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B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV / DEC 2012

B.E. AGRICULTURE & IRRIGATION ENGINEERING

V SEMESTER

AI 9305 DESIGN AND DRAWING OF AGRICULTURAL MACHINERY

(Regulation 2008.)

Note: Use of PSG design data book is permitted.

Time : 3 Hours

Answer ALL Questions

Max. Marks 100

PART-A (10 x 2 = 20 Marks)

1. Define allowable stress.
2. How the keys are classified? Draw neat sketches of different types of keys.
3. Discuss the different types of belts with neat sketches.
4. What are the advantages and disadvantages of belt drives?
5. What are the applications and advantages of rope drives?
6. Write the design procedure for sleeve or muff coupling.
7. Write the applications and materials used for gears.
8. What are the causes of gear tooth failure?
9. What is basic load rating of an antifriction bearing?
10. What is meant by tolerance? How many types of tolerance is there?

Part – B (5 x 16 = 80 marks)

11. i) Discuss in detail the design procedure for knuckle joint. **(8 marks)**
ii) Find the diameter of a solid shaft to transmit 20 kW at 200 rpm. The ultimate shear stress for the steel may be taken as 360 MPa and a factor of safety as 8. If a hollow shaft is to be used in place of the solid shaft, find the inside and outside diameter when the ratio of inside to outside diameter is 0.5. **(8 marks)**
12. a) The open belt drive is used to transmit 15KW power. The centre distance between the pulleys is twice the diameter of the big pulley. The belt should operate at a velocity of 20 m/s approximately and the stress in the belt should not exceed 2.25 N/mm^2 . The density of the leather is 0.95 gm/cc and μ is 0.3. The thickness of the belt is 5mm. $n = 1440 \text{ rpm}$, $N = 480 \text{ rpm}$. Calculate: The diameter of the pulleys, the length and width of the belt, the belt-tensions. **(16 marks)**

OR

- b) A compressor requiring 90 kW is to run at about 250 rpm the drive is by V – belt from an electric motor running at 750 rpm. The diameter of the pulley and the compressor shaft must not be greater than 1 m while the centre distance between the pulley is limited to 1.75 m. The belt speed should not exceed 1600 m/min. Determine the number of V-belts required to transmit the power if each belt has cross sectional area of 375 mm², $\rho = 1000 \text{ kg/m}^3$, $\sigma = 2.5 \text{ MPa}$. The groove angle of pulley is 35°, $\mu = 0.25$. (16 marks)

13. a) Select a wire rope for a vertical mine hoist to lift 11 kN from a depth of 60 metres. A rope speed of 150 m/min is to be attained in 10 seconds. Take $E_r = 0.75 \times 10^5 \text{ N/mm}^2$. (16 marks)

OR

- b) Design a protective type of cast iron flange coupling for a steel shaft transmitting 15KW at 200 rpm and having an allowable shear stress of 40 MPa. The working stress in the bolts should not exceed 30 MPa. Assume that the same material is used for shaft and key and that the crushing stress is the value of two times its shear stress. The maximum torque is 25% greater than the full load. The shear stress for cast iron is 14 MPa. (16 marks)

14. a) How the gears are classified and what are the various terms used in spur gear terminology. (16 marks)

OR

- b) Two spur gears are to be used for a rock crusher drive and are to be of minimum size. Gears are to be designed for the following requirements. Power to be transmitted 15 kW, speed of pinion 1000 rpm, angular velocity 3:1, tooth profile 20° stub. Assume that gears are made of case hardened alloy steel. Design the drive. (16 marks)

15. a) i) Give the interrelationship between tolerances and limits. (6 marks)
ii) A simply supported shaft, diameter 50mm, on bearing supports carries a load of 15kN at its center. The axial load on the bearings is 4kN. The shaft speed is 1500 rpm. Select a bearing for 1200 hours of operation. (10 marks)

OR

- b) The shaft and the flange of a marine engine are to be designed for flange coupling, in which the flange is forged on the end of the shaft. The following particulars are to be considered in the design: Power of the engine = 3 MW, Speed of the engine = 1000 rpm, Permissible shear stress in bolts and shaft = 60 MPa, Number of bolts used = 8, Pitch circle diameter of bolts = 1.6 x Diameter of shaft. Find: 1) The diameter of shaft, 2) Diameter of bolts, 3) thickness of flange, and 4) diameter of flange. (16 marks)