ROLL NO. _____

Code: AE03 **Subject: APPLIED MECHANICS**

AMIETE – ET (OLD SCHEME)

Time: 3 Hours **DECEMBER 2011** **Max. Marks: 100**

NOTE: There are 9 Questions in all.

- **Please write your Roll No. at the space provided on each page immediately after receiving the Question Paper.**
- **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)**

a. On which of the following parameters the moment of inertia of a body does not depend?

(A) Distribution of mass in the body
(B) Mass of the body
(C) Angular velocity of the body
(D) All of the above

b. _____ is the maximum frictional force which comes in to play when a body just begins to slide over another surface

(A) Dynamic friction **(B)** Sliding friction
(C) Limiting friction **(D)** Rolling friction

c. Jet engine works on the principle of

(A) Conservation of linear momentum
(B) Conservation of mass
(C) Conservation of energy
(D) Conservation of angular momentum

d. In case of simply supported beam carrying several concentrated loads the shear force would be maximum

(A) Under the smallest load **(B)** Under the largest load
(C) At mid open **(D)** At either of the supports

e. A cantilever 'AB' of length 'l' has a moment 'M' applied at its free end. The deflection at the free end 'b' is given as

(A) $\frac{M^2 l}{EI}$ **(B)** $\frac{Ml^2}{2EI}$

(C) $\frac{M l}{2EI}$ **(D)** $\frac{M^2 l}{2EI}$

f. The ratio of lateral strain to linear strain is known as

(A) Modulus of elasticity **(B)** Modulus of rigidity
(C) Poisson's ratio **(D)** Elastic limit

g. Which one of the following statements is correct? A rigid body in translation

(A) Can move along a straight or curved path
(B) Can only move in straight line
(C) Cannot move on a circular path
(D) Must undergo curvilinear motion

h. Regarding 'frequency of a vibrating string', which of the following statement is correct?

(A) It is inversely proportional to the square root of the mass parameter for unit length.
(B) It is inversely proportional to the diameter of the string
(C) It is directly proportional to the square root of the mass per unit length
(D) None of the above

i. The force which produces an acceleration of $1 m/s^2$ in a mass of 1 kg is called

(A) One Newton **(B)** One Joule
(C) One watt **(D)** None of the above

j. The type of fluid flow in which the velocity at any given time does not change with respect to space is called

(A) Steady flow **(B)** Compressible flow
(C) Uniform flow **(D)** Rotational flow

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

Q.2 Using the method of joints, find the axial forces and nature in all the members of a truss with the loading as shown in Fig.1. **(16)**

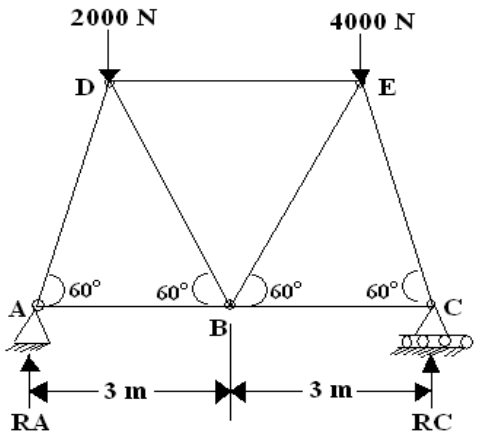

Fig. 1

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Q.3 a. Define moment of inertia and centroid of a body. **(6)**

b. Find the moment of inertia of the section as shown in Fig.2 about the centroidal axis XX perpendicular to the web. **(10)**

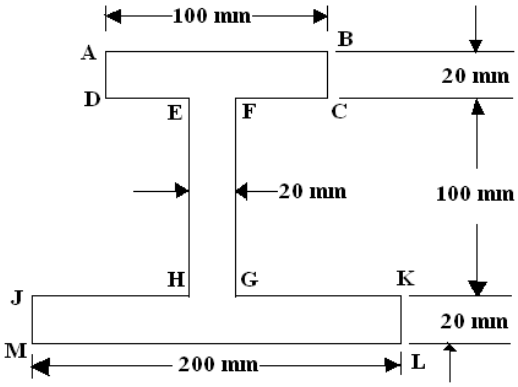

Fig. 2

Q.4 a. Explain the work and energy principle for a system for of particles. **(4)**

b. Two blocks 'A' and 'B' of masses 100kg and 150 kg are connected by a string as shown in Fig. 3. If the system is released from the rest find the velocity of the block 'A' after it has moved a distance of 1 m. Assume the coefficient of friction between the block 'A' and the horizontal plane μ=0.20. **(12)**

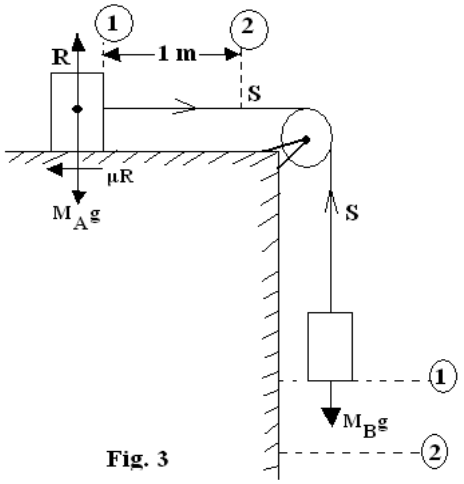

Fig. 3

Q.5 A beam 'AB' 10 meters long has supports at its end 'A' and 'B'. It carries a point load of 5 kN at 3 meters from 'A' and a point load of 5 kN at 7 meters from 'A' and a uniformly distributed load of 1 kN per meter between the point loads. Draw SF and BM diagrams for the beam. **(16)**

Q.6 a. Explain Hook's law and Poisson's ratio. **(6)**

b. The shaft shown in Fig.4, rotates at 200 rpm with 30 kW and 15 kW taken off at 'A' and 'B' respectively and 45 kW applied at 'C'. Find the maximum shear stress developed in the shaft and the angle of twist of the gear 'A' relative to 'C'. Assume G=8.5 × 10^4 N/mm^2 **(10)**

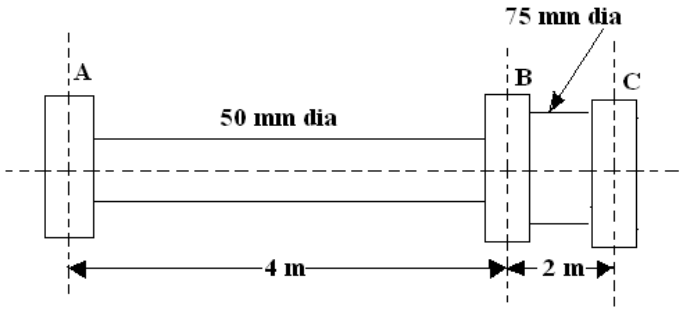

Fig. 4

Q.7 a. Explain the principle of impulse and momentum. **(6)**

b. A bullet travelling horizontally with a velocity of 600 m/s and weighing 0.25 N strikes a wooden block of weight 50 N resting on a rough horizontal floor (Fig.5). If the bullet remains embedded in the block, find the velocity of the block. **(10)**

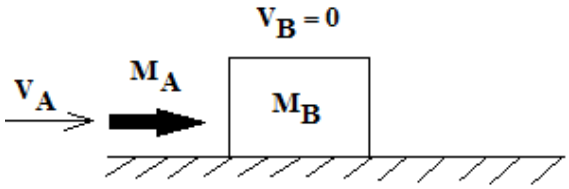

Fig. 5

Q.8 a. Define the terms:

(i) Boundary layer
(ii) Boundary layer thickness
(iii) Drag and lift. **(6)**

b. The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The centre of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe, if the difference of mercury level in the two limbs is 20 cm. **(10)**

Q.9 a. State Bernoulli's theorem and explain what are the assumptions made for its derivation. **(8)**

b. If for a two dimensional potential flow, the velocity potential is given by $\phi = x(2y-1)$. Determine the velocity at the point P(4, 5). Determine also the value of stream function ϕ at the point P. **(8)**