

**B.Tech. MECHANICAL ENGINEERING
(BTMEVI)****Term-End Examination**

June, 2013

00427

BIME-008 : MACHINE DESIGN - I

Time : 3 hours

Maximum Marks : 70

Note : Attempt any five questions. All questions carry equal marks. Use of scientific calculator is permitted. Use of Design Data Book is permitted.

1. (a) (i) Specify materials suitable for cotter and Knuckle joint for Mechanical application ? **6+8**
- (ii) Enumerate various applications of cotter and Knuckle joint ?
- (b) A cotter of 20 mm thickness and 80 mm width is used in the cotter joint. The inner and outer diameters of socket are 50 mm and 80 mm respectively. The outer diameter of the socket flange is 100 mm. What is the maximum load that the cotter joint can be subjected to without failure of the cotter if $\sigma_d = 60 \text{ N/mm}^2$, $\sigma_{dc} = 70 \text{ N/mm}^2$, and $\tau_d = 30 \text{ N/mm}^2$.

2. (a) Discuss the influence of various factors on the endurance limit of a ductile material. **6+8**
- (b) A round shaft is made of a brittle material and subjected to a bending moment of 15 N.m as shown in figure - 1. The stress concentration factor at the fillet is 1.5 and the ultimate tensile strength of the shaft material is 200 MPa. Determine the diameter d , the magnitude of stress at the fillet and factor of safety.

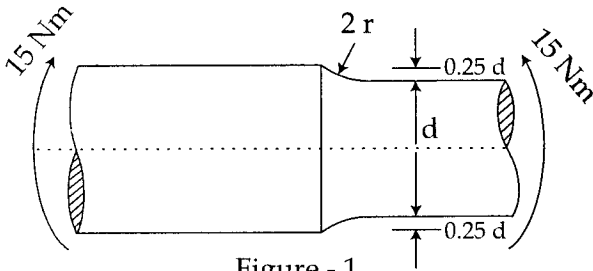


Figure - 1

3. (a) Explain how the factor of safety is determined under steady and varying loading by different methods. **6+8**
- (b) Design a helical compression spring for a maximum load of 1000 N and for a deflection of 25 mm. The maximum permissible shear stress for spring material is 420 N/mm^2 . Modulus of rigidity is $0.84 \times 10^5 \text{ N/mm}^2$. Spring index is 6.

4. (a) What do you understand by overhauling and self-locking screws ? 6+8
- (b) Discuss the following (*any four*) :
- (i) Stress concentration and its mitigation
 - (ii) Selection of materials
 - (iii) Pneumatic presses
 - (iv) Reverse engineering
 - (v) Creep and fatigue
5. (a) What do you mean by Prestressing of leaf springs ? 6+8
- (b) Design the leaf spring for the rear suspension of a heavy duty truck. The distance between axles is 6 m, weight is 2 MN and the c.g. is 2 m from the rear axle. The no. of full length leaves is 2 and remaining graduated. Allowable stress is 300 MPa. Length of spring is 1600 mm and central band is 100 mm wide. Width of each leaf is 75 mm. Deflection is 50 mm. Determine the thickness and no. of graduated leaves.
6. (a) (i) Why hollow shafts are stronger than solid shafts for the same cross-sectional area ? Explain in detail. 6+8
- (ii) Why Grey cast iron is used for machine beds and guide ways ?

(b) A power screw having double start square thread of 25 mm nominal diameter, 21 mm core diameter and 5 mm pitch is acted upon by an axial thrust of 10 KN. The outer diameter of collar is 50 mm and inner diameter of collar is 20 mm. The coefficient of friction at the screw is 0.2. The screw rotates at 12 rpm. Calculate (i) the stress in screw. (ii) torque required to rotate the screw, and (iii) the power required to drive it. Use $\mu_c = 0.15$.

7. (a) Write short notes on the following (*any three*) : **6+8**

- (i) welded joints
- (ii) riveted joints
- (iii) creative design
- (iv) concurrent engineering
- (v) design for environment

(b) A semi elliptic laminated leaf spring has an eye to eye span of 1.2 m and supports a central load of 20 kN, for the purpose three full length and six graduated leaves including master leaf are used. Width of the central band is 0.2 m. The width to thickness ratio for each leaf is 6. The allowable stresses are 200 N/mm². Take $E = 2 \times 10^5$ N/mm².

Calculate the section of leaves and deflection at full load if :

- (i) Leaves are not stressed initially
- (ii) Leaves are stressed initially for equalised stresses at maximum load.

8. (a) Suggest suitable materials for following 6+8 components giving reasons for their choice.

- (i) turbine blades
- (ii) chemical vessels
- (iii) connecting rod
- (iv) piston and cylinder
- (v) bearings
- (vi) springs

- (b)
- (i) Why rebound clips are used in leaf springs ?
 - (ii) What are the various design considerations for leaf springs ?
 - (iii) Why the 'factor of safety' is sometimes called 'factor of ignorance' ? Explain it.
 - (iv) What are the different stresses developed in the welded joint ? Compare the welded joint with riveted joint