USN | | | | | | | | | | |

06CIV13/23

First/Second Semester B.E. Degree Examination, December 2011
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions choosing at least two from each part.*
2. Answer all objective type questions only in OMR sheet page 5 of the Answer Booklet.
3. Answers to objective type questions on sheets other than OMR will not be valued.

PART - A

1 a. Choose the correct answer : **(04 Marks)**

i) The discipline which deals with sub – structure is called as
(A) Structural Engg. (B) Environmental Engg.
(C) Geo – technical Engg. (D) None of these.

ii) The minimum breadth of a national highway is
(A) 45m (B) 15m (C) 30m (D) 60m

iii) Krishnaraja Sagar dam is an example for
(A) Gravity dam (B) Earth dam (C) Arch dam (D) None of these

iv) The Howrah bridge and K.R. Puram bridge are the examples for
(A) Arch bridge (B) Hanging bridge (C) Skew bridge (D) Steel bridge

b. Explain how the infrastructure development will help the growth of economy of the country. **(05 Marks)**

c. Explain the following parts of a highway with a neat sketch :
i) Kerb ii) Camber iii) Formation width. **(06 Marks)**

d. Draw a neat sketch of the cross – section of the earthen dam. **(05 Marks)**

2 a. Choose the correct answer : **(04 Marks)**

i) In the SI system, the unit of force and power are respectively
(A) Newton & Watt (B) Newton & Joule
(C) Newton & Pascal (D) Newton & Hertz

ii) The principle of transmissibility can be applied when the body is treated as
(A) Particle (B) Rigid body (C) Deformable (D) a continuum

iii) Mathematical statement of the law of triangle of forces is
(A) Sine law (B) Cosine law
(C) Law of parallelogram of forces (D) Law of polygon of forces

iv) The action of a given system of forces on a rigid body will no way be changed if we add or subtract from them another system of forces in equilibrium is called
(A) Law of superposition (B) Law of transmissibility
(C) Free body diagram (D) Law of gravitational force

b. List and explain the concepts of Engineering Mechanics. **(06 Marks)**

c. In a triangle ABC, the sides AB, BC and AC are of distances 6m, 8m and 10m respectively. A force at 'A' produces a clockwise moment of 90kN-m at B and an anti clockwise moment of 45 kN-m at C. Find the magnitude and direction of the force. **(10 Marks)**

3 a. Choose the correct answer : **(04 Marks)**

i) Two forces equal in magnitude act at a point. The angle between the lines of action of these two forces is 60^0. If the resultant of these two force is 50N, the magnitude of the force is
(A) 25.88N (B) 50N (C) 28.87N (D) 25N

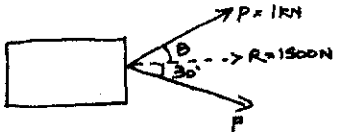
ii) The angles between two forces to make their resultant a minimum and a maximum respectively are
(A) 0 & 90 (B) 180 & 90 (C) 180 & 0 (D) 0 & 270

iii) A bar under tension is called as
(A) Strut (B) Tie (C) Flexible string (D) None of these

iv) The resultant of two forces P & Q is 'R' which acts at right angle to the force P. Then the angle between P & Q is
(A) $\cos^{-1}(-P/Q)$ (B) $\cos^{-1}(-Q/P)$ (C) $\sin^{-1}(-P/Q)$ (D) $\sin^{-1}(-Q/P)$

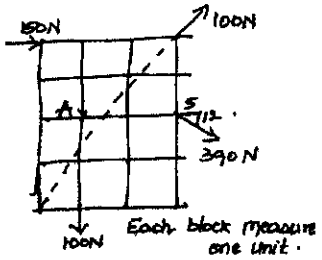
b. A vehicle is pulled by means of two ropes as shown in fig. Q3(b). If the resultant pull is 1500N, find the angle θ and the force F. **(06 Marks)**

Fig.Q3(b)



c. The force 390N, is shown in fig. Q3(c), is the resultant of four forces. Out of them, 3 forces are shown in the fig.Q3(c). Find the magnitude and direction of the force and its position with respect to point A. **(10 Marks)**

Fig.Q3(c)



4 a. Choose the correct answer : **(04 Marks)**

i) Centroid refers to a figure, which has
(A) Volume (B) Weight (C) Plane lamina (D) None of these

ii) The centroid of a equilateral triangle of side "b" from the base is
(A) $h/3$ (B) $\frac{b}{2}$ (C) $\frac{\sqrt{3}}{6}b$ (D) $\frac{\sqrt{5}}{2}b$

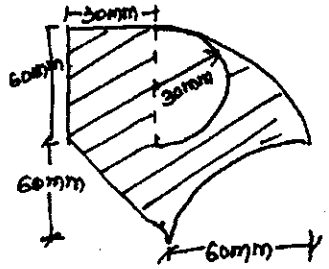
iii) Centroid should always lie in the
(A) lamina (B) outside the lamina (C) either A or B (D) None of these

iv) While defining the radius of gyration the object is considered as
(A) thin lamina (B) irregular object
(C) regular object of size L × B (D) None of these

b. Derive an expression for the centroid of the semi circular lamina, when its base is placed on the ordinate. **(06 Marks)**

c. Locate the centroid of the lamina shown in figure Q4(c). **(10 Marks)**

Fig.Q4(c)



PART - B

5 Choose the correct answer : **(04 Marks)**

a. i) The force which cancels the effect of the force system is known as
(A) Resultant (B) Neural force (C) Balancing force (D) Equilibriant

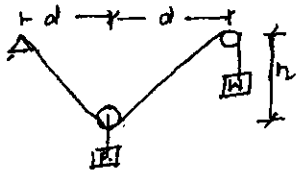
ii) Reaction force at the contact surface is
(A) Internal force (B) Applied force (C) either A or B (D) Neither A nor B

iii) If the resultant of all the forces is not equal to zero, then the object will have
(A) Rotary motion (B) Translatory motion (C) Both A & B (D) None of these

iv) The object is in equilibrium means
(A) R = 0 ; moves in the opposite direction or remains at the same point.
(B) R = 0 ; moves in the same direction or remains at the same point.
(C) $\Sigma H = +P$ & $\Sigma V = -P$; and moves in its same direction.
(D) None of the above.

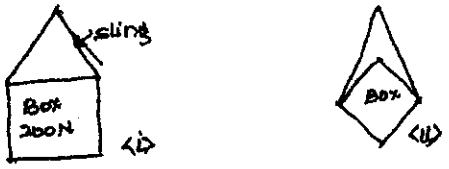
b. In the fig. Q5(b), determine the value 'h' if W = 80N, P = 100N and d = 20cm. **(06 Marks)**

Fig.Q5(b)



c. The figs. Q5(c) (i) and (ii) show two alternatives for lifting a 80cm square box, using a sling 7m long. The weight of the box is 200N. Which alternative would place lesser tension? **(10 Marks)**

Fig.Q5(c)



6 Choose the correct answer : **(04 Marks)**

a. i) A beam AB of length 4m supports 4kN from the left support, at a distance of 3m. Then, the reactions in supports A & B respectively are
(A) 3 & 1 (B) 3.5 & 0.5 (C) 2 & 2 (D) 1 & 3

ii) A beam has one end fixed and other end is simply supported ; then it is called as a
(A) Fixed beam (B) Propped cantilever (C) Simply supported (D) Overhung beam

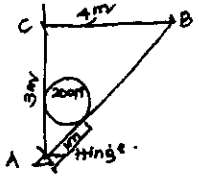
iii) A water tank placed on a beam produces _____ load.
(A) UVL (B) Point (C) UDL (D) None of these

iv) The number of reactions in the roller support are
(A) 1 (B) 2 (C) 3 (D) 0

b. Explain different type of loads applied on a beam. **(04 Marks)**

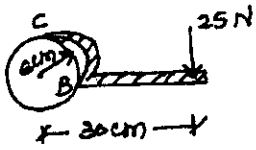
c. Determine the reaction at the hinge and tension in string in the figure Q6(c). **(07 Marks)**

Fig.Q6(c)



d. Determine the forces exerted on the cylinder at B and C shown in figure Q6(d). **(05 Marks)**

Fig.Q6(d)



7 Choose the correct answer : **(04 Marks)**

a. i) Coulomb's law of friction can be applied to
(A) Fluid friction (B) Lubricated friction
(C) Dry friction (D) Fluid structure interaction

ii) At the point of impending motion, the static friction is
(A) zero (B) maximum (C) minimum (D) infinite

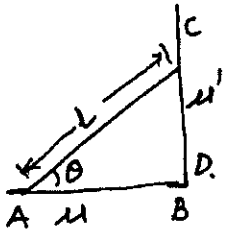
iii) Angle of friction is given as
(A) $\sin^{-1}\mu$ (B) $\cos^{-1}\mu$ (C) $\tan^{-1}\mu$ (D) $\cot^{-1}\mu$

iv) When a block of weight W, resting on a rough inclined plane of inclination θ does not slide, then the frictional force acting on it is
(A) Wsin θ (B) Wcos θ (C) μ Wsin θ (D) μ Wcos θ

b. Define i) coefficient of friction ii) cone of friction iii) angle of friction. **(06 Marks)**

c. A homogeneous bar of length 'ℓ' placed between two perpendicular rough walls AB & CD as shown in fig.Q7(c). Show that the angle of inclination is $\tan^{-1}\left[\frac{1-\mu\mu^1}{2\mu}\right]$. **(10 Marks)**

Fig.Q7(c)



8 Choose the correct answer : **(04 Marks)**

a. i) The moment of inertia of a square of side 'a' on the diagonal axis is
(A) $\frac{a^4}{6}$ (B) $\frac{a^4}{12}$ (C) $\frac{a^4}{8}$ (D) $\frac{a^4}{10}$

ii) Which of the following physical quantities can be positive or negative?
(A) I_{xx} (B) I_{yy} (C) I_{xy} (D) I_p

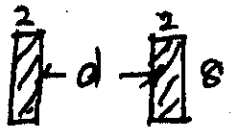
iii) I_{zz} of right angle of a triangle of base 'b' and height 'h' is
(A) $\frac{bh}{36}[h^2+b^2]$ (B) $\frac{bh}{36}[h^2-b^2]$ (C) $\frac{bh}{36}[h-b]^2$ (D) $\frac{bh}{36}[h+b]^2$

iv) The polar moment of inertia of a circular area of diameter D is
(A) $\frac{\pi D^4}{64}$ (B) $\frac{\pi D^4}{32}$ (C) $\frac{\pi D^4}{16}$ (D) $\frac{\pi D^4}{8}$

b. Find the moment of inertia on the symmetrical axis of the isosceles triangle. **(06 Marks)**

c. Determine the distance between two plates of 2cm × 8cm, so that $I_{xx} = I_{yy}$. Refer fig.Q.8(c). **(10 Marks)**

Fig.Q8(c)



*****