(Following Roll No. to be filled by candidate)

Roll No. | 1 | 1 | 5 | 4 | 3 | 5 | 0 | 0 | 4 | 3 |

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B. TECH.
FIFTH SEMESTER EXAMINATION 2013-14
EME501
MACHINE DESIGN – I

Max. Marks: 50

Time: 2 Hours

Note
- Attempt all questions.
- Marks and numbers of questions to be attempted from the section is mentioned before each section.
- Assume missing data suitably. Illustrate the answers with suitable sketches.

1. Attempt **any four parts** of the following: [4 x 3]

   a. What are the different stages in the design of a machine element, explain.
   b. What is alloy steel? State the effects of various alloying elements in alloy steel.
   c. What is the necessity of having more than one theory of failure? Write briefly about various theories of failure.
   d. What is impact loading? How stresses generated by impact loading is different from static loading.
   e. Define the following terms:
      i. Modulus of Elasticity
      ii. Toughness
      iii. Poisson's ratio
   f. Derive the formula for stress in case of eccentric axial loading applied on a solid shaft.

2. Attempt **any four parts** of the following: [4 x 3]

   a. Write notes on fatigue failure and endurance limit.
   b. What is meant by stress concentration? How do you take it into consideration in case of a component subjected to dynamic loading?
   c. Discuss Soderberg and Goodman criterion. For what purpose are they used?
   d. Define factor of safety. What is the importance of factor of safety and on what parameters does it depend?
   e. Find the efficiency of a double riveted lap joint of 6 mm thick plates with 20 mm diameter rivets having a pitch of 65 mm. Check the rivet against the failure due to tearing, shearing and crushing. The permissible tensile stress in plate is 120 MPa, the permissible shearing stress in

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   rivets is 90 MPa and the permissible crushing stress in rivets is 180 MPa.
   f. What is caulking and fullering? Explain with the help of neat sketches.

3. Attempt **any two parts** of the following: [2 x 6.5]

   a. A line shaft rotating at 200 r. p. m. is to transmit 200 KW power. The shaft carries a central load of 900 N and is simply supported between bearings 3 m apart. The allowable shear stress for the shaft is 42 N/mm². while allowable tensile stress for the shaft is 50 N/mm². Determine the diameter of the shaft.
   b. A square key is used for fixing a gear on a shaft of 25 mm diameter. The gear rotates at 550 r. p. m. and transmits 12 KW power to the meshing gear. The key is made of steel having tensile and compressive yield strength of 400 N/mm². Design the key considering 2.5 as the factor of safety.
   c. What are couplings? State the difference between clutch and coupling. Give the procedure for the design of rigid and flexible couplings.

4. Attempt **any two parts** of the following: [2 x 6.5]

   b. Design a helical compression spring for a maximum load of 1000 N for a deflection of 25 mm using the value of spring index as 5. The maximum permissible shear stress for spring wire is 420 MPa and modulus of rigidity is 84 KN/mm².
   c. Describe various forms of threads used for power screw, giving their merits and demerits. Discuss the procedure for the design of a screw having square threads.
   d. Write short notes on the following. [2.5+2+2]
      i. Wahl factor
      ii. Materials for helical spring
      iii. Splined shaft