Reg. No. : | | | | | | | | | | |

Question Paper Code: 44703

B.E. / B.Tech. DEGREE EXAMINATION, DEC 2020

Fifth Semester

Mechanical Engineering

14UME503 - DESIGN OF MACHINE ELEMENTS

(Regulation 2014)

Duration: One hour Maximum: 30 Marks

PART A - (6 x 1 = 6 Marks)

(Answer any six of the following questions)

1. 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

2. The bending stress in a curved beam is

   (a) Zero at the centroidal axis (b) Zero at the point other than centroidal axis
   (c) Maximum at the neutral axis (d) Minimum at the neutral axis

3. A keyway lowers

   (a) The strength of the shaft
   (b) The rigidity of the shaft
   (c) Both the strength and rigidity of
   (d) The ductility of the material the shaft of the shaft

4. The sleeve or muff coupling is designed as a

   (a) thin cylinder (b) thick cylinder
   (c) solid shaft (d) hollow shaft

5. The transverse fillet welded joints are designed for

   (a) Tensile strength (b) Compressive strength
   (c) Bending strength (d) Shear strength

6. The parallel fillet welded joint is designed for _____

(a) tensile strength (b) compressive strength
(c) bending strength (d) shear strength

7. When helical compression spring is cut into halves, the stiffness of the resulting spring will be

(a) same (b) double (c) one-half (d) one-fourth

8. The stress in the full length leaf is _____% more than the stress induced in the graduated leaf

(a) 50% (b) 25% (c) 40% (d) 0%

9. When the length of the journal is equal to the diameter of the journal, then the bearing is said to be a

(a) short bearing (b) long bearing
(c) medium bearing (d) square bearing

10. The ball bearings are usually made from

(a) low carbon steel (b) medium carbon steel
(c) high speed steel (d) chrome nickel steel

PART – B (3 x 8= 24 Marks)

(Answer any three of the following questions)

11. A mild steel shaft of 50 *mm* diameter is subjected to a bending moment of 2000 *N-m* and a torque *T*. If the yield point of the steel in tension is 200 *MPa*, find the maximum value of this torque without causing yielding of the shaft according to 1. The maximum principal stress; 2. The maximum shear stress; and 3. The maximum distortion strain energy theory. (8)

12. A Shaft Supported at the ends in ball bearing carries a straight tooth spur gear at its mid span and is to transmit 7.5 *KW* at 300 *r.p.m*. The pitch circle diameter of the gear is 150 *mm*. The distance between the centre line of bearing and gear are 100 *mm* each. If the shaft is made of steel and the allowable shear stress is 45 *MPA* determine the diameter of the shaft. Show in a sketch how the gear will be mounted on the shaft. also indicate the ends where the bearing will be mounted ? and the pressure angle of the gear may be taken as 20*ºC*. . (8)

13. Design a lap joint for a mild steel flat tie-bar 200 *mm* × 10 *mm* thick, using 24 *mm* diameter rivets. Assume allowable stresses in tension and compression of the plate

material as 112 *MPa* and 200 *MPa* respectively and shear stress of the rivets as 84 *MPa*. Show the disposition of the rivets for maximum joint efficiency and determine the joint efficiency. Take diameter of rivet hole as 25.5 *mm* for a 24 *mm* diameter rivet. (8)

14. A mechanism used in printing machinery consists of a tension spring assembled with a preload of 30 *N*. The wire diameter of spring is 2 *mm* with a spring index of 6. The spring has 18 active coils. The spring wire is hard drawn and oil tempered having following material properties: Design shear stress = 680 *MPa*; Modulus of rigidity = 80 kN/mm^2. Determine: 1. The initial torsional shear stress in the wire; 2. spring rate; and 3. The force to cause the body of the spring to its yield strength. (8)

15. The load on the journal bearing is 150 *kN* due to turbine shaft of 300 *mm* diameter running at 1800 *r.p.m*. Determine the following : 1. Length of the bearing if the allowable bearing pressure is 1.6 N/mm^2, and 2. Amount of heat to be removed by the lubricant per minute if the bearing temperature is 60°*C* and viscosity of the oil at 60°*C* is 0.02 *kg/m-s* and the bearing clearance is 0.25 *mm*. (8)