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Question Paper Code: 96A02

B.E. / B.Tech. DEGREE EXAMINATION, MAY 2022

Sixth semester

Agriculture Engineering

19UAG602- Design of Agriculture machinery

(Regulation 2019)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. The ratio of ultimate stress to allowable stress is called CO1- U
(a) Frature (b) maximum stress (c) theories of failure (d) factor of safety
2. Stress is defined as the ratio of CO1- U
(a) Load to area (b) pressure to area (c) load to volume (d) pressure to volume
3. Which one of the following drives is used without slipping CO1- U
(a) V belt (b) flat belt (c) cone pulley (d) Chain drive
4. The groove angle for rope is CO1- U
(a) 35° (b) 40° (c) 25° (d) 45°
5. The elements which joints the two shaft is called CO1- U
(a) couplings (b) key (a) couplings (b) key
6. If the given shear stress/ bending stress is more than determined CO1- U
value, the design is
(a) not safe (b) moderate (a) not safe (b) moderate
7. A device which deflects or distorts under the action of load is called CO1- U
(a) shaft (b) spline (c) key (d) spring
8. Stiffness of spring is the ratio of CO1- U
(a) load/ deflection (b) deflection/ load
(c) deflection/pressure (d) pressure/ deflection

9. The ratio of the pitch circle diameter to the number of teeth is called CO1- R
 (a) diametral pitch (b) pitch circle (c) module (d) circular pitch
10. The radial distance of a tooth from the pitch circle to the top of the tooth. CO1- R
 (a) addendum (b) dedendum (c) pitch (d) pitch circle

PART – B (5 x 2= 10 Marks)

11. Describe the term of machine design. CO1- U
12. Name the few material for belt drives CO1- U
13. Describe the whirling speed of the shaft. CO2- App
14. State the application of springs in daily usages. CO1- U
15. Explain the term of arc of approach in gears CO1- U

PART – C (5 x 16= 80 Marks)

16. (a) The stress state in a machine member is given as follows. $\sigma_x = 15\text{MPa}$, $\sigma_y = 5\text{MPa}$; $\tau_{xy} = 5\text{MPa}$. Estimate the maximum and minimum principal stresses and locate the angle made from the x axis. CO3- App (16)

Or

- (b) The piston of a reciprocating compressor has a diameter of 70 mm. the maximum pressure on the piston fall is 1.25MN/m^2 . Assuming the gudgeon pin passing through the small end of the connecting rod can be safely loaded in shear upto 20M/m^2 . Evaluate the minimum diameter of the gudgeon pin. CO6- E (16)
17. (a) A compressor is to run by a motor pulley running at 1440rpm, Speed ratio 2.5. Choose a flat belt crossed drive. Centre distance between pulleys is 3.6m. Take belt speed as 16 m/s. Load factor is 1.3. Take a 5-ply, flat Dunlop belt. Power to be transmitted is 12 KW. High speed load rating is 0.0118 KW/ply/mm, width at $v = 5\text{m/s}$. Evaluate the width and length of the belt. CO6- E (16)

Or

- (b) A pulley of 800 mm diameter revolving at 180 rpm is to transmit 7.5 kW. Find the width of the leather belt, if the maximum tension is not exceed 145 N in 10 mm width. The tension of the tight side is twice that at the slack side. Evaluate the diameter of the shaft and the dimensions of the various parts of the pulley assuming it have six arms. Maximum shear stress is not exceeds 63MN/m^2 CO6- E (16)

- 18 (a) A shaft of 1000 mm long is subjected to shear stress of 60 MPa and has an angle of twist is equal to 0.017 radian. Determine the diameter of the shaft. Take $G = 0.8 \times 10^5$ MPa. CO3- App (16)
- Or
- (b) Examine and Design a muff or sleeve couplings for a shaft to transmit 35 kw at 350 rpm. The safe shear stress for the steel shaft is 60 N/mm² and for the cast iron muff is 16 N/mm². The allowable shear and crushing stresses for the key material are 50 and 150 N/mm². CO3- C (16)
- 19 (a) A helical valve spring is to be designed for an operating load range of 90N to 135 N. the deflection of the spring for this load range is 7.5 mm. Assuming a spring index of 10. A permissible shear stress of 480 N/mm² and modulus of rigidity of 0.85×10^5 N/mm² for the material. Determine the dimensions of the spring. CO3- App (16)
- Or
- (b) A helical tension spring is used in printing machinery requires a preload of 40 N. the wire diameter of spring is 5 mm. with spring index is 5. The spring has 18 coils. The maximum permissible shear stress for the spring is 420 MPa and modulus of rigidity is 84 kN/mm². Determine CO3-App (16)
- (i) The initial torsional shear stress in the wire.
- (ii) The spring index
- (iii) The spring rate
- (iv) The spring deflection corresponding to the load found.
- 20 (a) A gear drive is required to transmit a maximum power of 25 kW. The velocity ratio is 1:2 and r.p.m. of the pinion is 200. The approximate centre distance between the shafts may be taken as 600 mm. The teeth have 20° stub involute profiles. The static stress for the gear material (which is cast iron) may be taken as 60 MPa and face width as 10 times the module. Find the module, face width and number of teeth on each gear. Check the design for dynamic and wear loads. The deformation or dynamic factor in the Buckingham equation may be taken CO6- E (16)

Or

- (b) A pair of helical gears are to transmit 17 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45° . The pinion runs at 10 000 r.p.m. and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 MPa; determine a suitable module and face width from static strength considerations and check the gears for wear, given $\sigma_{es} = 618$ MPa. CO2- App (16)