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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2013

B.E. AGRICULTURAL AND IRRIGATION ENGINEERING

Fifth Semester

AI 9305 DESIGN AND DRAWING OF AGRICULTURAL MACHINERY

(Regulation 2008)
(Use of approved design data book is permitted.)

Time: 3 Hours   Answer ALL Questions   Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. What types of stresses are induced in the shaft?

2. Write a short notes on eccentric loading and eccentricity

3. Write the types and uses of belt drives

4. Derive the relation for the ratio of driving tensions of a V-belt.

5. What are the stresses in wire ropes?

6. Write the design procedure for sleeve coupling.

7. What are the causes of gear tooth failure?

8. Indicate the terms used in spur gear terminology with neat sketch.

9. What is basic load rating of a rolling contact bearing?

10. What is meant by tolerance? How many types of tolerance is there?

Part – B (5 x 16 = 80 marks)

11. i) It is required to design a knuckle joint to connect two circular rods subjected to an axial tensile force of 50 kN. Design the joint and specify the dimensions of its components. Take permissible tensile and compressive stress is 80 N/mm^2. Permissible shear stress is 40 N/mm^2. (10 Marks)

   ii) A pair of wheels of a railway wagon carries a load of 50 kN on each axle box, acting at a distance of 100 mm outside the wheel base. The gauge of the rails is 1.4 m. Find the diameter of the axle between the wheels, if the stress is not to exceed 100 N/mm^2. (6 Marks)

12. a) An electric motor drives on exhaust fan. Following data are provided:

	Motor pulley	Fan pulley
Diameter	40 cm	160 cm
Angle of wrap	2.5 radians	3.78 radians
Coefficient of friction	0.3	0.25
Speed	700 rpm	---
Power transmitted	50 kW	---

Calculate the width of 5mm thick flat belt. Take permissible stress for the belt material as 50 N/mm^2. (16 Marks)

(OR)

b) A compressor requiring 70 kW is to run at 400 rpm. The drive is by V-belts from an electric motor running at 600 rpm. The diameter of the pulley on the compressor shaft must not be greater than 1.25 m, while the centre distance between the pulleys is limited to 2 m. The belt speed should not exceed 1500 m/min. Determine the V – belts required to transmit the power if each belt has a cross-sectional area of 350 mm², density 1000 kg/m³ and an allowable tensile stress of 2.5 MPa. The groove angle of the pulley is 35°. Calculate also the length required for each belt. The coefficient of friction between the belt and the pulley is 0.25.   (16 Marks)

13. a) Select a suitable wire rope to lift 12kN of debris from a well 60m deep. The weight of the bucket is 5kN. The weight is being lifted with a maximum speed of 160 m/min and the maximum speed is attained in 1.5 second. Determine also the stress induced in the rope due to starting without any slack. Take E_r = 0.75 x 10⁵ N/mm².   (16 Marks)

(OR)

b) i) Design a clamp coupling to transmit 30 kW at 100 rpm. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are six. The permissible tensile stress for the bolts is 70 MPa. The coefficient of friction between the muff and shaft surface may be taken as 0.3.
        (8 Marks)

ii) An universal coupling is used to connect two mild steel shafts transmitting a torque of 5000 N-m. Assuming that the shafts are subjected to torsion only. Find the diameter of the shaft and pins. The allowable shear stress for the shaft and pin may be taken as 60 MPa and 28 MPa respectively.   (8 Marks)

14. a) Calculate a straight spur gear drive. Transmitted power 8 kW. Pinion speed 800 rpm. Speed ratio = 2. The gears are to be made of C45. Life is to be 10,000 hrs.
        (16 Marks)

(OR)

b) i) Derive Lewis equation to determine beam strength of gear teeth.   (4 Marks)

ii) Design a pair of spur gears with the following data. Centre distance = 300 mm (approximately) Power to be transmitted = 80 kW, speed of the pinion = 700 rpm. Speed reduction ratio = 5:1, Material to be used 40 Cr 1.   (12 Marks)

15. a) i) What are the types of bearings?   (2 Marks)

ii) A simply supported shaft, diameter 50 mm on bearing supports carries a load of 10 kN at its center. The axial load on the bearings is 3 kN. The shaft speed is 1440 rpm. Select a bearing for 1000 hours of operation.   (14 Marks)

(OR)

b) i) What are the types fit? Describe the differences.   (2 Marks)
ii) Select a single row deep groove ball bearing for a radial load of 4 kN and an axial load of 5kN, operating at a speed of 1600 rpm for an average life of 1000 hours of operation. Assume uniform and steady load.   (12 Marks)