

**B.Tech Odd Semester (CBCS) Exam.,
December—2016**

AGRICULTURAL ENGINEERING

(5th Semester)

Course No. : AE-502

(Machine Design)

Full Marks : 75

Pass Marks : 30

Time : 3 hours

- Note :*
1. Attempt **one** question from each Unit.
 2. Begin each answer in a new page.
 3. Answer parts of a question at a place.
 4. Assume reasonable data wherever required.
 5. The figures in the margin indicate full marks for the questions.

UNIT—I

1. (a) Classify different types of materials for engineering use. 4
- (b) What are the factors to be considered for the selection of materials for the design of machine elements? Discuss. 5

- (c) Define the following properties of a material : 6
 - (i) Hardness
 - (ii) Stiffness
 - (iii) Ductility
 - (iv) Fatigue

2. Explain different heat treatment processes of steel. 15

UNIT—II

3. Discuss different types of stresses in elementary machine parts. A mild steel rod supports a tensile load of 50 kN. If the stress in the rod is limited to 100 MPa, find the size of the rod when the cross-section is (a) circular, (b) square and (c) rectangular with width 3X thickness. 15
4. What is fit? Discuss different types of fits. 4+11=15

UNIT—III

5. What are different purposes of using shaft coupling? Design and make a neat dimensioned sketch of a muff coupling which is used to connect two steel shafts transmitting 40 kW at 350 r.p.m. The

(3)

material for the shafts and key is plain carbon steel for which allowable shear and crushing stresses may be taken as 40 MPa and 80 MPa respectively. The material for the muff is cast iron for which the allowable shear stress may be assumed as 15 MPa. 15

6. (a) Discuss different requirements of a good shaft coupling. What are the different types of shaft coupling? 7
- (b) Design a shaft and a muff (for clamp coupling) to transmit 30 kW at 100 r.p.m. 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 the shaft surface may be taken as 0.3. 8

UNIT—IV

7. Discuss about different types of gears with their application. Discuss the design procedure of a worm gear. 7+8=15
8. With proper diagram, discuss different types of springs with their applications. 15

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UNIT—V

9. What is a belt drive? Give some examples of uses of belt drives for different purposes. Discuss different advantages and disadvantages of V-belt drive over flat belt drive. 5+3+7=15
10. A compressor, requiring 90 kW, is to run at about 250 r.p.m. The drive is by V-belts from an electric motor running at 750 r.p.m. The diameter of the pulley on the compressor shaft must not be greater than 1 metre while the centre distance between the pulleys is limited to 1.75 metre. The belt speed should not exceed 1600 m/min. Determine the number of V-belts required to transmit the power if each belt has a cross-sectional area of 375 mm², density 1000 kg/m³ and an allowable tensile stress of 2.5 MPa. The groove angle of the pulleys is 35°. The coefficient of friction between the belt and the pulley is 0.25. Calculate also the length required of each belt. 15

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