

**STATE COUNCIL OF TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA
TEACHING AND EVALUATION SCHEME FOR DIPLOMA IN ENGINEERING COURSES**

DISCIPLINE: MECHANICAL ENGINEERING									SEMESTER: 6 TH			
SL NO	SUBJECT CODE	SUBJECT	PERIODS			EVALUATION SCHEME						
			L	T	P	INTERNAL EXAM			END SEM EXAM	TERM WORK	PRACTICAL EXAM	TOTAL MARKS
						TA	CT	Total				
THEORY												
1.	HMT 601 OR BST 501	ENTREPRENEURSHIP AND MANAGEMENT OR ENVIRONMENT STUDIES	5			10	20	30	70			100
2.	MET 601	INDUSTRIAL ENGINEERING AND QUALITY CONTROL	4			10	20	30	70			100
3.	MET 602	AUTOMOBILE ENGINEERING	4			10	20	30	70			100
4.	MET 603	ADVANCED MANUFACTURING AND CAD/CAM	4			10	20	30	70			100
5.	MET 604	ELECTIVE (any One)	4			10	20	30	70			100
		POWER PLANT ENGINEERING										
		ALTERNATE ENERGY SOURCES AND MANAGEMENT										
		INDUSTRIAL FLUID POWER										
		MECHANICAL MEASUREMENTS AND CONTROL										
PRACTICAL/TERM WORK												
6.	MEP 601	CAD/CAM LAB			4					50	0	50
7.	MEP 602	AUTOMOBILE LAB			6					25	50	75
8.	MEP 603	PROJECT & SEMINAR			6					25	100	125
		LIBRARY STUDIES			2							
GRAND TOTAL			21		18	50	100	150	350	100	150	750

Total Contact hours per week: 39

Abbreviations: L-Lecture, T-Tutorial, P-Practical, TA- Teacher's Assessment, CT- Class test

Minimum Pass Mark in each Theory Subject is 35% and in Practical subject is 50%

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ENVIRONMENTAL STUDIES

(Common to all Branches of Engg.)

BST-501

Period/Week: 05

Total Marks: 100

Total Periods: 75

Theory End Exams: 70; CT (20) +IA (10)

Rationale:

Due to various aspects of human developments including the demand of different kinds of technological innovations, most people have been forgetting that, the Environment in which they are living is to be maintained under various living standards for the preservation of better health. The degradation of environment due to industrial growth is very much alarming due to environmental pollution beyond permissible limits in respect of air, water industrial waste, noise etc. Therefore, the subject of Environmental Studies to be learnt by every Engineering student in order to take care of the environmental aspect in each and every activity in the best possible manner.

OBJECTIVES:

After completion of study of environmental studies, the student will be able to:

1. Gather adequate knowledge of different pollutants, their sources and shall be aware of solid waste management systems and hazardous waste and their effects.
2. Develop awareness towards preservation of environment.

Unit 1: The Multidisciplinary nature of environmental studies (04 periods)

Definition, scope and importance, Need for public awareness.

Unit 2: Natural Resources (12 periods)

Renewable and non renewable resources:

- a) Natural resources and associated problems.
 - Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction mining, dams and their effects on forests and tribal people.
 - Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems.
 - Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.
 - Food Resources: World food problems, changes caused by agriculture and over grazing, effects of modern agriculture, fertilizers- pesticides problems, water logging, salinity, .
 - Energy Resources: Growing energy need, renewable and non-renewable energy sources, use of alternate energy sources, case studies.
 - Land Resources: Land as a resource, land degradation, man induces landslides, soil erosion, and desertification.
- b) Role of individual in conservation of natural resources.
- c) Equitable use of resources for sustainable life styles.









Unit 3: Systems

(12 periods)

- Concept of an eco system.
- Structure and function of an eco system.
- Producers, consumers, decomposers.
- Energy flow in the eco systems.
- Ecological succession.
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the following eco system:
- Forest ecosystem:
- Aquatic eco systems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit 4: Biodiversity and it's Conservation

(08 periods)

- Introduction-Definition: genetics, species and ecosystem diversity.
- Biogeographically classification of India.
- Value of biodiversity: consumptive use, productive use, social ethical, aesthetic and optin values.
- Biodiversity at global, national and local level.
- Threats to biodiversity: Habitats loss, poaching of wild life, man wildlife conflicts.

Unit 5: Environmental Pollution.

(18 periods)

Definition Causes, effects and control measures of:

- a) Air pollution.
- b) Water pollution.
- c) Soil pollution
- d) Marine pollution
- e) Noise pollution.
- f) Thermal pollution
- g) Nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution.

Disaster management: Floods, earth quake, cyclone and landslides.

Unit 6: Social issues and the Environment

(12 periods)

- Form unsustainable to sustainable development.
- Urban problems related to energy.
- Water conservation, rain water harvesting, water shed management.
- Resettlement and rehabilitation of people; its problems nd concern.
- Environmental ethics: issue and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.
- Air (prevention and control of pollution) Act.
- Water (prevention and control of pollution) Act.
- Public awareness.

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Unit 7: Human population and the environment

(09 periods)

- Population growth and variation among nations.
- Population explosion- family welfare program.
- Environment and human health.
- Human rights.
- Value education
- Role of information technology in environment and human health.

Recommended Books:

1. Textbook of Environmental studies, Erach Bharucha, #UGC
2. Fundamental concepts in Environmental Studies, D.D. Mishra, S.Chand & Co-Ltd,
3. Text book of Environmental Studies by K.Raghavan Nambiar, SCITECH Publication Pvt. Ltd.
4. Environmental Engineering by V.M.Domkundwar- Dhanpat Rai & Co.
5. Environmental Engineering & Safety by B.K.Mohapatra.

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ENTREPRENEURSHIP & MANAGEMENT

(Code : HMT-601)

Period/Week: 05
Total Periods: 75

Total Marks: 100
Theory End Exams: 70; CT (20) +IA (10)

(COMMON TO ALL BRANCHES OF ENGG EXCEPT CIVIL/ CSE/ IT)

OBJECTIVES:

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

1. Understand the concept of different forms of organization including MSME and various managerial functions.
2. Understand Entrepreneurship and choose it as a career option after study.
3. Learn about the basic financial accounting and cost control.
4. Know different areas of management relating to stores and purchase, finance, production, sales and marketing and human resources in an organization.
5. Learn about various reasons of industrial sickness and its remedial measures.
6. Have a comprehensive idea on important legislations relating to employment in Factory.

SYLLABUS

1. Concept of Organization & Enterprise Management: 12 periods

- 1.1. Meaning, features and components of Business
- 1.2. Different forms of Business Organizations with features
- 1.3. Meaning, definitions and importance of management
- 1.4. Difference between Management & Administration
- 1.5. Functions of management- Planning, Organizing, Staffing, Directing (including Motivation, Leadership & Communication), Coordinating and Controlling.
- 1.6. Principles of Scientific Management.

2. Entrepreneurship & Management of MSME: 12 periods

- 2.1. Meaning & Need of Entrepreneurship
- 2.2. Qualities of an Entrepreneur
- 2.3. Relevance of Entrepreneurship of Socio-economic gain (Generating national wealth, creating wage & self employment, developing MSME enterprises, Optimizing human and national resources, building enterprising personalities and society)
- 2.4. Micro, Small and Medium Enterprises. (investment limits of MSME)
- 2.5. Project Report- PPR & DPR. (Preparation of a PPR)
- 2.6. Incentives available to MSME as per the latest IPR
- 2.7. Role of DIC, OSFC, OSIC, IDCO, SIDBI, IPICOL and Commercial Banks in the context of MSME.









3. **Financial Accounting & Cost Control:** **12 periods**
- 3.1. Double- entry System of Book –keeping and types of accounts
 - 3.2. Journal, Ledger, Cash Book (different types), Trial balance
 - 3.3. Components of Final Accounts- Trading A/c, Profit & Loss A/c and Balance Sheet
 - 3.4. Elements of Cost and Preparation of Cost Sheet
 - 3.5. Break-even Analysis
4. **Financial Management:** **04 periods**
- 4.1. Meaning & Importance
 - 4.2. Finance Functions
 - 4.3. Types of Capital- Fixed & Working Capital
 - 4.4. Components of Working Capital, Working Capital Cycle
5. **Stores & Purchase Management:** **05 periods**
- 5.1. Inventory Control : Importance & Techniques
 - 5.2. Purchase management-Principles & Procedures
 - 5.3. Important Store Records (Bin Card, Stores Ledger & GRN)
6. **Production Management:** **04 periods**
- 6.1. Production & Productivity
 - 6.2. Production , Planning & Control- (meaning & steps)
7. **Sales & Marketing Management:** **08 periods**
- 7.1. Sales & Marketing Management- Meaning & Importance
 - 7.2. Selling Methods
 - 7.3. Product Policy- (Branding, Packaging, Labeling)
 - 7.4. Product-mix, Pricing methods and Sales Promotion including its techniques.
 - 7.5. Advertising & its media
8. **Human Resource Management:** **06 periods**
- 8.1. Need & Importance
 - 8.2. Recruitment & its sources
 - 8.3. Selection- Methods
 - 8.4. Training- Need, & Methods
 - 8.5. Need of Performance Appraisal
9. **Industrial Sickness:** **04 periods**
- 9.1. Meaning & Symptoms of Sickness
 - 9.2. Causes of Industrial Sickness
 - 9.3. Remedial measures of Sickness









10. Industrial Legislation:

08 periods

- 10.1. Major Provisions of Factories Act relating to Health, Welfare, Safety, Accidents, Hours of Work, employment of Women
- 10.2. Duties and Power of Factory Inspector
- 10.3. Major Provisions of Employee's Compensation Act.

Books Recommended

1. Industrial Engineering & Management : O.P.Khanna
2. Entrepreneurship for Engineers : B.Badhai
3. Principles & Practice of Management : L.M.Prasad
4. Industrial Engineering & Management: Banga & Sharma
5. Mercantile Law: N.D.Kapoor
6. Industrial Engineering & production Management: M.Mahajan
7. Industrial Policy Resolution (latest)









INDUSTRIAL ENGINEERING & QUALITY CONTROL

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 601	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

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 engineering.

Course Objectives:

1. Identification of place for a new plant set up and systematic arrangement of machinery and shop for smooth production.
2. Understanding of stock management and maintenance to reduce plant ideal time.

1.0 Plant location and Layout Periods

- 1.1 Describe the features governing plant location. 8
- 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.

2.0 Operations Research:

- 2.1 Introduction to Operations Research and its applications
- 2.2 Define Linear Programming Problem, Solution of L.P.P. by graphical method
- 2.3 Evaluation of Project completion time by Critical Path Method and PERT (Simple problems)- Explain distinct features of PERT with respect to CPM

3.0 Inventory Control: 6

- 5.1 Classification of inventory.
- 5.2 Objective of inventory control.
- 5.3 Describe the functions of inventories.
- 5.4 Explain and Derive economic order quantity for Basic model. (Solve numerical)
- 5.5 Define and Explain ABC analysis.

6.0 Plant maintenance: 7

- 6.1 Describe the objectives of plant maintenance.
- 6.2 Describe the duties, functions and responsibilities of plant maintenance department.
- 6.3 Describe the types of maintenance: Preventive, Breakdown, Scheduled and Predictive maintenance.



7.0 Inspection and Quality Control: 12

- 7.1 Define Inspection and Quality control.
- 7.2 Describe planning of inspection.
- 7.3 Describe types of inspection.
- 7.4 Study of factors influencing the quality of manufacture.
- 7.5 Explain the Concept of statistical quality control, Control charts (X, R, P and C - charts). Solve related problems.

8.0 Contemporary Quality Management concepts 6

- 8.1 Concept of total quality management (TQM)
- 8.2 ISO-9000/14000, concept & its evolution & implications.
JIT, Six Sigma, 7S, Lean manufacturing

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	Telsang	Industrial Engg & Production Management	S. Chand
3	M.Mahajan	Statistical Quality Control	Dhanpat Rai & Sons

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AUTOMOBILE ENGINEERING

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 602	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

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 engineers.

Course Objectives:

1. Understanding of automobile chassis, electrical system, transmission, breaking and fuel system etc. So that a mechanical engineer can understand the problem of automobile vehicles.

1.0	Introduction:	Periods
1.1	Automobiles: Definition, need and classification	5
1.2	Layout of automobile chassis with major components (Line diagram)	
1.3	Manufacturer's specification of auto engines of motorcycle, scooter, car & bus one from each.	
1.4	State the classification of engines basing on working principle, fuel used, position of cylinder, arrangement of cylinder.	
2.0	Transmission system:	10
2.1	Clutch System: Need, Types (Single & Multiple) and Working principle with sketch	
2.2	Gear Box: Purpose of gear box, Construction and working of a 4 speed gear box, Concept of automatic gear changing mechanisms	
2.3	Propeller shaft: Constructional features	
2.4	Differnetial: Need, Types and Working principle	
3.0	Braking system:	7
3.1	Braking systems in automobiles: Need and types.	
3.2	Mechanical Brake	
3.3	Hydraulic brake	
3.4	Air brake	
3.5	Air assisted hydraulic brake	
3.6	Vacuum Brake	
4.0	Auto electric system:	8
4.1	Wiring diagram of Horn circuit, Lighting circuit, Cut-out circuit, Voltage current regulator circuit and Flasher circuit (Sketch and description)	
4.2	State the common ignition troubles and its remedies.	
4.3	Spark plugs: Purpose, construction and specifications	
5.0	Suspension System:	5
6.1	Description of the conventional suspension system for Rear and Front axle.	

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- 6.2 Description of independent suspension system used in cars (coil spring and tension bars)
- 6.3 Constructional features and working of a telescopic shock absorber.
- 6.4 State tyre specifications.
- 6.5 Explain the causes and remedies of tyre wear.
- 6.0 Cooling and Lubrication:** 7
- 7.1 Describe necessity of engine cooling.
- 7.2 Describe defects of cooling and their remedial measures.
- 7.3 Describe the Function of lubrication.
- 7.4 Describe the lubrication System of I.C. engine.
- 7.0 Fuel and Ignition system:** 12
- 8.1 For petrol Engine:
- 8.1.1 Describe carburetion and Air fuel ratio.
- 8.1.3 Describe the Battery ignition and Magnet ignition system.
- 8.1.4 Describe Multipoint fuel injection system.
- 8.2 For Diesel engine:
- 8.2.1 Describe the working principle of Fuel feed pump, Injector and Fuel filter.
- 8.2.2 Describe the working principle of fuel injection system for multi cylinder engine.

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

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ADVANCE MANUFACTURING & CAD/CAM

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 603	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Rationale:

Today Indian Industries are faced with global Competition and hence the need for improving their manufacturing processes and techniques to the latest world standards.

Course Objectives:

1. Describe the various non traditional manufacturing processes which are specially used in research laboratories.
2. Understanding of CNC and DNC systems as now in industries automation is a major factor.
3. Understanding the robot technology and CAD/CAM

		Periods
1.0	Non conventional machining process: Explain the Working principle, advantages, disadvantages and area of application of	14
	1.1 Electro chemical machining process	
	1.2 Electro discharge machining process	
	1.3 Plasma arc machining process	
	1.4 Laser beam machining process	
	1.5 Abrasive jet machining process	
	1.6 Electron beam machining process	
2.0	Automation:	6
	2.1 Define Automation	
	2.2 List types of Automation	
	2.3 Explain need for Automation	
3.0	Numerical Control:	16
	3.1 Define Numerical Control	
	3.2 Explain the NC system with block diagram.	
	3.3 Describe the types of NC co-ordinate: Point – to – point, Straight Cut, and Contouring.	
	3.4 NC part programming: G code and M-code. Reference Point (Machine Zero, Work zero, Tool zero & Tool offset). Simple part program for lathe.	
	3.5 Explain the Extension of NC with the block diagram: (i) DNC (Direct numerical Control) (ii) CNC (Computer numerical Control) (iii) Adaptive Control	
4.0	Robot Technology:	8
	4.1 Defining a robot (ISO) Fields of application of robots	

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- 4.2 Explain Robot anatomy.
- 4.3 Describe Robot Configuration
- 5.0 Flexible Manufacturing System (FMS):** 8
- 5.1 Need for FMS
- 5.2 Explain the components of FMS: Processing Station, Material handling & storage and Computer Control System.
- 6.0 CAD / CAM and CIM:** 8
- 6.1 Define CAD, CAM and CIM
- 6.2 Explain the benefits of CAD. CAD software and hardware.
- 6.3 Explain the benefits of CAM, differentiate between CAD and CAM
- 6.4 Explain the concept, background. Software and hardware of CIM.

Learning resources			
<i>Sl. No.</i>	<i>Name of Authors</i>	<i>Title of the Book</i>	<i>Name of the Publisher</i>
	O.P khana	Production technology, Vol-II	Dhanpat Rai Publication
	B.S. Raghuwanshi	Workshop Technology, Vol – II	Dhanpat Rai & Co.
	Mikel P.Groover	CAD /CAM	Pearson
	Dr. P.N. Rao	CAD / CAM Principle & application	TMH

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POWER PLANT ENGINEERING (Elective)

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 604	Semester	6th
Total Period:	60	Examination	3 hrs (Steam Table is allowed)
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Rationale:

Bulk powers used in industries and for domestic purposes are generated in power plants. A large number of diverse and specialized equipment and system are used in a power plant should have this specialized elective course.

Course Objectives:

1. Understanding the generation of power by utilizing various energy sources.
2. Understanding the use of steam, its operation in steam power plants.
3. Understanding the nuclear energy sources and power developed in nuclear power plant.
4. Understanding the basics of gas turbine power plant, diesel engine power plant and hydro electric power plant.

	1.0 Introduction:	Period
	1.1 Describe sources of energy.	4
	1.2 Explain concept of Central and Captive power station.	
	1.3 Classify power plants.	
2.0	Steam Power Plant:	18
	2.1 Layout of steam power plant.	
	2.2 Steam power cycle.	
	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 Explain reheat cycle and regenerative cycle and combination of reheat and regenerative cycle.	
	2.6 Boiler Accessories: Air pre heater, Economiser, Electrostatic precipitator and superheater. Need of boiler mountings	
	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, Compounding and governing of steam turbine. Performance of steam turbine: Explain Thermal efficiency, Stage efficiency and Gross efficiency. Solve Simple problems.	
	2.9 Steam condenser: Function of condenser, Classification of condenser (explain jet and surface condensers), function of condenser auxiliaries such as hot well, condenser extraction pump, air extraction pump, cooling water and circulating pump.	

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Cooling Tower:

Function and types of cooling tower, Describe the various types of cooling tower (Natural draft cooling tower and Mechanical draft cooling tower)

- 3.0 Nuclear Power Plant:** 12
- 3.1 Classify nuclear fuel (Fissile & fertile material)
 - 3.2 Explain fusion and fission reaction.
 - 3.3 Explain nuclear reactor: Components of nuclear reactor such as fuel, moderator, reflector, coolant, control rod, Shielding, reactor vessel & their function.
 - 3.4 Explain the working principle of PWR and BWR power plant.
 - 3.5 Compare the nuclear and thermal plants.
 - 3.6 Explain the disposal of nuclear waste.
- 4.0 Diesel engine power plant:** 8
- 4.1 State the advantages and disadvantages of diesel plant.
 - 4.2 Explain briefly different systems of diesel power plant:
Fuel storage and fuel supply system, Fuel injection system, Air supply system, Exhaust system, Cooling system, Lubrication system, Starting system, Governing system.
- 5.0 Hydel Power Plant:** 8
- 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.

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	Nagpal G.R	Power plant engineering	Khanna Publisher

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ALTERNATE ENERGY SOURCES AND MANAGEMENT (Elective)

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 604	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Rationale:

With the depleting source of fossil fuel coupled with the thread of global warming, search for an alternative, clean and viable source of energy is now a world-wide concern. Research and application of non-conventional sources of energy is rapidly taking place in India also. This elective is important for those wish to pursue their career in this emerging field.

Course Objectives:

On the completion of the course, the student should be able to

1. Understand the need for alternate sources of energy.
2. Understand the solar radiation.
3. Describe the principle of conversion of solar radiation into heat.
4. Describe the methods of storing solar energy.
5. Understand the application of solar energy.
6. Understand the application of wind energy.
7. Understand the application of tidal energy.
8. Understand the application of bio-energy.

1.0	Introduction:	Periods
1.1	Global energy scene, World energy consumption.	6
1.2	Explain nonconventional renewable energy source and potential of renewable energy source	
1.3	Pollution aspects of conventional sources of energy. Global warming and Green House effects.	
2.0	Solar radiation:	8
2.1	Solar constant, Solar radiation at earth's surface.	
2.2	Instruments for measuring solar radiation: Pyranometer, Pyrheliometer.	
2.3	Determination of solar radiation on earth surface on a particular day of a year.	
2.4	Calculate monthly average & annual average of solar radiation.	
3.0	Solar energy collection: (No mathematical treatment)	7
3.1	Principle of conversion of solar radiation into heat.	
3.2	Explain Liquid flat plate collectors and solar water heaters,	
3.3	Explain Solar air heater and parabolic collector.	
3.4	Explain Flat plate collectors with plane reflectors.	
4.0	Solar energy storage: (No mathematical treatment)	7
4.1	Methods of storing solar energy.	
4.2	Define Solar pond, Working principle and description of solar pond with a schematic diagram.	
4.3	Application of solar pond.	
5.0	Solar energy application: (No mathematical treatment)	6
5.1	Explain Solar water heater: natural circulation type & forced	

	circulation type.	
	5.2 Explain Solar drier – cabinet type and convective type.	
	5.3 Explain Solar cooker - box type.	
6.0	Wind energy: (No mathematical treatment)	8
	6.1 Introduction	
	6.2 Power developed by wind forces on the blades of a wind mill.	
	6.3 Wind data – energy estimation.	
	6.4 Wind mill construction details & working principle.	
	6.5 Type of wind mill.	
7.0	Tidal energy:	8
	7.1 Introduction	
	7.2 Components of tidal power plant.	
	7.3 Methods of utilization of tidal energy.	
	7.4 Advantages & limitation of tidal power generation.	
8.0	Bio-energy:	10
	8.1 Introduction to bio-mass and bio-mass conversion into energy.	
	8.2 Bio-gas generation, composition & properties of bio-gas.	
	8.3 Utilisation of bio-gas classification of bio-gas plants - Continuous & batch type.	
	8.4 Explain the drum type bio-gas plants.	
	8.5 Construction details and working principle of fixed dome type and floating gas holder type bio-gas plants.	
	8.6 Materials used for bio-gas generation	
	8.7 Capacity of biogas plant and starting of bio-gas plant.	

Learning Resources			
Sl. No.	Name of Author	Title of the Book	Name of the Publisher
1	B.H.Khan	Non Conventional Energy Resources	Mc graw Hill
2	TTTI Madras	Introduction to alternate sources of energy	
3	R K rajput	Non Conventional Energy Sources	S Chand
4	O.P.Chawla	Advantages in bio-gas technology	Publications and Information Division, Indian Council of Agricultural Research

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INDUSTRIAL FLUID POWER (Elective)

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 604	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Rationale:

Fluid power means the power developed by utilising the energy of fluid flow. In industries utilisation of fluid power have been raised to great extent, that alternatively provides power other than the expensive electricity.

Course Objectives:

1. Understanding the energy of fluid and power developed from fluid.
2. Understanding the different components used in fluid power generation.
3. Understanding the different types of control valves and circuits used in fluid power development.
4. 4. Understanding the concept of hydraulic and pneumatic systems.

1.0	Fluid power Fundamental:	Periods
1.1	Basic methods of transmitting power.	3
1.2	Fluid systems	
1.3	Fluid power physics	
2.0	Pumps:	8
2.1	Pump classifications	
2.2	Describe hydrodynamic displacement pumps	
2.3	Describe hydrostatic displacement pumps	
2.4	Explain about external gear pump and internal gear pump Describe balanced and unbalanced vane pump.	
3.0	Actuators:	10
3.1	Concept of actuators	
3.2	Air cylinders and Hydraulic cylinders.	
3.3	Air & Hydraulic motors.	
3.4	Hydrostatic transmission	
3.5	Rotary actuators	
4.0	Pressure Control	5
4.1	Describe different control valves: Relief valve, unloading valve, sequence valve, reducing valves, counter balanced valve.	
5.0	Direction control valve	5
5.1	Function of direction control valves.	
5.2	Describe different direction control valves: Standard type, restriction type and pilot-operated type	
6.0	Flow control valve	5
6.1	Function of flow control valves	
6.2	Describe different flow control methods.	
7.0	Hydraulic circuit	12
7.1	Single and double acting cylinder circuit.	
7.2	Regenerative circuit	
7.3	Pump unloading circuit	

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- 7.4 Application of unloading valve
- 7.5 Circuit to protect the system from overload
- 7.6 Accumulator circuit

8.0 Pneumatic system components and circuits:

12

- 8.1 Air compressors
- 8.2 Air reservoir, filters, Safety relief valves, pressure switch, Air regulator and Air lubricators.
- 8.3 Actuators and output devices
- 8.4 2/2, 3/2 and 4/2 way valve.
- 8.5 Control of single acting cylinder
- 8.6 Two step speed control of a cylinder

Learning Resources:			
<i>Sl. No.</i>	<i>Name of Author</i>	<i>Title of the Book</i>	<i>Name of Publisher</i>
1	K Shanmuga Sundaram	Hydraulic and Pneumatic controls	S Chand
2	J.F. Blackburn, G. Reethof & J.L. Shearer	Fluid Power Control	

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MECHANICAL MEASUREMENTS AND CONTROL (Elective)

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MET 604	Semester	6th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Tutorial:	1 P/W	Teacher's Assessment:	10
Maximum marks:	100	End Semester Examination:	70

Rationale:

Diploma holders in this course required to measure for ensuring quality of product. For this purpose, knowledge & skills about standards of measurement, limits, fits & tolerances and various measuring instruments are necessary.

Course Objectives:

1. Understanding the measurement process and types by using various measuring instruments.
2. Understanding the concept of limit, fits and tolerance in manufacturing.
3. Understanding the concept of transducers for measuring the parameters like pressure, displacement, temperature, strain etc with more accuracy.

1.0	Introduction to measurement:	Periods
1.1	Definition of metrology.	7
1.2	Standards of measurement.	
1.3	Precision and accuracy, errors in measurement.	
1.4	Construction and working of Dial test indicators. Advantages and uses.	
1.5	Need and principles of comparators. Classifications: mechanical, electrical, optical and pneumatic.	
2.0	Linear measurement:	5
2.1	Study of linear measuring instruments like callipers, surface plate, straight edge, vernier callipers, micrometers, vernier height gauge, depth gauge, slip gauges.	
3.0	Angular measurement:	4
3.1	Study of angular measuring instruments like bevel protractor, sine bars. Use of sine bars. Limitation and practical applications.	
4.0	Limits fits and tolerances:	8
4.1	Terminology of limits and fits.	
4.2	Conventional diagram for limits and fits.	
4.3	Limit. Types of limits. Fits. Types of fits.	
4.4	Tolerance and allowance. Unilateral and bilateral system.	
4.5	Hole basis and shaft basis system.	
4.6	Taylor's principle of gauge design (GO and NOT GO gauge)	
5.0	Transducers:	10
5.1	Define transducer.	
5.2	Classification of transducers.	
5.3	Requirements of transducers.	
5.4	Resistance, capacitance and inductance type transducers.	
6.0	Strain measurement:	8
6.1	The electrical resistance strain gauge.	
6.2	The metallic resistance strain gauge.	
7.0	Measurement of Pressure :	10

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- 7.1 Define Pressure measurement devices.
- 7.2 Mechanical instruments
- 7.3 Electro-mechanical instruments
- 7.4 Electronic instruments

8.0 Temperature measurement:

8

- 8.1 Classify temperature measuring instruments.
- 8.2 Explain different mechanical temperature sensors
- 8.3 Explain electrical temperature sensors
- 8.4 Explain optical sensors.

Learning Resources:			
<i>Sl. No.</i>	<i>Name of Author</i>	<i>Title of the Book</i>	<i>Name of Publisher</i>
1	R.K Jain	Engineering Metrology	Khanna Publisher
2	M. Mahajan	Engineering Metrology	Dhanpat Rai & Co.
3	A.K Sawhney and P.K Sawhney	A course in measurement and instrumentation	Dhanpat Rai

270

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CAD & CAM LAB

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MEP 601	Semester	6 th
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/W	Term Work	50
Maximum marks:	50	End Semester Examination:	

SL. No **Content**

- 1.0 2D Drafting.
 - 1.1 Create Rectangle, Circle, Polygon.
 - 1.2 Dimensioning
 - 1.3 Commands essential for creating 2D drawing.
- 2.0 3D drafting.
 - 2.1 Create various drawing views of the 3-D parts.
 - 2.2 Extrude the face / plane to get 3-D views.

AUTOMOBILE ENGINEERING LAB

Name of the Course: Diploma in MECHANICAL ENGINEERING			
Course code:	MEP 602	Semester	6th
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/W	Term Work	25
Maximum marks:	75	End Semester Examination:	50

SL. No **Content**

- 1 Study of Automobile chassis.
- 2 Study the differential mechanism of an automobile.
- 3 Study the electrical system of automobile.
- 4 Study of barking system (Hydraulic /Air brake).
- 5 Study of multiple Clutch of automobile.
- 6 Study and demonstration of different circuit of carburettor.
- 7 Checking the spark plug and setting the port and check the ignition in the spark plug.
8. Study the assembly of car engine.
9. Calibration of Bourdon's tube Pressure gauge.
10. Air pollution testing of CO₂, Co, HC, NOX

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