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Total No. of Pages : 02

Total No. of Questions : 09

**B.Tech(AE) (2011 Onwards) (Sem.-5)**  
**DESIGN OF AUTOMOTIVE COMPONENTS**

Subject Code : BTAE-504

Paper ID : [A2064]

Time : 3 Hrs.

Max. Marks : 60

**INSTRUCTION TO CANDIDATES :**

1. SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.
2. SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.
3. SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.
4. Use of design data book is permitted.
5. Assume missing data suitably, if any.

**SECTION-A****Q1. Write briefly :**

- i) What are the methods and materials used in manufacturing of crankshafts?
- ii) How is axial thrust in helical gears overcome?
- iii) What is crossed helical gear?
- iv) What is thick film lubrication?
- v) Why are shock and fatigue factors involved in shaft design?
- vi) Why it is necessary to use factor of safety?
- vii) Define tolerance. How is it related to limits?
- viii) What is interchangeability?
- ix) What are assumptions for short shoe brake analysis?
- x) State any two advantages of deep groove ball bearing.

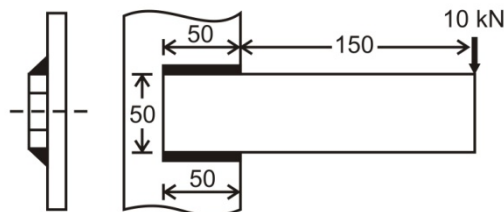
**SECTION-B**

- Q2 Discuss different types of wear failure and breakage failure of gear tooth due to static and dynamic loads.
- Q3 A closely coiled helical spring is made of 10 mm diameter steel wire, the coil consisting of 10 turns with a mean diameter of 120 mm. The spring carries an axial pull of 200 N. Determine the shear stress induced in the spring neglecting the effect of stress concentration. Determine also the deflection in the spring, its stiffness and strain energy stored by it if the modulus of rigidity of the material is  $80 \text{ kN/mm}^2$ .

- Q4 Explain the criterion for selection of suitable material for connecting rod and method of manufacturing the same.
- Q5 Design a muff coupling to connect two shafts transmitting 30 kW at 110 rpm. The permissible shear and crushing stress for the shaft and key material are 40 MPa and 70 MPa respectively. The material of muff is cast iron with permissible shear stress of 18 MPa. Assume that the maximum torque transmitted is 25 percent greater than mean torque.
- Q6 What is stress concentration? State the relation between stress concentration factor, fatigue stress concentration factor and notch sensitivity.

### SECTION C

- Q7 A pair of spur gears with  $20^\circ$  full-depth involute teeth consists of a 20 teeth pinion meshing with 41 teeth gear. The module is 3 mm while the face width is 40mm. The material for the pinion as well as for the gear is steel with an ultimate tensile strength of  $600 \text{ N/mm}^2$ . The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 1450 rpm and the surface factor for the application is 1.75. Assume the velocity factor accounts for the dynamic load, and the factor of safety is 1.5. Determine wear strength, effective load, torque, beam strength and rated power of gears. Assume lewis form factor as 0.32 for 20 teeth.
- Q8 A cone clutch is used to connect an electric motor running at 1440 rpm with a machine that is stationary. The machine is equivalent to a rotor of mass 150 kg and radius of gyration as 250 mm. The machine has to be brought to the full speed of 1440 rpm from a stationary condition in 40 sec. The semi-cone angle  $\alpha$  is  $12.5^\circ$ . The mean radius of the clutch is twice the face width. The coefficient of friction is 0.2 and the normal intensity of pressure between contacting surfaces should not exceed  $0.1 \text{ N/mm}^2$ . Assuming uniform wear criterion, calculate :
- The inner and outer diameters;
  - The face width of friction lining;
  - The force required to engage the clutch
  - The amount of heat generated during each engagement of clutch.
- Q9 A weld connection of steel plates, as shown in Figure, is subjected to an eccentric force of 10 kN. Determine the throat dimension of the welds, if the permissible shear stress is limited to  $95 \text{ N/mm}^2$ . Assume static conditions.



Figure