[Total No. of Questions - 9] [Total No. of Printed Pages - 4] (2125)

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B. Tech 5th Semester Examination

Design of Automobile Component-I (NS)

AU-313

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

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : Candidates are required to attempt five questions in all selecting one question from each of the sections A, B, C, D, and all the questions in Section E. Draw neat and comprehensive sketches wherever necessary to clearly illustrate your answer. Assume missing data suitably if any and specify the same. Use of non-programmable calculators is allowed.

SECTION - A

1. (i) What do you understand by term 'machine design'? Write the name of different types of design. Write their advantages and disadvantages in designing of a machine element.

   (ii) What is interchangeability? Explain with example.

   (iii) State any four mechanical properties commonly used for analyzing the characteristics of an engineering materials and explain any two from your answer. ([3+2+4]+5+6=20)

2. (i) State and explain the basic criteria for selection of materials.

[P.T.O.]

   (ii) State and explain the B.I.S. system of Fits & Tolerances. Give examples and explain.

   (iii) What is combined variable stress? Explain the characteristics of this stress using Goodman and Soderberg's criteria. (5+6+9=20)

SECTION - B

3. (i) How is the shaft designed when it is subjected to twisting moment only? Explain.

   (ii) A solid shaft is transmitting 1 MW at 240 rpm. Determine the diameter of the shaft if the maximum torque transmitted exceeds the mean torque by 20%. Take the maximum allowable shear stress as 60MPa.

   (iii) 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 having ultimate tensile stress of 700 MPa and an ultimate shear stress of 500 MPa. Assume a factor of safety as 6, determine the diameter of the shaft. (5+7+8=20)

4. (i) A steel shaft transmits 4 kW at 800 rpm. The angular deflection should not exceed 0.25° per metre of the shaft. If the modulus of rigidity for material of the shaft is 84 GPa, find the diameter of the shaft and the shear stress induced in the shaft.

   (ii) Design a rectangular key for a shaft of 50 mm diameter. The shearing and crushing stresses for the key are 42 MPa and 70 MPa respectively. Assume any missing data and design the key.

   (iii) What do you understand by critical speed of shaft? Explain briefly with mentioning its role in designing of shaft and key. (7+8+5=20)

SECTION - C

5. (i) What is an eccentrically loaded riveted joint? Considering an example discuss the procedure for designing such joint. How this joint is different from eccentrically loaded welded joint? Answer with example.

   (ii) A 65 mm diameter solid shaft is to be welded to a flat plate and the weld around the circumference of the shaft. Design the weld joint and determine the size of the weld if the torque on the shaft is 3 kN-m. The allowable shear stress in the weld is 70 MPa. Draw a simple sketch for the joint. ([2+5+4]+9=20)

6. (i) Explain the detail procedure for designing of bolts eccentrically loaded in shear and under combined stress.

   (ii) A bolt is to be used for lifting a load of 60 kN. Find the nominal diameter of the bolt, if the tensile stress is not to exceed 100 MPa. Assume coarse threads.

   (iii) List out the various stresses induced in screwed fastenings and explains how shear stress is important due to external forces applied on the screw joint. (7+6+7=20)

SECTION - D

7. (i) Design a cotter joint to support a load varying from 30 kN in compression to 30 kN in tension. The material used is carbon steel for which the following allowable stresses may be used. The load is applied statically. Take tensile stress = 50 MPa, compressive stress = 50 MPa, shear stress = 35 MPa, and crushing stress = 90 MPa. Draw a neat sketch of the joint designed.

   (ii) Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression. (12+8=20)

[P.T.O.]

8. (i) A cast iron pipe of internal diameter 200 mm and thickness 50 mm carries water under a pressure of 5 N/mm^2. Calculate the tangential and radial stresses at the inner, middle (radius =125 mm); and outer surfaces. Sketch the stress distributing curve.

   (ii) Discuss how the pipes are designed?

   (iii) Write the importance and significance of 'hydraulic pipe joint for high pressure'. (11+5+4=20)

SECTION - E

9. Answer the following questions. (compulsory)

   (i) How bending is associated in designing of automobile components?

   (ii) What is concurrent engineering? Explain briefly.

   (iii) What do you mean by steam pipe fittings? List out the name of various fittings on a steam pipe.

   (iv) Distinguish between keys and cotters with examples.

   (v) What are rivet materials? How are rivet materials selected?

   (vi) Distinguish between square and trapezoidal threads with examples.

   (vii) What are the main factors required to be considered while designing of a hollow shaft? Explain briefly.

   (viii) What is the function of key? Draw simple sketch of Kennedy key and level different region.

   (ix) What is spline? Where it is used?

   (x) Explain B.I.S. system of designation of cast iron (C.I.). (10×2=20)