

	Alexandria Higher Institute of Engineering & Technology (AIET)		
	Communications and Computer Departments		2 nd Year
	ME252	Mechanical Engineering	Final, End-of-Semester-3 Exam, Aug.18,2013
	Examiners:	Dr. Rola Afify and Committee	Time: 3 hours

Answer the following questions:-

Part (I)

Question One (15 Marks):

a) Write short notes about :

Elasticity – Plasticity – Stiffness – Resilience – Toughness.

- b) A magnesium alloy has a modulus of elasticity of 45 GN/m^2 , yield strength of 200 MN/m^2 and an ultimate strength 300 MN/m^2 . A rod 12.5 mm in diameter and 300 cm long is to be made using this material. Determine:
- I. The load required to produce an extension of 6.25 mm.
 - II. The load required to produce yielding.
 - III. The maximum load.

Question Two (10 Marks):

A bar of metal $10 \text{ cm} \times 8 \text{ cm}$ in cross section is 25 cm long. It carries a tensile load of 48 tons in the direction of its length, a compressive load of 100 tons on its $10 \text{ cm} \times 25 \text{ cm}$ faces and a tensile load of 90 tons on its $8 \text{ cm} \times 25 \text{ cm}$ faces. If $E = 2 \times 10^6 \text{ kg/cm}^2$ and Poisson's ratio is 0.25, determine the change of the bar volume.

Question Three (10 Marks):

A circular shaft transmitting 80 kilowatt power at 250 rev. per minute; Design a suitable diameter for the shaft, if the maximum torque transmitted exceeds the mean by 30 %. Take the maximum allowable shear stress is not exceeding 70 MN/m^2 .

Question Four (10 Marks):

Two pulleys, one 400 mm diameter while the other 150 mm diameter are on parallel shafts and are 2 m apart and are connected by a crossed belt. Find the length of the belt required and the angle between the belt and each pulley. What is the power transmitted when the larger pulley rotates at 250 r.p.m., if the tension in the tight side is 1 kN and the coefficient of friction between the belt and pulleys is 0.4.

Part (II)

Question Five (15 Marks):

- a) Define the following: System – Boundary – Cycle.
- b) What is the difference between intensive and extensive properties?
- c) The temperature of a system drops by 30°C during a cooling process. Express this drop in temperature in Kelvin's.
- d) Prove that the pressure changes in the vertical direction.
- e) A pressure gauge connected to a tank reads 400 kPa at a location where the atmospheric pressure is 1 bar. Determine the absolute pressure in the tank.
- f) A Barometer reads 760 mm Hg at the bottom of a building. If the building height is 45 m, what would the barometer read at the top of that building. Take the air density as 1 kg/m^3 .