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Total Number of Pages: 03

B.Tech.  
PME5I001

5<sup>th</sup> Semester Regular Examination 2017-18

Design of Machine Element

BRANCH: MECH

Time: 3 Hours

Max Marks: 100

Q.CODE: B497

Answer Question No.1 and 2 which are compulsory and any four from the rest.  
The figures in the right hand margin indicate marks.

**Q1 Answer the following questions: multiple type or dash fill up type (2x10)**

- a) The objective of caulking in a riveted joint is to make the joint  
(a) free from corrosion (b) stronger in tension  
(c) free from stresses (d) leak-proof
- b) The longitudinal joint in boilers is used to get the required  
(a) length of boiler (b) diameter of boiler  
(c) length and diameter of boiler (d) efficiency of boiler
- c) The diameter of the rivet hole is usually ..... the nominal diameter of the rivet.  
(a) equal to (b) less than (c) more than
- d) In transverse fillet welded joint, the size of weld is equal to  
(a)  $0.5 \times$  Throat of weld (b) Throat of weld  
(c)  $2 \times$  Throat of weld (d)  $2 \times$  Throat of weld
- e) The size of the weld in butt welded joint is equal to  
(a)  $0.5 \times$  Throat of weld (b) Throat of weld  
(c)  $2 \times$  Throat of weld (d)  $2 \times$  Throat of weld
- f) The spring mostly used in gramophones is  
(a) helical spring (b) conical spring  
(c) laminated spring (d) flat spiral spring
- g) When two concentric coil springs made of the same material, having same length and compressed equally by an axial load, the load shared by the two springs will be ..... to the square of the diameters of the wires of the two springs.  
(a) directly proportional (b) inversely proportional  
(c) equal to
- h) The ball bearings are usually made from  
(a) low carbon steel  
(b) medium carbon steel  
(c) high speed steel  
(d) chrome nickel steel
- i) Ball and roller bearings in comparison to sliding bearings have  
(a) more accuracy in alignment (b) small overall dimensions  
(c) low starting and running friction (d) all of these
- j) The stress which vary from a minimum value to a maximum value of the same nature (*i.e.* tensile or compressive) is called  
(a) repeated stress (b) yield stress  
(c) fluctuating stress (d) alternating stress

**Q2 Answer the following questions: Short answer type (2x10)**

- a) Name the three commonly used types of cotter joints to connect two coaxial rods
- b) Differentiate between ductile and brittle fracture.
- c) Why maximum shear stress theory applicable is generally applicable for ductile material?
- d) What is endurance limit?
- e) Compare a flat belt drive to that of a V-belt drive in terms of ratio of power transmitted
- f) What is distortion energy of failure criterion?
- g) Sketch a cone clutch and label the parts
- h) Suggest the engineering material for leaf spring for an automobile
- i) Distinguish between limit and fit
- j) What are the advantages of welded joints over riveted joints

**Q3 a) Design a knuckle joint to sustain a maximum load of 10 kN. Allowable stress for all the parts are  $\sigma_t=80 \text{ N/mm}^2$ ,  $\tau= 50\text{N/mm}^2$  and  $\sigma_c=100 \text{ N/mm}^2$ . (10)**

**b) Design a simple cotter joint for an axial load 80 kN. Allowable stress for all the parts are  $\sigma_t=60 \text{ MPa}$ ,  $\tau= 42 \text{ MPa}$  and  $\sigma_c=80 \text{ MPa}$  (5)**

**Q4 a) A cylindrical shaft made of MS (yield strength=700 MPa) is subjected to static load consisting BM=10 kN-m and TM=30kN-m. Determine the diameter of shaft. ( take FOS=2, E=210 GPa and  $\gamma=0.25$ ) (10)**

**b) What are the different theories of failure of static loading, explain (5)**

**Q5 a) Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used :**

Shear stress for shaft, bolt and key material = 40 MPa

Crushing stress for bolt and key = 80 MPa

Shear stress for cast iron = 8 MPa

Draw a neat sketch of the coupling

**b) Describe, with the help of neat sketches, the types of various shaft couplings mentioning the uses of each type. (5)**

**Q6 a) Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5 m in diameter subjected to a steam pressure of 0.95 N/mm<sup>2</sup>. Assume joint efficiency as 75%, allowable tensile stress in the plate 90 MPa ; compressive stress 140 MPa ; and shear stress in the rivet 56 MPa. (10)**

**b) Show by neat sketches the various ways in which a riveted joint may fail. (5)**

**Q7 a) Determine the length of the weld run for a plate of size 120 mm wide and 15 mm thick to be welded to another plate by means of (10)**

1. A single transverse weld; and

2. Double parallel fillet welds when the joint is subjected to variable loads.

**b) What is an eccentric loaded welded joint? Discuss the procedure for designing such a joint. (5)**

**Q8 a) Design a spring for a balance to measure 0 to 1000 N over a scale of length 80 mm. The spring is to be enclosed in a casing of 25 mm diameter. The approximate number of turns is 30. The modulus of rigidity is 85 kN/mm<sup>2</sup>. Also calculate the maximum shear stress induced. (10)**

**b) What do you understand by full length and graduated leaves of a leaf spring? Write the expression for determining the stress and deflection in full length and graduated leaves. (5)**

**Q9 a)** Design a journal bearing for a centrifugal pump from the following data : **(10)**  
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.

**b)** What are rolling contact bearings? Discuss their advantages over sliding contact bearings. **(5)**