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10AU63

# Sixth Semester B.E. Degree Examination, Feb./Mar. 2022
## Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

**Note:** *1. Answer any FIVE full questions, selecting at least TWO full questions from each part.*
*2. Use of Design data hand book is permitted.*



### PART – A

1 a. Give differences between a straight beam and a curved beam. **(05 Marks)**

b. A curved beam with a circular centre line has trapezoidal cross-section and is subjected to pure bending in its planes of symmetry. The concave side face is 100mm and 100mm from the centre line of curvature. The depth is 100mm. Find the proper value of other parallel face, if the maximum extreme fibre stress in tension and compression are numerically equal. Determine the magnitude of couple, if it is subjected to a maximum fibre stress of $50N/mm^2$. **(15 Marks)**

2 a. Derive Lame's equation for thick cylinders. **(10 Marks)**

b. A cast iron cylinder of internal diameter 200mm and thickness 50mm is subjected to a pressure of $5N/mm^2$. Calculate the tangential and radial stresses at the inner, middle (radius = 125mm) and outer surfaces. **(10 Marks)**

3 a. A loaded narrow gauge car weights 18kN and moving at a velocity of 80m/min is brought to rest by a buffer consist of two helical springs. The spring undergoes compression of 200mm. The allowable shear stress is 300MPa and the spring index is 8. Design suitable spring, take G = 84GPa. **(10 Marks)**

b. A truck spring has an overall length of 1m and sustains a load of 70kN at its centre. The spring has 3 full length leaves and 15 graduated leaves with a central band of 100mm wide. All leaves are to be stressed to 400MPa when fully loaded. The ratio of the total spring depth to that of width is 2. $E = 210kN/mm^2$. Determine:

i) Thickness and width of the leaves
ii) Initial gap
iii) Load exerted on the band. **(10 Marks)**

4 a. A 25kW at 3000rpm is to be transmitted by a multiplate friction clutch. The plate having friction surface of steel and phosphors bronze alternatively and run in oil. Design the clutch for 25% over load. **(10 Marks)**

b. A simple band brake of drum diameter 600mm and band passing over it with angle of contact of 225°, while one end is connected to the fulcrum, the other end is connected to the brake lever at a distance of 400mm from the fulcrum. The brake lever is 1m long. The brake is to absorb a power 15kW at 720rpm. Design the brake lever of rectangular cross-section, assuming depth to be thrice the width. Take allowable stress 80MPa. **(10 Marks)**

## PART – B

5 a. Derive the Lewis equation for the beam strength of a gear tooth and list the assumptions. **(05 Marks)**

b. A pair of spurgears having 20° full depth involute system is to transmit 12kW at 300rpm of the pinion. The allowable static stress for steel pinion is 105MPa and for the CI gear is 60MPa. Design the spur gear and check dynamic and wear conditions. Assume surface endurance strength as 580MPa and velocity ratio is 3:1. **(15 Marks)**

6 a. Explain with a sketch, the formative number of teeth based on bevel gears. **(04 Marks)**

b. Design a pair of bevel gears to transmit 12kW at 300rpm of the gear and 1470rpm of the pinion. The pinion has 20 teeth and the material for gears is cast steel C30 untreated. Take service factor as 1.25 and check the gears for wear and dynamic loads. **(16 Marks)**

7 a. Derive Petroff's equation with usual notations. **(08 Marks)**

b. A turbine shaft 60mm in diameter rotates at a speed of 10000rpm. The load on each bearing is estimated as 2kN and the length of bearing is 80mm. Taking radial clearance as 0.05mm and SAE 20 oil for lubrication. Determine coefficient of friction, power loss and oil flow rate. The temperature of the bearing is not to exceed 50°C. **(12 Marks)**

8 a. Derive an expression for power rating of a V-Belt drive. **(08 Marks)**

b. Two shaft's 1m apart as connected by V-Belts drive to transmit 95kW at 1000rpm of driver pulley of 300mm effective diameter. The driven pulley runs at 375rpm. The angle of groove is 40° and the co-efficient of friction between the belt and pulley rim is 0.28. The area of the belt section is $400mm^2$ and permissible stress is 2.1MPa. Density of belt material is $1100kg/m^3$. Calculate the number of belts required and length of the belt. **(12 Marks)**

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