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**BME-024**

# B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

## Term-End Examination

00113

## December, 2016

## BME-024 : MECHANICAL ENGINEERING DESIGN

*Time : 3 hours* *Maximum Marks : 70*

***Note :*** *Answer any **five** questions. All questions carry equal marks. Use of calculator and design data book is permitted. Assume missing data, if any.*

1. (a) Explain in brief the design consideration for machine element. 7

   (b) Write Soderberg's equation and state its application to different types of loading. 7

2. Two plates of 10 mm thickness each are to be joined by means of a single riveted double strap butt joint. Determine the rivet diameter, rivet pitch, strap thickness and efficiency of the joint. Take the working stress in tension and shearing as 80 MPa and 60 MPa respectively. 14

3. Design a clamp coupling to transmit 30 kW at 100 rpm. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0·3. *14*

4. Find the diameter of a solid steel shaft to transmit 20 kW at 200 rpm. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameters, when the ratio of inside to outside diameter is 0·5. *14*

5. A helical compression spring made of circular wire is subjected to an axial force which varies from 2·5 kN to 3·5 kN. Over this range of force, the deflection of the spring should be approximately 5 mm. The spring index can be taken as 5. The spring has square and ground ends. The spring is made of patented and cold-drawn steel wire with ultimate tensile strength of 1050 $N/mm^2$ and modulus of rigidity is 81370 $N/mm^2$. The permissible shear stress for the spring wire would be taken as 50% of the ultimate tensile strength. Design the spring. *14*

6. A multi-disc clutch has three discs on the driving shaft and two on the driven shaft. The inside diameter of the contact surface is 120 mm. The maximum pressure between the surface is limited to 0·1 $N/mm^2$. Design the clutch for transmitting 25 kW at 1575 rpm. Assume uniform wear condition and coefficient of friction as 0·3. *14*

7. A footstep bearing supports a shaft of 150 mm diameter which is counterbored at the end with a hole diameter of 50 mm. If the bearing pressure is limited to 0·8 $N/mm^2$ and the speed is 100 rpm, find (i) the load to be supported, (ii) the power lost in friction, and (iii) the heat generated at the bearing. (Assume coefficient of friction = 0·015) *14*

8. Write short notes on the following : $4 \times 3\frac{1}{2} = 14$

   (a) Failure in gear tooth and their causes

   (b) Advantages and disadvantages of stub-gear tooth

   (c) Phenomenon of interference in involute gear

   (d) Sliding Contact Bearings