

**Code No: C1501****JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD****M.Tech I - Semester Examinations, March/April 2011****ADVANCED MECHANICAL ENGINEERING DESIGN****(MACHINE DESIGN)****Time: 3hours****Max. Marks: 60**

**Answer any five questions**  
**All questions carry equal marks**

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- 1.(a) Sketch the heart of a design process, and explain its components.  
(b) Distinguish between the Asirnov model and Norton model. [12]
- 2.(a) Explain the mathematical modeling similitude relations in product design.  
(b) Bring out the differences between design for safety and design for reliability. [12]
- 3.(a) Write a note on the aesthetic and ergonomic considerations in product design.  
(b) Discuss the product design for sand castings from the point of view of designing for minimizing the shrinkage defects. [12]
- 4.(a) Explain the following terms:  
Product specification; Product planning; Product strategies  
(b) Differentiate between the harmful and beneficial residual stresses. [12]
5. A solid circular shaft made of steel Fe 620 ( $S_{ut} = 620 \text{ N/mm}^2$  and  $S_{yt} = 380 \text{ N/mm}^2$ ) is subjected to an alternating torsional moment which varies from -200 N-m to +400 N-m. The shaft is ground, and the expected reliability is 90%. Neglecting stress concentration, calculate the shaft diameter for infinite life, using the distortion energy theory of failure. The factor of safety may be taken as 2.0 [12]
6. (a) The work cycle of a mechanical component subjected to completely reversed bending stresses consists of the following elements:  
i)  $\pm 350 \text{ N/mm}^2$  for 85% of time,  
ii)  $\pm 400 \text{ N/mm}^2$  for 12% of time, and  
iii)  $\pm 500 \text{ N/mm}^2$  for 3% of time.  
The material of the component is 50C4 ( $S_{ut} = 660 \text{ N/mm}^2$ ), and the corrected endurance strength of the component is  $280 \text{ N/mm}^2$ . Determine the life of the component.  
(b) Distinguish between the design procedures for surface failure due to adhesive wear and abrasive wear. [12]
- 7.(a) Discuss the effect of dynamic contact stresses in surface failures.  
(b) Write a note on the material and process selection in value engineering. [12]
8. Write short notes on:  
(a) Breakeven analysis  
(b) Ergonomics in engineering design [12]

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