

Enrollment No.

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B.TECH (Aerospace Engineering)
II YEAR, III SEMESTER EXAMINATION
ENGINEERING MECHANICS (KAE-301)

[Time : 03:00 Hours]

[Max. Marks : 70]

NOTE: all questions are compulsory and the scientific calculator is allowed.

Q.1. ATTEMPT ANY TWO PARTS OF THE FOLLOWING:

(7X2)

- a) Explain following terms
 - i. law of parallelogram of forces ii. Limiting Friction iii. Dynamic friction
- b) Explain the types of force systems with neat sketch.
- c) Two forces of 100 N and 150 N are acting simultaneously at a point. What is the resultant of these two forces, if the angle between them is 45° ?

Q.2. Attempt any two of the following

(7x2)

- a) What is beam? Write different types of beams with neat sketch.
- b) State clearly the difference between a perfect frame and an imperfect frame.
- c) Draw shear force and bending moment diagram of given figure 1.

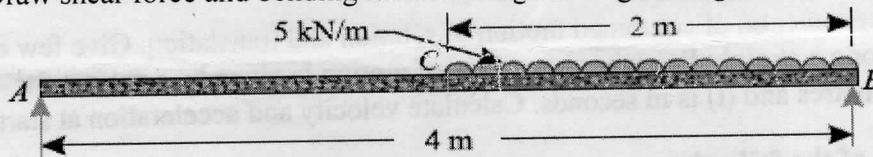


Figure: 1

Q.3. Attempt any two of the following

(7x2)

- a) State and prove the parallel axis theorem?
- b) Figure 2 shows a Warren girder consisting of seven members each of 3 m length freely supported at its end points. The girder is loaded at B and C as shown. Find the forces in all the members of the girder, indicating whether the force is compressive or tensile.

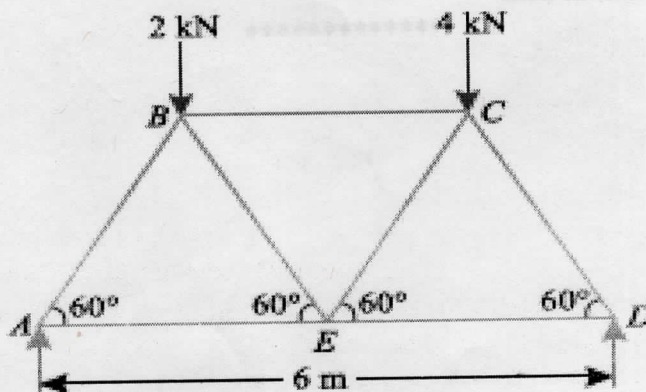


Figure: 2

- c) Find the moment of inertia of a T-section with flange as $150 \text{ mm} \times 50 \text{ mm}$ and web as $150 \text{ mm} \times 50 \text{ mm}$ about X-X and Y-Y axes through the centre of gravity of the section. Fig. 3.

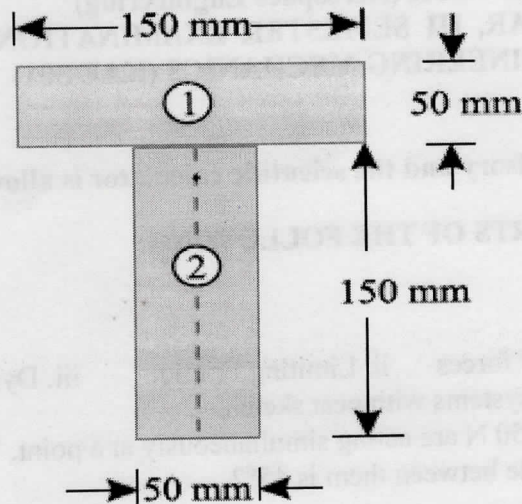


Figure: 3

Q.4. Attempt any two of the following

(7x2)

- A train travelling at 27 km per hour is accelerated at the rate of 0.5 m/s^2 . What is the distance travelled by the train in 12 seconds?
- Describe the phenomenon of combined motion of rotation and translation. Give few examples.
- A car moves along a straight line whose equation of motion is given by $s = 12t + 3t^2 - 2t^3$, where (s) is in metres and (t) is in seconds. Calculate velocity and acceleration at start

Q.5. Attempt any two of the following

(7x2)

- A body of weight 200 N is placed on a horizontal plane. Determine the coefficient of friction if a horizontal force of 130 N is sufficient to cause the body to slide over the plane. Also, calculate the resultant reaction.
- An uniform ladder of length 10 m and weighing 20 N is placed against a smooth vertical wall with its lower end 8 m from the wall. In this position, the ladder is just to slip. Determine (i) Coefficient friction between the ladder and floor. (ii) Frictional force acting on the ladder at the point of contact between the ladder and floor.
- Derive the relation for tension in belt.

27-12-24

ting Pages : 1

Paper Code : - KAE-304

(C) (SVSU) : 2024-2025/R

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**B.TECH (AEROSPACE ENGINEERING)
II YEAR, III SEMESTER EXAMINATION
MATERIALS ENGINEERING**

03:00 Hours]

[Max. Marks : 70]

ATTEMPT ALL THE QUESTIONS AS PER INSTRUCTIONS.**Attempt any two of the following.**

(7x2) = 14

Discuss the austempering and martempering of steels. What are the mechanical properties that improve due to these processes?

Write a brief note on surface hardening of steels.

Discuss different types of composite materials technology along with their advantages and disadvantages.

Attempt any two of the following.

(7x2) = 14

Explain the construction, working and operation of a cupola furnace.

Differentiate between Brass and Bronze. Also Differentiate between soft brass and hard brass and mention their application.

What are the advantages of nonferrous materials? Write the name of some nonferrous material and its application.

Attempt any two of the following.

(7x2) = 14

Explain BCC, FCC and HCP with neat and clean diagram.

Define the term 'Solid solution'. Give five examples of solid solutions.

What are Miller indices? What is procedure for finding Miller indices?

Attempt any two of the following.

(7x2) = 14

Explain the heat treatment and also explain its objectives.

Describe cast iron and discuss composition and application of grey cast iron, Malleable cast iron, White cast iron, Spheroidal cast iron.

Discuss the need of alloying of steel and also discuss the effect of different alloying elements on properties of steel.

Attempt any two of the following.

(7x2) = 14

Explain the Crystal Structure (System) in detail.

Describe the process of Annealing and Normalizing and its effect on different properties.

Explain Case Hardening? Mention its types.

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B.TECH (Aerospace Engineering)
II YEAR, III SEMESTER EXAMINATION
AERO ENGINEERING THERMODYNAMICS

[Time : 03:00 Hours]

[Max. Marks : 70]

NOTE:- ATTEMPT ALL THE QUESTIONS AS PER GIVEN INSTRUCTIONS.
STEAM TABLE, MOILER CHART AND PSYCHROMETRIC CHART IS ALLOWED.

QUESTION NO.-1: ATTEMPT ANY TWO PARTS.

(2*7=14)

- Differentiate between the Microscopic and Macroscopic properties of the system.
- Explain the concept of a Carnot engine and derive the efficiency of a Carnot cycle.
 - What is the difference between heat and work? Explain with examples.
- Define a thermodynamic system and distinguish between open, closed, and isolated systems.
 - Define thermodynamics and explain its importance in science and engineering

QUESTION NO.-2: ATTEMPT ANY TWO PARTS.

(2*7=14)

- Write the Difference between Point Function and Path Function.
 - During one cycle the working fluid in an engine engages in two work interactions: 15 kJ to the fluid and 44 kJ from the fluid, and three heat interactions, two of which are known: 75 kJ to the fluid and 40 kJ from the fluid. Evaluate the magnitude and direction of the third heat transfer.
- In a cyclic process, heat transfers are + 14.7 kJ, - 25.2 kJ, - 3.56 kJ and +31.5 kJ. What is the net work for this cyclic process?
 - Discuss about the term Thermodynamic Equilibrium in detail.
- A blower handles 1 kg/s of air at 20°C and consumes a power of 15 kW. The inlet and outlet velocities of air are 100 m/s and 150 m/s respectively. Find the exit air temperature, assuming adiabatic conditions. Take c_p of air is 1.005 kJ/kg-K.

QUESTION NO.-3: ATTEMPT ANY TWO PARTS.

(2*7=14)

- Define and derive the steady flow energy equation.
- An engine working on the Otto Cycle is supplied with air at 0.1MPa, 35°C. The compression ratio is 8 & Heat supplied is 2100KJ/Kg. Calculate the cycle efficiency.
- Write the difference between Otto Cycle & Diesel Cycle.

QUESTION NO.-4: ATTEMPT ANY TWO PARTS.

(2*7=14)

- An engine working on the Otto Cycle is supplied with air at 0.5MPa, 45°C. The compression ratio is 8 & Heat supplied is 4130KJ/Kg. Calculate the cycle efficiency.
- Derive the equation of Clausius-Clapeyron equation for evaporation of liquids
- Prove that : $C_p - C_v = -T(\partial V / \partial T)^2_T (\partial P / \partial V)_T$
- An air turbine forms part of an aircraft refrigerating plant. Air at a pressure of 295 kPa and a temperature of 58°C flows steadily into the turbine with a velocity of 45 m/s. The air leaves the turbine at a pressure of 115 kPa, a temperature of 2°C, and a velocity of 150 m/s. The shaft work delivered by the turbine is 54 kJ/kg of air. Neglecting changes in elevation, determine the magnitude and sign of the heat transfer per unit mass of air flowing. For air, take $c_p = 1.005$ kJ/kg K and the enthalpy $h = c_p t$.

QUESTION NO.-5: ATTEMPT ANY TWO PARTS.

(2*7=14)

- Explain Carnot theorem. Also explain its corollary.
- Derive the efficiency of Diesel cycle.
- A turbine operates under steady flow conditions, receiving steam at the following state: Pressure 1.2 MPa, temperature 188°C, enthalpy 2785 kJ/kg, velocity 33.3 m/s and elevation 3 m. The steam leaves the turbine at the following state: Pressure 20 kPa, enthalpy 2512 kJ/kg, velocity 100 m/s, and elevation 0 m. Heat is lost to the surroundings at the rate of 0.29 kJ/s. If the rate of steam flow through the turbine is 0.42 kg/s, what is the power output of the turbine in kW?

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B.TECH (AEROSPACE ENGINEERING)
II YEAR, III SEMESTER EXAMINATION
INTRODUCTION TO AEROSPACE

[Time : 03:00 Hours]

[Max. Marks : 70]

NOTE: ATTEMPT ALL THE QUESTIONS AS PER INSTRUCTIONS.**QUESTION NO.-1: ATTEMPT ANY FOUR PARTS.**

(4*3=12)

- a) What are the four fundamental aerodynamic forces acting on an aircraft during flight? Explain with neat sketch.
- b) What are the primary functions of the wings on a flight vehicle?
- c) Describe the role of the elevator in controlling an aircraft's flight.
- d) Explain the difference between a civil aircraft and a military aircraft.
- e) What is the difference between alternating current (AC) and direct current (DC) in aircraft electronics?

QUESTION NO.-2: ATTEMPT ANY THREE PARTS.

(3*4=12)

- a) What are the main components of a flight control system? Explain the role of each.
- b) Explain how the properties of non-metallic materials differ from metallic materials. What factors make non-metallic materials desirable for certain aerospace applications?
- c) Describe how GPS (Global Positioning System) is used for navigation.
- d) Compare and contrast titanium and stainless steel in terms of their mechanical properties and uses in aerospace engineering.

QUESTION NO.-3: ATTEMPT ANY THREE PARTS.

(3*6=18)

- a) Define the terms "Young's Modulus," "Bulk Modulus," and "Shear Modulus." Discuss their relevance in understanding material behavior under stress.
- b) Describe the role of wings, fuselage, and tail in the flight vehicle's design.
- c) Define stress and strain in the context of material deformation. Discuss how Hooke's Law relates stress to strain in elastic materials.
- d) Discuss the types of engines used in modern aircraft and their function.

QUESTION NO.-4: ATTEMPT ANY TWO PARTS.

(2*7=14)

- a) Explain the structure of Earth's atmosphere, including its layers, and describe the characteristics of each layer. How do these layers affect the behavior of aircraft and spacecraft?
- b) Discuss the differences between piston engines, turboprop engines, and jet engines.
- c) How does the density of air change with altitude? Describe the relationship between air density, temperature, and pressure. How does density influence the performance of aircraft at different altitudes?

QUESTION NO.-5: ATTEMPT ANY TWO PARTS.

(2*7=14)

- a) List and explain the main parts of an aircraft's structure with neat sketch. Describe the role of wings, fuselage, and tail in the flight vehicle's design.
- b) Explain materials. Describe the use of aluminum alloys in aerospace engineering, focusing on their advantages.
- c) Explain the differences between a turboprop, turbojet, and turbofan engine.