Techno India NJR Institute of Technology

Course File

Session 2021-22

Basic Mechanical Engineering (1FY-07)

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I & II Semester
Common to all branches of UG Engineering & Technology

1FY3-07/ 2FY3-07: Basic Mechanical Engineering

Credit: 2   Max. Marks: 100 (IA:20, ETE:80)
2L+0T+0P   End Term Exam: 2 Hours

SN	CONTENTS	Hours
1	**Fundamentals:** Introduction to mechanical engineering, concepts of thermal engineering, mechanical machine design, industrial engineering and manufacturing technology. Steam Boilers classification and types of steam boilers and steam turbines. Introduction and Classification of power plants.	
2	**Pumps and IC Engines:** Applications and working of Reciprocating and Centrifugal pumps. Introduction, Classification of IC Engines, Main Components of IC Engines, Working of IC Engines and its components.	
3	**Refrigeration and Air Conditioning:** Introduction, classification and types of refrigeration systems and air-conditioning. Applications of refrigeration and Air-conditioning.	
4	**Transmission of Power:** Introduction and types of Belt and Rope Drives, Gears.	
5	**Primary Manufacturing Processes:** Metal Casting Process: Introduction to Casting Process, Patterns, Molding, Furnaces. Metal Forming Processes: Introduction to Forging, Rolling, Extrusion, Drawing. Metal Joining Processes: Introduction to various types of Welding, Gas Cutting, Brazing, and Soldering.	
6	**Engineering Materials and Heat Treatment of Steel:** Introduction to various engineering materials and their properties.	

Course Overview:

To give the fundamental concepts of machine design and its importance. To identify the role of machine design in mechanical engineering. To study about design of various power transmission elements, joints and bearings. To understand and learn the design of pressure vessels.

Course Outcomes:

CO. NO.	Cognitive Level	Course Outcome
1	Analysis	To understand the basics of material properties, stress and strain
2	Synthesis	To apply knowledge of mathematics, science, for engineering applications
3	Synthesis	Ability to identify, formulate, and solve engineering & real life problems
4	Synthesis	Ability to design and conduct experiments, as well as to analyze and interpret data

Prerequisites:
1. Basic Knowledge about Free Body Diagram
2. Must have completed the course on Engineering Mechanics.

Course Scheme -

THEORY

| SN | Category | Course | | Contact hrs/week | | | Marks | | | | Cr |
		Code	Title	L	T	P	Exm Hrs	IA	ETE	Total	
1	BSC	3ME2-01	Advance Engineering Mathematics-I	3	0	0	3	30	120	150	3
2	HSMC	3ME1-02/ 3ME1-03	Technical Communication/ Managerial Economics and Financial Accounting	2	0	0	2	20	80	100	2
3	ESC	3ME3-04	Engineering Mechanics	2	0	0	2	20	80	100	2
4		3ME4-05	Engineering Thermodynamics	3	0	0	3	30	120	150	3
5	PCC	3ME4-06	Materials Science and Engineering	3	0	0	3	30	120	150	3
6		3ME4-07	Mechanics of Solids	3	1	0	3	40	160	200	4
			Sub Total	16	1	0		170	680	850	17

Course Outcome Mapping with Program Outcome:

III SEM
Mechanics of Solids-I Year of study: 2015-16

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	3	1	2	1	1	2	2	0	1	2	1	1
CO2	2	2	2	2	1	1	1	0	2	1	0	1	0	1	1
CO3	2	2	2	2	1	2	1	1	1	2	0	1	1	1	1
CO4	2	2	2	2	0	2	1	1	1	2	0	1	1	1	1
CO5	2	2	2	1	1	2	1	0	1	2	0	1	1	0	1
CO6	2	2	2	2	1	1	1	1	1	2	0	1	1	0	1
CO7	2	2	1	1	1	1	1	0	1	1	0	1	1	1	1
Average	2.00	2.00	1.71	1.86	0.86	1.57	1.00	0.57	1.29	1.71	0.00	1.00	1.00	0.71	1.00

COs.

CO1: Understand basics of thermodynamics and components of a thermal power plant like turbine, pumps, boilers etc.

CO2: Identify engineering materials, their properties encountered in engineering practice.

CO3: Understand basics of heat transfer, refrigeration and internal combustion engines.

CO4: Understand mechanism of power transfer through belt, rope, chain and gear drives.

CO5: Understand basics of various manufacturing processes such as casting, forming and welding.

Course Coverage Module Wise:

Lecture No.	Chapter Number	Topic Name
1	1	**INTRODUCTION:** Introduction to Mechanical Engineering, concepts of thermal engineering
2	1	Mechanical machine design, industrial engineering and manufacturing technology.
3	1	Steam Boilers classification
4	1	types of steam boilers
5	1	Steam turbines.
6	1	Introduction and Classification of power plants.
7	2	**PUMP:** Applications and working of Reciprocating pumps
8	2	Applications and working of Centrifugal pumps.
9	2	Introduction, Classification of IC Engines
10	2	Main Components of IC Engines, Working of IC Engines and its components.
11	2	Numerical on IC Engine
12	3	**REFRIGERATION SYSTEM:** Introduction of refrigeration systems
13	3	classification and types of refrigeration systems
14	3	Air-conditioning types of air-conditioning.
15	3	Applications of refrigeration and Air-conditioning
16	3	Numerical on refrigeration
17	4	**POWER TRANSMISSION:** Transmission of Power
18	4	Introduction and types of Belt and Rope Drives
19	4	Introduction and types of Gears
20	4	Numerical on Belt Drive and Gears
21	5	**PRIMARY MANUFACTURING PROCESES:** Metal Casting Process: Introduction to Casting Process, Patterns
22	5	Moulding, Furnaces
23	5	Metal Forming Processes: Introduction to Forging, Rolling,
24	5	Basic Concept about Extrusion, Drawing.
25	5	Metal Joining Processes: Introduction to various types of Welding,
26	5	Gas Cutting, Brazing, and Soldering.
27	6	**Introduction of Engineering materials.**
28	6	Heat Treatment of Steel

TEXT/REFERENCE BOOKS

1. Tata McGraw Hill Basic Mechanical Engineering.

Teaching and Learning resources:

- **MOOC (NPTEL): -**
  https://drive.google.com/drive/u/1/folders/1gimy5aZo207_Oja05Hw6JE2qNjyotPOz.

- YouTube Videos Link –
  https://www.youtube.com/c/TECHNICALCLASSES_TC

- **Assessment Methodology:**
1. Two Midterm exams where student have to showcase subjective learning.
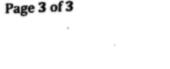2. Final Exam (subjective paper) at the end of the semester.
3. Surprise Test

Last Year Paper.

2E2306

B. Tech. II Sem. (Main) Exam., May – 2018
ME -102 Basic Mechanical Engineering

Time: 3 Hours

Maximum Marks: 80
Min. Passing Marks: 28

Instructions to Candidates:

*Attempt any **five** questions including Question No. 1, which is Compulsory. All questions carry **equal** marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly.*

Units of quantities used/calculated must be stated clearly.

Use of following supporting material is permitted during examination.

(Mentioned in form No.205)

1. **NIL**   2. **NIL**

Q.1   Compulsory   [8×2=16]

Answers for each sub-question be given 50 words- (each question carry 2 marks)

(a)   Describe different modern tools used in mechanical engineering.

(b)   Describe law of thermodynamics.

(c)   Describe different fields of manufacturing technology.

(d)   Differentiate between water tube boiler and fire tube boiler.

(e)   Differentiate between impulse and reaction turbine.

(f)   Write a short note on different types of power plant.

(g)   What is industrial engineering & its scope?

(h)   Define steam boiler & write different types of boiler.

Q.2 (a) Differentiate between 2 stroke & 4 stroke engine. [4]

(b) Describe ideal Otto cycle & derive formula for its efficiency. [4]

(c) Diesel cycle with compression ratio of CR=20 : 1 and cut –off ratio α=2. The air is at 100 kPa=1 bar. 20°C (293K), and the volume of the chamber is 500 cm³ prior to the compression stroke.

(i) Specific heat capacity at constant pressure of air at atmospheric pressure and room temperature: C_p = 1.01 kJ/kgK

(ii) Specific heat capacity at constant volume of air at atmospheric pressure and room temperature: C_v = 0.718 kJ/kgK.

(iii) K= C_p/C_v = 1.4

Calculate: The mass of intake air, the temperature T2, the pressure P2, the temperature T3, the amount of heat added by burning of fuel-air mixture, the thermal efficiency of this cycle. [8]

Q.3 (a) What is meant by refrigeration system?Describe vapor compression refrigeration system. [8]

(b) What is air conditioning ? Draw and describe different components used in it. [4]

(c) Ice is formed at 0°C from water at 20°C, the temperature of refrigerant is 10°C. Find the ice formed per KWH ,assume latent heat of ice is 334 kJ/kg. Assume working in perfect Carnot cycle. [4]

Q.4 (a) What is gear transmission? Describe different types of gear. [8]

(b) Describe with figure different types of belt drive. [4]

(c) Two spur gear have velocity ratio 1/3, driven gear has 72 teeth of 8 module & rotate at 300 rpm, calculate no. of teeth & speed of driver, also calculate pitch line velocity. Given:

T2=72, VR=1/3, N2=300 rpm, m=8mm

VR=N2/ N1= T1/T2=1/3. [4]

Q.5 (a) Write a short note on- [6]

    (i)   Extrusion

    (ii) Rolling

    (iii) Drawing

(b) What is metal casting? Describe different methods of metal casting. [5]

(c) Write a brief note on Lathe machine. [5]

Q.6 (a) Describe hardening and tempering of steel. [8]

(b) Describe the following terms- [8]

    (i)   Case hardening

    (ii) Carburizing

    (iii) Nitriding

    (iv) Cyaniding

    (v) Carbonitriding

Q.7 (a) What is Computer Added Design (CAD)? Describe its working. [8]

(b) What is MEMS? Write an essay on it. [8]

1E2407

B. Tech. I - Sem. (Main/Back) Exam., Dec. 2019
1FY1 – 07 Basic Mechanical Engineering

Time: 2 Hours

Maximum Marks: 80
Min. Passing Marks: 28

Instructions to Candidates:

Attempt all five questions from Part A, four questions out of six questions from Part B and two questions out of three from Part C.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used /calculated must be stated clearly.

Use of following supporting material is permitted during examination. (Mentioned in form No. 205)

1. NIL _____   2. NIL _____

PART – A

(Answer should be given up to 25 words only)   [5×2=10]
All questions are compulsory

Q.1 Define blade velocity co – efficient.

Q.2 What is the role of moderator in nuclear power plant?

Q.3 Why priming of a pump is required?

Q.4 Describe Zeroth law of thermodynamics.

Q.5 Differentiate between Joule's law and Gay – Lussac's law

PART – B

Q.1 Write a short note on points given below-

- (a) Power output of Parson's reaction turbine.
- (b) Velocity diagram of Parson's reaction turbine
- (c) Blade efficiency of Parson's reaction turbine.
- (d) Stage efficiency of Parson's reaction turbine
- (e) Nozzle efficiency of Parson's reaction turbine

Q.2 (a) Discuss various components of nuclear power plant.

- (b) Differentiate between coal thermal power plant and Geo thermal power plant in brief.

Q.3 Explain working of a reciprocating pump along with their applications and neat diagram.

Q.4 Describe the following points –

- (a) Case hardening
- (b) Unit of Refrigeration
- (c) Co – efficient of performances
- (d) Cast Iron and types
- (e) Cutting speed

Q.5 Explain Locomotive Boiler by using following points –

- (a) Neat sketch
- (b) Working principle
- (c) Components / parts & their working
- (d) Applications

Q.6 Explain the following processes-

- (a) Soaking
- (b) Brazing
- (c) Soldering
- (d) Drilling
- (e) Extrusion

PART – C

Q.1 (a) Describe different types of belt drives.

(b) Derive an expression for the length of open belt drive.

(c) Ice is formed at 0°C from water at 20°C. The temperature of refrigerant is 10°C. Find the Ice formed per kWh. Assume latent heat of Ice is 334 kJ/kg. Assume working in perfect Carnot cycle. http://www.rtuonline.com

Q.2 (a) Explain working of an I.C. Engine with their components.

(b) Derive the formula of mechanical efficiency and indicated power of an I.C. Engine.

Q.3 (a) Describes Electrolux refrigerator with neat sketch.

(b) Two parallel shafts 6m apart are to be connected by a belt running over pulleys of diameter 50 cm and 30 cm respectively. Determine the exact and approximate lengths of belt required.

   (i)   If the belt is open

   (ii) If the belt is crossed

(c) What is centrifugal tension? Derive an expression for the same.