

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



Reduced Draft Syllabus
of
Diploma in Mechanical Engineering
Part-III (6th Semester)

Only for Academic Session 2021 - 2022



West Bengal State Council of Technical Education

(A Statutory Body under West Bengal Act XXI of 1995)
Kolkata Karigori Bhavan, 2nd Floor, 110 S. N. Banerjee Road, Kolkata - 700 013.

Name of the Course : Diploma in Mechanical Engineering		
Subject Title: DESIGN OF MACHINE ELEMENTS		
Course code: ME/		Semester : Sixth
Duration : 17 weeks /8		Maximum Marks : 150
Teaching Scheme:		Examination Scheme:
Theory : 4 hrs/week		Internal Assessment:20 Marks
Tutorial: hrs/week		Teacher’s assessment (Assignment & Quiz): 10 Marks
Practical : 2 hrs/week		End Semester Exam: 70 Marks
Credit: 5		Practical: Internal Sessional continuous evaluation:25 Marks
		Practical: External Sessional Examination:25 Marks
Aim :-		
S.No		
1	To enable the student to design and draw simple machine components used in small and medium scale industries. Fundamental knowledge of Applied Mechanics, Strength of Materials, Engineering Materials and Theory of Machines is essential. To develop analytical abilities to give solutions to engineering design problems.	
Objective :-		
S No	The student will able to	
1	Analyze the various modes of failure of machine components under different load patterns.	
2	Design and prepare part and assembly drawings.	
3	Use design data books and different codes of design.	
4	Select standard components with their specifications from manufacturer’s catalogue.	
5	Develop drawings on CAD software	
Pre-Requisite:-NIL		
Contents		Hrs/week
Chapter	<i>Name of the Topic</i>	Hours
GROUP:A		
01	Introduction to Design General Considerations in Machine Design Fundamentals:- Types of loads, concepts of stress, Strain, Stress – Strain Diagram for Ductile and Brittle Materials, Types of Stresses such as Tension, Compression, Shear, Bearing pressure Intensity, Crushing, bending and torsion, Creep strain and Creep Curve Fatigue, S-N curve, Endurance Limit. Factor of Safety and Factors governing selection of factor of Safety. Stress Concentration – Causes & Remedies	02
02	Design of simple machine part	
	Knuckle Joint	03

GROUP:B		
03	<i>Design of Shafts, Couplings and Pulley:</i> <i>Types of Shafts, Shaft materials, Standard Sizes, Design of Shafts (Hollow and Solid)-design for line shafts supported between bearings with one or two pulleys in between or one overhung pulley</i> Design of Couplings – Protected type Flange Coupling, Design of C.I. Pulley.	09
04	<i>Design of Fasteners</i> Stresses in Screwed fasteners, bolts of Uniform Strength. Design of parallel and transverse fillet welds, axially loaded symmetrical section, Merits and demerits of screwed and welded joints	06
GROUP:C		
05	<i>Antifriction Bearings</i> Classification of Bearings – Sliding contact & rolling contact. Terminology of Ball bearings – life load relationship, basic static load rating and basic dynamic load rating, limiting speed. Selection of ball bearings using manufacturer's catalogue.	06
06	<i>Estimating & Costing</i> Definition of estimating and costing, elements of costing, overhead Determination of weight of various parts such as simple bush, flanged pipe, Lathe centre, Rivets, Bolts & Nuts, Simple spanner, Estimation of selling price of cast part such as C. I. pulley, Coupling, and Wooden pattern of flange. Estimation of fabricated job such as Simple chimney, Funnel, Cylindrical tank	06
	Total	32
S.No List of Assignments: (Any three) 1 Assignment on selection of materials for given applications [at least two applications should be covered] using design data book. List the mechanical properties of material selected. 2 Problems on design of simple machine parts like, Knuckle Joint, , C.I. Pulley (One example on each component) with free hand sketches. 3 Design Project: Observe the system where transmission of power takes place through shaft, Keys, coupling, pulley and belt drive. Get the required information regarding power transmitted (power output by motor or engine etc.). By selecting suitable materials, design the shaft, key and coupling. Also select suitable Ball Bearing from Manufacturer's catalogue. Prepare design report and assembly drawing indicating overall dimensions, tolerances, and surface finish. Also prepare bill of materials. (Activity should be completed in a group of five to six students) . 4. Assignments on overhead cost calculation, selling price calculation, 5. Assignments on weight and cost calculation of different parts. 6. Survey of Prime movers – Electric motors / I.C. Engines available in the market along with specifications suitable for your design project. Survey report should be prepared with the relevant catalogue.		

Name of the Course : DIPLOMA IN PRODUCTION ENGINEERING / TECHNOLOGY (SUBJECT TITLE: INDUSTRIALMANAGEMENT)		
Course code:		Semester : Six
Duration : 17 week		Maximum Marks : 100
Teaching Scheme		Examination Scheme
Theory : 3 hrs/week		Semester Exam: 70 Marks
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 10 Marks
Practical : 4 hrs/week		Internal Assessment: 20 Marks
Credit: 3		
Aim :-		
	To study the techniques for improvement in productivity of the people and equipment. to plan the production schedule accordingly organize material supply for the manufacturing activities. To minimize the direct and indirect cost by optimizing the use of resources available. To learn accounting process, inventory control and process planning. Modern manufacturing system employ techniques such as JIT, TPM , FMS, 5'S', kaizen which should be known to the technician.	
Objective :-		
S No	The student will able to	
1	Familiarize environment in the world of work	
2	Explain the importance of management process in Business.	
3	Identify various components of management	
4	Describe Role & Responsibilities of a Technician in an Organizational Structure.	
5	Apply various rules and regulations concerned with Business & Social Responsibilities of the Technician	
Pre-Requisite:-Nil		
Contents		Hrs/week
Chapter	Name of the Topic	Hours
GROUP:A		
01	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	02
02	Management Process 2.1 What is Management? □ Evolution □ Various definitions □ Concept of management □ 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	04
	□ Organizing □ Directing □ Controlling 2.4 Social responsibility and Environmental dimension of management.	
GROUP:B		

03	Organizational Management 3.1 Organization :- <input type="checkbox"/> Definition <input type="checkbox"/> Steps in organization 3.2 Types of organization <input type="checkbox"/> Line <input type="checkbox"/> Line & staff <input type="checkbox"/> Functional <input type="checkbox"/> Project 3.3 Departmentation <input type="checkbox"/> Centralized & Decentralized <input type="checkbox"/> Authority & Responsibility <input type="checkbox"/> Span of Control	04
04	Human Resource Management 4.1 Personnel Management <input type="checkbox"/> Introduction <input type="checkbox"/> Definition <input type="checkbox"/> Objectives <input type="checkbox"/> Functions 4.2 Staffing <input type="checkbox"/> Introduction to HR Planning <input type="checkbox"/> Recruitment Procedure 4.3 Personnel– Training & Development <input type="checkbox"/> Types of training <input type="checkbox"/> Induction <input type="checkbox"/> Skill Enhancement Leadership & Motivation <input type="checkbox"/> Maslow's Theory of Motivation	05
GROUP:C		
05	Financial Management 5.1 Financial Management- Objectives & Functions 5.2 Capital Generation & Management <input type="checkbox"/> Types of Capitals <input type="checkbox"/> Sources of raising Capital	04
06	Materials Management 6.1. Inventory Management (No Numerical) <input type="checkbox"/> Meaning & Objectives 6.2 ABC Analysis 6.3 Economic Order Quantity(EOQ) 6.4 Stores function, Stores system, BIN card, Materials issue request(MIR), Pricing of materials <input type="checkbox"/> Introduction & Graphical Representation 6.5 Purchase Procedure <input type="checkbox"/> Objects of Purchasing <input type="checkbox"/> Functions of Purchase Dept. <input type="checkbox"/> Steps in Purchasing	04
07	Safety Engineering Accidents-causes of accidents Need for safety	1
	Total	24

Reference books :- Nil

Suggested List of Assignments/Tutorial:- (Any Two)

1. Preparation of financial budget of any organization.
2. 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.

Name of the Course : Mechanical Engineering				
Subject: FLUID POWER				
Course code: ME			Semester: Sixth.	
Duration: 17 weeks			Maximum Marks : 150	
Teaching Scheme			Examination Scheme:	
Theory : 3 hrs/week			Internal Assessment: 20 Marks	
Tutorial: hrs/week			Teacher's Assessment (Assignment & Quiz): 10 Marks	
Practical : 2 hrs/week			End Semester Exam: 70 Marks	
Credit: 4			Practical: Internal Sessional continuous evaluation: 25 Marks	
			Practical: External Sessional examination: 25 marks	
Aim :-				
S. No.				
1	To impart the basic concept of Fluid power system.			
2	To understand the applications of Hydraulic and Pneumatic Systems in industries as clean source of motive power, convenient way of power transmission and easier way of automation.			
3	To understand the limitations of Hydraulic and Pneumatic Systems.			
Objective :-				
S. No.	The Students should be able to:			
1	• Identify various components of Hydraulic & Pneumatic Systems.			
2	• Know the working principle of various components used for Hydraulic & Pneumatic Systems.			
3	• Select appropriate components required for simple Hydraulic and Pneumatic Circuits.			
4	• List probable causes of faults or defects in the components of Hydraulic & Pneumatic Circuits.			
Pre-Requisite: Elementary knowledge on Physics, Thermal Engineering and Fluid Mechanics & Machinery.				
Content			Hrs/week	
FLUID POWER				
Chapter		Name of the Topic	Hours	Marks
		GROUP-A		
01	1.0. 1.1. 1.2. 1.3. 1.4.	Introduction to Fluid Power Systems: Basic concept, general layout, basic components and their function of fluid power systems. Practical applications of fluid power systems. Advantages and limitations of fluid power systems. Classification of fluid power system and comparison of hydraulic & pneumatic systems.	04	
02	2.0. 2.1. 2.2. 2.3. 2.4. 2.5. 2.6.	Components of Hydraulic Systems: Types, function and symbols of hydraulic pumps. Working principle and construction of external gear pump and piston pumps (swash plate type & bent axis type). Types, function and symbols of pressure control valves. Working principle and construction of pressure relief valve and pressure reducing valve. Types, function and symbols of direction control valves. Working principle and construction (spool positions only) of spool type 3/2 direction control valve.	08	

	2.7.	Types, function and symbols of flow control valves.		
	2.8.	Working principle and construction of needle valve.		
	2.9.	Types, function and symbols of hydraulic actuators (rotary and linear actuators).		
	2.10.	Function and symbols of hydraulic accessories (oil filter, intensifier and accumulator).		

03	3.0.	Hydraulic Circuits:	04	
	3.1.	Meter in, Meter out circuits.		
	3.2.	Pump unloading circuit.		
	3.3.	Motion synchronization circuit.		
	3.4.	Sequencing circuit.		
GROUP-B				
04	4.0.	Components of Pneumatic System:	06	
	4.1.	Types, function and symbols of compressors.		
	4.2.	Working principle and construction of reciprocating compressors.		
	4.3.	Types, function and symbols of pneumatic pressure control valves, flow control valves and direction control valves.		
	4.4.	Working principle and construction poppet type 3/2 direction control valve.		
	4.5.	Types, function and symbols of pneumatic actuators (rotary and linear actuators).		
	4.6.	Function and symbols of pneumatic accessories (FRL unit and silencer).		
05	5.0.	Pneumatic Circuits:	02	
	5.1.	Speed control circuits.		
	5.2.	Sequencing circuits.		
Sub Total:			24	
Internal Assessment Examination & Preparation of Semester Examination			6	
Total			30	

Practical:

List of Practical: At least Three (03)

1. Study of Vane pump / Gear pump generally used in Hydraulic System.
2. Study of Direction Control Valve generally used in Hydraulic / Pneumatic System.
3. Study of Rotary / Linear (single acting / double acting) Actuator generally used in Hydraulic / Pneumatic System.
4. Study of FRL Unit generally used in Pneumatic System.
5. Study of Hydraulic Trainer System & Pneumatic Trainer system
6. Design, Prepare & operate of Meter in and Meter out Circuit.
7. Design, Prepare & operate of Sequencing Circuit.
8. Design, Prepare & operate of Hydraulic Circuit for Shaper Machine.
9. Design, Prepare & operate of Pneumatic Circuit for Speed Control of Double Acting Cylinders.
10. Design, Prepare & operate of Pneumatic Circuit for Speed Control of Pneumatic Motor.
11. Design, Prepare & operate a pneumatic circuit for lifting & then holding a load.

Suggested List of Assignments / Tutorial :- Atleast Any three
1. Draw Hydraulic Meter in and Meter out Circuits by using Symbols.
2. Draw Pneumatic Sequencing circuit by using Symbols.
3. Draw Hydraulic Circuit for Shaper Machine by using Symbols.
4. Draw Hydraulic Circuit for Speed Control of Hydraulic Motor by using Symbols.



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Name of the Course : Diploma in Mechanical Engineering		
Subject Title: CAD-CAM & AUTOMATION		
Course code: ME/		Semester : sixth
Duration : 17 weeks		Maximum Marks : 100
Teaching Scheme:		Examination Scheme:
Theory : 3 hrs/week		Internal Assessment: 10 Marks
Tutorial: hrs/week		Teacher's assessment (Assignment & Quiz): 05 Marks
Practical : 2 hrs/week		End Semester Exam: 35 Marks
		Practical: Internal Sessional continuous evaluation:25 Marks
Credit: 4		Practical: External Sessional Examination:25 Marks
Aim :-		
S.No		
1	The need of today's manufacturing industrial world is based on best quality & precision oriented shorter manufacturing cycle time .To satisfy this need the use of CAD/CAM & automation is inevitable .To satisfy industrial need, diploma engineer should be able to cope with CAD/CAM technology. With this intention this subject is introduced in the curriculum.	
S No	The student will able to	
1	1. Understand the fundamentals & use CAD. 2. Conceptualize drafting and modelling in CAD. 3. Prepare CNC part programming. 4. Operate CNC machines. 5. Conceptualize automation and FMS.	
Pre-Requisite:-		
S.No		
1	Knowledge on engineering graphics, engineering drawing, mechanical engineering drawing, basic idea on manufacturing technology, transducer & sensor, fluid power. .	
Contents		Hrs/week
Chapter	Name of the Topic	Hours
Group A		
01	Introduction to CAD/CAM Computers in industrial manufacturing. Product Cycle, CAD/CAM	02

Group B		
03	Introduction to computer numerical Control Introduction - NC, CNC, DNC, Advantages of CNC, The coordinate system in CNC, Motion control system - point to point, straight line, Continuous path (Contouring). Application of CNC.	05
04	Part programming Fundamentals, manual part programming, NC –Words, Programming format, part programming for turning centre & Machining centre using G and M code, use of subroutines and do loops,	10
Group C		
05	Industrial Robotics Application – Material transfer, machine loading, welding, assembly, inspection.	02
06	Automation Basic elements of automated system, advanced automation functions, levels of automation. Flexible manufacturing system :-Introduction, FMS equipment, FMS application	05
		24
Practical: List of Practical: ((At least Any Three) <ol style="list-style-type: none"> 1. Two assignments on CAD for 2D drafting (Using AutoCAD) 2. Two assignments on CAD for 3D Modelling. (Using any 3-D Modelling software) 3. Two assignments on CAM Software. 		
<ol style="list-style-type: none"> 4. Manufacturing one turning and one Milling component on CNC. 5. At least four assignments on part programming using subroutines do loops for turning and milling component. 6. Report writing on visit to industry having CNC machine. 7. Report writing on visit to industry having robot Application. 8. Report writing on visit to Industry having Automation in manufacturing. 		

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING		
Subject Title: ALTERNATE ENERGY SOURCES AND MANAGEMENT (ELECTIVE II)		
Course code:		Semester : Sixth
Duration : 17 weeks		Maximum Marks : 100
Teaching Scheme		Examination Scheme:
Theory : 3 hrs/week		Internal Assessment: 10Marks
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 5 Marks
Practical : 2 hrs/week		End Semester Exam: 35 Marks
Credit: 4		Practical: Internal Sessional continuous evaluation: 25 Marks
		Practical: External Sessional examination: 25 Marks
Aim :-		
S.No		
1	To develop, operate and maintain alternative energy sources systems. It is therefore essential to know basics of energy conversion, conservation, energy audit and waste heat recovery techniques.	
Objective :-		
S No	The student will able to	
1	Develop awareness for effective utilization of alternative energy sources.	
2	Identify different components of solar energy and wind energy devices.	
3	Identify and analyze biomass plant.	
4	Identify and apply energy conservation techniques for commonly used power absorbing and generating devices.	
5	Apply principles of energy conservation and energy management techniques.	
Pre-Requisite:-		
	Nil	
Contents		Hrs/week
Chapter	<i>Name of the Topic</i>	Hours
Group: A		
01	Introduction to Energy Sources Major sources of energy: Renewable and Non-renewable. Primary and secondary energy sources. - Need of Alternate energy sources	01
02	Solar Energy Principle of conversion of solar energy into heat and electricity Applications of Solar energy: - - Construction and working of typical flat plate collector and solar concentrating collectors and their applications, advantages and limitations - Space heating and cooling. - Photovoltaic electric conversion. - Solar distillation, Solar cooking and furnace. - Solar pumping and Green House.	05
Group: B		
	Wind Energy Basic Principle of wind energy conversion.	
03	Main considerations in selecting a site for windmills. Advantages and limitations of wind energy conversion. Classification of wind mills Main applications of wind energy for power generation and pumping	03
04	Energy from Biomass Common species recommended for biomass. Methods for obtaining energy from biomass Biodiesel production and application Agriculture waste as a biomass Comparison of Biomass with conventional fuels	03

Group: C		
05	Energy Conservation & Management:- Global and Indian energy market Need and importance of energy conservation and management Concept of Payback period, Return on investment (ROI), Life cycle cost, Sankey diagrams, specific energy consumption.	03
06	Energy Conservation Techniques Distribution of energy consumption Principles of energy conservation. Energy audit Types of audit Methods of energy conservation Cogeneration and its application Combined cycle system	05
07	Economic approach of Energy Conservation Costing of utilities like steam, compressed air, electricity and water. Thermal insulation, Waste heat recovery systems, their applications, criteria for installing unit. An introductory approach of energy conservation in compressed air, refrigeration, air conditioning, pumps and fans.	04
	Total	24

1.

Motor skills:

1. List technical details of components and subsystems of power plants.
 - a) HP & LP Heater feed cycle
 - b) Condenser Cooling System including Cooling Tower.
 - c) Generator Cooling System.
 - d) HP & LP Bypass system.
 - e) Turbine sealing system.
2. Draw layouts of different power plants
3. Operate devices using solar energy inputs

ASSIGNMENT

Visit to steam power plants/nuclear power plants/wind power plants/ Hydro power plants
and prepare a report.(Any one Plant).
To collect information about global and Indian energy market.
To perform an experiment on solar flat plate collector used for water heating.
To study construction and working of photo voltaic cell.
To study construction, working and maintenance of solar cooker.
To study construction and working of horizontal axis wind mill or to visit a nearest wind farm.
To visit a biomass/ biogas plant of municipal waste or else where.
To perform energy audit for workshop/Office/Home/SSI unit.
to study of various waste heat recovery devices.

Name of the Course : Mechanical Engineering				
Subject: MATERIAL HANDLING SYSTEM (ELECTIVE II)				
Course code: ME			Semester: Sixth.	
Duration: 17 weeks			Maximum Marks : 100	
Teaching Scheme			Examination Scheme:	
Theory : 3 hrs/week			Internal Assessment: 10Marks	
Tutorial: hrs/week			Teacher's Assessment (Assignment & Quiz): 5 Marks	
Practical : 2 hrs/week			End Semester Exam: 35 Marks	
Credit: 4			Practical: Internal Sessional continuous evaluation: 25 Marks	
			Practical: External Sessional examination: 25 Marks	
Aim :-				
S. No.				
1	To know the operational features of the material handling equipment & its practical application, carrying parts & products in a shop from one work station to another and from shop to another shop or taking care of stockpiling and reclaiming operations, material handling equipment/systems enable the process to go on without interruptions & at a predetermined space. To understand, select, operate and maintain the material handling equipment.			
Objective :-				
S. No.	The Students should be able to:			
1	<ul style="list-style-type: none">Understand constructional & operational features of various materials handling systems.			
2	<ul style="list-style-type: none">Identify, compare & select proper material handling equipment for specified applications.			
3	<ul style="list-style-type: none">Know the controls & safety measures incorporated on material handling equipment.			
4	<ul style="list-style-type: none">Understand different material handling processes used in industries.			
5	<ul style="list-style-type: none">Appreciate the role of material handling devices in mechanization & automation of industrialprocess.			
Pre-Requisite: Nil				
Contents			Hrs/week	
Chapter		Name of the Topic	Hours	Marks
		GROUP-A		
01	1.0 1.1	Introduction to Material Handling System Over view of Materials handling system, importance of material handling equipment in relation to productivity and cost of production. Principle groups of equipment. Unit load, bulk load and their designation	4	
02	2.0 2.1 2.2 2.3	Hoisting Machinery & Equipment Working principle and application of Hand Operated Hoists, Electric Hoists and Winch. Essential parts, operating principle of EOT Cranes. Break arrangement and safety arrangement of EOT Cranes. Essential parts, operating principle of mobile Crane. Basic principle of level lifting mechanism, luffing gear hoisting mechanism and slewing gear mechanism of Crane. Applications of Bucket Elevator.	7	
		GROUP-B		
03	3.0 3.1	Conveying Machinery: Essential components and applications of Belt Conveyors, Roller Conveyors, Screw Conveyors,	4	
04	4.0 4.1	Surface Transportation Equipment: Working principle and application of trackless Equipment: Powered Trucks, Tractors, Working principle and application: Automatic Guided Vehicle (AVG)	4	
05	5.0	Selection of Material Handling Equipment:	5	

	5.1	Factors affecting choice of material handling equipment such as type of loads, hourly capacity of the unit, direction & length of travel, production process involved, specific load conditions & economics of Material handling system.		
Sub Total:			24	
Internal Assessment Examination & Preparation of Semester Examination			6	
Total			30	
Practical: List of Practical: <ol style="list-style-type: none"> 1. Study & demonstration of Hand Operated Hoists / Electric Hoists / Winch. 2. Study & demonstration of any one type of conveyor – belt, Screw, pneumatic, hydraulic. 3. Study and demonstration of any one type of crane (working model or actual). 4. Study and demonstration of fork lift truck (using electric drive or diesel engine). 5. Study and demonstration of Bucket Elevator. 6. Study of preventive maintenance schedule of any one major material handling equipment using operation manual. 7. Visit to coal handling plant of thermal power plant or cement industry to observe working of different types of bulk material handling devices (at least three equipment). Write report of the visit. 8. Collect and write detail specifications of any two major material handling devices. 9. Collect photographs of ten different types of cranes used in industries. Write name and specific utility of each. 10. Collect photographs of ten different types of conveyers used in industries. Write name and specific utility of each. Note: At least THREE (03) nos. of Practical / Study are to be conducted.				

Name of the Course : Diploma in Mechanical Engineering	
Subject Title: REFRIGERATION AND AIR CONDITIONING (Elective-II)	
Course code: ME/	Semester : Sixth
Duration : 17 weeks	Maximum Marks : 100
Teaching Scheme:	Examination Scheme:
Theory : 3 hrs/week	Internal Assessment: 10 Marks
Tutorial: hrs/week	Teacher's assessment (Assignment & Quiz): 05 Marks
Practical : 2 hrs/week	End Semester Exam: 35 Marks
	Practical: Internal Sessional continuous evaluation:25Marks
	Practical: External Sessional Examination:25 Marks
Credit: 4	
Aim :-	
Sl. No	

1	<p>This subject is classified as an Applied Technology. The 21st century predicts revolutionary developments in Refrigeration and Air Conditioning. Refrigeration and Air conditioning is one of the most meaningful job areas for diploma holders in Mechanical Engineering. Considering the wide and increasing use of Refrigeration and Air conditioning for domestic, commercial and industrial applications and the challenges put by the use of Refrigeration and air conditioning equipments in existing stage, it is absolutely necessary that Diploma Engineers should learn this subject. They should know the processes, equipments, systems of Refrigeration and Air Conditioning with their functioning, maintenance, repairs and measures to meet the challenges of the near future in this area.</p>
S No	The student will able to
	<ol style="list-style-type: none"> 1. Describe types, working principles and construction of Refrigeration and Air Conditioning systems. 2. Calculate performance of refrigeration and air conditioning system. 3. Use various charts and tables used in refrigeration and air conditioning. 4. Enlist properties of refrigerants, their applications and effects on environment. 5. Identify various components and controls used in refrigeration and air conditioning. 6. Describe various air conditioning systems and their applications. 7. Estimate cooling and heating loads. 8. Identify and describe different components of air distribution system.

Pre-Requisite:-		
Sl. No	Elementary knowledge on thermal engineering & Power engineering	
1		
Contents		Hrs/w week
Chapter	Name of the Topic	Hours
Group A		
01	Basics of Refrigeration Definition of refrigeration. Necessity of refrigeration Concept of heat pump and refrigerator. Unit of refrigeration, C.O.P. and refrigerating effect. Major application areas of R.A.C. like domestic, commercial and industrial.	03

02	Refrigeration Cycles Reversed Carnot Cycle and its representation on P-V and T-S diagram & determination of COP. Air Refrigeration Cycles: - <ul style="list-style-type: none"> - Bell Coleman air refrigerator, it's representation on P-V and T-S diagram, types and applications like air craft refrigeration using simple air cooling system. - (Simple numerical on Reversed Carnot cycle) Vapour Compression Cycle (V.C.C): - <ul style="list-style-type: none"> - Principle, Components, Representation on P-H and T-S diagram, COP, , Effect of superheating, under cooling, suction pressure and discharge pressure, (simple numerical) Vapour Absorption system : - <ul style="list-style-type: none"> - Flow diagram and working principle of aqua- ammonia system (practical) - Comparison of above Refrigeration Cycles. 	10
03	Refrigerants Classification of refrigerants. Desirable properties of refrigerants. Eco-friendly refrigerants like R-134a, hydrocarbon refrigerants.	03

Group B		
04	Psychrometry Definition and necessity of air conditioning. Properties of Air, Dalton's law of partial pressure Psychrometric chart Discussion on Psychrometric processes using Psychrometric chart & flow diagram, Concept of Bypass Factor, ADP, SHF, Simple numerical using Psychrometric chart	06
05	Air- conditioning systems Classification of A.C. systems Summer, winter and year round A.C. systems	02
	Total	24

Group A: (Any three)

1. Trial on water cooler test rig.
3. Visit to cold storage
4. Demonstration of domestic refrigerator in View of construction, operation and controls used.
5. Demonstration of various controls like L.P./H.P. cut outs, thermostat, overload protector, solenoid valve used in RAC.
6. Identification of components of 'hermetically sealed compressor'.
7. Visit to repair and maintenance workshop in view of use of various tools and charging procedure.
8. Cooling load calculations for cabin, classrooms, laboratory, canteen and dairy plant, milk storage, small freezers (minimum one).
9. Trial on A.C. test rig.
10. Visit to central A.C. plant in view of ducting system and Air distribution system (e.g. frozen food industry/ice- cream industry/mushroom plants/textile industries).

Assignments:

1. Prepare a chart mentioning name VCC equipments and their applications.
2. Prepare a chart mentioning different Refrigerants & their specific application.
3. Prepare Air distribution system of central air conditioning system.
4. Two problems on VCC.
5. Two problems on Air refrigeration cycle.
6. One problem on each Psychrometric process using Psychrometric chart.
7. Flow diagram of simple air craft cooling system

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING		
Subject: PRODUCTION MANAGEMENT		
Course code:		Semester : Sixth
Duration : 17 week		Maximum Marks : 100
Teaching Scheme		Examination Scheme
Theory : 3 hrs/week		Semester Exam: 70 Marks
Tutorial: hrs/week		Teacher's Assessment (Assignment & Quiz): 10 Marks
Practical : hrs/week		Internal Assessment: 20 Marks
Credit: 3		
Aim :-		
	To study the techniques for improvement in productivity of the people and equipment. to plan the production schedule accordingly organize material supply for the manufacturing activities. Tominimize the direct and indirect cost by optimizing the use of resources available. To learn accounting process, inventory control and process planning. Modern manufacturing system employ techniques such as JIT, TPM , FMS, 5'S', kaizen which should be known to the technician.	
Objective :		
Sl. No.	The student will able to	
1	Understand importance of productivity and factors for improvement of productivity.	
2	Know different production systems and modern trends in manufacturing systems.	
3	Find the break even point for manufacturing a product.	
4	Prepare / modify layout of production system.	
5	Select suitable material handling devices and plant facilities.	
	Prepare process plan and specify toolings for it.	
	Prepare process chart for analysis of existing process.	
	Use pert & cpm techniques for scheduling and controlling the manufacturing activities.	
	Apply techniques of method study and work measurement for improvement of existingmanufacturing methods.	
	Find the economic order quantity (EOQ) for given situation.	
Pre-Requisite: Nil		
Contents		Hrs/week
Chapter	Name of the Topic	Hours
GROUP:A		
01	Production System Production - Definition , Types of production systems Productivity - Importance , Measurement of Productivity , Techniques of improving productivity Elements of cost- Fixed cost, Variable Cost. Break even analysis	03

02	Plant location, Plant layout and Material Handling Plant Location - Importance of Site Selection, Factors affecting Site Selection. Plant Layout - Objectives, types, characteristics of Plant Layout. Material handling – Need, Types of material handling devices- conveyors, Hoist & cranes , fork lift, Automated Guided Vehicles (AGV's)	04
GROUP: B		
03	Process Planning Planning of Processes from raw material to finished product, Factors affecting Process Planning, Deciding sequence of operations, Operation Sheet Determination of Inspection Stages. Plant Capacity, Machine Capacity, Plant Efficiency.	04
04	Production Planning and Control Routing, Sequencing, Scheduling, Dispatching, Meaning of Control, Progressive Control, Gantt chart.	03
GROUP: C		
05	Work Study Method Study - Objectives, Recording Techniques - Process Charts – Outline process chart, Flow process chart, Two Hand process chart, Multiple activity chart, Flow diagram, Work Measurement - Objectives, procedure, Time Study, Time Study Equipments. Standard Time, Allowances, Calculation of Standard Time,	05
06	Quality Control: A) Quality: Definitions, meaning of quality of product and services, quality characteristics, quality of design, quality of conformance, quality of performance, concept of reliability, cost, quantity assurance, cost of rework and repair, quality and inspection. B) ISO 9000 Series & other standards: Concept, ISO 9000 series quality standards, Qs 14000, Standards certification.	05
	Total	24
Suggested List of Assignments/Tutorial:- (Any two) 1. Making a conceptual layout of an Engg. Industry conforming ISO 9000 series. 2. Preparation of EOQ model. 3. Preparation of a flow process and operation process chart. 4. Preparation of a chart of Total Quality Management.		

Name of the Course : DIPLOMA IN MECHANICAL ENGINEERING (INDUSTRIAL PROJECT)	
Course code: ME	Semester: Sixth.
Duration: 17 weeks	Maximum Marks : 100
Teaching Scheme	Examination Scheme:
Theory : hrs/week	Practical: Internal Sessional continuous evaluation: 50 Marks
Tutorial: hrs/week	Practical: External Sessional examination: 50 Marks
Practical : 6 hrs/week	
Credit: 3	

Aim :-

S. No.	
1	To solve the problems involving drawings, designs, manufacturing, installation, testing and maintenance of machines. In order to cultivate the systematic methodology for problem solving using acquired technical knowledge & skills, and to enhance the generic skills & professional skills.

Objective :-

	The Students should be able to:
	<ol style="list-style-type: none"> 1. Identify, analyze & define the problem. 2. Generate alternative solutions to the problem identified. 3. Compare & select feasible solutions from alternatives generated. 4. Design, develop, manufacture & operate equipment/program. 5. Acquire higher-level technical knowledge by studying recent development in mechanical engineering field. 6. Compare machines/devices/apparatus for performance practices. 7. Work effectively in a team.

Pre-Requisite: Nil

Contents:

Part A-Project (Any one)

A batch of maximum 4 students will select a problem and then plan, organize & execute the project work of solving the problem in a specified duration. Student is expected to apply the knowledge & skills acquired. Batch may select any one problem/project work from following categories.

- a) Fabrication of small machine / devices/ test rigs/ material handling devices/ jig & fixtures/ demonstration models, etc. Report involving aspects of drawing, process sheets, costing, Installation, commissioning & testing should be prepared and submitted.
- b) Design & fabrication of mechanisms, machines, Devices, etc. Report involving aspects of designing & fabricating should be prepared & submitted
- c) Development of computer program for designing and /or drawing of machine components, Simulation of movement & operation, 3D modeling, pick & place robots etc.
- d) Industry sponsored projects- project related with solving the problems identified by industry should be selected. One person / engineer from industry is expected to work as co- guide along with guide from institution.
- e) Literature survey based projects: Project related with collection tabulation, classification, analysis & presentation of the information. Topic selected must be related with latest technological developments in mechanical or mechatronics field, and should not be a part of diploma curriculum. Report should be of min 60 pages.
- f) Investigative projects- Project related with investigations of causes for change in performance or structure of machine or component under different constraints through experimentation and data analysis.
- g) Maintenance based projects: The institute may have some machine/ equipment/ system which are lying idle due to lack of maintenance. Students may select the specific machines/equipment/system. Overhaul

it, repair it and bring it to working condition. The systematic procedure for maintenance to be followed and the report of the activity are submitted.

h) Industrial engineering based project: Project based on work study, method study, methods improvement, leading to productivity improvement, data collection, data analysis and data interpretation be undertaken.

i) Low cost automation projects: Project based on hydraulic/pneumatic circuits resulting into low cost automated equipment useful in the identified areas.

j) Innovative/ Creative projects – Projects related with design, develop & implementation of new concept for some identified useful activity using PLC, robotics, non-conventional energy sources, CIM , mechatronics,

k) Environmental management systems projects: Projects related with pollution control, Solid waste management, liquid waste management, Industrial hygiene, etc, Working model or case study should be undertaken.

m) Project based on use of appropriate technology particularly benefiting rural society or economically weaker section.

Part B- Seminar

1. Selection of topic for the seminar should be finalized in consultation with teacher guide allotted for the batch to which student belongs.

3. for presentation of seminar, following guide lines are expected to be followed:-

b) Time for question/answer : 2 to 3 minutes /student

4. Topic of the seminar should not be from diploma curriculum.

5. Seminar can be on project selected by batch.

Name of the Course : Mechanical Engineering		
Subject Title: Professional Practices-IV		
Course code:	Semester: Sixth.	
Duration :	Maximum Marks : 50	
Teaching Scheme	Examination Scheme	
Theory : hrs/week	Practical: Internal Sessional Continuous Evaluation: 25 Marks	
Tutorial: hrs/week	Practical: External Sessional Examination: 25 Marks	
Practical : 4 hrs/week		
Credit: 2		
Aim :-		
Sl. No.		
1	To develop general confidence, ability to communicate and attitude, in addition to basic technological concepts through Industrial visits, expert lectures, seminars on technical topics and group discussion.	
Objective :-		
Sl. No.	The student will able to:	
1	<ul style="list-style-type: none"> Acquire information from different sources. 	
2	<ul style="list-style-type: none"> Prepare notes for given topic. 	
3	<ul style="list-style-type: none"> Present given topic in a seminar. 	
4	<ul style="list-style-type: none"> Interact with peers to share thoughts. 	
5	<ul style="list-style-type: none"> Prepare a report on industrial visit, expert lecture 	
Pre-Requisite:-Nil		
Contents		Hrs/week

Chapter	Name of the Topic	
01	<p>Group Discussion : (Two topics)</p> <p>The students shall discuss in group of six to eight students and write a brief report on the same as a part of term work. The topic for group discussions may be selected by the faculty members.</p> <p>Some of the suggested topics are:</p> <ul style="list-style-type: none"> i) Solar Vehicles / Electric Vehicles. ii) Auto Vehicles – Comparison. iii) Two stroke versus four stroke engines. iv) Recycling of plastics and other waste material. v) Attributes of product design. vi) Creativity and innovativeness. vii) Energy conservation in institutes. viii) Value engineering. ix) Revolution in communication technology. x) Pneumatic tools and equipment, xi) Wear mechanisms. 	12 Hrs.
02	<p>Seminar on technical topic:</p> <p>Individual student should present a seminar on technical topic and also submit a brief report on the same as a part of term work. The seminar topic may be suggested by the faculty members.</p>	20 Hrs.
	Total	32 Hrs.

Name of the Course: Diploma in Mechanical Engineering		
Subject: General Viva-Voce		
Course Code:	AE	Semester: Sixth
Duration:	N.A	Maximum Marks: 100
Teaching Scheme :	N.A	Examination Scheme : viva-voce
Theory:	Nil	Continuous Internal Examination : Nil
Tutorial:	Nil	End Semester Exam.: Nil
Practical:	Nil	End Semester Examination (viva-voce): 100 Marks
Credit: 3		
Aim :		
The object of conducting Grand viva-voce is to assess out going students on their general understanding of all subjects (Theory, practical, laboratory etc.) taught and also on expected technical sense / ability developed being an engineer during this periods.		
Examination Scheme (at semester end): Grand Viva-voce		Total Marks : 100
<ul style="list-style-type: none"> • End Semester Examination (viva-voce): - 100 marks. <p>Examiner –Internal Lecturers headed by HOD (Mechanical)</p>		