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Question Paper Code: 56A03

B.E. / B.Tech. DEGREE EXAMINATION, NOV 2019

Sixth semester

Agriculture Engineering

15UAG603 – DESIGN OF AGRICULTURAL MACHINERY

(Regulation 2015)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. At the neutral axis of a beam CO1- R
 - (a) the layers are subjected to maximum bending stress
 - (b) the layers are subjected to tension
 - (c) the layers are subjected to compression
 - (d) the layers do not undergo any strain

2. The property of a material which enables it to undergo change in space and size without rupture under the external load is CO1- R
 - (a) Malleability
 - (b) Stiffness
 - (c) Ductility
 - (d) Stiffness

3. The cross section of V belt is CO2- R
 - (a) Triangle
 - (b) Circular
 - (c) Trapezoidal
 - (d) Rectangular

4. Which of the following rope will be most flexible CO2- R
 - (a) 6 x 7
 - (b) 6 x 19
 - (c) 6 x 37
 - (d) 8 x 19

5. The _____ are provided half in the keyway of the shaft and half in the keyway of the hub or boss of the rotating element. CO3- R
 - (a) Sunk key
 - (b) Rectangular Key
 - (c) Gib-head Key
 - (d) Parallel Key

6. How splines are designated CO3- R
 - (a) N x t x T
 - (b) N x t x D
 - (c) N x t x d
 - (d) N x d x D

7. _____ springs are used where high stiffness is required. CO4- R
 (a) Belleville Spring (b) Helical Spring (c) Leaf Spring (d) Spiral Spring
8. When a helical compression spring is subjected to an axial compressive load, the stress induced in the wire is CO4- R
 (a) tensile stress (b) compressive stress (c) shear stress (d) bending stress
9. Bevel gears having shaft angle 90 degree are known as CO5- R
 (a) Zero bevel gear (b) Crown gear (c) Spiral bevel gear (d) Spiral bevel gear
10. In a full journal bearing, the angle of contact of the bearing with the journal is CO5- R
 (a) 120° (b) 180° (c) 270° (d) 360°

PART – B (5 x 2= 10 Marks)

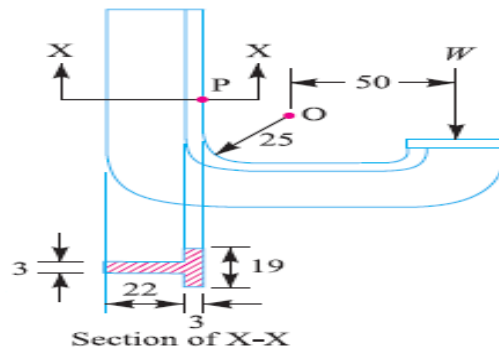
11. What is an S-N Curve? CO1 R
12. Discuss the uses and construction of wire ropes. CO2 R
13. Define equivalent twisting moment and equivalent bending moment. CO3 R
14. Explain the following terms of the spring: (i) Spring index; and (ii) Stress factor CO4 R
15. What is meant by hydrodynamic lubrication? CO5 R

PART – C (5 x 16= 80Marks)

16. (a) A hollow shaft of 40 mm outer diameter and 25 mm inner diameter is subjected to a twisting moment of 120 N-m, simultaneously, it is subjected to an axial thrust of 10 kN and a bending moment of 80 N-m. Calculate the maximum compressive and shear stresses. CO1- U (16)

Or

- (b) A C-clamp is subjected to a maximum load of W , as shown in Fig. 5.13. If the maximum tensile stress in the clamp is limited to 140 MPa, find the value of load W . CO1- U (16)



17. (a) A rope drive is to transmit 250 kW from a pulley of 1.2 m diameter, running at a speed of 300 r.p.m. The angle of lap may be taken as π radians. The groove half angle is 22.5° . The ropes to be used are 50 mm in diameter. The mass of the rope is 1.3 kg per metre length and each rope has a maximum pull of 2.2 kN, the coefficient of friction between rope and pulley is 0.3. Determine the number of ropes required. If the overhang of the pulley is 0.5 m, suggest suitable size for the pulley shaft if it is made of steel with a shear stress of 40 MPa

Or

- (b) Select a flat belt to drive a mill at 250rpm from a 10Kw,730rpm motor. Centre distance is to be around 2m. The mill shaft pulley is of 1m diameter
- CO2- App (16)
18. (a) A shaft is supported on bearings A and B, 800 mm between centres. A 20° straight tooth spur gear having 600 mm pitch diameter, is located 200 mm to the right of the left hand bearing A, and a 700 mm diameter pulley is mounted 250 mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3 : 1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa.

Or

- (b) A shaft is used for transmitting 50 kW power at 1200 rpm. It is subjected to a maximum bending moment of 275N-m. The shaft is not to twist more than 2degree in a length of 2m. The allowable shear stress for the shaft is $60\text{N}/\text{mm}^2$. If the modulus of rigidity is $80 \times 10^3\text{N}/\text{mm}^2$.Design a shaft.
- CO3- Ana (16)

19. (a) A concentric spring for an aircraft engine valve is to exert a maximum force of 5000 N under an axial deflection of 40 mm. Both the springs have same free length, same solid length and are subjected to equal maximum shear stress of 850 MPa. If the spring index for both the springs is 6, find (a) the load shared by each spring, (b) the main dimensions of both the springs, and (c) the number of active coils in each spring. Assume $G = 80 \text{ kN/mm}^2$ and diametral clearance to be equal to the difference between the wire diameters. CO4- U (16)

Or

- (b) A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05m apart and the central band is 85mm wide. The ratio of total depth to the width of the spring is 3. The central load is 5.4kN. if the permissible stress is 280MPa. Determine CO4- U (16)
- (i) The thicknedd and the width of the steel spring leaves and
(ii) The deflection of the spring.

20. (a) A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 r.p.m. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diametral clearance of the bearing is 0.15 mm and the absolute viscosity of the oil at the operating temperature is 0.011 kg/m-s, find the power wasted in friction. CO5- U (16)

Or

- (b) Design a helical gear drive to transmit the power of 5kW at a pinion speed of 1440 rpm. The wheel speed is 400 rpm. Choose proper materials. CO5- U (16)