Total Number of Pages: 02

Course: B.Tech/IDD
Sub_Code: MEPC3001

5th Semester Regular Examination: 2025-26
SUBJECT: DESIGN OF MACHINE ELEMENTS-II
BRANCH(S): MECH, ME
Time: 3 Hours
Max Marks: 100
Q.Code: U129
Answer Q1 (Part-I) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right-hand margin indicate marks.
(Use of relevant data book is permissible)

Part-I

Q1   Answer the following questions: (2 x 10)

a) State the relationship for the shear stress developed in a shaft, when it is subjected to torsion.

b) What is the ratio of the endurance limit to the ultimate tensile strength, when a material is subjected to fatigue loading?

c) What is the function of a connecting rod of an internal combustion engine?

d) Why the area of the inlet valve port is made larger than the area of exhaust valve port?

e) Name the different types of clutches.

f) What is the significance of pV value in brake design?

g) For horizontal belts which side (tight or slack) of the belt should run on the top and why?

h) Under what circumstances a fiber rope and a wire rope is used?

i) What do you understand by simplex, duplex, and triplex chains?

j) How are the gears classified?

Part-II

Q2   Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)   (6 x 8)

a) Write short note on maximum shear stress theory verses maximum strain energy theory.

b) Write Soderberg's equation and state its application to different type of loadings.

c) Discuss the design of piston for an internal combustion engine.

d) Discuss the design of crank shaft for an internal combustion engine.

e) Describe with the help of neat sketches, the working principles of two different types of friction clutches.

f) Discuss the design procedure of spur gears.

g) Sketch neatly the working drawing of bevel gears in mesh.

h) Sketch the cross-section of a V-belt and label its important parts.

i) Explain the design procedure for a chain drive.

j) A single block brake is shown in Fig. 1. The diameter of the drum is 250 mm and the angle of contact is 90°. If the operating force of 700 N is applied at the end of a lever and the coefficient of friction between the drum and the lining is 0.35, determine the torque that may be transmitted by the block brake.
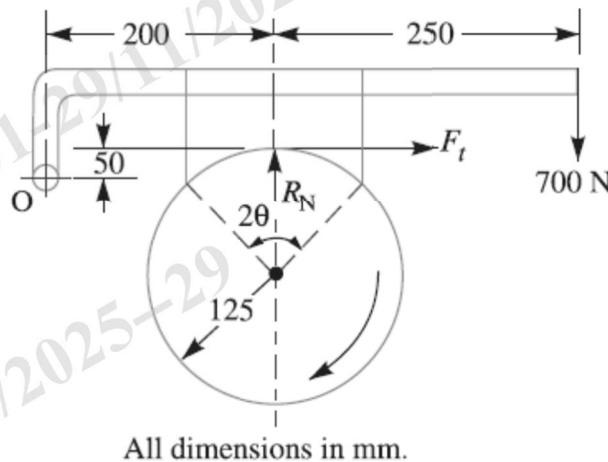

All dimensions in mm.

Fig. 1

k) Discuss the different types of brakes giving at least one practical application for each.

l) Explain, with the help of neat sketches, the types of various flat belt drives.

Part-III
Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is to be subjected to a tensile load that has a maximum value of 250 kN and a minimum value of 100 kN. The properties of the plate material are as follows:
Endurance limit stress = 225 MPa, and Yield point stress = 300 MPa. The factor of safety based on yield point may be taken as 1.5. **(16)**

Q4 Design the various components of a valve gear mechanism for a horizontal diesel engine having the following specifications:
Brake power = 10 kW; Bore = 140 mm; Stroke = 270 mm; Speed = 500 r.p.m. and maximum gas pressure = 3.5 N/mm².
The valve open 30° before top dead centre and closes 2° after bottom dead centre. It opens and closes with constant acceleration and deceleration for each half of the lift. The length of the rocker arm on either side of the fulcrum is 150 mm and the included angle is 135°. The mass of the valve is 0.3 kg. **(16)**

Q5 Describe with the help of a neat sketch the principle of operation of an internal expanding shoe brake. Derive the expression for the braking torque. **(16)**

Q6 A worm drive transmits 15 kW at 2000 r.p.m. to a machine carriage at 75 r.p.m. The worm is triple threaded and has 65 mm pitch diameter. The worm gear has 90 teeth of 6 mm module. The tooth form is to be 20° full depth involute. The coefficient of friction between the mating teeth may be taken as 0.10. Calculate:
a) tangential force acting on the worm; b) axial thrust and separating force on worm; and c) efficiency of the worm drive. **(16)**