



Insem Examination-I Winter 2023		
Exam Seat No.:		
Academic Year: 2023-2024	Semester: I	
Name of Programme: B.Tech	Pattern: 2023	
Name of Course: Fundamentals of Mechanical Engineering	Course Code: 2300114A	
Max. Marks: 30	Duration: 1 Hr.	

**Instructions:** Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 2 pages.
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required and draw the neat labelled diagrams, wherever necessary.
4. The last column indicates the Course Outcome of the Question/sub-question

**Question No. 1 Attempt following Question**

- a) Which material is more elastic on stress-strain curve? How do you compare toughness of materials on a stress-strain curve? (5) CO4

**OR**

- b) The force is required to stretch a steel wire 2 cm<sup>2</sup> in cross-section to triple its length is  $8 \times 10^7$  N. If the original length of the wire is 1m, determine the Modulus of Elasticity? Assume that the elastic limit is not exceeded. (5) CO4

- c) Suggest suitable gear (s) for the followings:
- i) When shaft axes are non-parallel, non-intersecting, right angle gear drive system applications where a high transmission gearing ratio is required.
  - ii) When shaft axes are parallel, parallel gear drive system where high speed is to be transmitted.
  - iii) When shaft axes are perpendicular and interesting.
  - iv) When shaft axes are parallel, noisy operation and used for low speed applications.
  - v) To convert rotational motion into linear motion and conversely linear motion into rotational motion.
- (5) CO5

**OR**

- d) Draw the constructional details of clutch used in mopeds. Explain its working principle. (5) CO5
- e) Illustrate how a chain and sprocket drive transfers power from the pedals to the wheels in a bicycle. (5) CO5

**OR**

- f) A spur pinion with 120 mm pitch circle diameter rotates at 1400 rpm and drives a gear having pitch circle diameter 300 mm. Determine the number of teeth on the pinion if gear has 55 teeth and Speed of the spur gear in rpm (5) CO5

**Question No. 2 Attempt following Question**

- a) 0.5 kg/s air flows steadily through a compressor, entering at 6 m/s velocity, 95 kPa pressure, and specific volume of  $1 \text{ m}^3/\text{kg}$  and leaves at velocity of 4 m/s, pressure of 600 kPa and specific volume of  $0.2 \text{ m}^3/\text{kg}$ . The change in internal energy is 90 kJ/kg. The heat lost by the compressor during the process is 60 kW. Calculate the work required for compression. (6) CO3

**OR**

- b) A working fluid in a refrigeration system undergoing a cycle, absorbs 150 kJ of heat from the cabinet. If the work required for operating the system is 50 kJ, Calculate COP and the heat rejected to the atmosphere. (6) CO3
- c) Explain Carnot cycle using PV and TS diagram and obtain expression for its efficiency. (4) CO3

**OR**

- d) Write a note on Perpetual Motion Machine of First and Second kind. (4) CO3
- e) Write a note on modes of heat transfer. Give example of each mode with proper sketch. (5) CO3

**OR**

- f) State Fourier's law of heat conduction? Derive the expression of heat flow through a plane wall. (5) CO3