

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

Term-End Examination

00293

December, 2018

BME-024 : MECHANICAL ENGINEERING DESIGN

Time : 3 hours

Maximum Marks : 70

Note : Question no. 1 is compulsory. Answer any four questions from the rest. Attempt five questions in all. All questions carry equal marks. Assume missing data, if any. Standard symbols and notations have usual meaning.

1. (a) What is design ? Briefly explain.
- (b) How can you make cast iron, ductile ?
- (c) Define factor of safety.
- (d) Distinguish between Square and Acme threads.
- (e) List the materials used in making springs. Name various applications of springs.
- (f) Enumerate different methods of power transmission. Give two applications of each.
- (g) What are the sources of friction in rolling contact bearings ?

$7 \times 2 = 14$

2. (a) What is the significance of theories of failure ?
- (b) A cylindrical tank is made of steel for which ultimate tensile strength is 150 MPa and the pressure inside the cylinder is to be 1.5 MPa. Using theory of maximum principal stress and maximum shearing stress, find the thickness of the cylinder. Take the diameter of the cylinder as 1.5 metres. Use factor of safety = 5. 4+10
3. (a) Describe the steps involved in designing a screw.
- (b) A horizontal fixed nut carries a vertical screw of square thread whose mean diameter is 50 mm and pitch is 10 mm. On the top of the screw, a circular disc of 200 N weight and 150 mm diameter is fixed and this disc has a radial hole into which a rod of 1.5 m is fixed such that 1.3 m length is out of the disc. If at the end of this rod an effort of 300 N is required to lift a load placed on the disc, calculate the load. The coefficient of friction between the threads of the screw and nut is 0.1. 4+10

4. (a) Define efficiency of a riveted joint and write the expression for various strengths.
- (b) A structural joint of double cover butt type has an efficiency of 85% with the condition that the lowest strength is in tearing mode of 10 mm thick plate in the outermost row, which is weakened by one hole. Find the tensile force carried by the joint and the number of rivets. The permissible stresses for plate and rivet are $\sigma_t = 100 \text{ N/mm}^2$, $\tau = 70 \text{ N/mm}^2$ and $\sigma_c = 150 \text{ N/mm}^2$. Design the joint completely and show d , d_1 , p , p_b and m on the sketch. Also give dimensions of the cover plate. 4+10

5. (a) Under what conditions do the deflection and twist of shaft become important ?
- (b) A hollow shaft with diameter ratio 0.8 is required to transmit 400 kW at 250 rpm with a uniform torque. Allowable shear stress is 60 N/mm^2 and twist in 3 metre length is not to exceed 1 degree. Calculate the minimum external diameter and internal diameter of the shaft, satisfying these conditions.

Take the value $G = 8 \times 10^4 \text{ N/mm}^2$. 4+10

6. (a) What is the profile of a gear tooth ? How do you generate this profile ? Discuss in brief.
- (b) A 30° helical gear transmits 7.5 kW to a conveyor. The gear carries 80 teeth whose transverse module is 5 mm. Calculate the normal module, imaginary number of teeth and three components of forces which are transmitted to the shaft which rotates at 1200 rpm. Show them in a sketch. Assume that pressure angle in transverse plane is 20° . 4+10
7. (a) Distinguish between a dog clutch and friction clutch.
- (b) An electric motor rotating at 400 rpm drives a machine through a plate clutch whose both sides are effective. When the clutch is engaged it takes 2 seconds for the driven machine to attain the speed of motor. The moment of inertia of driven shaft is 5 kg-m^2 . Calculate the torque produced by the motor and its power. 4+10
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