Roll No. ....

Total No. of Questions : 09]   [Total No. of Pages : 03

B. Tech. (Sem. – 5ᵗʰ)
AUTOMOTIVE DESIGN - I
SUBJECT CODE : AE - 301
Paper ID : [A0713]
[Note : Please fill subject code and paper ID on OMR]

Time : 03 Hours   **Maximum Marks : 60**

Instruction to Candidates:

  1)   Section -A is **Compulsory**.
  2)   Attempt any **Four** questions from Section - B.
  3)   Attempt any **Two** questions from Section - C.

Section - A

Q1) $(10 \times 2 = 20)$

  a) What is fundamental deviation?
  b) What is a ductile material? Give its examples.
  c) What is the effect of keyway and how this is taken care off in design of shafts?
  d) Which of the theories of elastic failure is used in design of shafts and why?
  e) Write the manufacturing methods of cotter and knucle joint?
  f) What are applications of coarse and fine threads?
  g) What is caulking and fullering? Differentiate between the two?
  h) Sketch parallel and transverse welds.
  i) What do you understand by self locking screw? Write its condition.
  j) Explain a woodruff key? What are its applications?

Section - B

$(4 \times 5 = 20)$

Q2) What is factor of safety? Why is it required? Describe various factors influencing the value of factor of safety.

Q3) Calculate the tolerances, fundamental deviations and limits of sizes for the shaft designated as 40 H8/f 7.

Q4) Determine the throat dimension of welded connection of steel plates as shown in figure 1 if the permissible shear stress is limited to 95 N/mm^2
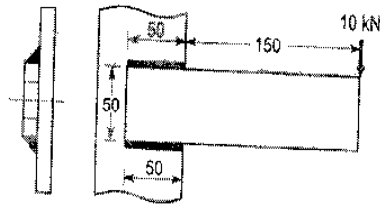

Figure 1

Q5) Explain notch sensitivity. State the relation between stress concentration factor, fatigue stress concentration factor and notch sensitivity.

Q6) What is preloading of bolts? What is its importance in fastening?

Section - C

(2 × 10 = 20)

Q7) A transmission shaft supporting a spur gear (Pressure angle 20°) B and pulley D is shown in figure 2 below. The shaft is mounted on two bearings A and C. The diameters of pulley and gear are 450 and 300 mm respectively. 20 kW power at 500 rpm is transmitted from the pulley to the gear. P_1 and P_2 are the belt tensions in tight and loose sides with ratio 3:1, while P_t and P_r are tangential and radial components of the gear-tooth force.

The gear and pulley are keyed to the shaft. The material of shaft is steel 50C4 (S_{ut} = 700 and S_{yt} = 460 N/mm^2). Determine the shaft diameter using the ASME code.
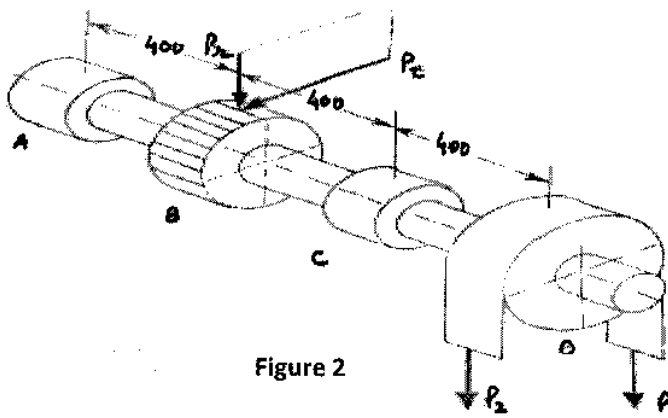

Figure 2

Q8) A double shoe brake as shown in figure3 is capable of absorbing a torque of 1400 N-m. The diameter of the brake drum is 350 mm and the angle of contact for each shoe is 100°. If the coefficient of friction between the brake drum and lining is 0.4, Find : the spring force necessary to set the brake and the width of the brake shoes, if the bearing pressure on the lining material is not to exceed 0.3 N/mm^2

Figure 3

All dimensions in mm.
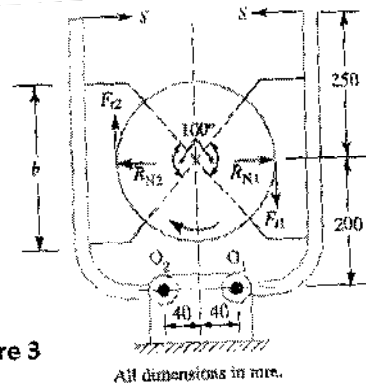
Q9) It is required to design a protective flange coupling for connecting the motor and centrifugal pump shafts. 18 kW of power is transmitted at 1000 rpm from motor to pump. The allowable shear stress in shaft is limited to 50 Mpa and angle of twist should not exceed 0.75 degrees in a length of 20 diameters. Allowable shear stress in coupling bolts is 30 Mpa. Assume the torsional moment to be transmitted 20% more than mean torsional moment. Take G = 84 Gpa.

■■■