

2123  
M.E. (Mechanical Engineering)  
Third Semester  
MME-301: Advanced Machine Design

Time allowed: 3 Hours

Max. Marks: 50

**NOTE:** Attempt five questions in all, selecting atleast two questions from each Part. Assume suitably the missing data, if any. Supplement your answer with neat and labeled sketch wherever required.

x-x-x

**Part-A**

- 1 While designing a shaft having drilled hole at its central location in lateral direction, how will you consider the stress concentration effects? Also draw the stress distribution curves for the shaft. (10)
- 2 A machine component is subjected to a flexural stress which fluctuates between + 300 MPa to – 150 MPa. Determine the value of minimum ultimate strength for safe design conditions. Assume yield strength as half of ultimate strength; Endurance strength also as half of ultimate strength; and factor of safety as two. (10)
- 3 Design two helical gears as per surface failure-based design approach. The two metallic gears are in contact to transfer 5 kW power from one shaft to another. Speed of the smaller gear is 1000 rpm, while that of the larger gear is 500 rpm. Assume required data suitably. (10)
- 4 Describe with sketches the wave action, stresses, time of separation, final velocity of a bar with free ends that is struck by a rigid body of infinite mass. (10)

**Part-B**

- 5 How is SDM utilized in vibration-based design of a refrigerator compressor? (10)
- 6 A fixed-fixed beam of length 4 m and diameter 50 mm at room temperature is made up of steel having coefficient of thermal expansion as  $9E-6$  per  $^{\circ}C$ . Temperature of the beam is increased by  $100^{\circ}C$ . Determine the stresses and strains produced in the beam. (10)
- 7 Guarantee period of an electric vehicle battery is to be decided. How will you use the ALT for this purpose? Demonstrate by designing a numerical example. (10)
- 8 What is analysis of variance? Why is it important in dynamic design? How is Derringer's function helpful in optimum design applications? (10)

x-x-x