Printed Pages : 6 | 569 | NME-501

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

Paper ID : 140501 | Roll No. | | | | | | | | | |

B.Tech.

(SEM. V) THEORY EXAMINATION, 2015-16

MACHINE DESIGN-I

Time : 3 hours] **[MaximumMarks : 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.

$10 \times 5 = 50$

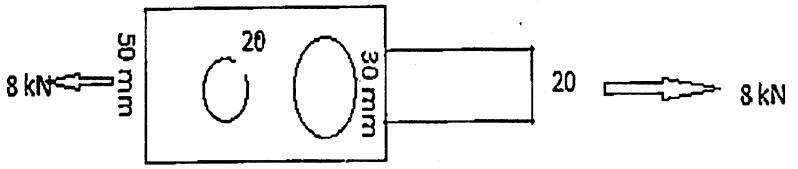
Q2. (a) What are preferred numbers in design?

(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.

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 (aal dimensions in mm).



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

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 saftey 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.

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 carying 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.

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^2 and 440 N/mm^2 with a factor of safety of 1.5.

12. A cylindrical steel shaft of ultimate and yield strength of 580 & 360 N/mm^2 respectively and a cylindrical corrected endurance strength of 200 N/mm^2 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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