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First/Second Semester B.E. Degree Examination, Dec.2015/Jan.2016
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 sheet will not be valued.****PART – A**

- 1 a.** Choose the correct answers for the following :
- i) A branch of civil engineering dealing with technical measures to use and protect the components of environment is
 A) Environmental engineering
 B) Irrigation Engineering
 C) Transportation Engineering
 D) Surveying
- ii) Bypass road is constructed
 A) Inside the city
 B) Around the city
 C) Over the main road
 D) All are true
- iii) A bridge constructed for carrying canal water across a valley is called
 A) Viaduct
 B) Aquaduct
 C) Super passage
 D) None of these
- iv) A dam constructed with a crest to permit overflow of surplus water is called
 A) Gravity dam
 B) Overflow dam
 C) Arch dam
 D) None of these (04 Marks)
- b. List the different fields of civil engineering. (05 Marks)
- c. Explain the different types of roads as per Nagpur road plan. (05 Marks)
- d. Explain the following bridges with sketches : (06 Marks)
 (i) Skew bridge
 (ii) Suspension bridge
- 2 a.** Choose the correct answers for the following :
- i) The characteristics of a force are
 A) Magnitude
 B) Point of application and line of action
 C) Direction
 D) All of these
- ii) The action of a force on a body is not affected by the action of any other force on the body is called
 A) Principle of transmissibility
 B) Principle of physical independence of force
 C) Principle of superposition of force
 D) None of above
- iii) The translatory effect of a couple on a rigid body is
 A) Zero
 B) Positive
 C) Negative
 D) None of these
- iv) The magnitude of the moment is ----- when a force is applied perpendicular to a lever
 A) Maximum
 B) Minimum
 C) Zero
 D) None of these (04 Marks)
- b. Explain the different system of force (08 Marks)
- c. Explain : (i) Moment (ii) Couple (04 Marks)
- d. Determine the moment of 100N force shown in Fig Q2 (d) about A, B, C, D. (04 Marks)
- 3 a.** Choose the correct answers for the following :
- i) When force P and Q act at a point, the maximum resultant occurs when the angle θ between the two forces is
 A) 0°
 B) 180°
 C) Both (A) and (B)
 D) None of these

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.

- ii) If two forces P and Q ($Q > P$) act on the same straight line but in opposite direction then their resultant is
 A) $P + Q$ B) PQ C) $Q - P$ D) $P - Q$
- iii) The position of the resultant force with respect to a point is obtained with the help of
 A) Law of parallelogram of force B) Lamis theorem
 C) Varignon's theorem D) None of these
- iv) In a force system if, $\Sigma F_x = 0$, then the resultant is
 A) Horizontal B) Vertical C) Inclined D) None of these
 (04 Marks)
- b. A collar which may slide on a vertical rod is subjected to these forces as shown in Fig Q3(b). Determine (i) the value of angle α for which the resultant is horizontal
 (ii) the magnitude of resultant
 (08 Marks)
- c. A body is subjected to forces as shown in Fig Q3 (c). Compute the resultant of force and its Y – intercept from point O.
 (08 Marks)
- 4 a. Choose the correct answers for the following :
- i) Centroid of plane is the point at which
 A) Weight of the body is concentrated
 B) Surface area is assumed to be concentrated
 C) Both A and B
 D) None of the above
- ii) Centroid of a triangle with base b and depth d is
 A) $\frac{b}{3}$ and $\frac{d}{3}$ B) $\frac{b}{2}$ and $\frac{d}{2}$ C) $\frac{b}{4}$ and $\frac{d}{4}$ D) None of these
- iii) Centroid of a sector of a circle lies at a distance of
 A) $\frac{4r}{3\pi}$ B) $\frac{2r \sin \alpha}{3\alpha}$ C) $\frac{2r \cos \alpha}{\alpha}$ D) $\frac{r \sin \alpha}{3\alpha}$
- iv) The centroid of a semicircle, shown in Fig Q4 a(iv) measured from point 'O' is
 A) 0, $\frac{4r}{3\pi}$ B) r , $\frac{4r}{3\pi}$ C) 0, 0 D) $\frac{4r}{3\pi}$, $\frac{4r}{3\pi}$
 (04 Marks)
- b. Determine the centroid of a sector of radius r by method of integration.
 (06 Marks)
- c. Find the centroid of the given Fig Q4 (c) with respect to point 'O'.
 (10 Marks)

PART – B

- 5 a. Choose the correct answers for the following :
- i) If a body is in equilibrium, we may conclude that
 A) No force is acting on the body
 B) The resultant of all forces acting on the body is zero
 C) The moment of forces about any point is zero
 D) Both B and C
- ii) A body acted upon by two forces of equal magnitude is in equilibrium, the angle between the two forces is
 A) 0° B) 90° C) 180° D) 45°
- iii) Lamis theorem is applicable when the three forces acting on a body are
 A) Vertical B) Inclined C) Equilibrium D) None of these
- iv) A force or a moment required to keep an object in equilibrium is called
 A) Resultant B) Equilibrant C) Couple D) None of these
 (04 Marks)
- b. Determine the magnitude and direction of force P shown in Fig Q5 (b) which keep, point 'O' in equilibrium.
 (08 Marks)
- c. Fig Q 5 (c) shows a system of cable in equilibrium condition under two vertical loads 60N and 80N. Determine the forces developed in different segments.
 (08 Marks)

- 6 a. Choose the correct answers for the following :
- In number of equations available for solving a beam supported by rollers at both ends is
A) 1 B) 2 C) 3 D) 4
 - When load acts at a particular point on a beam, it is called
A) Uniformly distributed load B) Point load
C) Variable load D) All of these
 - A framed structure of triangular shape is
A) Perfect B) Imperfect C) Difficient D) Redundant
 - In case of a perfect truss the following condition is satisfied
A) $n < 2j - 3$ B) $n > 2j - 3$ C) $n = 2j - 3$ D) None of these
- (04 Marks)
- b. Determine the reactions at supports for the beam loaded as shown in Fig.Q6 (b). (08 Marks)
- c. Determine the forces in the members by method of joints for the truss shown in Fig.Q6(c) (08 Marks)
- 7 a. Choose the correct answers for the following :
- Unit of coefficient of friction is
A) Newton B) Degree C) Meter D) Dimensionless
 - Impending motion of a body refers to
A) Body at rest B) Body about to move
C) Body moving with uniform speed D) Body moving with uniform acceleration
 - Limiting force of static friction is ----- of area of two surfaces in contact.
A) Dependent B) Independent C) Both A and B D) None of these
 - The angle of inclination of an inclined plane at which motion impends is called
A) Angle of friction B) Angle of repose C) Cone of friction D) None of these
- (04 Marks)
- b. State the law of static and kinetic friction. (06 Marks)
- c. A ladder shown in Fig Q7(c) is 5m long and is supported by a vertical wall and the floor. Coefficient of friction for all contact surface is 0.3. A load weighting 1000N is made to climb up the ladder. The weight of ladder is 250N. At what position of load the ladder slips. (10 Marks)
- 8 a. Choose the correct answers for the following :
- Moment of inertia of an equilateral triangle of side b about its base is
A) $\frac{b^4}{12}$ B) $\frac{b^4}{36}$ C) $\frac{\sqrt{2}b^4}{32}$ D) $\frac{\sqrt{3}b^4}{32}$
 - The radius of gyration of a circular area of radius R about a centroidal axis in its plane is
A) R B) $\frac{R}{2}$ C) $\frac{R}{4}$ D) $\frac{3R}{2}$
 - The moment of inertia of a quadrant of a circle about its centroidal axis is
A) $0.11 R^4$ B) $0.055 R^4$ C) πR^4 D) $\frac{\pi R^4}{2}$
 - Moment of inertia of an area about an axis which is in a plane perpendicular to area is called
A) Radius of gyration B) Polar moment of inertia
C) Second moment of area D) None of these
- (04 Marks)
- b. Derive the equation of moment of inertia of a triangular section about its centroidal axis from first principals (06 Marks)
- c. Find the moment of inertia of the given Fig. Q8 (c) about the horizontal axis passing through the centroid. Also find the radius of gyration. (10 Marks)

