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Question Paper Code: 96A02

B.E. / B.Tech. DEGREE EXAMINATION, APRIL 2024

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 Centroidal axis and neutral axis are not co-incident is called CO1- U
(a) Straight beam (b) cantilever beam (c) fixed beam (d) curved beam
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 difference between tensions on the tight and slack sides of the belt drive CO1- U
is 3000N. if the belt speed is 15m/s. the power transmitted in kW
(a) 25 (b) 35 (c) 45 (d) 55
5. Compared to belt drive, chain drive is generally characterized by CO1- U
(a) constant (b) absence of slip (c) heavier construction (d) all of the
velocity ratio above
6. The Direct stress can be calculated as CO1- U
(a) $\frac{P}{a}$ (b) $\frac{A}{a}$ (c) $\frac{A}{P}$ (d) $\frac{A a}{P}$
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

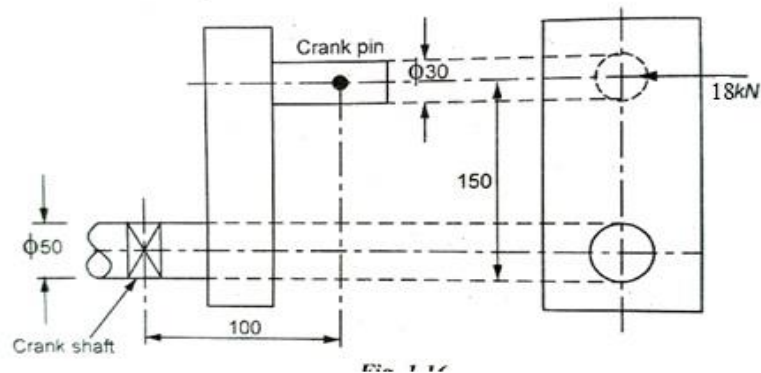
9. The ratio of the pitch circle diameter to the number of teeth is called CO1- R
 (a) diametral pitch (b) pitch circle (c) module (d) circular pitch
10. The radial distance of a tooth from the pitch circle to the top of the tooth. CO1- R
 (a) addendum (b) dedendum (c) pitch (d) pitch circle

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 piston of a reciprocating compressor has a diameter of 70 mm. CO6- E (16)
 the maximum pressure on the piston fall is 1.25 MN/m^2 . Assuming the gudgeon pin passing through the small end of the connecting rod can be safely loaded in shear upto 20 M/m^2 . Evaluate the minimum diameter of the gudgeon pin.
- Or
- (b) The crankshaft is loaded as shown in fig. Evaluate the maximum CO3- App (16)
 principal stress, minimum principal stress and maximum shear stress.



17. (a) A compressor is to run by a motor pulley running at 1440rpm, Speed CO6- E (16)
 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.

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 63 MN/m^2 CO6- E (16)

- 18 (a) A line shaft rotating at 300 rpm is to transmit 30 kW power. The allowable shear stress for the shaft material is 52 N/mm^2 . If the shaft carries a central load of 1100 N and is simply supported between bearings 4 m apart. Determine the diameter of the shaft. The maximum tensile or compressive stress is not to exceed 56 N/mm^2 . 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/mm^2 and fr the cast iron muff is 16 N/mm^2 . The allowable shear and crushing stresses for the key material are 50 and 150 N/mm^2 . 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/mm^2 and modulus of rigidity of $0.85 \times 10^5 \text{ N/mm}^2$ for the material. Determine the dimensions of the spring. CO3- App (16)

Or

- (b) Design of cantilever leaf spring to absorb 600N-m energy without exceeding a deflection of 150 mm and a stress of 800 N/mm^2 . The length of the spring is 600 mm. the material of the spring is steel. CO4-D (16)

- 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 dynamicfactor in the Buckingham equation may be taken CO6- E (16)

Or

- (b) A gear drive is required to transmit a maximum power of 22.5 kW. CO2- App (16)
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 as 80 and the material combination factor for the wear as 1.4.