

SECTION - D

8. Using uniform wear theory, show that in a disc clutch torque transmission is maximum when ratio  $R_1/R_2 = 0.577$ , where  $R_1$  = inner radius and  $R_2$  = outer clutch radius. Draw a graph between torque and  $R_1/R_2$  = ratio. 20

9. A hoist is used to lower a load of 20kN at a speed of 1 m/s. When the brakes are applied and load is brought to rest at a distance of 2 metres. Brake sheave of diameter 0.6m is mounted on drum shaft. Diameter of hoist drum is 1.0m. The kinetic energy of the drum is neglected. Determine : 20

- (a) Braking capacity of a double shoe brake, and  
(b) Dimensions of brake lining if  $pV = 1$ , where  $p$  is pressure in MPa and  $V$  is velocity in m/s.

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Roll No. ....

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B. Tech. 5th Semester (ME)  
Examination – February, 2022  
MECHANICAL MACHINE DESIGN - I

Paper : ME-303-P

Time : Three Hours ]

[ Maximum Marks : 100

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after commencement.

Note : Attempt five questions. Question No. 1 is compulsory. Attempt any one question from each Section.

The use of following Design Data book is permitted :

- (i) Design Data Handbook (In SI and Metric Units) for Mechanical Engineers by Mahadevan  
(ii) Design Data Book PSG College of Technology  
Coimbatore

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P. T. O.

1. Explain following :

4 × 5 = 20

- Principle of operation of clutch.
- Why is the maximum moment of inertia contributed by rim in a flywheel ?
- Show the failure modes of a rivet in a riveted joint.
- Difference between loose, easy and close running fit.

#### SECTION - A

2. A journal of nominal diameter 70mm runs in a bearing with a close running fit. Find the limits on the dimensions of the shaft and the bearing. What are the values of minimum and maximum clearance ? 20

3. (a) Why is the fatigue strength of a forged part better than that of a cast part ? 6

- (b) Classify different engineering materials. 14

#### SECTION - B

4. Determine the lifting and lowering torques and efficiency of a power screw using a 30mm-5mm Acme thread, single start power screw. Axial load is 5kN and mean diameter of collar thrust bearing is 45mm. The screw and nut are lubricated with oil. Sliding friction is 0.15 and rolling friction is 0.02. The conditions are :

20

- When collar is having sliding friction.
- When collar has rolling friction, using thrust ball bearing.

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5. A boiler drum of internal diameter 15m is to be designed to sustain internal pressure of 2 N/mm<sup>2</sup>. Taking efficiency of longitudinal joint as 75%, determine the thickness of the plate. Take factor of safety as 5 and design a double-cover, double-riveted butt joint along the length of boiler drum. What is the efficiency of the joint ? For the material  $\sigma_{uc} = 420$  MPa,  $\sigma_{uc} = 640$  MPa and  $\tau_u = 300$  MPa. 20

#### SECTION - C

6. At the concentration site, 1 tonne of steel is to be lifted up to a height of 20m with the help of 2 wire ropes of 6 × 19 size, nominal diameter 12mm and kerale designation 1770. Determine the factor of safety if the sheave diameter is 56d and if wire rope is suddenly stopped in 1 second when travelling at a speed of 1.2m/s. What is factor of safety if bending load is neglected ? 20

7. A standard splined connection, 12 × 45 × 50 mm, is used for a gear and shaft assembly, rotating at 400rpm. The length of the gear hub is 60mm and the normal pressure on the splines is limited to 6.5MPa. Calculate the power which can be transmitted from the gear to the shaft. What is the shear stress developed in the splined shaft and in the splined hub ? 20

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