

Writing anything except roll number on question paper will be deemed as an act of indulging in unfair means and action shall be taken as per rules.

2E000721	Roll No.	Total No. of Pages: 3
	2E000721 B. Tech. II Semester End-Term Examination (Main), June-2022 Branch: Computer Science & Engineering 2FY3-07: Mechanical Engineering	

Time: 3 Hours

Maximum Marks: 140

Instructions to Candidates:

The question paper is divided in three parts A, B & C.

- (i) **Part-A:** 7 Basics/Fundamentals related questions (without choice).
- (ii) **Part-B:** 5 Numerical/Analytical questions (with internal choice i.e. attempt one question either A or B from each question).
- (iii) **Part-C:** 5 Descriptive/Analytical/Problem Solving/Design questions (attempt any 3 out of 5).

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:

1. Nil
2. Nil

PART-A

(Basics/Fundamentals related questions)

All questions are compulsory

- Q.1 (a)** State the 'Kelvin-Planck' and 'Clausius' statements of the second law of thermodynamics. Show that they are equivalent. [2+2]
- (b)** What are four main differences between a fire tube boiler and a water tube boiler? [4]
- (c)** Define specific heat at constant pressure and specific heat at constant volume. Which is greater and why? [2+2]
- (d)** State the chemical formula of refrigerants R-11, R-12, R-21 and R-22. [4]
- (e)** List the main alloying elements used in alloy steels. How do they affect the properties of steel? [2+2]
- (f)** Describe the term 'Creep' and 'Slip' associated with belt drives. [2+2]
- (g)** Draw neat and clean sketch of the P-V and T-S diagram for constant volume air cycle. [2+2]

PART-B

(Numerical/Analytical questions)

- Q.2 (A)** Describe the construction and working of Babcock Wilcox boiler with neat and labeled diagram. [8]

OR

- (B) A cylinder fitted with a movable piston contains hydrogen at a pressure and temperature of 3.5 bar and 93°C respectively. The piston moves outward, no heat is gained or lost by gas during this process and at the end of expansion pressure is 0.7 bar. This piston is then fixed and heat is added until the gas temperature is 93°C, when the pressure is found to be 1.1 bar. Determine the specific heats of gas. The gas constant R= 4.16 kJ/kg K. [3+3+2]

- Q.3 (A) Explain the pressure-velocity-compounded steam turbine. Showing the pressure and the velocity variations along the axis. Where this system of compounding is used? [8]

OR

- (B) What are the four main circuit of thermal power plant? Draw the layout of steam thermal power plant with labeled diagram. [4+4]

- Q.4 (A) With the help of a sketch explain the working of a single acting reciprocating pump. Why this type of pump is called a positive displacement pump? [6+2]

OR

- (B) Derive an expression for air standard efficiency of Otto cycle. [8]

- Q.5 (A) With the help of a labeled diagram explain the principle of operation of a vapour compression refrigeration system. [8]

OR

- (B) For a flat belt, prove that: [8]

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

Where:

T1 = Tension in the tight side of the belt,

T2 = Tension in the slack side of the belt,

μ = Coefficient of friction between the belt and the pulley, and

θ = Angle of contact between the belt and the pulley (in radians)

- Q.6 (A) Describe the three types of flames used in gas welding. [8]

OR

- (B) Why are allowances required on patterns? Discuss the different types of pattern allowances. [8]

PART-C

(Descriptive/Analytical/Problem Solving/Design questions)

(attempt any 3 out of 5) (Q.7 to Q.11)

- Q.7 (i) An engineer claims his engine to develop 4 kW. On testing the engine consumes 0.5 kg of fuel per hr. having a calorific value of 42000 kJ/kg. The engine operates between temperatures 1400° C to 350° C. Find whether the engineer is justified in this claim. [12]

- (ii) Derive the steady flow energy equation and state the assumptions made. [12]

- Q.8 (i) Why mountings are essential in boilers? Give neat sketch and description of fusible plug. [12]

- (ii) State the essential elements of hydroelectric power plant. Describe the followings [12]
with reference to hydro-electric power plant:
- a. Penstock
 - b. Draft Tube
 - c. Spillway
 - d. Surge tank

- Q.9** (i) A four cylinder, four stroke engine has a displacement volume of 300 CC per cylinder. The compression ratio of the engine is 10 and operates at a speed of 3000 rev/min. The engine is required to develop an output of 40 kW at this speed. Calculate the thermal efficiency of the cycle, assuming that the engine operates on the Otto cycle and that the pressure and temperature at the inlet conditions are 1 bar and 27°C respectively. If the above engine is operating on diesel cycle and receiving heat at the same rate. Calculate thermal efficiency and maximum temperature of the cycle. [12]
- (ii) Explain the working of Domestic refrigerator with neat and labeled sketch. [12]

- Q.10** (i) Define the following terms used in gear: [12]
- a) Circular pitch
 - b) Module
 - c) Diametral pitch
 - d) Addendum and Dedendum
- (ii) Two pulleys, one 450 mm diameter and the other 200 mm diameter are on parallel shafts 1.95 m apart and are connected by a crossed belt. Find the length of the belt required and the angle of contact between the belt and each pulley. What power can be transmitted by the belt when the larger pulley rotates at 200 rev/min, if the maximum permissible tension in the belt is 1 kN, and the coefficient of friction between the belt and pulley is 0.25? [12]

- Q.11** (i) Differentiate between brazing and soldering process. [8]
- (ii) With the help of a neat sketch, describe the working of the arc welding process. [8]
- (iii) Describe the common casting defects and give their causes. [8]
