

Code: AE03

Subject: APPLIED MECHANICS

**AMIETE – ET (OLD SCHEME)**

Time: 3 Hours

**JUNE 2012**

Max. Marks: 160

**PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.**

**NOTE: There are 9 Questions in all.**

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 Minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

**Q.1 Choose the correct or the best alternative in the following (2 × 10)**

- Lami's theorem can be applied for
 

(A) 3 concurrent forces	(B) 3 non-concurrent forces
(C) 3 parallel forces	(D) 3 collinear forces
- In plane motion, the acceleration will be
 

(A) non uniform	(B) increasing
(C) uniform	(D) none
- Newton-meter/second is the unit of
 

(A) force	(B) momentum
(C) moment	(D) deflection
- Power transmitted by a circular shaft is given by
 

(A) $\pi DN / 60$ joules	(B) $2\pi NT / 60$ watts
(C) $\pi DNT / 60$ watts	(D) $2\pi NT / 1000$ watts
- Moment of Inertia of an area  $dA$  at a distance  $x$  from a reference axis is
 

(A) $\int x dA$	(B) $\int x^2 dA$
(C) $\int x^3 dA$	(D) $\int x^3 dA$
- A point in a body where the entire weight of the body is assumed to be concentrated is known as
 

(A) axis	(B) center of gravity
(C) moment of inertia	(D) centroid

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- g. A truss having 5 joints and 7 members is termed as \_\_\_\_\_ truss.
- (A) perfect (B) imperfect or deficient  
(C) redundant (D) none
- h. A body isolated from all the members which are connected to it is called the \_\_\_\_\_ body.
- (A) free (B) rigid  
(C) plane (D) solid
- i. Newton-meter is the unit of
- (A) force (B) momentum  
(C) moment (D) deflection
- j. \_\_\_\_\_ deals with relationship between forces and the resulting motion of bodies on which they act
- (A) Dynamics (B) Statics  
(C) Kinetics (D) Kinematics

**Answer any FIVE Questions out of EIGHT Questions.**  
**Each question carries 16 marks.**

- Q.2** a. State the parallelogram of forces and find an expression for the resultant of forces. (6)
- b. A smooth sphere weighing 200 N is lying in a triangular groove as shown in Fig.1. Draw the free body diagram and find the reactions at the surfaces of contact, assuming surfaces of groove to be smooth. (10)

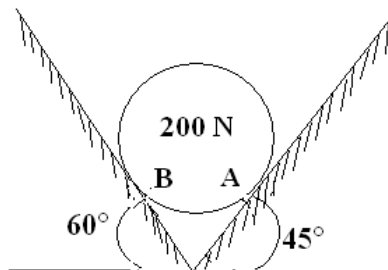


Fig. 1

- Q.3** a. Define
- (i) perfect frame  
(ii) deficient frame  
(iii) redundant frame (6)

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- b. Determine the forces and give their nature in all the members of the truss shown in Fig.2. (10)

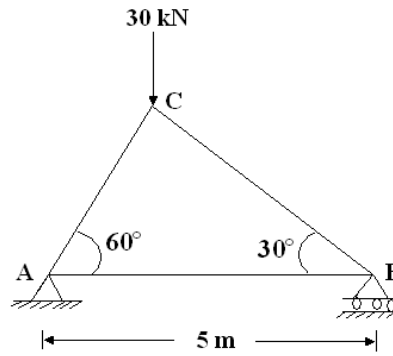


Fig. 2

- Q.4 a. Give the equations of equilibrium for coplanar  
 (i) non-concurrent force systems (ii) concurrent force system. (4)
- b. Locate the centroid of the shaded area shown in Fig.3 (12)

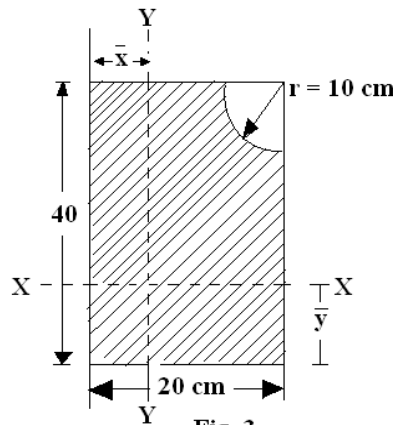


Fig. 3

- Q.5 a. Define  
 (i) point of contra flexure (ii) bending moment (3)
- b. Determine shear force and bending moments and construct the shear force and bending moment diagrams for the beam loaded as shown in Fig.4 (13)

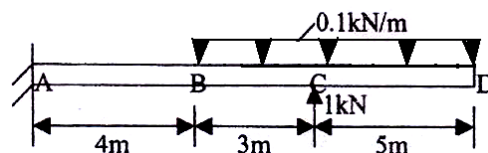


Fig. 4

- Q.6 a. Define  
 (i) D'Alembert's principle (ii) Rectilinear translation (4)
- b. A steel shaft transmits 105 kW at 160 rpm. If the shaft is 100 mm in diameter, find the torque on the shaft and the maximum shearing stress induced. Find also the twist of the shaft in a length of 6 m. Take  $G = 8 \times 10^4 \text{ N/mm}^2$  (12)

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- Q.7**
- a. A solid circular shaft of 3 m length and 200 mm diameter is subjected to torque of 100 kN-m. Find the relative rotation between the end cross section of the shaft. Take  $G = 1 \times 10^5 \text{ N/mm}^2$  (8)
  - b. A wooden tie is 60 mm wide, 120 mm deep and 1.5 m long. It is subjected to an axial pull of 30 kN. The stretch of the member is found to be 0.625 mm. Determine Young's modulus of the tie material. (8)
- Q.8**
- a. Derive the equations for the centre of pressure of a vertical lamina. (8)
  - b. A rectangular plate 1 m wide and 1.5 m deep is held vertically in water so that its upper edge is 1.25m below the free water surface. Find the total pressure on one face of the plate and the depth of the centre of pressure. Sp. Wt. Of water =  $9810 \text{ N/m}^3$ . (8)
- Q.9**
- a. Describe the working of any turbine with the help of a sketch. (6)
  - b. State the Bernoulli equation with its assumption. (5)
  - c. Describe flow around cylindrical body. (5)