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

10CIV13/23

First/Second Semester B.E. Degree Examination, January 2013
Elements of Civil Engineering and Engineering Mechanics

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Choose the correct answers for the following : **(04 Marks)**

i) A branch of civil engineering that deals with testing soils and foundation design is called:
A) Geotechnical engineering B) Structural engineering
C) Environmental engineering D) Highway engineering

ii) Highways which are superior to National Highways and are provided wherever volume of traffic is very high are:
A) Airways B) Expressways C) Roadways D) District roads

iii) Composite material made using cement concrete and steel is called:
A) Plain cement concrete B) Composite cement concrete
C) Reinforced cement concrete D) Prestressed cement concrete

iv) A bridge constructed at some angle to river flow is:
A) Bascule bridge B) Square bridge C) RCC bridge D) Skew bridge

b. Write a note on impact of infrastructural development on the economy of the country. **(08 Marks)**

c. Explain different types of dams, with neat sketches. **(08 Marks)**

2 a. Choose the correct answers for the following : **(04 Marks)**

i) Forces whose line of action lie along the same line are:
A) Coplanar non-concurrent B) Coplanar parallel C) Collinear D) Concurrent

ii) Moment of a force about a moment centre is the measure of its
A) Rotational effect B) Translatory effect C) Both A and B D) None of these

iii) The translatory effect of a couple on the rigid body is,
A) Zero B) Maximum C) Minimum D) None of these

iv) An object with only mass but no size in mechanics is,
A) Rigid body B) Point body C) Particle D) Deformable body

b. State and prove Varignon's theorem. **(08 Marks)**

c. i) A force of 200 N is acting on a block shown in Fig. Q2 (c) (i). Find the components of forces along horizontal and vertical axes. Ignore the friction between contact surfaces.

ii) A nail is to be removed by applying 4 kN force and a force 'F' as shown in Fig. Q2 (c)-(ii). Find the magnitude of force 'F' so that the nail is pulled out vertically from the ground. Also, determine the resulting pull along vertical axis. **(08 Marks)**

3 a. Choose the correct answers for the following : **(04 Marks)**

i) If two concurrent forces each of P act at right angles to each other, their resultant will be equal to,
A) $P\sqrt{2}$ B) $2\sqrt{P}$ C) 4P D) P

ii) The technique of finding the resultant of a system of forces is called,
A) Composition B) Resolution C) Equilibrium D) None of these

iii) In a coplanar concurrent force system, if $\sum V = 0$, then the resultant is,
A) Moment of the force system B) Vertical C) Horizontal D) None of these

iv) If two forces act at an angle of 120°, the greater force is 50 N and their resultant is perpendicular to smaller force, the magnitude of smaller force is,
A) 43.33 N B) 32.50 N C) 25 N D) None of these

b. Determine the resultant force acting on the structure at point 'O' both in magnitude and direction for the system of forces shown in Fig. Q3 (b). **(06 Marks)**

c. Determine the magnitude, direction and point of application of the resultant force for the system of forces shown in Fig. Q3 (c) with respect to point 'O'. **(10 Marks)**

4 a. Choose the correct answers for the following : **(04 Marks)**

i) Centroid of plane is the point at which,
A) Weight of the body is concentrated B) Mass of the body is concentrated
C) Surface area of the body is concentrated D) All of these

ii) An axis over which one half of the plane figure is just the mirror of the other half is called:
A) Bottom axis B) Axis of symmetry C) Unsymmetrial axis D) All of these

iii) The centroid of the plane lamina will not be at its geometrical centre if it is a:
A) Rectangle B) Square C) Circle D) Right angle triangle

iv) Centroid of a quarter of circular lamina lies from diameter line at a distance of:
A) $4R / 3\pi$ B) $R / 3\pi$ C) $2R / 3\pi$ D) None of these

b. Locate the centroid of a triangle by the method of integration. **(06 Marks)**

c. Locate the centroid of the shaded area shown in Fig. Q4 (c) with respect to OX and OY. All dimensions are in mm. **(10 Marks)**

5 a. Choose the correct answers for the following : **(04 Marks)**

i) A free body diagram is a diagram,
A) Drawn by free hand B) Represents a floating body
C) Separating the body from its surrounding and replacing with force vector D) All of these

ii) The Lami's theorem can be applied only when number of unknown forces are:
A) Two B) Three C) Five D) None of these

iii) If a body is in equilibrium, it is concluded that,
A) No force is acting B) Resultant is zero C) Moment about any point is zero D) Both B & C

iv) For a smooth spherical surface reaction acts:
A) Horizontal to plane of contact B) Inclined to plane of contact
C) Perpendicular to plane of contact D) None of these

b. An electric bulb weighing 150 N is suspended between wall and the roof by two wires as shown in Fig. Q5 (b). Determine the tension in the wires using Lami's theorem. **(06 Marks)**

c. Find the reaction at the contact surface for two identical cylinders weighing 1000N each as shown in Fig.Q5(c) **(10 Marks)**

6 a. Choose the correct answers for the following : **(04 Marks)**

i) Reaction line at roller support with respect to plane of contact is,
A) Oblique B) Perpendicular C) Inclined D) None of these

ii) When a load acts at constant rate over given length of a beam is called,
A) point load B) udl C) uvl D) All of these

iii) At the fixed end of Cantilever, the number of unknowns reaction components are:
A) 1 B) 2 C) 3 D) 4

iv) Minimum number of members required to form a simple truss is,
A) 2 B) 3 C) 4 D) 5

b. Define perfect and imperfect truss. Hence list the assumptions made in the analysis of simple truss. **(06 Marks)**

c. Determine the reaction components for the loaded beam shown in Fig. Q6 (c). **(10 Marks)**

7 a. Choose the correct answers for the following : **(04 Marks)**

i) The maximum frictional force developed when the body just begins to slide is called:
A) limiting friction B) Rolling friction C) Static friction D) None of these

ii) Compared to static friction, kinetic friction is,
A) Larger B) Equal C) Smaller D) None of these

iii) Angle of friction is the angle between,
A) Normal reaction and friction force B) Normal reaction and resultant
C) Weight of the body and friction force D) Normal reaction and weight of the body

iv) The force of friction depends on:
A) Area of contact B) Roughness of contact surface C) Both A & B D) None of these

b. Explain briefly: i) Angle of repose ii) Cone of friction **(06 Marks)**

c. A ladder weighing 200 N is supported as shown in Fig. Q7 (c). If a man weighing 650 N climbs to the top of the ladder, determine the inclination of the ladder with the floor at which the ladder is to be placed to prevent slipping. Take $\mu = 0.25$ for all contact surfaces. **(10 Marks)**

8 a. Choose the correct answers for the following : **(04 Marks)**

i) Moment of inertia is,
A) Second moment of area B) First moment of area C) Third moment of area D) None of these

ii) M.I. of circular section about centroidal axis is,
A) $\pi D^4 / 32$ B) $\pi D^4 / 48$ C) $\pi D^4 / 64$ D) $\pi D^4 / 128$

iii) The unit of radius of gyration is,
A) mm B) mm^2 C) mm^3 D) mm^4

iv) M.I. of a square of side 'B' about its centroidal axis is,
A) $B^4 / 8$ B) $B^4 / 12$ C) $B^4 / 36$ D) $B^4 / 48$

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

c. Determine radius of gyration of shaded area shown in Fig. Q8 (c) about the base AB. **(10 Marks)**

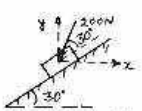

Fig. Q2 (c) (i)

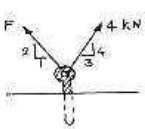

Fig. Q2 (c) – (ii)

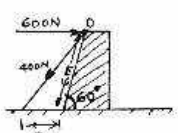

Fig. Q3 (b)

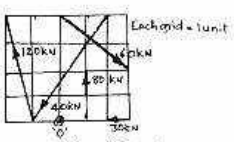

Fig. Q3 (c)

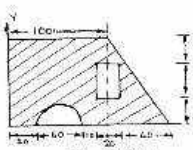

Fig. Q4 (c)

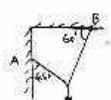

Fig. Q5 (b)

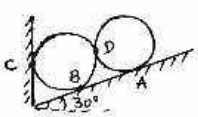

Fig. Q5 (c)

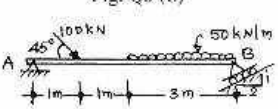

Fig. Q6 (c)

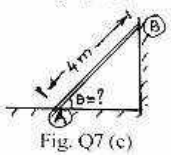

Fig. Q7 (c)

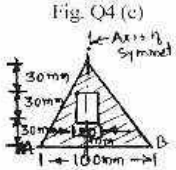

Fig. Q8 (c)