

(Following Paper ID and Roll No. to be filled in your Answer Book)

Paper ID : 140501

Roll No.

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**B.Tech.**

**(SEM. V) THEORY EXAMINATION, 2015-16**

**MACHINE DESIGN-I**

**Time : 3 hours]**

**[Maximum Marks : 100**

Note : Attempt all sections (A, B and C)

**Section-A**

1. Attempt **all** parts. All sections carry equal marks. Write answer of each section in short. (10×2=20)
- (a) List the factors that influence the selection of materials for specific application.
- (b) What is ergonomic consideration in design?
- (c) Why Wahl's correction factor is used in spring design?

- (d) Why preferred numbers are important in machine design?
- (e) Why fatigue failure of materials is important while designing machine part?
- (f) Why efficiency of screw jack should not be more than 50%?
- (g) Why most of the components are designed for infinite life?
- (h) Why repeated stresses are crucial in ductile materials?
- (i) List components designed for finite life.
- (j) What is rated life of a system?

### Section-B

**Note:** Attempt any five questions from this section.

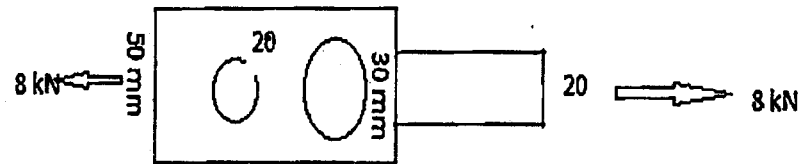
$$10 \times 5 = 50$$

- Q2. (a) What are preferred numbers in design?
- (b) A manufacturer is interested to start a business with six models of machines ranging from 7.5 kW -75 kW. Specify power capacity of six models.

(2)

NME-501

- 3. (a) What do you understand by i) FE320 ii) FeE 200 iii) 40C8.
- (b) How will you designate the following varieties of steel i) carbon= 30-40%, Si=0.8-0.9%, Mn=0.7-0.9%, Cr=3.5-4.5%. ii) C=45-55%, Cr=18%, Va=21%
- 4. (a) A rectangular bar made of carbon steel 40C8 is subjected to a tensile load as shown in fig 1.0. Calculate the max stress in the bar with fillet radius being 3mm (all dimensions in mm).



- (b) A cylindrical bar made of Fe620 is subjected to combined bending moment and to torsional moment of 10kN-m & 30kN-m respectively. Determine the diameter of the bar for a factor of safety of 2.0

(3)

P.T.O

5. (a) A stepped shaft, stepped from 40 mm to 30 mm is subjected to a torsional moment of 100 N-m. If the stress concentration at fillet is 2.3, what is the max stress in the shaft?
- (b) A machine components is subjected to a bending, stress varying from 300 MPa to -150 MPa. Calculate the minimum required ultimate strength, if the factor of safety is 1.5
6. (a) Differentiate between collar friction and thread friction.
- (b) Design a triple riveted butt joint for a boiler of 1.2m inner diameter operating at a steam pressure of 1.5mPa.
7. Design a protected type flange coupling to transmit 135 kW @ 120 rpm. Assume 40C8 as material for all components. Assume any missing data.

(4)

NME-501

8. A helical spring made of oil tempered carbon steel subjected to varying load from 600N to 1000N. Design the spring for a spring index of 6 and a factors of safety of 1.5. The material of the spring may be selected as music wire.
9. Design the screw of a screw jack to lift a load of 95 kN through a height of 250 mm. verify the design using principal stresses and buckling failure.

### Section-C

Attempt **any two** questions from this section.

(2×15=30)

10. (a) Distinguish between shaft axle and spindle.
- (b) Design a shaft to transmit 25 kW @ 200 rpm carrying a central load of 900 N and is simply supported between bearings 1.0 m apart. Allowable tensile and shear stresses for material are 56 & 42 MPa respectively.

(5)

P.T.O.

11. A hot rolled steel shaft is subjected to a variable bending moment of +440 Nm to -220 Nm and a torsional moment of 330 Nm to 110 Nm. Shaft is of no varying cross-section. Determine the required shaft diameter. If the material has ultimate tensile and yield strength of 550 N/mm<sup>2</sup> and 440 N/mm<sup>2</sup> with a factor of safety of 1.5.
12. A cylindrical steel shaft of ultimate and yield strength of 580 & 360 N/mm<sup>2</sup> respectively and a cylindrical corrected endurance strength of 200 N/mm<sup>2</sup> is subjected to a combined bending & torsional moments -30 MPa to +30 MPa and -15 MPa to +30MPa respectively. Calculate the factors of safety.

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