F 3466 (Pages : 2) Reg. No.....

Name.....

B.TECH. DEGREE EXAMINATION, NOVEMBER 2014

Seventh Semester

Branch : Mechanical Engineering

MACHINE DESIGN AND DRAWING – I (M)

(Old Scheme – Prior to 2010 Admissions)

[Supplementary/Mercy Chance]

Time : Three Hours Maximum : 100 Marks

Answer any **four** *questions by selecting* **two** *from Part A and* **two** *from Part B.*
Missing data, if any may be assumed suitably.
Each question carries 25 *marks.*

Part A

1. Explain the following theories of failure :
   (a) Maximum principal stress theory.
   (b) Maximum shear stress theory.
   (c) Maximum strain theory.
   (d) Shear – Energy theory.
   (e) Maximum strain energy theory.
2. Design a knuckle joint for a tie rod of circular section to sustain a maximum pull of 60 kN, The ultimate strength of the material against tearing is 420 MPa. The ultimate compressive and shear strength of the pin material are 510 MPa and 396 MPa respectively. Determine the tie rod section and pin section. Take factor of safety as 6. Also draw the designed sketch.
3. A cast iron protective type flange coupling is used to connect two shafts of 80 mm diameter. The shaft runs at 250 r.p.m. and transmits a torque of 4300 N mts. The permissible shear stress for shaft and bolts material is 50 MPa and permissible shear stress for flange is 8 MPa. Design the bolts, hub and flange for the coupling.
4. Design a double rivetted butt joint with two cover plates of equal width for the longitudinal seam of a boiler shell of 1 meter diameter subjected to a steam pressure of 2 MPa. The rivet pitch is to be same in all rows and zig-zag invetting is to be used. The allowable stresses in tension, shear and crushing are 124 MPa, 93 MPa and 180 MPa respectively. Assume that the rivets in double shear are 1.875 times stronger than in single shear.

(2 × 25 = 50 marks)

Turn over

Part B

5. A section of steel shaft of 2 meters long supported between bearings running at 1000 r.p.m. carries a 20° involute spur gear of pitch diameter 200 mm at its midpoint. The gear delivers 20 KW power to its mating gear located directly above the shaft. If the shaft material selected has an allowable shear stress of 40 MPa, determine the size of the shaft. Assume loads are steady.

6. A steel pipe of 100 mm interval diameter and 400 mm long is welded to the vertical plate by an all round fillet weld. The thickness of the pipe is 10 mm. Determine the size of the weld, if it is to have the same strength as that of the pipe. Also determine the load that can be supported at the end of the pipe, if the maximum permissible stress is 100 MPa.

7. Design a closed-coil helical spring for a boiler safety valve which is required to blow off steam at the pressure of 1.5 N/mm^2. The diameter of the valve is 50 mm. The initial compression of the spring is 40 mm and lift is limited to 20 mm.

8. Design a flywheel for a single cylinder four-stroke vertical cylinder diesel engine developing 4 kW at 1500 r.p.m. Assume co-efficient of speed fluctuation, $\varsigma = 0.01$.

(2 × 25 = 50 marks)