Reg. No.															

B.Tech. DEGREE EXAMINATION, NOVEMBER 2016
Sixth Semester

ME1020 – MECHANICAL ENGINEERING DESIGN
(For the candidates admitted during the academic year 2013 – 2014 and 2014 -2015)

Note:
(i) **Part - A** should be answered in OMR sheet within first 45 minutes and OMR sheet should be handed over to hall invigilator at the end of 45th minute.
(ii) **Part - B** and **Part - C** should be answered in answer booklet.

Time: Three Hours Max. Marks: 100

PART – A (20 × 1 = 20 Marks)
Answer **ALL** Questions

1. The ratio of the ultimate stress to the design stress is known as
   (A) Elastic limit (B) Strain
   (C) Factor of safety (D) Bulk modulus

2. The neutral axis of a beam is subjected to
   (A) Zero stress (B) Maximum tensile stress
   (C) Maximum compressive stress (D) Maximum shear stress

3. A solid shaft transmits a torque (T), and the allowable shear stress is τ. The diameter of shaft is
   (A) $\sqrt[3]{\frac{16T}{\pi\tau}}$ (B) $\sqrt[3]{\frac{32T}{\pi\tau}}$
   (C) $\sqrt[3]{\frac{64T}{\pi\tau}}$ (D) $\sqrt[3]{\frac{16T}{\tau}}$

4. Rankine's theory is used for
   (A) Brittle materials (B) Ductile materials
   (C) Elastic materials (D) Plastic materials

5. The stress which vary from a minimum value to a maximum value of the same nature is called
   (A) Repeated stress (B) Yield stress
   (C) Fluctuating stress (D) Alternating stress

6. The resistance of fatigue of a material is measured by
   (A) Elastic limit (B) Young's modulus
   (C) Ultimate tensile strength (D) Endurance limit

7. The surface finish factor for a mirror polished material is
   (A) 0.45 (B) 0.65
   (C) 0.85 (D) 1

8. In cyclic loading, stress concentration is more serious in
   (A) Brittle materials (B) Ductile materials
   (C) Brittle as well as ductile materials (D) Elastic materials

9. Which of the following cotter joint is used to connect strap end of a connecting rod?
   (A) Socket and spigot cotter joint (B) Sleeve and cotter joint
   (C) Gib and cotter joint (D) Cotter foundation bolt

10. In a steam engine, the valve rod is connected to an eccentric by means of a
   (A) Knuckle joint (B) Universal joint
   (C) Flange coupling (D) Cotter joint

11. The square threads are usually found on
   (A) Spindles of bench vices (B) Railway carriage couplings
   (C) Feed mechanism of machine tools (D) Screw cutting lathes

12. When a nut is tightened by placing a washer below it, the bolt will be subjected to
   (A) Tensile stress (B) Compressive stress
   (C) Shear stress (D) Principal stress

13. The objective of caulking in a riveted joint is to make the joint
   (A) Free from corrosion (B) Stronger in tension
   (C) Free from stresses (D) Leak-proof

14. The longitudinal joint in boilers is used to get the required
   (A) Length of boiler (B) Diameter of boiler
   (C) Length of diameter and boiler (D) Efficiency of boiler

15. The transverse fillet welded joints are designed for
   (A) Tensile strength (B) Compressive strength
   (C) Bending strength (D) Shear strength

16. The size of the weld in butt welded joint is equal to
   (A) 0.5×throat of weld (B) Throat of weld
   (C) $\sqrt{2} \times$ throat of weld (D) $2 \times$ throat of weld

17. The bell crank levers used in railway signaling arrangement are of
   (A) First type of levers (B) Second type of levers
   (C) Third type of levers (D) Fourth type of levers

18. An I section is more suitable for a
   (A) Rocker arm (B) Cranked lever
   (C) Foot lever (D) Lever of safety valve

19. Which of the following spring is used in a mechanical wrist watch?
   (A) Helical compression spring (B) Spiral spring
   (C) Torsion spring (D) Belleville spring

20. In leaf springs the longest leaf is known as
   (A) Lower leaf (B) Master leaf
   (C) Upper leaf (D) Semi leaf

PART – B (5 × 4 = 20 Marks)
Answer **ANY FIVE** Questions

21. Briefly explain the general procedure is machine design.

22. The piston rod of a stream engine is 50mm in diameter and 600 mm long. The diameter of the piston is 400 mm and the maximum stream 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 210 KN/mm^2.

23. Illustrate how the stress concentration in a component can be reduced.

24. An unknown weight falls through 12mm, on to a collar rigidly attached to the lower end of a vertical rod, 2.5m long and 500 mm^2 cross section. The maximum instantaneous extension is 2mm. Determine the magnitude of the weight and the corresponding stress induced. Take E=2.1×10^5 MPa.

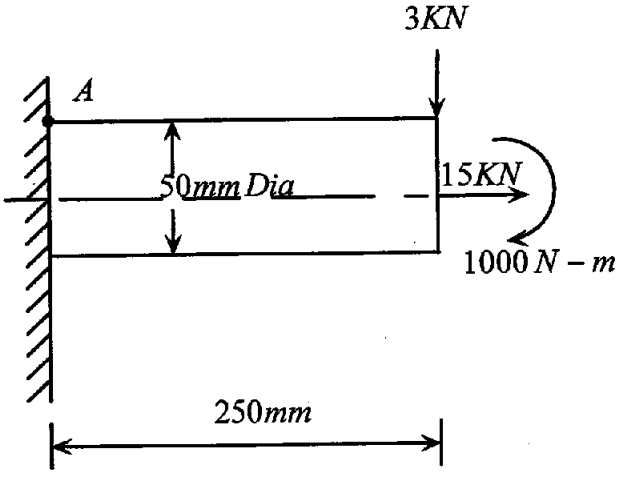
25. Write short note on nut locking devices covering the necessity and various types.

26. A double riveted lap joint is made between 15mm thick plates. The rivet diameter and pitch are 25mm and 75 mm respectively. If the ultimate stresses are 400 MPa in tension, 320 MPa in shear and 640 MPa in crushing, find the minimum force per pitch which will rupture the joint.

27. Discuss the materials and practical applications for the various types of springs.

PART – C (5 × 12 = 60 Marks)
Answer **ALL** Questions

28. a. A shaft as shown in below. subjected to a bending load of 3KN, pure torque of 1000 N-m and axial pulling force of 15 KN. Calculate the stresses at 'A'.



(OR)

b. A cylindrical shaft made of steel of yield strength 700 MPa is subjected to static loads consisting of bending moment 10 KN-m and a torsional moment of 30 KN-m. Determine the diameter of the shaft using
   (i) Maximum shear stress theory
   (ii) Maximum strain energy theory

Assume a factor of safety of 2. Take Young's modulus E=210 GPa and Poisson's ratio $\frac{1}{m} = 0.25$.

29. a. A machine component is subjected to a flexural stress which fluctuates between +300 $MN.m^2$ and −150 MN/m^2. Determine the value of minimum ultimate strength according to
   (i) Gerber relation
   (ii) Modified Goodman relation and
   (iii) Soderberg relation. Take yield strength = 0.55× ultimate strength; endurance strength = 0.5× ultimate strength; and factor of safety = 2.

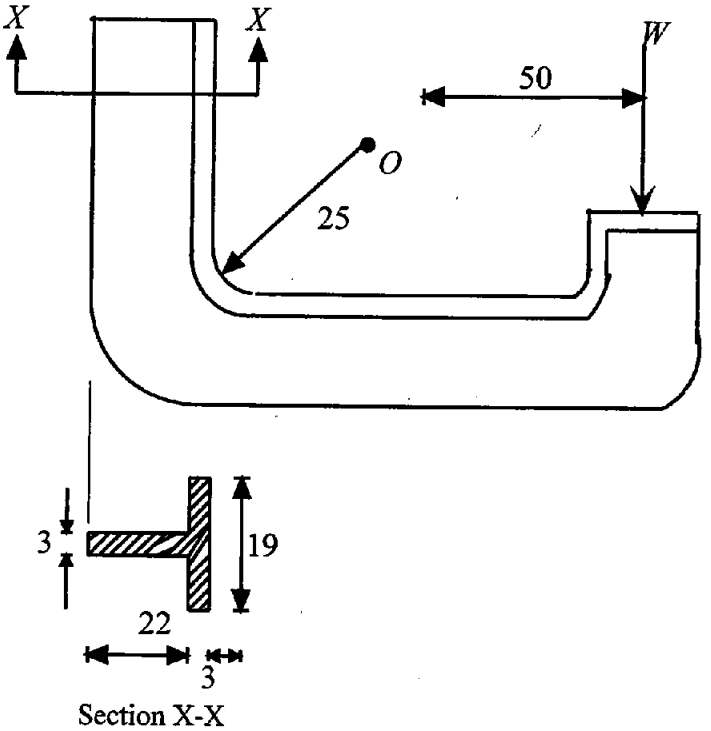
(OR)

b. A circular bar of 500mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50kN. Determine the diameter of bar by taking a factor of safety of 1.5, size effect of 0.85, surface finish factor of 0.9, stress concentration factor of 1. The material properties of bar are given by ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength f 350 MPa.

30. a. Design a sleeve and cotter joint to connect two mild steel rods for a pull of 30 KN. The maximum permissible stresses are 55 MPa in tension; 40 MPa is shear and 70 MPa in crushing.

(OR)

b. A C-clamp is subjected to a maximum load of W, as shown in below. If the maximum tensile stress in the clamp is limited to 140 MPa, find the value of load W. (All dimensions in mm)



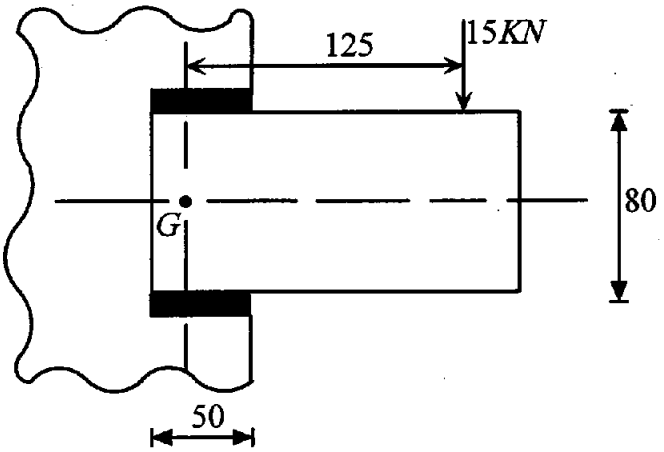
Section X-X

All dimensions are in mm

31. a. Design a double riveted butt joint with two cover plates for the longitudinal seam of a boiler shell 1.5m in diameter subjected to a stream pressure of 0.95 N/mm^2. Assume joint efficiency as 75% allowable tensile stress in the plate 90 MPa; compressive stress 140 MPa; and shear stress in the rivet 56 MPa.

(OR)

b. A bracket carrying a load of 15 KN is to be welded as shown in below. Find the size of weld required if the allowable shear stress is not to exceed 80 MPa. (All dimensions in mm)



32. a. Design a foot brake lever from the following data: length of lever from the centre of gravity of the spindle to the point of application of load = 1 metre, maximum load on the foot plate = 800N, overhang from the nearest bearing = 100 mm, and permissible tensile and shear stress = 70 MPa.

(OR)

b. Design a helical compression spring for a maximum load of 1000N for a deflection of 25mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 KN/mm^2.

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