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06CIV13/23

First/Second Semester B.E. Degree Examination, June-July 2009
Elements of Civil Engineering & Engineering Mechanics

Time: 3 hrs. Max. Marks:100

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

PART - A

1 a. i) A branch of civil engineering dealing with the technical measures to use and protect the components of environment is

A) Transportation engineering B) Hydraulics engineering
C) Geotechnical engineering D) Environmental engineering

ii) Composite material consisting of cement concrete and steel used in civil engineering structural construction is

A) Prestressed concrete (PSC) B) Reinforced cement concrete (RCC)
C) Fibre reinforced concrete (FRC) D) Plain cement concrete(CC)

iii) Highways which are superior to National Highways and are provided wherever volume of traffic is very high are

A) State Highways B) Roadways C) airways D) Expressways

iv) A bridge constructed at some angle to river flow is

A) Skew bridge B) Square bridge C) Steel bridge D) Lift bridge **(04 Marks)**

b. Bring out briefly scope of following specialization of civil engineering :
i) Structural engineering ii) Transportation engineering **(08 Marks)**

c. Write a brief note on role of civil engineering in infrastructure development. **(08 Marks)**

2 a. i) Forces whose lines of action lie along the same line are

A) Coplanar parallel forces B) Collinear forces
C) Coplanar concurrent forces D) Coplanar non-concurrent forces.

ii) An object regarded as only mass but no size in mechanics is

A) Point force B) Rigid body C) Deformable body D) Particle

iii) Moment of a force about a moment centre is the measure of its

A) Translatory effect B) rotational effect C) Both a & b D) None of the above

iv) The translatory affect of a couple on the rigid body is

A) Positive B) Negative C) Zero D) None **(04 Marks)**

b. State and explain basic idealizations in mechanics. **(06 Marks)**

c. Find moment of force about A and B for the 30 KN force shown in fig.2(c).

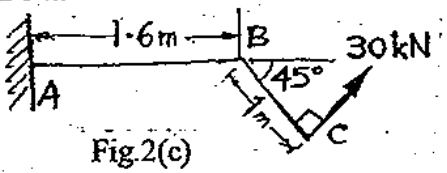

Fig.2(c) **(05 Marks)**

d. A door needs 7500 N-mm to open it. Mr.X applies the force at the edge of the door shutter which is at a distance of 750 mm from hinge and Mr. Y applies it at a distance of 500 mm from the hinge. What forces have they to apply to open the door? **(05 Marks)**

3 a. i) Component of a force at rt-angles to its line of action is

A) Zero B) Positive C) Negative D) None of the above

ii) If two concurrent forces each of P act at right angles to each other, their resultant is

A) 2P B) P C) $P\sqrt{2}$ D) $2\sqrt{P}$

iii) The resultant force of two concurrent forces become maximum and minimum if angle between them is

A) 0^0 and 180^0 B) 0^0 and 90^0 C) 90^0 and 0^0 D) None

iv) A rigid body acted upon by coplanar non-concurrent forces system has

A) Both translatory and rotary motion

B) Translatory motion in one direction and rotary motion about itself

C) Under rest completely

D) All of the above **(04 Marks)**

A truck is to be pulled along a straight road as shown in Fig.3(b).

b. i) If the force applied along rope A is 5 kN inclined at 30^0, what should be the force in the rope B, which is inclined at 20^0, so that vehicle moves along the road?

ii) If force of 4 KN is applied in rope B at what angle rope B should be inclined so that the vehicle is pulled along the road?

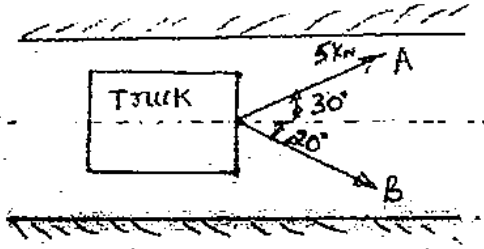

Fig.3(b)

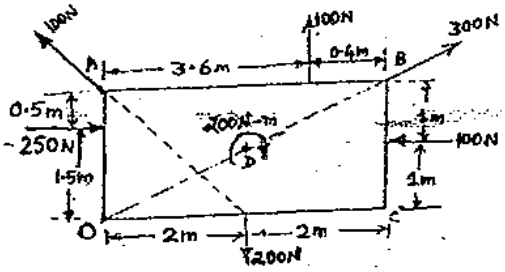

Fig.3(c) **(06 Marks)**

c. Determine the magnitude, direction and point of application of the resultant force for the system of coplanar forces shown in Fig.3(c). Locate position w.r.t. 'O'. **(10 Marks)**

4 a. i) Centroid of plane is the point at which

A) Volume of body concentrated B) surface area is assumed to be concentrated

C) Weight of the body assumed to be concentrated D) All the above

ii) Centroid of quarter of circular lamina lies from diameter line at a distance of

A) $\frac{2R}{3\pi}$ B) $\frac{3R}{3\pi}$ C) $\frac{4R}{3\pi}$ D) $\frac{5R}{3\pi}$

iii) Centroid of trapezim of height 'h' and parallel sides 'a' and 'b'. measured from base b is at a distance of

A) $\frac{h}{2}\left(\frac{b+2a}{a+b}\right)$ B) $\frac{h}{2}\left(\frac{b-2a}{a+b}\right)$ C) $\frac{h}{3}\left(\frac{b+2a}{a+b}\right)$ D) $\frac{h}{3}\left(\frac{b-2a}{a+b}\right)$

iv) The centroid of a triangular lamina of height 'h' is situated at a distance ___ from its apex.

A) $h/3$ B) $2h/3$ C) $h/2$ D) $h/4$ **(04 Marks)**

b. Locate centriod of quadrant of circular lamina from first principle. **(06 Marks)**

c. Locate centroid of lamina shown in Fig,4(c). with respect to point A.

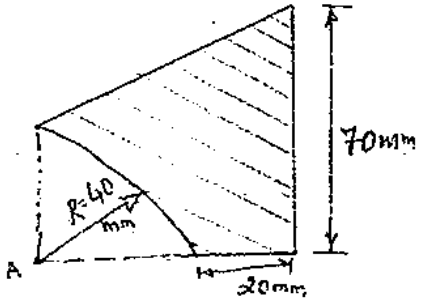

Fig.4(c) **(10 Marks)**

PART - B

5 a. i) A rigid body is in equilibrium if the resultant force of concurrent force system is
A) Positive B) Negative C) Zero D) None of these

ii) A system of force that possesses resultant force move in
A) the direction of line of action of resultant
B) opposite to the direction of line of action of resultant
C) perpendicular to the direction of line of action of resultant
D) none of the above

iii) Lamis theorem valid for
A) Two concurrent forces in equilibrium B) Four concurrent forces in equilibrium
C) Three concurrent forces in equilibrium D) None of the above

iv) For a smooth spherical surface reaction acts
A) Horizontal to the plane of contact B) Inclined to the plane of contact
C) Perpendicular to the plane of contact D) None of the above. **(04 Marks)**

b. Investigate whether the given system of forces shown in Fig.5(b)(i) and (ii) are in equilibrium or not. If not state the type of motion that exist.

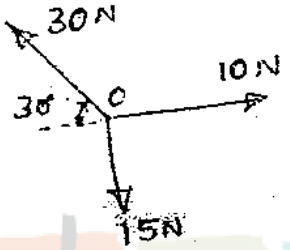

Fig.5(b) (i)

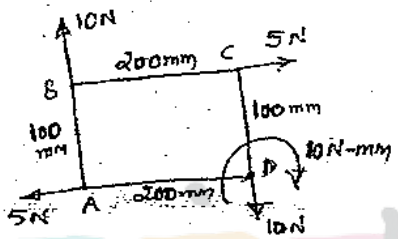

Fig.5(b) (ii)

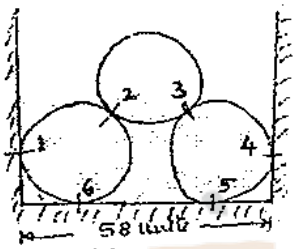

Fig.5(c) **(06 Marks)**

c. Three cylinders weighing 500N each 24 units in diameter are placed in channel as shown in Fig.5(c). Determine reactions at all contact points. Take cylinders are smooth. **(10 Marks)**

6 a. i) Reaction line at roller support with respect to plane of contact is
A) Oblique B) Obtuse C) Perpendicular D) None

ii) Support reactions for statically determined beams can be determined by applying
A) Conditions of static equilibrium B) Lamis theorem
C) Varignons principle D) None of the above

iii) When load acts at constant rate over given length of beam it is called
A) Point load B) u d l C) u v l D) None

iv) A beam having one end hinged support and other roller support subjected to vertical loading can be regarded as
A) Fixed beam B) Cantilever beam
C) Simply supported beam D) None of the above **(04 Marks)**

b. With sketch, explain different types of supports and mark reaction line. **(06 Marks)**

c. A beam ABCDE has a flexible link BC as shown in Fig.6(c). Determine the support reaction at A, D and E.

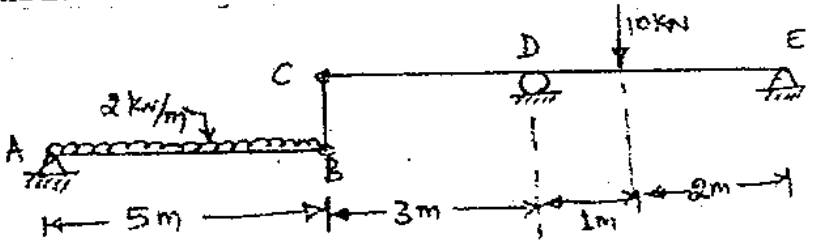

Fig.6(c) **(10 Marks)**

7 a. i) The maximum frictional force developed when a body just begins to slide over the surface of an another body is

A) Sliding friction B) Rolling friction C) Limiting friction D) None

ii) The angle which an inclined surface makes with the horizontal when a body placed on it is in the verge of moving down, is called

A) angle of repose B) angle of friction C) angle of inclination D) None

iii) Frictional force is independent of

A) coefficient of friction B) angle of friction

C) shape and size of surface of contact D) none of the above

iv) Compared to static friction, Kinetic friction is

A) Greater B) Smaller C) Very large D) Zero **(04 Marks)**

b. Briefly explain : i) Angle of friction ii) Angle of repose and iii) Cone of friction **(06 Marks)**

c. A uniform bar AB 5m long weighing 280N is hinged at B, rest upon 400N block at A as shown in Fig.7(c). If coefficient of friction is 0.4 for all contact surfaces, find the horizontal force P required to move the 400N block.

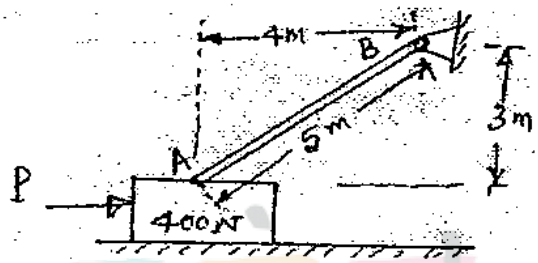

Fig.7(c) **(10 Marks)**

8 a. i) Moment of inertia is a

A) First moment of area B) Second moment of area

C) Third moment of area D) None of the above

ii) M.I. of circular section about centroidal axis is

A) $\frac{\pi D^4}{48}$ B) $\frac{\pi D^4}{32}$ C) $\frac{\pi D^4}{64}$ D) $\frac{\pi D^4}{128}$

iii) M.I. of triangular section about base having base 'b' and heigh 'h' is

A) $\frac{bh^3}{36}$ B) $\frac{bh^3}{12}$ C) $\frac{bh^3}{64}$ D) none

iv) M.I. of hollow circular section whose external diameter is 8mm and internal diameter 4mm about centroidal axis is

A) 437.5 mm^4 B) 337.5 mm^4 C) 237.5 mm^4 D) 137.5 mm^4 **(04 Marks)**

b. State and prove Perpendicular axis theorem. **(06 Marks)**

c. Compute Moment of Inertia of the shaded area about centroidal axis shown in Fig.8(c).

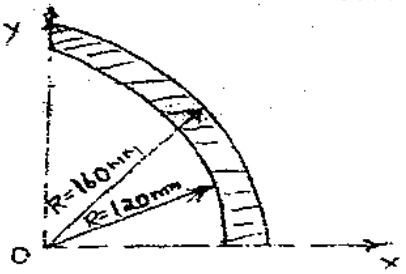

Fig.8(c) **(10 Marks)**

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