

# AMIETE – ET (OLD SCHEME)

Code: AE03  
Time: 3 Hours

**DECEMBER 2010**

Subject: APPLIED MECHANICS  
Max. Marks: 100

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.
- 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: (2x10)**

a. Polar moment of inertia of a rectangular area of width 'b' and depth 'd' is

(A)  $\frac{bd(b^2 + d^2)}{24}$

(B)  $\frac{bd(b^3 + d^3)}{12}$

(C)  $\frac{bd(b^3 + d^3)}{24}$

(D)  $\frac{bd(b^2 + d^2)}{12}$

b. If the diameter of shaft is doubled its stiffness increases by a factor of

(A) 4

(B) 8

(C) 16

(D) 32

c. A force of 30 N acts on a particle at an angle of  $60^\circ$  with the horizontal. If the particle moves horizontally by 1.5 m, the work done by the force is

(A) 22.5 J

(B) 12.5 J

(C) 17.5 J

(D) 7.5 J

d. If 'L' is the side of a square plate, then M.O.I about the diagonal of the plate is given by

(A)  $L^2 / 24$

(B)  $L^2 / 12$

(C)  $L^2 / 6$

(D)  $L^2 / 3$

e. A truck is travelling at a speed of 60 km/hr for first 60 km and travels at a speed of 20km/hr for next 60 km. Its average speed would be

(A) 30 km/hr

(B) 45km/hr

(C) 60km/hr

(D) 50 km/hr

f. In a cantilever beam the bending moment is maximum at

(A) the center

(B) the free end

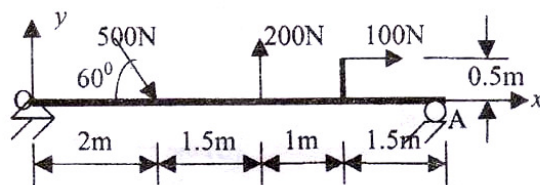
(C) the fixed end

(D) any point on the beam

- g. While analyzing a truss, it has been assumed that the members are non-rigid  
 (A) True (B) False
- h. Which of the following equation is an equation of motion  
 (A)  $v = u + at^2$  (B)  $v^2 - u^2 = 2at$   
 (C)  $s = ut + \frac{1}{2}at^2$  (D)  $u = s + at$
- i. 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
- j. The ratio of maximum horizontal shear stress to the mean stress in a circular beam is  
 (A)  $3 / 4$  (B)  $1 / 4$   
 (C)  $1 / 2$  (D)  $4/3$

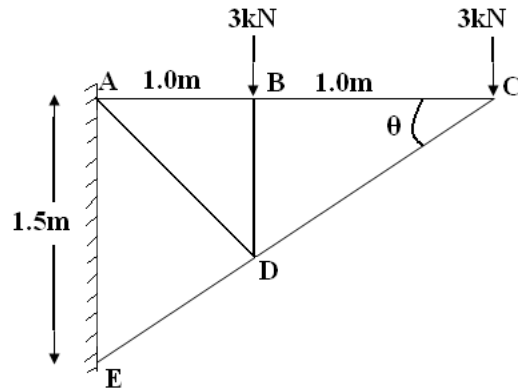
**Answer any FIVE Questions out of EIGHT Questions.  
 Each question carries 16 marks.**

- Q.2** a. State the principle of *Polygon law of forces* (4)  
 b. A beam is subjected to various loads as shown in Fig.1 Determine the magnitude, direction and location of the resultant force. (12)



**Fig.1**

- Q.3** a. What are the assumptions to be made for analysis of force in trusses? (4)  
 b. A the pin jointed plane truss is subjected to forces as shown in Fig.2. Using method of joints, determine the forces in all the members of the trusses. Tabulate the results. (12)



- Q.4** a. Differentiate between angle of friction and angle of repose (4)
- b. A ladder with negligible self weight is resting against a vertical wall at an angle of  $30^\circ$ . A man weighing 0.75 kN climbs the ladder. Find the maximum distance along the length of the ladder, just before the ladder slips when the man is climbing it. Assume coefficient of friction between the ground and ladder as 0.4. (12)
- Q.5** a. Show that kinetic energy of rotation of a rigid body =  $(1/2) I \omega^2$ , where 'I' is mass moment of inertia and ' $\omega$ ' is angular velocity (6)
- b. A particle moves with a velocity  $v = (3t^2 - 6t)$  m/sec. To start with (at  $t=0$ ) the particle is at origin. Find the time 't' at which the velocity changes its sign. During the time interval  $t = 0$  to  $t = 3.5$  sec, determine (10)
- (i) the distance travelled
- (ii) average velocity
- (iii) average speed
- Q.6** a. State the Bernoulli equation with its assumptions. (5)
- b. Calculate the maximum allowable discharge of water through a venturi meter, throat 5 cm, fitted in a 10 cm diameter line with its inlet at an open channel. Assumes  $C_d = 0.95$ . (11)
- Q.7** a. Define (i) Buoyancy (ii) Control volume (iii) Drag (iv) Turbulence (6)
- b. A circular shaft of 50 mm diameter is subjected to torsional load of 1000 N. Determine the maximum shear stress and the angle of twist. (10)
- Q.8** Cantilever beam 4 meter long is subjected to various forces and bending moment as shown in Fig.3 Determine shear force and bending moment and draw SFD and BMD. Also determine the point of contraflexure. (16)

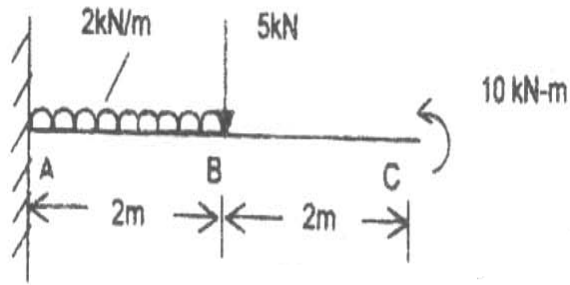


Fig.3

- Q.9** A simply supported beam of I-section shown in Fig.4 is subjected to UDL over its entire length of span. The length of span of the beam is 4 m. The maximum tensile stress the beam can withstand due to the applied UDL is  $15 \times 10^3$  kPa. Determine the value of UDL/m length. Also determine the maximum compressive stress. (16)

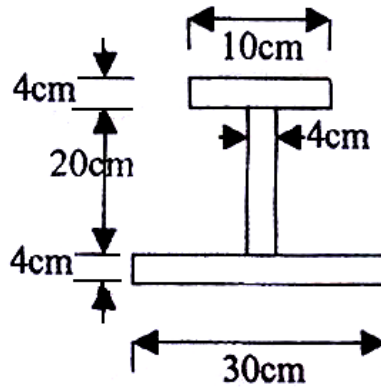


Fig.4