practical. Each class is of minimum 55 minutes duration									
Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%									
SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM /Idea Tinkering and Innovation Lab Practice etc. ,Seminar and SCA shall be conducted in a section.									
There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester									

TH1. INDUSTRIAL ENGINEERING & MANAGEMENT

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Main objective of Mechanical Engineering is to produce goods and services for benefit to mankind. Such productions are done utilizing various resources like Men, Materials, machines and Money. Industrial engineering and quality control is the subject which allows optimized use of such resources and hence very important for a mechanical engineer.

B. COURSE OBJECTIVES:

After undergoing this course, the students will be able to:

1. Identify the place for a new plant set up and systematic arrangement of machinery and shop for smooth production.
2. Take right decisions to optimize resources utilizations by improving productivity of the lands ,buildings,people,material,machines,money,methods and management effectively.
3. Understanding of stock management and maintenance to reduce plant ideal time.
- 4 To use the charts to record the quality of products.
- 5.To eliminate unproductive activities under the control of the management, supervisor, worker and the design of products and processes.

C. CHAPTER WISE DISTRIBUTION OF PERIODS

SI No.	Topic	Periods
1	PLANT ENGINEERING	10
2	OPERATIONS RESEARCH	10
3	INVENTORY CONTROL	10
4	INSPECTION AND QUALITY CONTROL	15
5	PRODUCTION PLANNING AND CONTROL	15

D. COURSE CONTENT

1. PLANT ENGINEERING:

- 1.1 Selection of Site of Industry.
- 1.2 Define plant layout.
- 1.3 Describe the objective and principles of plant layout.
- 1.4 Explain Process Layout, Product Layout and Combination Layout.
- 1.5 Techniques to improve layout.
- 1.6 Principles of material handling equipment.
- 1.7 Plant maintenance.

1.7.1 Importance of plant maintenance.

1.7.2 Break down maintenance.

1.7.3 Preventive maintenance.

1.7.4 Scheduled maintenance.

2. OPERATIONS RESEARCH:

2.1 Introduction to Operations Research and its applications.

2.2 Define Linear Programming Problem,

2.3 Solution of L.P.P. by graphical method.

2.4 Evaluation of Project completion time by Critical Path Method and PERT (Simple problems)-

2.5 Explain distinct features of PERT with respect to CPM.

3. INVENTORY CONTROL:

3.1 Classification of inventory.

3.2 Objective of inventory control.

3.3 Describe the functions of inventories.

3.4 Benefits of inventory control.

3.5 Costs associated with inventory.

3.6 Terminology in inventory control

3.7 Explain and Derive economic order quantity for Basic model. (Solve numerical)

3.8 Define and Explain ABC analysis.

4. INSPECTION AND QUALITY CONTROL:

4.1 Define Inspection and Quality control.

4.2 Describe planning of inspection.

4.3 Describe types of inspection.

4.4 Advantages and disadvantages of quality control.

4.5 Study of factors influencing the quality of manufacture.

4.6 Explain the Concept of statistical quality control, Control charts (X, R, P and C - charts).

4.7 Methods of attributes.

4.8 Concept of ISO 9001-2008.

4.9.1 Quality management system, Registration /certification procedure.

4.9.2 Benefits of ISO to the organization.

4.9.3 JIT, Six sigma, 7S, Lean manufacturing

4.9.4 Solve related problems.

5.0 PRODUCTION PLANNING AND CONTROL

5.1 Introduction

5.2 Major functions of production planning and control

5.3 Methods of forecasting

5.3.1 Routing

5.3.2 Scheduling

5.3.3 Dispatching

5.3.4 Controlling

5.4 Types of production

5.4.1 Mass production

5.4.2 Batch production

5.4.3 Job order production

5.5 Principles of product and process planning.

Syllabus to be covered before IA: Chapter 1,2,3

Learning Resources:			
<i>Sl. No.</i>	<i>Name of Authors</i>	<i>Title of the Book</i>	<i>Name of the Publisher</i>
1	O.P.KHANNA	INDUSTRIAL ENGINEERING & MANAGEMENT	DHANPAT RAI & SONS
2	MARTAND TELSANG	INDUSTRIAL ENGG & PRODUCTION MANAGEMENT	S.CHAND
3	M.MAHAJAN	STATISTICAL QUALITY CONTROL	DHANPAT RAI & SONS
4			

TH.2 AUTOMOBILE ENGINEERING AND HYBRID VEHICLES

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Automobiles are the principal mode of transport system. Their manufacture and maintenance gives a major scope for employment. Many entrepreneur pass outs go for servicing of automobiles or trading/manufacturing of auto components. Thus automobile engineering is an important subject to be in the regular curriculum of the mechanical engineering.

B. COURSE OBJECTIVES:

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

- Understand automobile chassis, transmission, breaking and fuel system etc.
- Understand the basics of electric vehicle kinematics.
- Understand the concepts of hybrid electric vehicles.

C.TOPIC WISE DISTRIBUTION OF PERIODS

Sl No.	Topic	Periods
1	Introduction & Transmission System	12
2	Braking system	5
3	Ignition & Suspension System	10
4	Cooling and Lubrication	8
5	Fuel system	10
6	Hybrid and Electric Vehicles	15

C.COURSE CONTENTS

1.0 INTRODUCTION & TRANSMISSION SYSTEM:

- 1.1 Automobiles: Definition, need and classification: Layout of automobile chassis with major components (Line diagram)
- 1.2 Clutch System: Need, Types (Single & Multiple) and Working principle with sketch
- 1.3 Gear Box: Purpose of gear box, Construction and working of a 4 speed gear box
- 1.4 Concept of automatic gear changing mechanisms
- 1.5 Propeller shaft: Constructional features
- 1.6 Differential: Need, Types and Working principle

2.0 BRAKING SYSTEM:

- 2.1 Braking systems in automobiles: Need and types
- 2.2 Mechanical Brake
- 2.3 Hydraulic Brake
- 2.4 Air Brake
- 2.5 Air assisted Hydraulic Brake
- 2.6 Vacuum Brake

3.0 IGNITION & SUSPENSION SYSTEM:

- 3.1 Describe the Battery ignition and Magnet ignition system
- 3.2 Spark plugs: Purpose, construction and specifications
- 3.3 State the common ignition troubles and its remedies
- 3.4 Description of the conventional suspension system for Rear and Front axle
- 3.5 Description of independent suspension system used in cars (coil spring and tension bars)
- 3.6 Constructional features and working of a telescopic shock absorber

4.0 COOLING AND LUBRICATION:

- 4.1 Engine cooling: Need and classification
- 4.2 Describe defects of cooling and their remedial measures
- 4.3 Describe the Function of lubrication
- 4.4 Describe the lubrication System of I.C. engine

5.0 FUEL SYSTEM:

- 5.1 Describe Air fuel ratio
- 5.2 Describe Carburetion process for Petrol Engine
- 5.3 Describe Multipoint fuel injection system for Petrol Engine
- 5.4 Describe the working principle of fuel injection system for multi cylinder Engine
- 5.5 Filter for Diesel engine
- 5.6 Describe the working principle of Fuel feed pump and Fuel Injector for Diesel engine

6.0 ELECTRIC AND HYBRID VEHICLES:

- 6.1 Introduction, Social and Environmental importance of Hybrid and Electric Vehicles
- 6.2 Description of Electric Vehicles, operational advantages, present performance and applications of Electric Vehicles
- 6.3 Battery for Electric Vehicles, Battery types and fuel cells
- 6.4 Hybrid vehicles, Types of Hybrid and Electric Vehicles: Parallel, Series, Parallel and Series configurations;
- 6.5 Drive train
- 6.6 Solar powered vehicles

D.SYLLABUS COVERED UP TO I.A-CHAPTERS 1,2 &3

E.LEARNING RESOURCES:

<i>Sl. No.</i>	<i>Name of Authors</i>	<i>Title of the Book</i>	<i>Name of the Publisher</i>
1	R.B.Gupta	Automobile Engineering	Satya Prakashan
2	Dr Kirpal Singh	Automobile Engineering Vol- I & II	Standard Publishers
3	C.P.Nakra	Automobile Engineering	Dhanpat Rai Publication
4	W.H.Course	Automotive Engine	McGraw Hill
5	Iqbal Hussain	Electric & Hybrid Vehicles – Design Fundamentals	CRC Press, 2
6	A.K. Babu	Statistical Electric & Hybrid Vehicles	Khanna Publishing House, New Delhi, 2018

TH.3 POWER STATION ENGINEERING

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Bulk powers used in industries and for domestic purposes are generated in power stations. A large number of diverse and specialized equipment and system are used in a power plant should have this important subject in mechanical engineering.

B. COURSE OBJECTIVES:

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

- Understand the generation of power by utilizing various energy sources.
- Understand the use of steam, its operation in thermal power stations.
- Understand the nuclear energy sources and power developed in nuclear power station.
- Understand the basics of diesel electric power station and hydroelectric power station.
- Understand the basics of gas turbine power station
-

C.TOPIC WISE DISTRIBUTION OF PERIODS

Sl No.	Topic	Periods
1	INTRODUCTION	05
2	THERMAL POWER STATIONS	20
3	NUCLEAR POWER STATIONS	10
4	DIESEL ELECTRIC POWER STATIONS	10
5	HYDEL POWER STATIONS	10
6	GAS TURBINE POWER STATIONS	05

D.COURSE CONTENTS:

1.0 INTRODUCTION:

- 1.1 Describe sources of energy.
- 1.2 Explain concept of Central and Captive power station.
- 1.3 Classify power plants.
- 1.4 Importance of electrical power in day today life.
- 1.5 Overview of method of electrical power generation.

2.0 THERMAL POWER STATIONS:

- 2.1 Layout of steam power stations.
- 2.2 Steam power cycle. Explain Carnot vapour power cycle with P-V, T-s diagram and determine thermal efficiency.
- 2.3 Explain Rankine cycle with P-V, T-S & H-s diagram and determine thermal efficiency, Work done, work ratio, and specific steam Consumption.
- 2.4 Solve Simple Problems.
- 2.5. List of thermal power stations in the state with their capacities.
- 2.6 Boiler Accessories: Operation of Air pre heater, Operation of Economiser, Operation Electrostatic precipitator and Operation of super heater. Need of boiler mountings and operation of boiler

- 2.7 Draught systems (Natural draught, Forced draught & balanced draught) with their advantages & disadvantages.
- 2.8 Steam prime movers: Advantages & disadvantages of steam turbine, Elements of steam turbine, governing of steam turbine. Performance of steam turbine: Explain Thermal efficiency, Stage efficiency and Gross efficiency.
- 2.9 Steam condenser: Function of condenser, Classification of condenser. function of condenser auxiliaries such as hot well, condenser extraction pump, air extraction pump, and circulating pump.
- 2.10 Cooling Tower: Function and types of cooling tower, and spray ponds
- 2.11 Selection of site for thermal power stations.

3.0 NUCLEAR POWER STATIONS:

- 3.1 Classify nuclear fuel (Fissile & fertile material)
- 3.2 Explain fusion and fission reaction.
- 3.3 Explain working of nuclear power plants with block diagram .
- 3.4 Explain the working and construction of nuclear reactor .
- 3.5 Compare the nuclear and thermal plants.
- 3.6 Explain the disposal of nuclear waste.
- 3.7 Selection of site for nuclear power stations.
- 3.8 List of nuclear power stations.

4.0 DIESEL ELECTRIC POWER STATIONS:

- 4.1 State the advantages and disadvantages of diesel electric power stations.
- 4.2 Explain briefly different systems of diesel electric power stations: Fuel storage and fuel supply system, Fuel injection system, Air supply system, Exhaust system, cooling system, Lubrication system, starting system, governing system.
- 4.3 Selection of site for diesel electric power stations.
- 4.4 Performance and thermal efficiency of diesel electric power stations.

5.0 HYDEL POWER STATIONS:

- 5.1 State advantages and disadvantages of hydroelectric power plant.
- 5.2 Classify and explain the general arrangement of storage type hydroelectric project and explain its operation.
- 5.3 Selection of site of hydel power plant.
- 5.4 List of hydro power stations with their capacities and number of units in the state.
- 5.5 Types of turbines and generation used.
- 5.6 Simple problems.

6.0 GAS TURBINE POWER STATIONS

- 6.1 Selection of site for gas turbine stations.
- 6.2 Fuels for gas turbine
- 6.3 Elements of simple gas turbine power plants
- 6.4 Merits, demerits and application of gas turbine power plants.

Syllabus covered up to I.A-Chapters 1,2 &3

E.LEARNING RESOURCES:			
Sl. No.	Name of Authors	Title of the Book	Name of the Publisher
1	R.K Rajput	Power Plant Engineering	Laxmi Publication
2	P.K.NAG	Power Plant Engineering	TMH
3	Nag pal G,R	Power plant Engineering	Khanna Publisher
4	P.C.SHARMA	Power Plant Engineering	S.K KATARIA &SONS

Th-4a-COMPOSITE MATERIALS (ELECTIVE)

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

RATIONALE: Composite material is the advanced engineering material and plays an important Role in design of engineering products.it is s.a valuable subject for mechanical engineer

COURSE OBJECTIVES:

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

- Understand the basic concept of composite materials
- Understand the Classification of Composites
- Understand the Mechanical Properties of Composites
- Understand the Laminates
- Understand the Joining Methods and Failure Theories.

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Introduction	15
2	Classification of Composites	8
3	Mechanical Properties of Composites	12
4	Laminates	15
5	Joining Methods and Failure Theories	10

CHAPTERS

1.0 Introduction:

- 1.1 Classifications of Engineering Materials, Concept of composite materials.
- 1.2 Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc.
- 1.3 Types of Reinforcements/Fibers: Role and Selection or reinforcement materials.
- 1.4 Types of fibers, Glass fibers, Carbon fibers, Aramid fibers , Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc.,
- 1.5 Mechanical properties of fibers.

2.0 Classification of Composites:

- 2.1 Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC), Ceramic matrix composites (CMC).
- 2.2 Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites.
- 2.3 Comparison with Metals, Advantages & limitations of Composites.

3.0 Mechanical Properties of Composites:

- 3.1 Geometrical aspects – volume and weight fraction.
- 3.2 Unidirectional continuous fiber, discontinuous fibers, Short fiber systems, woven

reinforcements – Mechanical Testing.

3.3 Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.

4.0 Laminates:

4.1 Plate Stiffness and Compliance, Assumptions, Strains, Stress Resultants, Computation of Stresses.

4.2 Types of Laminates - Symmetric Laminates, Antisymmetric Laminate, Balanced Laminate, Quasi-isotropic Laminates, Cross-ply Laminate, Angle ply Laminate. Orthotropic Laminate.

4.3 Laminate Moduli, Hydrothermal Stresses.

5.0 Joining Methods and Failure Theories:

5.1 Joining –Advantages and disadvantages of adhesive and mechanically fastened joints.

5.2 Typical bond strengths and test procedures.

Syllabus covered up to I.A-Chapters 1, 2 & 3

E.LEARNING RESOURCES:			
<i>Sl. No.</i>	<i>Name of Authors</i>	<i>Title of the Book</i>	<i>Name of the Publisher</i>
1	A.K Bhargava	Engineering Materials: Polymers, Ceramics and Composites	Prentice Hall India
2	G. Dieter	Mechanical Metallurgy	Mc-Graw Hill
3	R.F. Speyer	Thermal Analysis of Materials	Marcel Decker

TH 4b ADVANCE MANUFACTURING PROCESSES

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

RATIONALE:

Advance manufacturing processes is the field of production by advance nontraditional methods which give the conversion of raw materials into finished product..

COURSE OBJECTIVES:

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

- Understand the working principle of modern machining processes.
- Understand the Plastic Processing
- Understand the additive manufacturing process
- Understand the Special Purpose Machines
- Understand the Maintenance of Machine Tools

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Modern Machining Processes	20
2	Plastic Processing	10
3	Additive Manufacturing Process	15
4	Special Purpose Machines	7
5	Maintenance of Machine Tools	8

DETAILED CONTENTS

1.0 Modern Machining Processes:

- 1.1 Introduction – comparison with traditional machining.
- 1.2 Ultrasonic Machining: principle, Description of equipment, applications.
- 1.3 Electric Discharge Machining: Principle, Description of equipment, Dielectric fluid, tools (electrodes), Process parameters, Output characteristics, applications.
- 1.4 Wire cut EDM: Principle, Description of equipment, controlling parameters; applications.
- 1.5 Abrasive Jet Machining: principle, description of equipment, Material removal rate, application.
- 1.5 Laser Beam Machining: principle, description of equipment, Material removal rate, application.
- 1.6 Electro Chemical Machining: principle, description of equipment, Material removal rate, application.
- 1.7 Plasma Arc Machining – principle, description of equipment, Material removal rate, Process parameters, performance characterization, Applications.
- 1.8 Electron Beam Machining - principle, description of equipment, Material removal rate, Process parameters, performance characterization, Applications.

2.0 Plastic Processing:

- 2.1 Processing of plastics.
- 2.2 Moulding processes: Injection moulding, Compression moulding, Transfer moulding.
- 2.3 Extruding; Casting; Calendering.
- 2.4 Fabrication methods-Sheet forming, Blow moulding, Laminating plastics (sheets, rods & tubes), Reinforcing.
- 2.5 Applications of Plastics.

3.0 Additive Manufacturing Process:

- 3.1 Introduction, Need for Additive Manufacturing
- 3.2 Fundamentals of Additive Manufacturing, AM Process Chain
- 3.3 Advantages and Limitations of AM, Commonly used Terms
- 3.4 Classification of AM process, Fundamental Automated Processes, Distinction between AM and CNC, other related technologies.
- 3.5 Application –Application in Design, Aerospace Industry, Automotive Industry, Jewelry Industry, Arts and Architecture. RP Medical and Bioengineering Applications.
- 3.6 Web Based Rapid Prototyping Systems.
- 3.7 Concept of Flexible manufacturing process, concurrent engineering, production tools like capstan and turret lathes, rapid prototyping processes.

4.0 Special Purpose Machines (SPM):

- 4.1 Concept, General elements of SPM, Productivity improvement by SPM, Principles of SPM design.

5.0 Maintenance of Machine Tools:

- 5.1 Types of maintenance, Repair cycle analysis, Repair complexity, Maintenance manual, Maintenance records, Housekeeping. Introduction to Total Productive Maintenance (TPM).

Syllabus covered up to I.A-Chapters 1,2 &3

E.LEARNING RESOURCES:			
<i>Sl. No.</i>	<i>Name of Authors</i>	<i>Title of the Book</i>	<i>Name of the Publisher</i>
1	O.P.KHANNA	Production technology –Vol-II	Dhanpat Rai Publication
2	B.S. Raghuwanshi	Workshop Technology, Vol – II	Dhanpat Rai Publication
3	HMT, Bangalore	Production Technology	Tata Mc-Graw Hill
4	1. Chua C.K., Leong K.F. and LIM C.S,	Rapid prototyping: Principles and Applications	WORLD SCIENTIFIC PUBLICATION,THIRD EDITION,2010
5	Stephen F. Krar & Arthur Gil	Exploring Advanced Manufacturing Technologies	1. Industrial Press

TH.4(c) INDUSTRIAL ROBOTICS & AUTOMATION (Elective)

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Internal assessment	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:

Today's manufacturing units are using robots as substitute for workers working in hazardous atmosphere. Any automation found are using robots which are known as industrial robots and helps in mass production and assembling parts to make a finished product. So to meet the need of the day this Subject should be included in the syllabus of mechanical engineering of diploma stream.

COURSE OBJECTIVES:

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

- Understand the basic concepts, parts of robots and types of robots.
- Understand the various drive systems for robot, sensors and their applications in robots and programming of robots.
- Understand the robots according to its usage.
- Understand the various applications of robots, justification and implementation of robot.
- Conceptualize automation and understand applications of robots in various industries.

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Fundamentals of Robotics	10
2	Robotic Drive System and Controller	12
3	Sensors	8
4	Introduction to Machine Vision	10
5	Robot kinematics and Robot Programming	15
6	Automation & Industrial Applications	5

CHAPTERS

1.0 Fundamentals of Robotics:

- 1.1 Definition; Robot anatomy (parts) and its working.
- 1.2 Robot Components: Manipulator, End effectors; Construction of links, Types of joints.
- 1.3 Classification of robots; Cartesian, Cylindrical, Spherical, Scara, Vertical articulated.
- 1.4 Structural Characteristics of robots; Mechanical rigidity; Effects of structure on control work envelope and work Volume.
- 1.5 Robot work Volumes, comparison.
- 1.6 Advantages and disadvantages of robots.

2.0 Robotic Drive System and Controller:

- 2.1 Actuators; Hydraulic, Pneumatic and Electrical drives; Linear actuator; Rotary drives.
- 2.2 AC servo motor; DC servo motors and Stepper motors; Conversion between linear and rotary motion.
- 2.3 Feedback devices; Potentiometers; Optical encoders; DC tachometers.

2.4 Robot controller; Level of Controller; Open loop and Closed loop controller.

2.5 Microprocessor based control system; Robot path control: Point to point, Continuous path control and Sensor based path control; Controller programming.

3.0 Sensors:

3.1 Requirements of a sensor.

3.2 Principles and Applications of the following types of sensors: Position sensors (Encoders, Resolvers, Piezo Electric); Range sensors (Triangulation Principle, Structured lighting approach).

3.3 Proximity sensing; Force and torque sensing.

4.0 Introduction to Machine Vision:

4.1 Robot vision system (scanning and digitizing image data); Image processing and analysis.

4.2 Cameras (Acquisition of images); Videocon camera (Working principle & construction).

4.3 Applications of Robot vision system: Inspection, Identification, Navigation & serving.

5.0 Robot kinematics and Robot Programming:

5.1 Forward Kinematics; Inverse Kinematics and Differences.

5.2 Forward Kinematics and Reverse Kinematics of Manipulators with Two Degrees of Freedom (In 2 Dimensional); Deviations and Problems.

5.3 Teach Pendant Programming; Lead through programming; Robot programming Languages; VAL Programming.

5.4 Motion Commands; Sensor Commands; End effector commands; and Simple programs.

6.0 Automation & Industrial Applications:

6.1 Basic elements of automated system, advanced automation functions, levels of automation.

6.2 Application of robots in machining; welding; assembly and material handling.

Syllabus covered up to I.A-Chapters 1, 2 & 3

E.LEARNING RESOURCES:

<i>Sl. No.</i>	<i>Name of Authors</i>	<i>Title of the Book</i>	<i>Name of the Publisher</i>
1	Saeed B. Niku	Introduction to Robotics: Analysis, Systems, Applications	Pearson Education Inc.New DELHI 2006
2	M.P. Groover	Industrial Robotics: Technology, Programming and Applications	Tata Mc Graw Hill Co,2001
3	Fu K S Gonzalz R Cand Lee C S G	Robotics control,sensing,visionand intelligence	1. Mc-Graw Hill Book Co, 1987.
4	Ganesh S. Hedge	A Text book on Industrial Robotics	1. , Laxmi Publications Pvt. Ltd., New Delhi
5	S.R. Deb & Sankha Deb	Robotics Technology and Flexible Automation Robot	1. Tata McGraw-Hill, 2010.

Pr.1 AUTOMOBILE ENGINEERING LAB

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Practical periods:	4 P/W	Sessional	50
Maximum marks:	100	End Semester Examination:	50

COURSE OBJECTIVES

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

List of Practical .

1. Study of Automobile chassis.
2. Study the differential mechanism of the Tractor.
3. Study the hydraulic braking system of automobile.
4. Study Study the cut section model of carburetor solex type and maruti car type.
5. Study the fuel pump cut section model.
6. Study the actual cut section of gear box.
7. Study of actual car engine.

Pr 2. POWER STATION ENGINEERING LAB

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:		Semester	6th
Total Period:	60	Examination	3 hrs
Practical periods:	4 P/W	Sessional	25
Maximum marks:	75	End Semester Examination:	50

COURSE OBJECTIVES

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

List of Practical

Experiment 01-To study the modern steam power plant with model.

Experiment 02-To determine the various efficiencies of steam turbine.

Experiment 03-To study the cooling tower.

Experiment 04-Study of jet condenser.

Experiment 05-Study of De-lavel turbine.

Experiment 06-To study the spring loaded safety valve.

Experiment 07-To study the following steam generators (boilers)models.

- a) Lancashire boiler.
- b) Cornish boiler.
- c)Babcock & Wilcox Boiler.
- d)Vertical water tube boiler.

Pr3. PROJECT Phase - II

Name of the Course: Diploma in Mechanical Engineering			
Course code:		Semester	6 th
Total Period:	150	Examination	3 hrs
Lab. periods:	10 P / week	Sessional	50
Maximum marks:	150	End Sem Examination	100

RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of Mechanical engineering and practices in real life situations, so as to participate and manage a large Mechanical engineering projects, in future. Entire Project spreads over 5th and 6th Semester. Part of the Project covered in 5th Semester was named as *Project Phase-I* and balance portion to be covered in 6th Semester shall be named as *Project Phase-II*.

OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- To achieve real life experience in Project design.
- To develop the skill of writing Project Report

Project Phase-I and Phase-II

The Project work duration covers 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group was done in the beginning of 5th semester under Project Phase-I. The students were allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work and Design of the system also have to be complete in Phase-I. Development may also begin in this phase. Project Milestones are to be set so that progress can be tracked .

In Phase-II Development, Testing, Documentation and Implementation have to be complete. Project Report have to be prepared and complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the components of Task and schedule.

At the end of Project Phase-II in 6th semester there shall be one presentation by each group on whole Project work undertaken by them.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

Sl. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations to such an exhibition.

The Project Report need to be prepared as per standard format and following is the indicative format. The Teacher Guide may make minor alteration keeping the sense in tact.

Organization of Project Report

1. Cover page:

It should contain the following (in order)

- (i) Title of the Project
- (ii) “Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>”
- (iii) By Name of the Student(s)
- (iv) Logo of the Institution
- (v) Branch Name/Depart Name and Institution Name with Address
- (vi) Academic Year

2. 1st Inner page

Certificate:

It should contain he following

“This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>” during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).

Seal and signature of the Supervisor/Guide with date

3. 2nd Inner Page

Acknowledgement by the Student(s)

4. Contents.

5. Chapter wise arrangement of Reports

6. Last Chapter: Conclusion

It should contain

- (i) Conclusion
- (ii) Limitations
- (iii) Scope for further Improvement

7. References

Pr-4 LIFE SKILL (Common to All Branches)

Practical	2 Periods per week	Sessional	25 Marks
Total Periods	30 Periods	Total Marks	25 Marks

Objective: After completion of this course the student will be able to:

- Develop team spirit i.e. concept of working in team
- Apply problem solving skills for a given situation
- Use effective presentation techniques
- Apply task management techniques for given projects
- Enhance leadership traits
- Resolve conflict by appropriate method
- Survive self in today's competitive world
- Face interview without fear

DETAIL CONTENTS:

1. SOCIAL SKILL

Society, Social Structure, Develop Sympathy and Empathy

Swot Analysis – Concept, How to make use of SWOT

Inter personal Relation: Sources of conflict, Resolution of conflict ,

Ways to enhance interpersonal relation

2. PROBLEM SOLVING

Steps of Problem solving:

- Identify and clarify the problem,
- Information gathering related to problem,
- Evaluate the evidence,
- Consider alternative solutions and their implications,
- Choose and implement the best alternative,
- Review
- Problem solving techniques:

1) Trial and error, 2) Brain storming, 3) Lateral (Out of Box) thinking

3. PRESENTATION SKILL

Body language , Dress like the audience

Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT,

Voice and language – Volume, Pitch, Inflection, Speed, Pause

Pronunciation, Articulation, Language, Practice of speech.

Use of AV aids such as Laptop with LCD projector, white board etc.

4. GROUP DISCUSSION AND INTERVIEW TECHNIQUES

Group Discussion:

Introduction to group discussion, Ways to carry out group discussion,

Parameters— Contact, body language, analytical and logical thinking, decision making

Interview Technique :

Dress, Posture, Gestures, facial expression, Approach

Tips for handling common questions.

5. WORKING IN TEAM

Understand and work within the dynamics of a groups.

Tips to work effectively in teams,

Establish good rapport, interest with others and work effectively with them to meet common objectives,

Tips to provide and accept feedback in a constructive and considerate way ,

Leadership in teams, Handling frustrations in group.

6. TASK MANAGEMENT

Introduction, Task identification, Task planning ,

organizing and execution, Closing the task

PRACTICAL

List of Assignment: *(Any Five to be performed including Mock Interview)*

1. SWOT analysis:-

Analyse yourself with respect to your strength and weaknesses, opportunities and threats. Following points will be useful for doing SWOT.

- a) Your past experiences,
- b) Achievements,
- c) Failures,
- d) Feedback from others etc.

2. Solve the True life problem assigned by the Teacher.

3. Working in a Team

Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slum area, social activities like giving cloths to poor etc. (One activity per group where Team work shall be exhibited)

4. Mock Interview

5. Discuss a topic in a group and prepare minutes of discussion.

6. Deliver a seminar for 5 minutes using presentation aids on the topic given by your teacher.

7. Task Management

Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management (with Break up into sub tasks and their interdependencies and Time)

Note: -1. Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic.

Note: -2. The following Topics may be considered for Seminar/GD in addition to other Topics at the discretion of the Teacher.

(Comparison with developed countries, Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Traffic Rules, Global Warming, Pollution, Environment, Labour Welfare Legislation, Labour Welfare Acts, Child Labour Issues, Gender Sensitisation, Harassment of Women at Workplace)

METHODOLOGY:

The Teacher is to explain the concepts prescribed in the contents of the syllabus and then assign different Exercises under Practical to the students to perform.

Books Recommended:-

Sl.No	Name of Authors	Title of the Book	Name of the Publisher
01	E.H. Mc Grath , S.J	Basic Managerial Skills for All	PHI
02	Lowe and Phil	Creativity and problem solving	Kogan Page (I) P Ltd
03	Adair, J	Decision making & Problem Solving	Orient Longman
04	Bishop , Sue	Develop Your Assertiveness	Kogan Page India
05	Allen Pease	Body Language	Sudha Publications Pvt. Ltd.

EQUIPMENT LIST

AUTOMOBILE ENGINEERING LAB

SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	Chassis of a car	01 no
02	Differential of a Tractor	01 no
03	Hydraulic brake system of a car working model	01 no
04	Solex carburetor	01 no
05	Maruty car type carburetor	01 no
06	Cut section of a fuel pump	01no
07	New car engine	01 no
08	Gear box	01no

POWER STATION ENGINEERING LAB

SL.NO	NAME OF THE EQUIPMENTS	QUANTITY
01	Stainless steel steam turbine test rig 01Kw 3000RPM	01no
02	Cooling Tower Apparatus or model	01no
03	Jet Condenser apparatus or model	01no
04	De Lavel turbine	01no
05	Spring loaded safety valve	02nos
06	Lancashire boiler model	01no
07	Babcock and Wilcox boiler model	01nos
08	Cornish boiler model	01no
09	Vertical water steam boiler model	01no