

**B. Tech 5th Semester Examination**  
**Design of Automobile Components-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 section 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 Design Data book is allowed. Use of non-programmable calculator is also allowed.

**SECTION - A**

1. (a) Define 'Mechanical Properties' of engineering material. State any six mechanical properties, give their definition and one example of material processing the properties. (10)
- (b) Explain the concept of Tearing, Shearing with Crushing with neat sketches. (10)
2. (a) State briefly unilateral system of tolerances covering the points of definition, application and advantages over the bilateral system. (10)
- (b) List the main advantages of forged components. (10)

**SECTION - B**

3. (a) When the shaft is subjected to fluctuating loads, what will be the equivalent twisting moment and equivalent bending moment? (6)

- (b) A shaft made of mild steel is required to transmit 100 kW at 300 r.p.m. The supported length of the shaft is 3 meters. It carries two pulleys each weighing 1500 N supported at a distance of 1 meter from the ends respectively. Assuming the safe value of stress, determine the diameter of the shaft. (14)
4. (a) What are the considerations in the design of dimensions of formed and parallel key having rectangular cross-section? (6)
- (b) A shaft is supported on bearings A and B, 800 mm between centers. A 20° straight tooth spur gear having 600 mm pitch diameter, is located 200 mm to the right of the left hand bearing A, and a 700 mm diameter pulley is mounted 250 mm towards the left of bearing B. The gear is driven by a pinion with a downward tangential force while the pulley drives a horizontal belt having 180° angle of wrap. The pulley also serves as a flywheel and weighs 2000 N. The maximum belt tension is 3000 N and the tension ratio is 3 :1. Determine the maximum bending moment and the necessary shaft diameter if the allowable shear stress of the material is 40 MPa. (14)

**SECTION - C**

5. (a) How the core diameter of the bolt is determined when a bracket having a rectangular base is bolted to a wall by four bolts and carries an eccentric load parallel to the axis of the bolt? (6)
- (b) The cylinder head of a steam engine is subjected to a steam pressure of 0.7 N/mm<sup>2</sup>. It is held in position by means of 12 bolts. A soft copper gasket is used to make the joint leak-proof. The effective diameter of cylinder is 300 mm. Find the size of the bolts so that the stress in the bolts is not to exceed 100 MPa. (14)

[P.T.O.]

6. (a) Explain the procedure for designing a longitudinal and circumferential joint for a boiler. (6)
- (b) A plate 100 mm wide and 12.5 mm thick is to be welded to another plate by means of parallel fillet welds. The plates are subjected to a load of 50 kN. Find the length of the weld so that the maximum stress does not exceed 56 MPa. Consider the joint first under static loading and then under fatigue loading. (14)

#### SECTION - D

7. (a) Why gibs are used in a cotter joint? Explain with the help of a neat sketch the use of single and double gib. (6)
- (b) Design and draw a cottered foundation bolt which is subjected to a maximum pull of 50 kN. The allowable stresses are:  $\sigma_t = 80$  MPa;  $\tau = 50$  MPa; and  $\sigma_c = 100$  MPa. (14)
8. (a) Describe with sketches, the various types of pipe joints commonly used in engineering practice. (6)
- (b) Design a square flanged pipe joint for pipes of internal diameter 50 mm subjected to an internal fluid pressure of 7 N/mm<sup>2</sup>. The maximum tensile stress in the pipe material is not to exceed 21 MPa and in the bolts 28 MPa. (14)

#### SECTION - E

9. (i) How do you classify materials for engineering use?
- (ii) Name the various manufacturing methods of machine parts which a designer should know.
- (iii) How the shafts are formed?
- (iv) What type of stresses are induced in shafts?

- (v) What do you understand by the single start and double start threads?
- (vi) State the difference between Pitch and Lead.
- (vii) What do you understand by splines? Write it's applications.
- (viii) What is the material used for rivets?
- (ix) What is the basic difference between semi-automatic welding and automatic welding.
- (x) Distinguish between cotter joint and knuckle joint. (10×2=20)