R16

Reg. No:

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR
(AUTONOMOUS)
B.Tech III Year I Semester Regular Examinations Nov/Dec 2019
DESIGN OF AGRICULTURAL MACHINERY
(Agricultural Engineering)

Time: 3 hours   Max. Marks: 60

(Answer all the Questions **5 x 12 = 60** Marks)

UNIT-I

1 What are the general design considerations should be followed while designing a machine element?   **12M**

OR

2 **a** The piston rod of a steam engine is 50 mm in diameter and 600 mm long. The diameter of the piston is 400 mm and the maximum steam pressure is 0.9 N/mm^2. Find the compression of the piston rod if the young's modulus for the material of the piston rod is 20 KN/mm^2.   **6M**

   b Write the following   **6M**
   i)   Moment of force
   ii)   Young's modulus
   iii) Modulus of rigidity
   iv)   Torque
   v)   Mass moment of inertia

UNIT-II

3 Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.   **12M**

OR

4 **a** What are the theories of failure under static load? Explain any one of them.   **6M**

   b An unknown weight falls through 10 mm on a collar rigidity attached to the lower end of a vertical bar 3 m long and 600 mm^2 in section. If the maximum instantaneous extension is known to be 2 mm. What is the corresponding stress and the volume of unknown weight? Take E = 200KN/mm^2.   **6M**

UNIT-III

5 A cranked lever, as shown in 15.10, has the following dimensions: **12M**
Length of the handle = 300 mm
Length of the lever arm = 400 mm
Overhang of the journal = 100 mm
If the lever is operated by a single person exerting a maximum force of 400 N at a distance of 1/3 rd length of the handle from its free end, find (i) Diameter of the handle, (ii) Cross-section of the lever arm, and (iii) Diameter of the journal. The permissible bending stress for the lever material may be taken as 50 MPa and shear stress for shaft material as 40 MPa.

OR

6 A handle for turning the spindle of a large valve is shown in figure. The length of the handle from the centre of the spindle is 450 mm. The handle is attached to the spindle by means of a round tapered pin. If an effort of 400 N is applied at the end of the handle, find: (i) mean diameter of the tapered pin, and (ii) diameter of the handle. The allowable stresses for the handle and pin are 100 MPa in tension and 55 MPa in shear.   **12M**

All dimensions in mm.
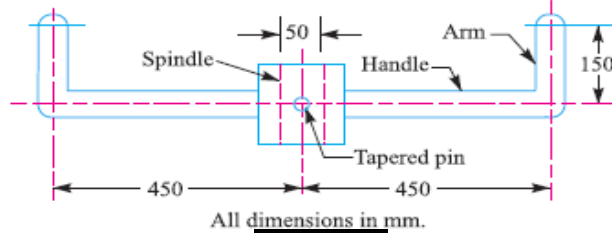
UNIT-IV

7 Design a cast iron protective type flange coupling to transmit 15 kW at 900 r.p.m. from an electric motor to a compressor. The service factor may be assumed as 1.35. The following permissible stresses may be used: **12M**
Shear stress for shaft, bolt and key material = 40 MPa
Crushing stress for bolt and key = 80 MPa
Shear stress for cast iron = 8 MPa
Draw a neat sketch of the coupling.

OR

8 **a** A mild steel shaft transmits 20 kW at 200 r.p.m. It carries a central load of 900 N and is simply supported between the bearings 2.5 metres apart. Determine the size of the shaft, if the allowable shear stress is 42 MPa and the maximum tensile or compressive stress is not to exceed 56 MPa. What size of the shaft will be required, if it is subjected to gradually applied loads?   **7M**

b A 15 kW, 960 r.p.m. motor has a mild steel shaft of 40 mm diameter and the extension being 75 mm. The permissible shear and crushing stresses for the mild steel key are 56 MPa and 112 MPa. Design the keyway in the motor shaft extension. Check the shear strength of the key against the normal strength of the shaft.   **5M**

UNIT-V

9 **a** The rolling contact ball bearings are to be selected to support the overhung counter shaft. The shaft speed is 720 r.p.m. The bearings are to have 99% reliability corresponding to a life of 24 000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life adjustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability.   **6M**

b Derive an expression for energy stored in a flywheel.   **6M**

OR

10 **a** What are the various types of radial ball bearings?   **6M**

b Explain briefly hydrodynamic lubrication and its assumptions.   **6M**

END