00554

# BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)

## Term-End Examination
## December, 2010

## BME–024 : MECHANICAL ENGINEERING DESIGN

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

***Note :*** *Answer **any five** questions. **All** questions **carry equal** marks. Use of calculator is **permitted**. Use of Design Data Book is allowed. Assume any missing data.*

**1.** (a) What are the factors to be considered for the selection of materials for the design of machine elements? **4+10**

(b) How the following properties of steel can be improved :

(i) Hardenability

(ii) Toughness

(iii) Resistance against corrosion

(iv) Wear resistance

(v) Fatigue strength.

2. (a) What are the different modes of failure of riveted joints ? What do you understand by ecentric Loading of a riveted joint ? Explain with the help of sketch . 7+7

(b) Determine the thickness of a 120 mm wide uniform plate for safe continuous operation if the plate is 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 = 225MPa, and

Yield point stress = 300 MPa

The factor of safety based on yield point may be taken as 15:

3. (a) How are the gears classified and what are the various terms used in spur gear terminology ? State the two important reasons for adopting involute curves for a gear tooth profile. 7+7

(b) The following are the data for a helical spring used for an engine :

length of spring when valve is open : 40 mm

length of spring when valve is closed : 50mm

Spring load when valve is open : 400 N

Spring load when valve is closed : 200N

Maximum inside dia of spring : 28 mm

Maximum permissible shearing stress for material of spring is 400 Mpa and its modulus of rigidity is $8 \times 10^4$ Mpa. Design the spring take Whal's

$$\text{factor} = \frac{4C-1}{4C-4} + \frac{0.165}{C}$$

C being spring index.

4. (a) What materials are used to make flat belt ? Sketch a pulley for flat belt and show various dimensions. How do you calculate the arms of the pulley ? 7+7

(b) A square threaded screw is required to work against an axial force of 6.0 kN and has following dimensions :

Major dia., $d = 32$ mm; pitch, $p = 4$mm with single start, $\mu = 0.08$ and the axial force rotates with the screw.

Calculate :

(i) torque required when screw moves against the load,

(ii) torque required when screw moves in the same direction as the load,

(iii) efficiency of the screw.

5. (a) Describe different types of shafts. How will you calculate load upon a shaft if it supports a pulley or when it supports a gear ? 7+7

(b) A double riveted lap joint is made between 15mm thick plates. The rivet diameter and pitch are 25 mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in Crushing, find the minimum force per pitch which rupture the joint. If the above joint is subjected to a load such that the factor of safety is 4, find out the actual stresses developed in the plates and rivets.

6. (a) Sketch a single plate friction clutch and state how axial force is applied ? Also discuss conditions of uniform pressure and uniform wear in friction clutch. Which condition is assumed in design ? Give reasons. 7+7

(b) Determine the maximum, minimum and average pressure in a plate clutch when the axial force is 4 kN. The inside radius of the contact surface is 50 mm and the outside radius is 100 mm. Assume Uniform wear.

7. (a) What are the different types of friction in sliding bearings ? How does absolute viscosity of an oil change with temperature and pressure ? Show typical variation of absolute viscosity with Temperature. **7+7**

(b) A roller bearing having a mean dia. of 65 mm carries a radial Load of 4500 N and rotates at 10000 rpm. Calculate the frictional power loss if bearing is lubricated by an oil bath having a kinematic viscosity of $20 \times 10^{-6} m^2/s$. Effective coefficient of friction $f_1$ for roller bearing (cylindrical) may taken as 0.0006 constant $f_2$ for single row cylindrical bearing under the conditions of jet lubrication may taken as $6.0 \times 10^3$.