

# C.U.SHAH UNIVERSITY

## Summer Examination-2019

**Subject Name: Machine Design-I**

**Subject Code: 4TE06MDE1**

**Branch: B.Tech (Mechanical)**

**Semester: 6**

**Date: 30/04/2019**

**Time: 10:30 To 01:30**

**Marks: 70**

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
  - (2) Instructions written on main answer book are strictly to be obeyed.
  - (3) Draw neat diagrams and figures (if necessary) at right places.
  - (4) Assume suitable data if needed.
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**Q-1**

**(14)**

- a) Which process will increase the fatigue duration of parts?  
(A) Finishing and polishing (B) Shot peening  
(C) Decarburisation (D) Electroplating
- b) The constant factor in case of R10 series of preferred numbers is  
(A) 1.06 (B) 1.12  
(C) 1.26 (D) 1.58
- c) Yield point in fatigue loading as compared to static loading is  
(A) Same (B) Higher  
(C) Lower (D) Depends on other factors
- d) The ratio of endurance limit in shear to the endurance limit in flexure is  
(A) 0.33 (B) 0.4  
(C) 0.5 (D) 0.55
- e) Shear stress theory is applicable for  
(A) Ductile materials (B) Brittle materials  
(C) Elastic materials (D) All of the above
- f) Ball bearing type screws are found in following application  
(A) Screw jack (B) Aeroplane engines  
(C) Crane (D) Steering mechanism
- g) The power transmitted by belt drive depends upon  
(A) Belt velocity (B) Initial belt tension  
(C) Arc of contact (D) All of the above
- h) The metal suitable for bearings subjected to heavy loads is  
(A) White metal (B) Silicon bronze  
(C) Monel metal (D) Phosphor bronze
- i) When two springs are in series (having stiffness K), the equivalent stiffness will be  
(A) K (B) K/2  
(C) 2K (D) K/4
- j) When a close coiled helical spring is compressed, its wire is subjected to  
(A) Tension (B) Shear  
(C) Compression (D) All of the above



- k) The bearings of heavy series have capacity \_\_\_\_\_ over the medium series.  
 (A) 20 to 30% (B) 10 to 20%  
 (C) 30 to 40% (D) 40 to 50%
- l) The ratio of circumferential stress to longitudinal stress in a thin cylinder subjected to an internal pressure is  
 (A) 1/2 (B) 1  
 (C) 2 (D) 4
- m) A pressure vessel is said to be a thick shell, if the ratio of wall thickness to its diameter is  
 (A) equal to 1/10 (B) less than 1/10  
 (B) (C) greater than 1/10 (D) none of these
- n) Which of the following spring is used in mechanical wrist watch?  
 (A) Helical compression spring (B) Spiral spring  
 (C) Torsion spring (D) Belleville spring

**Attempt any four questions from Q-2 to Q-8**

**Q-2**

**Attempt all questions**

- (a) What is standardization? Explain role of preferred numbers in standardization? **07**  
 Explain its significance. State their advantages and applications.
- (b) Explain the following terms of the spring : **07**  
 (i) Free length; (ii) Solid height; (iii) Spring rate; (iv) Active coil (v) Inactive coils;  
 (vi) Spring index (vii) Pitch.

**Q-3**

**Attempt all questions**

- (a) Explain thermal and wear Design Consideration. **07**
- (b) Find the maximum shear stress and deflection induced in a helical spring of the **07**  
 following specifications, if it has to absorb 1000 N-m of energy. Mean diameter of  
 spring = 100 mm; Diameter of steel wire, used for making the spring = 20 mm;  
 Number of coils = 30 ; Modulus of rigidity of steel = 85 kN/mm<sup>2</sup>.

**Q-4**

**Attempt all questions**

- (a) Explain the stress concentration and Illustrate how the stress concentration in a **07**  
 component can be reduced.
- (b) A cast iron cylinder of internal diameter 200 mm and thickness 50 mm is **07**  
 subjected to a pressure of 5 N/mm<sup>2</sup>. Calculate the tangential and radial stresses  
 at the inner, middle (radius = 125 mm) and outer surfaces.

**Q-5**

**Attempt all questions**

- (a) Explain Endurance strength and Explain Soderberg diagrams. **07**
- (b) Prove that the ratio of the driving tensions on the two side of a pulley is **07**

$$\frac{T_1}{T_2} = e^{\mu\theta}$$

Where,

T1 = Tension in the tight side of the belt,

T2 = Tension in the slack side of the belt,

μ = Coefficient of friction between the belt and pully,

θ = Angle of contact in radians.

**Q-6**

**Attempt all questions**

- (a) What are the advantages and disadvantages of V-belt drive over flat belt drive? **07**
- (b) A single dry plate clutch is to be designed to transmit 7.5 kW at 900 R.P.M. Find : **07**  
**1) Diameter of the shaft, 2) Mean radius and face width of the friction lining**  
 assuming the ratio of the mean radius to the face width as 4, **3) Outer and inner**  
 radii of the clutch plate, and **4) Dimensions of the spring, assuming that the**

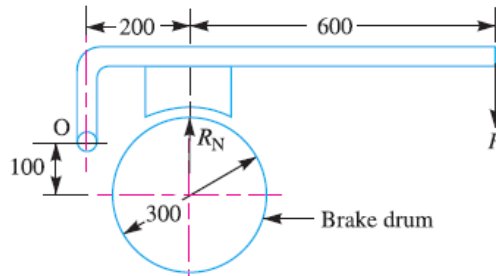


number of springs are 6 and spring index = 6. The allowable shear stress for the spring wire may be taken as 420 MPa.

**Q-7**

**Attempt all questions**

- (a) Why single plate clutches are dry type, whereas multi-plate clutches are wet type? Explain the difference between single plate and multiplate clutch. **07**
- (b) The block brake, as shown in Fig. provides a braking torque of 360 N-m. The diameter of the brake drum is 300 mm. The coefficient of friction is 0.3. Find : **1.** The force (P) to be applied at the end of the lever for the clockwise and counter clockwise rotation of the brake drum; and **2.** The location of the pivot or fulcrum to make the brake self-locking for the clockwise rotation of the brake drum. **07**



**Q-8**

**Attempt all questions**

- (a) Derive the expressions for actuating force and braking torque capacity of internal expanding shoe brake. **07**
- (b) Design a journal bearing for a centrifugal pump from the following data: Load on the journal = 20 000 N; Speed of the journal = 900 r.p.m.; Type of oil is SAE 10, for which the absolute viscosity at 55°C = 0.017 kg / m-s; Ambient temperature of oil = 15.5°C ; Maximum bearing pressure for the pump = 1.5 N / mm<sup>2</sup>. Calculate also mass of the lubricating oil required for artificial cooling, if rise of temperature of oil be limited to 10°C. Heat dissipation coefficient = 1232 W/m<sup>2</sup>/°C. Take  $k = 0.002$ ,  $t_0 = 63^\circ\text{C}$ , clearance ratio = 0.0013. **07**

