AMIETE – ET (OLD SCHEME)

Code: AE03   **Subject: APPLIED MECHANICS**
Time: 3 Hours   **Max. Marks: 100**

DECEMBER 2009

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. Moment vector of a couple is
      (A) a free vector
      (B) a fixed vector
      (C) Neither a free vector nor a fixed vector
      (D) a scalar quantity

   b. The moment of inertia of a thin ring of mass m and radius R about any diameter is

      (A) mR^2 **(B)** $\dfrac{mR^2}{2}$

      (C) $\dfrac{mR^2}{4}$ **(D)** $\dfrac{mR^2}{8}$

   c. A beam carries transverse loads & is simply supported with overhang on the both sides. The point of contra flexure is a point where
      (A) shear force is maximum
      (B) shear force is minimum
      (C) bending moment is maximum
      (D) bending moment changes sign

   d. The limiting force of friction between two contacting materials depend on
      (A) only normal reaction
      (B) only the properties of contact surfaces
      (C) both on normal reaction & properties of contact surfaces
      (D) None of these

   e. The principle of virtual work states that the virtual work should be zero for
      (A) a body moving with constant velocity
      (B) a body rotating with angular velocity
      (C) a body in equilibrium
      (D) none of these

f. A simply supported beam of length L carries a uniformly distributed load ω/unit length. The maximum BM at the centre is

(A) $\dfrac{\omega L}{4}$

(B) $\dfrac{\omega L}{8}$

(C) $\dfrac{\omega L^2}{4}$

(D) $\dfrac{\omega L^2}{8}$

g. At a point in a body subjected to two perpendicular normal stresses & a shear stress, the plane at which the principle stresses occur, the value of the shear stress is

(A) Maximum

(B) Minimum

(C) zero

(D) arbitrary value

h. A rectangular block of ice floats on the surface of water contained in a rectangular tank. When ice melts completely the level of water will

(A) remain same

(B) rise

(C) fall

(D) depend on temperature of water

i. For two shafts connected in series, choose the correct statement

(A) Shear stress in each shaft is the same

(B) Torsional stiffness of each shaft is the same

(C) torque in each shaft is the same

(D) none of these

j. The property of the material to store strain energy is called

(A) Toughness

(B) resilience

(C) malleability

(D) rigidity

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

Q.2   (i) What are the conditions for the equilibrium?   **(2)**

(ii) Find the reactions at the supports given in Fig.1   **(14)**
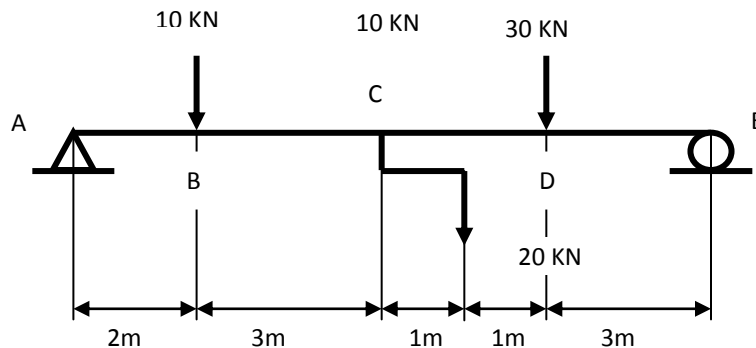

Fig.1

Q.3   Cylinders A & B weigh 500 N & cylinders C weighs 1000 N as shown in

Fig.2. compute all contact forces **(16)**

(8)

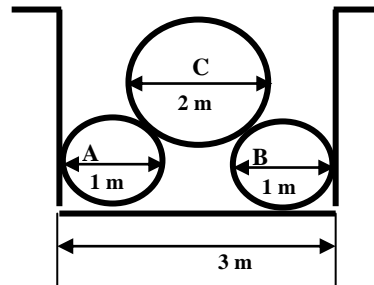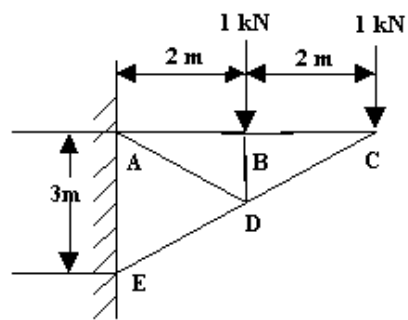**Fig.2**

Q.4   Find the magnitude and nature of forces in all the members of a truss as shown in Fig.3. **(16)**

Q.5   ıt tl
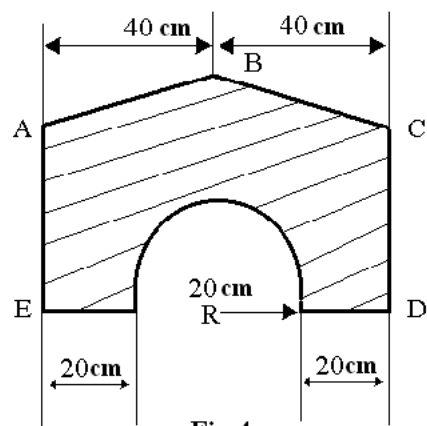

Fig.4

Q.6   a.

b. A hollow steel shaft having a length of 3m has outside & inside diameters of 10 cm & 6.25 cm respectively. Find the length, value of the applied torque, and the angle of twist, if maximum shear stress is 475 N/cm^2 and modulus of rigidity is 825 x 10^3 N/cm^2. What will be torque on the same shaft if it is solid having the same length and subjected to same maximum stress?

(10)

Q.7 a. What is elastic strain energy? Write its equation. **(4)**

(4)

b. Draw the shear force diagram and bending moment diagram for the beam as shown in Fig.5. **(12)**
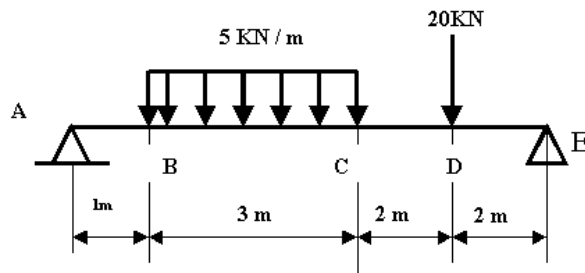

Fig.5

Q.8   A gate ABC, 2 m wide holds a 3 m high stationary column of water as shown in Fig.6. Calculate the tension in the string SA and the reaction at the hinge C. **(16)**
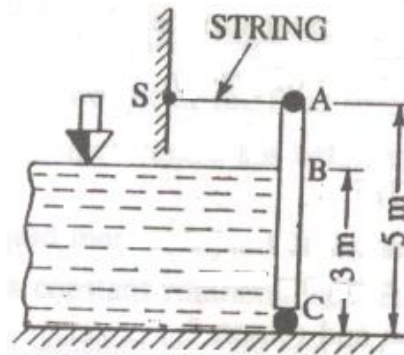

Fig.6

Q.9   What is a turbine. ....rifugal pump with a labelled sketch. **(16)**