1137

Code : 9ME-53

Register Number | | | | | | | |

V Semester Diploma Examination, Nov./Dec., 2014

DESIGN OF MACHINE ELEMENTS

Time : 3 Hours] **[Max. Marks : 100**

Note : (i) Answer any **two** full questions from each section.
(ii) Use of design data hand book is permitted.
(iii) Any missing data may be suitably assumed.

SECTION – I

1. (a) Explain stress-strain diagram for mild steel with sketch. **5**

   (b) A steam engine cylinder has an effective diameter of 230 mm. It is subjected to a maximum steam pressure of 1.75 N/mm^2. Calculate the number and size of studs required to fix, the cylinder on to the cylinder of flange, assuming the permissible stress in the studs as 30 mPa. Take the pitch circle diameter of the studies as 320 mm. Also check the circumferential pitch of the studs so as to give a leak proof joint. **10**

2. (a) List the applications of computers in design process. **5**

   (b) Design a bolt from the following details :

   The initial tightening load on the bolt is 5 kN.

   The external tensile load acting on the bolt is 9 kN.

   The value of 'K' for gasket material is 0.5.

   The bolt with coarse thread is made of plain carbon steel with yield strength is 375 mPa.

   Assume factor of safety as 4. **10**

3. (a) Explain the forces acting on sunk key. **4**

   (b) Explain the requirements of shaft couplings. **3**

   (c) A solid circular shaft is subjected to a bending moment of 3000 N-m and a torque of 10,000 N-m. The shaft is made of 45C8 steel, halling ultimate tensile stress of 700 mPa and a ultimate shear stress of 500 mPa. Assuming a factor of safety as 5. Determine the diameter of the shaft. **8**

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SECTION – II

4. Design a rigid flange coupling to transmit a torque of 260 N-m between two co-axial shafts. The shaft and key is made of alloy steel C-40 and C-35 steel for bolts. Four bolts are used to couple the flanges. Flanges are made of cast-iron with a allowable shear stress 200 mPa. **20**

5. Design a screw jack for lifting a load of 80 kN, through a height of 400 mm. An effort of 300 N is applied at the end of the lever. The co-efficient of friction between the nut and screw is 0.125 and with that of collar 0.147. The screw has single start square threads of 8 mm pitch. Design load may be considered as 25% more than the capacity of the Jack. The following allowable stresses may be assumed.

   For Screw :

   Tensile strength = 200 mPa.

   Compressive strength = 200 mPa.

   Shear strength = 120 mPa.

   For Phosphor-Bronze nut

   Elastic limit in tension – 100 mPa.

   Elastic limit in compression – 90 mPa.

   Elastic limit in shear – 80 mPa.

   Bearing pressure – 18 N/mm^2

   Take factor of safety – 3

   The screw and handle are made of some material. **20**

6. Design a Knuckle joint to connect two mild steel bars under a tensile load of 25 kN. The allowable stresses are 65 mPa in tension, 50 mPa in shear and 83 mPa in crushing. **20**

SECTION – III

7. (a) Design a helical spring for a spring loaded safety valve for the following conditions :

   Diameter of valve seat = 65 mm.

   Operating pressure = 0.7 N/mm^2.

   Maximum pressure when the valve blows off freely = 0.75 N/mm^2.

   Maximum lift of the valve when the pressure rises from 0.7 N/mm^2 to 0.75 N/mm^2 is 3.5 mm.

   Maximum allowable stress = 550 mPa.

   Modulus of rigidity = 84 N/mm^2.

   Spring Index = 6 **10**

   (b) Explain the various types of springs. **5**

8. (a) List the types of welded joints and mention their applications. **5**

(b) A plate 100 mm wide and 10 mm thick is to be welded with another plate by means of parallel fillet weld. The plates are subjected to a load of 70 kN. Find the size of weld for

(i) Static loading

(ii) Dynamic loading

Consider permissible shear stress 56 mPa. **10**

9. (a) Explain over hauling and self locking in screws. **5**

(b) List the materials used for shaft. **3**

(c) What are the standard sizes of shaft ? **2**

(d) A flat sunk key is used to connect a pulley of 40 mm dia. shaft. The standard cross-section of the key is 12 × 8 mm. The permissible shear stress for key material is 40 mPa. Determine the length of the key. **5**
