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First/Second Semester B.E. Degree Examination, June/July 2015
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.*

PART – A

1 a. Choose the correct answers for the following :   **(04 Marks)**
   i)   Remote sensing is a type of
         A) Smelling with a remote   B) Surveying
         C) Construction technology   D) Transportation system
   ii)   Fencing is provided to
         A) Village roads   B) State highways
         C) National highways   D) Express highways
   iii) A Bascule bridge is a
         A) Floating bridge   B) Arch bridge
         C) Suspension bridge   D) Movable bridge
   iv)   Shoulders are the components of
         A) Roads   B) Bridges   C) Dams   D) Building.
   b. Explain how the infrastructure development will help the growth of economy of the country.
                                                                                        (06 Marks)
   c. Explain briefly the scope of civil engineering in geotechnical engineering.   **(04 Marks)**
   d. Explain: i) Kerbs in roads   ii) Galleries in dams.   **(06 Marks)**

2 a. Choose the correct answers for the following :   **(04 Marks)**
   i)   A particle has
         A) Only Mass   B) Only Size   C) Both Mass and Size   D) Neither Mass nor Size
   ii)   To define a force completely, the following characteristics should be specified:
         A) Magnitude and direction   B) Point of application
         C) Line of action   D) All of these
   iii) The forces which pass through a single point and lie in the same plane are
         A) Collinear forces   B) Coplanar non-concurrent forces
         C) Coplanar concurrent forces   D) None of these
   iv)   Which of the following is the basic concept of mechanics?
         A) Change   B) Power   C) Force   D) Energy.
   b. State three principles of forces.   **(06 Marks)**
   c. Define a couple. Mention its characteristics.   **(04 Marks)**
   d. For the brake pedal shown in Fig.Q.2(d), determine the smallest force P which has a 104 Nm
      clockwise moment about B.   **(06 Marks)**

3 a. Choose the correct answers for the following :   **(04 Marks)**
   i)   The resultant force of two concurrent forces become maximum and minimum, if angle
         between them is
         A) 0° and 180°   B) 0° and 90°   C) 90° and 0°   D) None
   ii)   Two forces each equal to P/2 act at right angles. Their effect may be neutralized by
         the third force, acting along their bisector in the opposite direction, with a magnitude of
         A) P   B) $\sqrt{2}$ P   C) –P/2   D) $P/\sqrt{2}$
   iii) Component of a force at right angles to its line of action is
         A) Zero   B) Positive   C) Negative   D) None of these
   iv)   Method of finding resultant force of a number of given forces is called
         A) Composition   B) Resolution   C) Decomposition   D) None of these.

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

c. A bracket is subjected to a system of forces as shown in Fig.Q.3(c). Determine the magnitude, direction and line of action of the resultant from 'A'. (08 Marks)

4 a. Choose the correct answers for the following : (04 Marks)
   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 concentrated
      D) All of these
   ii) An axis over which one half of the plane figure is just mirror image of the other half is
      A) Axis of symmetry   B) Unsymmetrical axis
      C) Bottom most axis   D) None of these
   iii) The centroid of a circle is
      A) At centre   B) Along circumference
      C) along tangent   D) outside circle
   iv) The centroid of a lamina is determined by the principles of
      A) Lamis theorem   B) Varignon's theorem
      C) Triangle law of forces   D) None of these

b. Determine the centroid of a semicircle from first principles. (06 Marks)

c. Locate the centroid of the shaded area shown in Fig.Q.4(c) with respect to point 'A'.
(10 Marks)

PART – B

5 a. Choose the correct answers for the following : (04 Marks)
   i) The force which is equal in magnitude and opposite in direction to resultant is
      A) Couple   B) Moment
      C) Equilibrant   D) None of these
   ii) 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 these
   iii) A free body diagram is a diagram
      A) Of a body suspended freely in air
      B) Drawn by free hand
      C) Drawn by detaching the body from its attachments with surrounding and replacing the attachments with force vector.
      D) Of a body in vaccum
   iv) The procedure of resolution is
      A) To find the equilibrant
      B) To find the resultant of the system
      C) To find two components of an inclined force
      D) None of these

b. Explain different types of beams with sketches. (08 Marks)

c. A 500N cylinder of 1m diameter is loaded between the cross pieces which make an angle of 60° with each other and are pinned at 'C' as in Fig.Q.5(c). Determine the tension in the horizontal rope DE assuming smooth floor. (08 Marks)

6 a. Choose the correct answers for the following :   (04 Marks)
      i)   When load acts at constant rate over given length of beam it is called
           A) ud$l$ B) uv$l$ C) point load   D) none of these
      ii) For a perfect frame, a guide line for identifying is
           A) $m \neq 2j - 3$ B) $m = 2j - 3$ C) $m = 2j + 3$ D) $m = 3 - j$
      iii) A beam is said to be determinate, if
           A) the reactions can be determined using the equations of equilibrium
           B) the reactions can be determined using the force equilibrium conditions
           C) the reactions can be determined using the moment equilibrium conditions only
           D) the reactions cannot be determined using the equations of equilibrium.
      iv) The minimum number of members to form a perfect truss is
           A) 2   B) 3   C) 4   D) 1
   b. Determine the tension in cable AB and AC required to hold a 50kg crate shown in
       Fig.Q.6(b).   (06 Marks)
   c. Three cylinders A, B and C weighing 150N, 400N and 200N respectively are piled in a
       channel as shown in Fig.Q.6(c). Determine the reactions offered by the walls and floors.
       Radii of A, B and C are respectively 40cm, 60cm and 50cm.   (10 Marks)

7 a. Choose correct answers for the following :   (04 Marks)
      i)   The friction experienced by a body when it rolls over another body is called
           A) Sliding friction   B) Rolling friction
           C) Static friction   D) None of the above
      ii) If the angle of friction is zero, a body will experience
           A) Zero friction
           B) Infinite friction
           C) The force of friction in the direction of motion
           D) The force of friction normal to the plane
      iii) The maximum inclination of the plane on which the body free from external forces,
           can repose is called
           A) Angle of friction   B) Cone of friction   C) Angle of repose   D) None of these
      iv) Force of friction developed at contact surface is
           A) Opposite to the direction of motion   B) Perpendicular to plane
           C) Along the direction of motion   D) All of these.
   b. State laws of friction.   (06 Marks)
   c. Determine the force P required to cause motion of blocks to impend. Take the weight of A
       as 90N and weight of B as 45N. Take the coefficient of friction for all contact surfaces as
       0.25 as shown in Fig.Q.7(c). Consider the pulley being frictionless.   (10 Marks)

8 a. Choose the correct answers for the following :   (04 Marks)
      i)   If I_G is the moment of inertia of a rectangle about its centroidal axis parallel to the base
           and I_{AB} is the moment of inertial about its base, then
           A) $I_G = I_{AB}$ B) $I_G < I_{AB}$ C) $I_G > I_{AB}$ D) None of these
      ii) The unit of moment of inertia of an area is
           A) m^2 B) m^4 C) m^3 D) N/m^2
      iii) Radius of gyration may be defined mathematically as
           A) $\dfrac{I}{A}$ B) $\dfrac{A}{I}$ C) $\sqrt{\dfrac{I}{A}}$ D) $\sqrt{\dfrac{A}{I}}$
      iv) The value of moment of inertia depends upon
           A) Weight of material   B) Density of material
           C) Cross sectional dimensions   D) Type of material.
   b. Derive the expression for moment of inertia of a circle about its diametral axis. (06 Marks)
   c. Determine the moment of inertia of the area shown in Fig.Q.8(c) about the base AB and the
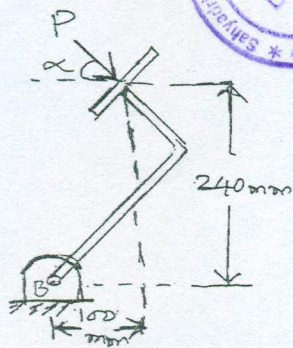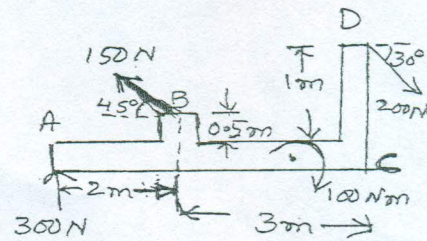   centroidal axis parallel to AB.   (10 Marks)
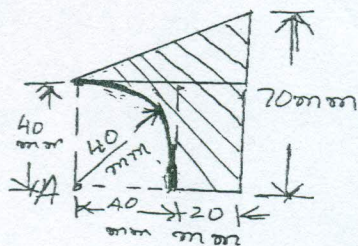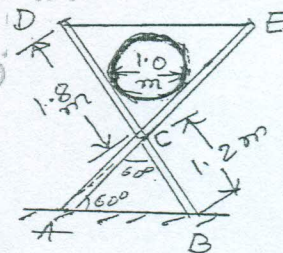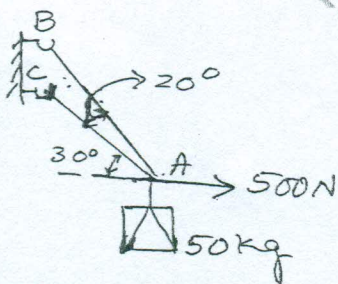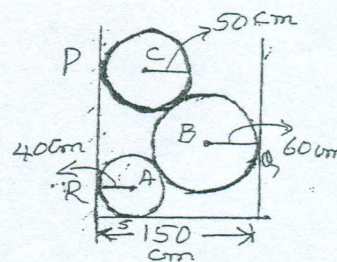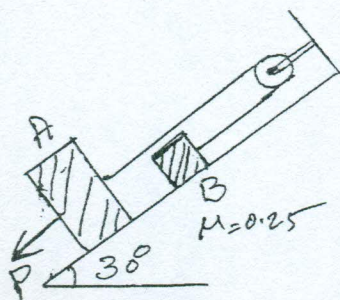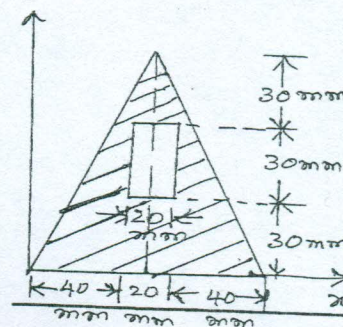
Fig.Q.2(d)

Fig.Q.3(c)

Fig.Q.4(c)

Fig.Q.5(c)

Fig.Q.6(b)

Fig.Q.6(c)

Fig.Q.7(c)

Fig.Q.8(c)

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