

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

<b>DISCIPLINE: MECHANICAL ENGINEERING</b>						<b>SEMESTER: 5<sup>TH</sup></b>						
<b>SL NO</b>	<b>SUBJECT CODE</b>	<b>SUBJECT</b>	<b>PERIODS</b>			<b>EVALUATION SCHEME</b>						
			<b>L</b>	<b>T</b>	<b>P</b>	<b>INTERNAL EXAM</b>			<b>END SEM EXAM</b>	<b>TERM WORK</b>	<b>PRACTICAL EXAM</b>	<b>TOTAL MARKS</b>
						<b>TA</b>	<b>CT</b>	<b>Total</b>				
<b>THEORY</b>												
1.	DCHR5101	ENVIRONMENTAL STUDIES	5			10	20	30	70			100
2.	DMMD5102	MACHINE DESIGN	4			10	20	30	70			100
3.	DMPT5103	PRODUCTION TECHNOLOGY	4			10	20	30	70			100
4.	DMAT5104	APPLIED THERMODYNAMICS	4			10	20	30	70			100
5.	DMOP5105	OBJECT ORIENTED COMPUTER PROGRAMMING	4			10	20	30	70			100
<b>PRACTICAL/TERM WORK</b>												
5.	DMHP5201	HEAT POWER LABORATORY			6					25	50	75
6.	DMTM5202	THEORY OF MACHINES AND MEASUREMENTS LAB			4					25	75	100
7.	DMCP5203	COMPUTER PROGRAMMING LAB			4					25	50	75
8		LIBRARY STUDIES			2							
9		PROFESSIONAL DEVELOPMENT TRAINING			2							
<b>GRAND TOTAL</b>			<b>21</b>		<b>18</b>	<b>50</b>	<b>100</b>	<b>150</b>	<b>350</b>	<b>75</b>	<b>175</b>	<b>750</b>

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%

# **ENVIRONMENTAL STUDIES**

**(Common to all Branches of Engg.)**

**DCHR5101**

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.

## **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.

## MACHINE DESIGN

Course code:	DMMD5102	Semester :	5th
Total Period:	60	Examination :	3 hrs (Design data book allowed)
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	Teacher's Assessment:	10
		End Sem Examination:	70

### Rationale:

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

### Course Objectives:

1. Understanding the behaviours of material and their uses.
2. Understanding the design of various fastening elements and their industrial uses.
3. Understanding the different failures of design elements.
4. Understanding the change of design to accomplish the different field of applications.

<b>1.0</b>	<b>Introduction:</b>	<b>Periods</b>
1.1	Introduction to Machine Design and Classify it.	8
1.2	State the types of loads.	
1.3	Define working stress, yield stress, ultimate stress & factor of safety.	
1.4	State mechanical properties of the material.	
1.5	State the factors governing the design of machine elements.	
1.6	Describe design procedure.	
<b>2.0</b>	<b>Design of fastening elements:</b>	<b>14</b>
2.1	State nomenclatures, form of threads & specifications.	
2.2	Design of Screw thread (Nut and Bolt)	
2.3	State types of welded joints.	
2.4	State advantages of welded joints over other joints.	
2.5	Determine strength of welded joints for eccentric loads.	
2.6	State types of riveted joints.	
2.7	Describe failure of riveted joints.	
2.8	Determine strength & efficiency of riveted joints.	
2.9	Design riveted joints for pressure vessel.	
2.10	Solve numerical on Screw thread, Welded Joint and Riveted Joints.	
<b>3.0</b>	<b>Design of shafts and Keys:</b>	<b>12</b>
3.1	State function of shafts.	
3.2	State materials for shafts.	
3.3	Design solid & hollow shafts to transmit a given power at given rpm based on <ol style="list-style-type: none"><li>a) Strength: (i) Shear stress, (ii) Combined bending &amp; tension;</li><li>b) Rigidity: (i) Angle of twist, (ii) Deflection, (iii) Modulus of rigidity</li></ol>	
3.4	State standard size of shaft as per I.S.	
3.5	State function of keys, types of keys & material of keys.	

3.6	Describe failure of key, effect of key way.	
3.7	Design rectangular sunk key considering its failure against shear & crushing.	
3.8	Design rectangular sunk key by using empirical relation for given diameter of shaft.	
3.9	State specification of parallel key, gib-head key, taper key as per I.S.	
3.10	Solve numerical on Design of Shaft and keys.	
<b>4.0</b>	<b>Design of belt drivers and pulleys:</b>	<b>14</b>
4.1	State types of belt drives & pulleys.	
4.2	State formula for length of open and crossed belt, ratio of driving and driven side tension, centrifugal tension, relation between centrifugal tension and tension on tight side for maximum power transmission.	
4.3	Determine belt thickness and width for given permissible stress for open and crossed belt considering centrifugal tension.	
4.4	Design a cast iron (C.I) pulley using empirical formula only.	
4.5	Solve numerical on design of belt and design of C.I pulley.	
<b>5.0</b>	<b>Design a closed coil helical spring:</b>	<b>12</b>
5.1	Materials used for helical spring.	
5.2	Standard size spring wire. (SWG).	
5.3	Terms used in compression spring.	
5.4	Stress in helical spring of a circular wire.	
5.5	End connection for helical tension spring.	
5.6	Deflection of helical spring of circular wire.	
5.7	Eccentric loading of spring.	
5.8	Surge in spring.	
5.9	Solve numerical on design of spring.	

**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.S. Khurmi & J.K. Gupta	A text book of Machine Design	S.Chand
2	P.C. Sharma & D.K. Aggarwal	A text book of Machine Design	S.K Kataria & Sons
3	V.B. Bhandari	Design of machine element	TMH
4	S. Md. Jalaludeen	Design data handbook	Anuradha Publication

## PRODUCTION TECHNOLOGY

Course code:	DMPT5103	Semester	5th
Total Period:	60	Examination	3 hrs
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	Teacher's Assessment:	10
		End Semester Examination:	70

### **Rationale:**

Production Technology involves a working knowledge in the field of product design, product development and rapid part production. It deals with the production methodology and its management to make a complete analysis on the products.

### **Course Objectives:**

1. Understanding the different components and processes involved in press tool operation.
2. To reduce the job setting and tool setting times in mass production.
3. Understanding the industrial requirements of fabrication systems.
4. Understanding the manufacturing processes like casting and powder metallurgy.

<b>1.0</b>	<b>Metal Forming Processes:</b>	<b>Periods</b>
1.1	Define Extrusion. Classify it.	
1.2	Explain direct, indirect and impact extrusion process.	7
1.3	Define rolling. Classify it.	
1.4	Differentiate between cold rolling and hot rolling process.	
1.5	List the different types of rolling mills used in Rolling process.	
<b>2.0</b>	<b>Welding:</b>	
2.1	Define welding and classify various welding processes.	
2.2	Explain fluxes used in welding.	
2.3	Explain Oxy-acetylene welding process.	
2.4	Explain various types of flames used in Oxy-acetylene welding process.	16
2.5	Explain Arc welding process.	
2.6	Specify arc welding electrodes.	
2.7	Define resistance welding and classify it.	
2.8	Describe various resistance welding processes such as butt welding, spot welding, flash welding, projection welding and seam welding.	
2.9	Explain TIG and MIG welding process	
2.10	State different welding defects with causes and remedies.	
2.11	Testing of welded joints	
<b>3.0</b>	<b>Castings:</b>	
3.1	Define Casting and Classify the various Casting processes.	
3.2	Explain the procedure of Sand mould casting.	
3.3	Explain different types of moulding sands with their composition and properties.	16
3.4	Classify different pattern and state various pattern allowances.	
3.5	Classify core and explain its construction.	
3.6	Describe construction and working of cupola and crucible furnace.	
3.7	Explain die casting method with relative advantages, disadvantages and field of application.	
3.8	Explain centrifugal casting such as true centrifugal casting, centrifuging with advantages, limitation and area of application.	
3.9	Explain Investment casting with relative advantages, limitation and area of application.	

- 3.10 Explain various casting defects with their causes and remedies.
- 3.11 Explain Inspection of casting
- 3.12 Economics of casting
- 4.0 Powder Metallurgy:**
- 4.1 Define powder metallurgy process.
- 4.2 State advantages of powder metallurgy technology technique 7
- 4.3 Describe the methods of producing components by powder metallurgy technique.
- 4.4 Explain sintering.
- 4.5 Economics of powder metallurgy.
- 5.0 Press Work:**
- 5.1 Describe Press Works: blanking, piercing and trimming.
- 5.1 List various types of die and punch 7
- 5.2 Explain simple, Compound & Progressive dies
- 5.3 Describe the various advantages & disadvantages of above dies
- 6.0 Jigs and fixtures:**
- 6.1 Define jigs and fixtures
- 6.2 State advantages of using jigs and fixtures
- 6.3 State the principle of locations 7
- 6.4 Describe the methods of location with respect to 3-2-1 point location of rectangular jig
- 6.5 List various types of jig and fixtures.

**Learning Resources:**

<i>Sl. No.</i>	<i>Name of Authors</i>	<i>Title of the Book</i>	<i>Name of the Publisher</i>
1	O.P. Khanna	Production Technology, Vol- I & II	Dhanpat Rai Publication
2	B.S Raghuwanshi	Workshop technology, Vol- I & II	Dhanpat Rai & Co.
3	P.N. Rao	Manufacturing technology, Vol- I & II	TMH



## APPLIED THERMODYNAMICS

Course code:	DMAT5104	Semester	5th
Total Period:	60	Examination	3 hrs (Refrigeration Chart is allowed)
Theory periods:	4 P/W	Class Test:	20
Maximum marks:	100	Teacher's Assessment:	10
		End Sem Examination:	70

### Rationale:

Modern society needs lots of applications of thermodynamics especially, the proper production of heat and its utilisations to solve human requirements. Refrigeration is a process of cooling below surrounding temperature. Air conditioning means distribution of air after controlling its temperature, humidity for human comfort.

### Course Objectives:

1. Understanding the power developed in the I.C engine and efficiency.
2. Understanding the principle, performance and applications of air compressor.
3. Understanding the storage of different decomposed materials for a long period.
4. Understanding the human comfort and the quality of air.

<b>1.0</b>	<b>Performance of I.C engine:</b>	<b>Periods</b>
1.1	Define the Mechanical efficiency, indicated thermal efficiency, brake thermal efficiency, overall efficiency, air standard efficiency, relative efficiency, Volumetric efficiency, mean effective pressure and specific fuel consumption.	10
1.2	Define Air-fuel ratio and calorific value of fuel.	
1.3	Work out problems to determine efficiencies and specific fuel consumption.	
<b>2.0</b>	<b>Air Compressor:</b>	<b>10</b>
2.1	Explain functions of compressor and industrial use of compressed air.	
2.2	Classify air compressor and principle of operation	
2.3	Describe the parts and working principle of Reciprocating air compressor.	
2.4	Explain the terminology of Reciprocating compressor such as bore, stroke, pressure ratio, free-air delivered and volumetric efficiency.	
2.5	Derive the work done of single stage and two stage compressor with and without clearance.	
2.6	Solve related simple problems.	
<b>3.0</b>	<b>Refrigeration:</b> (No mathematical treatment)	<b>12</b>
3.1	Describe different components of Vapour compression refrigeration system.	
3.2	Explain Vapour compression refrigeration process.	
3.2	Classify various types of refrigerants and their properties.	
3.3	Vapour absorption refrigeration system:	
3.3.1	Simple vapour absorption system	
3.3.2	Practical absorption system	
3.3.4	Comparison between vapour absorption & vapour compression system	
<b>4.0</b>	<b>Psychrometry:</b>	<b>12</b>
4.1	Properties of air-vapour mixture.	
4.2	Define the following terms: Dry bulb, wet bulb, thermodynamic wet bulb, and adiabatic saturation and dew point temperatures, Humidity	

- ratio, relative humidity, Degree of saturation and enthalpy of moist air.
- 4.3 Explain Sling Psychrometer.
- 4.4 Describe different Psychrometric processes.
- 4.5 Solve related problems using Psychrometric chart.
- 5.0 Physiological Factors:** 8
- 5.1 Explain various Factors affecting human body.
- 5.2 Explain the Metabolism of human body.
- 5.3 Explain Comfort Chart.
- 6.0 Air conditioning system:** 8
- 6.1 Classify Air conditioning System.
- 6.2 Describe Summer, Winter and Year round Air conditioning system.
- 6.3 Explain Air distribution systems and ducting.
- 6.4 Explain Air filters, dampers, fans, blower and diffusers.

### Learning Resources

<i>Sl. No.</i>	<i>Name of Authors</i>	<i>Title of the Book</i>	<i>Name of the Publisher</i>
1	M.Rathod	Thermal Engineering	TMH
2	R.S. Khurmi	Refrigeration and air conditioning	S. Chand
3	S.C. Domkundwara and Arora	Refrigeration and air conditioning	Dhanpat Rai & Sons
4	C.P Arora	Refrigeration and air conditioning	TMH

## Object Oriented Methodology

Name of the Course: Diploma in Mechanical Engineering

Course code:	DMOP5105	Semester	5 <sup>th</sup>
Total Period:	60	Examination	3 hrs
Theory periods:	4P/week	Class Test:	20
Tutorial:		Teacher's Assignment:	10
Maximum marks:	100	End Semester Examination:	70

### **RATIONALE**

Now-a-days object oriented Methodology is adopted almost for every computer based programs due to the reusability of the objects. This subject exposes the learner to the various typical object oriented concepts like, classes, objects, inheritance, Operator Overloading etc. It also makes the reader to realize the advantages of object oriented Programming Methodology over the conventional procedural programming methodology.

### **1.0 PRINCIPLES OF OBJECT ORIENTED PROGRAMMING 05**

- 1.1 Procedure Oriented paradigm
- 1.2 Object oriented paradigm
- 1.3 Object oriented Design & Analysis

### **2.0 DATA TYPES & I/O OPERATIONS 08**

- 2.1 Basic data types
- 2.2 User defined data types & derived data types
- 2.3 Dynamic initialization of variables
- 2.4 Operators & expressions
- 2.5 Formatted & unformatted I/O

### **3.0 CLASSES 08**

- 3.1 Introduction to classes.
- 3.2 Member functions
- 3.3 Static Data Member
- 3.4 Arrays within a class
- 3.5 Pointers to members

### **4.0 CONSTRUCTOR AND DESTRUCTOR 07**

- 4.1 The purpose of Constructor & Destructor.
- 4.2 Constructors with parameters
- 4.3 Multiple constructors in a class
- 4.4 Dynamic initialization of objects
- 4.5 Destructors

### **5.0 OPERATOR OVERLOADING 07**

- 5.1 Definition of operator over loading

- 5.2 Unary operator overloading
- 5.3 Binary operator overloading
- 5.4 String manipulation using operator
- 5.5 Type conversions

**6.0 INHERITANCE OF CLASSES 10**

- 6.1 Derived classes
- 6.2 Single inheritance
- 6.3 Multilevel and Multiple inheritance
- 6.4 Hierarchical inheritance
- 6.5 Virtual Base Classes

**7.0 POLYMORPHISM 04**

- 7.1 Fundamental idea on Polymorphism
- 7.1 Pointer to objects & derived classes
- 7.2 Virtual Functions

**8.0 FILE HANDLING 07**

- 8.1 Streams and stream classes
- 8.2 Classes for file stream operation
- 8.3 Opening and closing files
- 8.4 How to handle Error
- 8.5 Command line arguments

**9.0 TEMPLATES AND EXCEPTION HANDLING 04**

- 9.1 Class templates & Function Templates
- 9.2 Template Arguments
- 9.3 Exception Handling

Learning Resources:

Reference Books:			
Sl no.	Name of Authors	Titles of the Book	Name of the publisher
1.	E. Balaguruswami	Object Oriented Programming With C++	TMH
2.	Kamthane	Object Oriented Programming With C++	Pearson
3.	Trivedi	Programming with ANSI C++	Oxford Univ. Press
4.	D.Jana	C++ and OOP Paradigm	PHI

## HEAT AND POWER LAB

Course code:	DMHP5201	Semester	5th
Total Period:	90	Examination	4 hrs
Lab. periods:	6 P/W	Term Work	25
Maximum marks:	75	End Sem Examination:	50

### **SL. No    Content**

- 1      Determine the brake thermal efficiency of single cylinder petrol engine.
- 2      Determine the brake thermal efficiency of single cylinder diesel engine.
- 3      Determine the B.H.P, I.H.P BSFC of a multi cylinder engine by Morse test.
- 4      Determine the mechanical efficiency of an air Compressor.
- 5      Study the Construction features of Domestic refrigerator.
- 6      Study the Construction features of Water cooler.
- 7      Study the Construction features of Window A.C.
8.     Study the Construction features of Split A.C.
9.     Determine the COP of a refrigerating tutor.
10.    Determine the COP of an A.C tutor.

## **THEORY OF MACHINES AND MEASUREMENTS LAB**

Course code:	DMTM5202	Semester	5th
Total Period:	60	Examination	4 hrs
Lab. periods:	4 P/W	Term Work	25
Maximum marks:	100	End Semester Examination:	75

### **SL. No Content**

- 1 Determination of centrifugal force of a governor (Hartnell / Watt/Porter).
- 2 Study & demonstration of static balancing apparatus.
- 3 Study & demonstration of journal bearing apparatus.
- 4 Study of different types of Cam and followers.
- 5 Study & demonstration of epicyclic gear train.
- 6 Determination of the thickness of ground M.S flat to an accuracy of 0.02mm using Vernier Caliper.
- 7 Determination of diameter of a cylindrical component to an accuracy of 0.01mm using micrometer.
8. Determine the heights of gauge blocks or parallel bars to accuracy of 0.02mm using Vernier height gauge.
9. Determine the thickness of ground MS plates using slip gauges.
10. Determination of angel of Machined surfaces of components using sin bar with slip gauges.

## Object Oriented Programming Lab

Name of the Course: Diploma in Mechanical Engineering

Course code:	DMCP5203	Semester	5 <sup>th</sup>
Total Period:	90	Examination	3hrs
Lab. periods:	6P/week	Term Work	25
Maximum marks:	75	End Semester Examination:	50

Write Programs On :

1. Objects and classes
2. Declaring and creating objects Constructors
3. Modifiers
4. Passing objects to methods
5. Instance variables and class variables Instance method & class method
6. Scope of variables interface and packages
7. Introductory Problems on Class Inheritance Super classes and sub class Calling super class constructors
8. Calling super class methods
9. Object class
10. Number class
11. Processing date and time
12. Class Templates and Exceptional handling

Reference Books:			
Sl no.	Name of Authors	Titles of the Book	Name of the publisher
1.	S.K.Pandey	OOPS with C++	Katson
2.	R.Singh	OOM	Kalyani