6.1(B) POWER PLANT ENGINEERING

RATIONALE

L Т Р 5 S (\$-4 to 5 Industrial / Field visits)

A Diploma holders in mechanical engineering is supposed to manage the power generating plant. Therefore, he must have relevant knowledge and skills about various power plants e.g. steam power plant, nuclear power plant, hydro power plant, diesel engine power plant and

Note: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

Introduction 1.

- Sources of energy-fuels, atomic nuclei, flowing stream of water, solar rays, 1.1 wind, terrestrial heat, ocean tides and waves.
- Concept of power station, central and industrial power station, captive power 1.2 station, classification of power station with respect to prime mover steam, IC engine, gas turbine and hydro power station.

2. **Steam Power Plant**

Steam Power Cycle 2.1

- 2.1.1 Parameter of a power cycle-thermal efficiency, work ratio, specific stream consumption.
- 2.1.2 Rankin cycle flow diagram, representation on thermodynamic planes, thermal efficiency, effect of change of condenser pressure, boiler pressure, degree of superheat on thermal efficiency.
- Reheat cycle. Simple regenerative cycle. 2.1.3

2.2 **Steam Generating Unit**

- Elements of a steam power plant, concept of steam generating unit, 2.2.1 classification, major components and their functions. Types of super heater, superheat control methods, steam, nuclear and hydro are being set up.
- 2.2.2 Feed water heating -advantages, types of feed water heaters, Airpreheaters-purpose and types, furnaces-purpose and classification. Pulverized fuel systems, and types of draft systems.
- Special features of modern high pressure boilers, Description of 2.2.3 representative high pressure boilers.
- Performance of a boiler, Efficiency, Equipment evaporation, capacity, 2.2.4 heating surface, combustion rate, absorption rate, absorption rate, energy balance.

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(30%)

2.3 **Steam Prime Movers**

- Concept of a prime mover, steam turbine-advantages as a prime mover, 2.3.1 principle elements of a steam -turbine and functions-nozzles, blades. rotor, shaft, casing, shaft seals diaphragm, bearings, steam control, oil system.
- 2.3.2 Governing of a steam turbines- classification of steam turbines.
- Starting and stopping procedures for turbines, precautions during the 2.3.3 running.
- Performance pf steam turbine, thermal efficiency, efficiency ratio, 2.3.4 Mechanical efficiency, steam rate.

2.4 Steam Condensing Equipment

- Functions of condensers, classification, surface condenser components 2.4.1 and their functions.
- 2.4.2 Condenser auxiliaries hot well, condensate pump, vacuum pump, air ejector, circulating pump, atmospheric relief valve.
- 2.4.3 Requirement of a good condensing system 2.4.4
- Cooling towers purpose and types.

2.5 **Steam Power Station Control** 2.5.1

- Effect of load verification of various parameters, Types of control systems - area and centralized, basic components of a control system, compressed air and electrical control systems, controls and instruments
- in a modern central station control room. Working of feed water control system and steam temperature control 2.5.2
- 2.5.3 Records maintained in a steam power station and their purpose.

Nuclear Power Plant

3.

- Nuclear reactions -fission, fusion, mass defect, binding energy, chain reaction, 3.1
- methods of control of rate of fusion reaction, types of nuclear materials. Nuclear reactors - functions of different elements, classification on the basis 3.2
- Nuclear power stations employing boiling water Went reactor, candu type 3.3

reactor -system components, advantages and disadvantages. 4. Diesel Engine Power Plant

Advantages and disadvantages of diesel engine. Essential elements of diesel power plant. Fuel injection system. Performance testing of diesel engine power plant. 5. Gas Turbine Power Plant Brayton cycle-schematric diagram, thermal efficiency. Advantages of gas turbines over diesel engines. Classification of gas turbines, advantages and disadvantages methods of improving thermal efficiency. Important parts and their functions, essential auxiliaries and controls for gas turbines power plant. Fuel for gas turbines.

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6.1(A) AUTOMOBILE ENGINEERING

L 5 (\$- 4 to 5 Industrial / Field visits)

RATIONALE

These days, automobile has become a necessity instead of luxury. The diploma holders in this course are required to supervise production and repair and maintenance of vehicles. For this purpose, knowledge and skills are required to be imparted to them regarding automobile industry as a whole. This subject aims at developing required knowledge and skills in this Note: Weightage of each topic for external examination is given in the brackets.

- Introduction

DETAILED CONTENTS

- 1.1
- Automobile and its development 1.2
- Various types of automobiles manufactured in India. 1.3 Layout of chassis

2. **Power System**

- 2.1 Fuel systems for petrol and diesel engines including multi point fuel injection
- 2.2
- (MPFI), common rail direct injection (CRDI), Fuel injectors and nozzles. Comparison of MPFI with carburetor system. 2.3
- Concept of double overhead cam, single overhead cam, Twin cam 16 valve technology in 4 cylinder engine.

3. **Transmission System**

- Clutch Function, Constructional details of single plate and multiplate friction 3.1 clutches, Centrifugal and semi centrifugal clutch, Hydraulic clutch
- Gear Box Function, Concept of sliding mesh, constant mesh and 3.2 synchromesh gear box, Torque converter and overdrive,
- 3.3 Types of drives - Front wheel, Rear wheel, Four Wheel.
- Function of Propeller shaft, Universal joint, Differential and Different types of 3.4 Rear axles and Front Axles.
- Wheels and Tyres Types of wheels, Types and specifications of tyres used in 3.5 Indian vehicles, Wheel balancing

4. **Steering System**

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Function and principle of Ackerman and Davis steering mechanism, types of steering gear boxes - Worm and nut, worm and wheel, worm and roller, rack and opinion, Power steering system and alignment of wheels - Toe in, toe out, camber, caster, kingpin inclination.

5. Braking system

(10%) Constructional details and working of mechanical, hydraulic brake. Concept of air and vacuum brake, brake adjustment, Introduction to Anti lock brake system and its working.

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(15%)

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(5%)

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6. Suspension System

Function, Types, Working of coil spring, leaf spring. Concept of Air suspension and Shock absorber.

7. Auto Electrical System:

(15%)

(10%)

- 7.1 Constructional details of lead acid cell battery. Maintenance of batteries, checking of batteries for voltage and specific gravity, Magnato and Battery coil ignition system.
- 7.2 Concept of Dynamo
- 7.3 Alternator Construction and working, Charging of battery by Alternator and Regulator.

Industrial / Field visits

6.1(C) Non - Conventional Sources of Energy

L Т Р 5 S (\$- 4 to 5 Industrial / Field visits)

RATIONALE

Note: Weightage of each topic for external examination is given in the brackets. DETAILED CONTENTS

Introduction: 1.

Fundamentals of energy, Conventional energy sources, their (15%) environmental impacts, Types of non- conventional sources of energy, capacity and expected potential of renewable energy: global and national scenarios, prospects of

Solar energy: 2.

Introduction, solar energy available, solar radiations: beam and diffuse, solar constant, solar photo-voltaic cells principle, applications, merits and demirits, working principle of solar thermal flat plate collectors and concentrating collectors and other solar energy applications: solar thermal power plant, solar pond, solar heating, solar water pumping, solar distillation, solar still, solar absorption air- conditioning.

Wind energy: 3.

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Introduction, cause of wind, wind power, principle of wind energy conversion, wind turbine ,types, cut in and cut out speed , tip speed ratio, Betz limit, power coefficient , wind energy limitations.

4. **Biomass energy:**

(10%) Introduction, Biomass Conversion Technologies, types of biomass based fuels, Biodiesel, Biogas, production, properties and applications.

5. Small hydro power systems:

Introduction, classification of hydroschemes and water turbines, essential components, efficiency.

6. Geothermal energy:

Introduction, geothermal sources, advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

7. Tidal and Wave energy:

Introduction, energy from tides, basic principle of tidal power, advantages, limitations. Wave Energy applications.

(10%)

(10%)

(10%)

(10%)

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6. Hydro Power Plant

(10%)

Advantages, Basic elements, Dams, Head works, water Turbines, Classification of water turbines speed and pressure control, plant auxiliaries, plan operation.

7. Plant Economy

(10%)

Elements of cost of power, fixed cost, operating cost, factors affecting economy in generation and distribution, Economy in plant selection.

Industrial / Field visits

6.2 Communication Skills & Personality Development

RATIONALE

Diploma holders are support to communicate verbally and in written forms. Further technical Dipional report writing forms another elsential requirement of these people. Keeping in view above requirements, this subject has been added to develop necessary competencies in written and oral communication. Efforts should be made to give practice of communication to the students.

DETAILED CONTENTS

Note: Weightage for each topic for external examination is given in the brackets.

Précis writing: 1.

Précis writing of simple extracts from any English Newspaper.

Concepts of Communication: 2.

- Importance of communication, one way and two way communication, i) methods of communication - oral, written and non-verbal, barriers to communication and techniques of overcoming the barriers, concept of effective communication, telephonic communication, public speaking and attending interviews.
- Body language, Eye contact, Dress sense, Posture Gestures. Image Building ii) through verbal & non-verbal, self esteem.

Correspondence: 3.

- Business, official, social letters, letters to press. Inter office communication. i) Two questions of 10 marks each are to be attempted out of four. notices.
- advertisement, release, communications, Press memorandum and Tagline. Two questions of 10 marks each are to be ii) attempted out of four. (15%)

Report Writing: 4.

- Technical i)
- General ii)
- Practice of writing resume and applications for job. 5.
- Importance & benefits of regular reading of Newspapers, writing a brief 6. newspaper clip.

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(10%)

(20%)

(40%)

(10%)

6.3 MACHINE DESIGN

RAT	IONAL	E	L 5	T 1	P
Diplo develo conve of the about	ma holo opment rsant wi se princ various	ders in mechanical engineering are required to assist in of prototype and other components. For this, it is essential ith the principles related to design of components and machine siples for designing. The aim of the subject is to develop know aspects related to design of machine components.	the that e and wledg	design he is l applic ge and	and made sation skills
Note:	Weigh	tage of each topic for external examination is given in the brack	kets.		
		DETAILED CONTENTS			
1.	Introd	luction to Design			
	1.1	Basic requirements for machine elements		(5%)	
	1.2	General design process			
	1.3	Mechanical properties			
	1.4	General methods considerations like fatigue, creep, fabri economic considerations, material selection, ergonomic etc.	catio	n met	hods,
2	Rivete	ed and Welded Joints			
	2.1	Types of riveted joints		(15%)	
	2.2	Possible failure of riveted joints			
	2.3	Design of Lap and butt type riveted joints (simple cases)			
	2.4	Strength and efficiency of riveted joints			
	2.5	Common types of welded joints			
	2.6	Transverse fillet and parallel fillet welded joints.			
3.	Screw	Joints		(20%))
	3.1	Introductions to screw and various definitions of screw threads	s.		
	3.2	Advantages and disadvantages of screwed joints over riveted a	and v	velded	
		joints.			
	3.3	Common types of screw fastening; through bolt, tap bolt, stud	, cap	screw	,
		machine screw and set screws			

- 3.4 Designation of screw threads
- 3.5 Stresses in screw fastenings
- Design of bolts for cylinder cover 3.6

4. Design of Cotter Joint for Round Rod

4.1 Design of cotter

- 4.2 Design of socket
- 4.3 Design of spigot

9 Page

(20%)

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5.	Design of Knuckle Joint 5.1 Design of Rod 5.2 Design of pin	(10%)
6.	Shafts, Keys and hooks(1)6.1Various type of shafts6.2Stresses in shafts6.3Design of the set	15%)
7.	 6.4 Types of hooks Couplings 	noment
	 7.1 Definition of term key; its various types 7.2 Splines 7.3 Definition of term key; its various types 	5%)
5	 Forces acting on sunk keys Shaft couplings and its various types Design of flange coupling 	
• An ex	pert from some industry may be invited to deliver lecture.	

METROLOGY AND INSTRUMENTATION 6.4

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RATIONALE	5	-	2
No.			-

Metrology is the science of measurement. Diploma holders in mechanical engineering are Metrology is a mechanical engineering are responsible for ensuring process control and quality control by making measurement and responsible of various parameters. For this purpose to be the set of the set of various parameters of the set of responsible and skills about various inspection of various parameters. For this purpose, knowledge and skills about various measuring instruments is required. Hence this subject. The aim of this subject is to develop measuring and skills regarding various measuring amongst the students.

Note: Weightage of each topic for external examination is given in the brackets.

DETAILED CONTENTS

1	Introduction			
1.	1.1 Meaning of metrology	(5%)		
	1.2 Precision and accuracy			
	1.3 Interchangeability			
2.	Linear Measurement	(20%)		
	2.1 Engineering scale	(_0,0)		
	2.2 Vernier Caliper			
	2.3 Micrometer			
	2.4 Height gauge and depth gauge			
	2.5 Radius gauge and feeler gauge			
	2.6 Dial indicator			
	2.7 Comparators (In general use only)			
	2.8 Slip gauges			
2	L.9 Box Gauge Angular Measurements	(10%)		
5.	Working principle and constructional details of			
	3.1 Combination set			
	3.2 Vernier bevel protractor			
	3.3 Sine bar			
	3.4 Taper measurement by rollers			
4.	Surface Measurements	(10%)		
	4.1 Straight edge			
	4.2 Try square			
	4.3 Surface plate (use and specifications)			
5.	Limit gauges Go and No Go gauges	(5%)		
	Sal	(15%)		
	Thread Measurements			
	6.1 Measurement of thead clement	6.36		
	0.2 Screw pitch gauge	111Pape		

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Gear Tooth Measurement 7.1 Major Dia. 7.2 Pitch Circle Dia (PCD) 7.3 Addendum 7.4 Dedendum Surface Finish Measurements 8.1 Roughness and Waviness 8.2 Various roughness valves-CLA valve, RMS valve, Mean valve. 8.3 Surface roughness measuring instrument-principle of working.

9. Other Measuring Instruments

- 9.1 Autocollimator
- 9.2 Tool maker's Microscope
- 9.3 Profile Projector
- 9.4 Coordinate Measuring Machine

Screw thread micrometer

Thread limit gauges

10. Instrumentation

6.3

6.4

7.

8.

(10%) Measurement of mechanical quantities such as displacement, vibrations, frequency, pressure, temperature, humidity by electromechanical transducers of resistance; capacitance and inductance type.

Note:

• - An expert from industry may be invited to deliver lecture.

LIST OF PRACTICAL (METROLOGY AND INSTRUMENTATION)

- Use of linear measuring instruments like vernier caliper and micrometer. 2. Use of height gauge and depth gauge
- 3.
- Measuring with the help of combination and bevel protractor Angle measurement by use of sine bar and slip gauges 4.
- 5.
- Use of slip gauges in measurement of centre distance between two pins. Use of comparator for measurement 6.
- 7.
- Measurement of taper by standard balls and rollers 8.
- Measurement of threads parameters by using toolmakers microscope. Measurement of gear elements by using gear tooth vernier 9.
- Measurement of profile-by-profile projector. 10.
- 11.

Measurement of surface roughness of a surface.

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(5%)

(10%)

(10%)

OPERATIONS MANAGEMENT 6.5

RATIONALE:

RATIONAL Diploma holders in mechanical engineering are responsible for controlling production and Diploma holders in meeting and on genering are responsible for controlling production and quality of the product on the shop floor as well as are responsible for production, planning erection, installation production, planning

quality of the product on the chop from as well as are responsible for production and and control. He is also required to supervise erection, installation and maintenance of and control. He is also required to lead a team of workers and maintenance of equipment including including and undertake work-study for better utilization of resources. He is also required to lead a team of workers and motivate them towards in the state of the sta resources. He is used to be imparted to them. This subject aims at double and skills about these realization of organization of them. This subject aims at development of competencies to material. Equipment and production control schedular and production control prepare material. Equipment and production control schedules and maintain required quality prepare material. Description control schedules and maintain required quality levels. In addition, it will also help in developing skills in erection, installation and testing of equipment.

Note: Weightage of each topic for external examination is given in the brackets.

Detailed contents

Overview of Operations Management 1.

Concept of the term Operations. Types of Business Operations - Manufacturing, Service and Trading. Types of manufacturing Systems - Mass, Batch and Produce to Order Manufacturing Systems. Necessity and Functions of Production Planning and Control. Concept of Product Life Cycle.

Plant Location and Layout. Material Handling 2.

15 % Plant Location decision and its importance. General factors affecting Plant Location decision. Concept of Plant layout, factors affecting Plant Layout. Types of Plant Layouts - Product, Process, Combination and Fixed Position Layouts. Concept of Line Balancing. Introduction and Functions of Material Handling. Different material Handling equipments and their selection.

3. Forecasting

Importance of Forecasting. Types of Forecasting - Long, Medium and Short term Forecasting. Concept of Time Series in Forecasting. Techniques in Forecasting -

- Qualitative Techniques Educated Guess, Executive Committee Consensus, i) Delphi Method, Sales Force Survey, Customer Survey, Historical Analogy and Market Research.
- Quantitative Techniques Moving Average, Weighted Moving Average, ii) Exponential Smoothing and Regression Analysis.
- Errors Estimates in Forecasting Mean Absolute Deviation and Standard 111) Error of Estimates.

Materials Management

- Introduction to Inventory Management Meaning and Objectives (No i)
- Economic order Quantity Introduction and Graphical Representation

10 %

20 %

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- iii) **ABC** Analysis
- Purchasing Procedure Objectives of Purchasing, Functions of purchasing iv) department, Steps in Purchasing.
- Introduction to Modern Materials Management Techniques JIT / SAP / ERP v)

Y) Material Planing Resource, BRP.

5. **Project Management**

- i) Meaning of the term project
- ii) Importance of Project Management
- iii) Drawing of simple project networks (Activity On Arrow and Activity On Node)
- iv) Introduction to CPM and PERT – Critical Time Calculations

6. Supply Chain Management

- i) Meaning of a Supply Chain
- ii) Overview of Supply Chain Management
- iii) Role of Logistics in Supply Chain Management
- iv) Make / Buy Decisions
- v) Introduction to E Commerce
- vi) Importance of Information Technology in Supply Chain Management

7. **Production Scheduling**

- i) Overview of Production Scheduling
- ii) Loading - Concept and Types of Loading iii)
- Types of Production Schedules Master Production Schedule iv)
 - Techniques of Scheduling Priority Rules in Sequencing, Sequencing n jobs in one, two and three machines.

8. Maintenance Management

- i) Meaning and Importance of Maintenance in an industry ii)
- Types of Maintenance Systems iii)
- Objectives of Maintenance Management The Bathtub Curve iv)
- Activities involved in Maintenance Management

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10 %

10 %

15 %

INDUSTRY BASED PROJECT WORK 6.6

RATIONALE

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RATIONALE The practical training cum project work is intended to place students for project oriented The practical training in actual work situations for the stipulated period with a view to:

- Develop understanding regarding the size and scale of operations and nature of filed work in which students are going to play their role after completing the course of a) study.
- Develop understanding of subject based knowledge given in the class room in the iii) context of its applications at work places.
- Develop first hand experience and confidence amongst the students to enable them to iv) use and apply polytechnic/institute based knowledge and skills to solve practical problem in the world of work.
- Develop special skills and abilities like interpersonal skills, communications skills, v) attitude and valves.

This practical training cum project work should not be considered as merely conventional industrial training in which students are sent at work places with minimal supervision. This experience is required to be planned and supervision on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnic may establish close linkage with 8-10 relevant organization for providing such as experience. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such which are of curricular interest to students and of professional value to industrial /field organization.

Effort should be made to identify actual field problems including repair & maintenance of inhouse machine & equipments as project work for the students project selected should not be too complex which is beyond the level of the students. The placement of the students for such a practical cum project work should match with the competency profile of students and the project work assigned to them. Students may be assessed both by industry and polytechnic faculty. The suggested performance criteria is given below:

- 1) Punctuality and regularity
- 2) Initiative in learning /working at site
- 3) Level/proficiency of practical skills acquired
- 4) Ability of solve live practical problems
- 5) Sense of responsibility
- 6) Self expression /communication skills
- 7) Interpersonal skills/ Human relation
- 8) Report writing skills
- 9) Viva Voce & Presentation

The project given to student should be such for which someone is waiting for solution. Some of the suggested project activities are given below:

- i) Projects connected with repair and maintenance of machine parts.
- ii) Estimating and costing projects
- iii) Design of components /parts/Jigs/Fixtures.
- iv) Projects related to quality control
- v) Project work related to increasing productivity
- vi) Project connected with work study
- vii) Project relating to erection, installation, calibration and testing.
- viii) Projects related to wastage reductionix) Any other project as parameter of the
- ix) Any other project as per needs of the industry

Practical load for Project in all workshops