First/Second Semester B.E. Degree Examination, June/July 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 will not be valued.*

PART – A

1 a. Choose the correct answers for the following :   **(04 Marks)**
   i) The part of civil engineering which deals with waste water and solid waste is called
      A) Water supply   B) Hydraulics
      C) Sanitary engineering   D) Geotechnical engineering
   ii) Composite material consisting of cement concrete and steel used in civil engineering
       structural construction is
      A) Pre Stress Concrete (PSC)   B) Reinforced Cement Concrete (RCC)
      C) Fiber Reinforced Concrete (FRC)   D) Plain Cement Concrete (PCC)
   iii) The science of map making is known as
      A) Estimation   B) Town planning   C) Surveying   D) Concrete Technology
   iv) Land use planning, zoning etc are a part of
      A) Transportation   B) Town planning
      C) Construction technology   D) Geotechnical engineering
   b. Briefly explain scope of the following in civil engineering:
      i) Hydraulics   ii) Water resources and irrigation engineering.   **(04 Marks)**
   c. Explain briefly the impact of infrastructural development on the economy of the country.
                                                                             (06 Marks)
   d. With the help of neat sketch briefly explain the components of a bridge.   **(06 Marks)**

2 a. Choose the correct answers for the following :   **(04 Marks)**
   i) Which is the following quantities has units as kg-m/s^2
      A) Energy   B) Force   C) Momentum   D) Power
   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) In SI units 1 N/mm
      A) 1   B) 10^{-3} C) 10^3 D) 10
   iv) A particle can have
      A) Only translational motion   B) Only rotational motion
      C) A combination of translational and rotational motions
      D) All of these
   b. Briefly explain the classification of the system of forces with examples.   **(04 Marks)**
   c. The moment of a force F is 195 N-m clockwise about A and 115 N-m counter clockwise
      about C. If its moment about B is zero, determine the force F as shown in Fig.Q.2(c).
                                                                             (06 Marks)

Fig.Q.2(c)
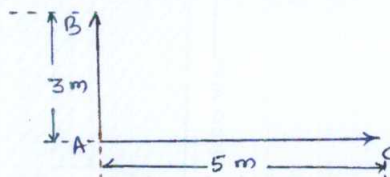
   d. The resultant of two forces, one of which is double the other is 260N. If the direction of the
      larger force is reversed and the other remains unaltered the resultant reduces to 180N.
      Determine the magnitude of the forces and the angle between the forces.   **(06 Marks)**

3 a. Choose the correct answers for the following : **(04 Marks)**
   i) Effects of force on a body depends on
      A) Direction   B) Magnitude   C) Position   D) All of these
   ii) The magnitude of the moment is maximum when a force is applied _____ the level
      A) Parallel to   B) Inclined to   C) Perpendicular to   D) At the hinge of
   iii) The X-component of a 10N force is 5N the angle made by the force with y-axis
      A) 0°   B) 30°   C) 45°   D) 60°
   iv) Every force acting on an object produces its own effects independent of the other forces is known as
      A) Principle of transmissibility of force
      B) Principle of physical independence of force
      C) Super position principle
      D) None of these

   b. What are the methods for finding out the resultant force for a given system of forces? Also explain the procedure for finding out the resultant force analytically, using method of resolution. **(04 Marks)**
   c. State and prove the Varignon's theorem of moments. **(04 Marks)**
   d. A bracket is subjected to three forces and a couple as shown in Fig.Q.3(d). Determine magnitude direction and the line of action of the resultant. **(08 Marks)**
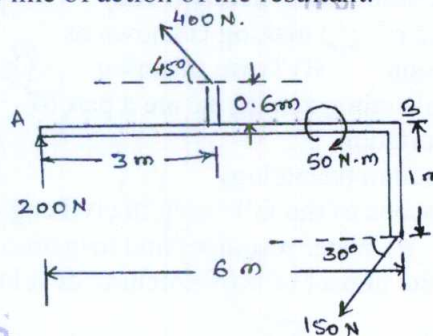

Fig.Q.3(d)

4 a. Choose the correct answers for the following : **(04 Marks)**
   i) Component of a force right angle to its line of action is
      A) Zero   B) Positive   C) Negative   D) None of these
   ii) The single force which will have the same effects as the system of force is
      A) couple   B) resultant   C) moment   D) force
   iii) Varignon's theorem is not applicable for forces which are
      A) Coplanar non-concurrent   B) Non-coplanar non concurrent
      C) Concurrent   D) Parallel
   iv) The technique of finding of the resultant of a system of forces is called
      A) Resultant   B) Resolution   C) Composition   D) None of these

   b. Differentiate between the centre of gravity and centroid. **(02 Marks)**
   c. Determine the centroid of a triangle from first principle. **(06 Marks)**
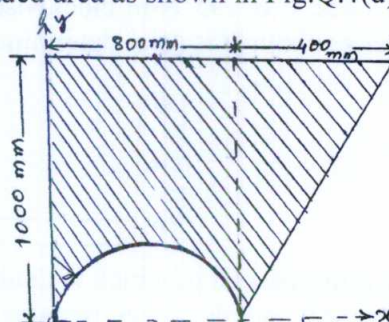   d. Locate the centroid of the shaded area as shown in Fig.Q.4(d). **(08 Marks)**


Fig.Q.4(d)

PART – B

5 a. Choose the correct answers for the following : **(04 Marks)**
  i) Centroid of a triangle with base b and depth d is
    A) b/3 and d/3   B) b/2 and d/2   C) b/4 and d/4   D) None of these
  ii) The centroid of a triangle lamina of height h is situated at a distance from its apex
    A) h/2   B) 2h/3   C) h/3   D) h
  iii) The first moment of an area about the Y axis is
    A) $\int xdA$ B) $\int ydA$ C) $\int x^2dA$ D) $\int y^2dA$
  iv) Centroid of a sector of a circle lies at a distance of
    A) $\dfrac{4r}{3\pi}$ B) $\dfrac{2r\sin\alpha}{3\alpha}$ C) $\dfrac{r\sin\alpha}{2\alpha}$ D) $\dfrac{2r\sin\alpha}{2\alpha}$

  b. Define the following: i) Equilibrium ; ii) Equlibrant. **(02 Marks)**
  c. State the equilibrium conditions for coplanar concurrent forces and coplanar non-concurrent forces. **(04 Marks)**
  d. A cylinder weighing 1000N and 1.5m diameter is supported by a beam of length 6m and weight 400N as shown in Fig.Q.5(d). Neglecting friction at the surface of contact of the cylinder determine: i) Wall reaction at D; ii) Tension in cable BC and   iii) Hinged reaction at support A. **(10 Marks)**


Fig.Q.5(d)
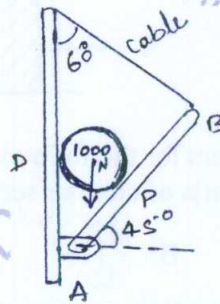
6 a. Choose the correct answers for the following : **(04 Marks)**
  i) A rigid body is an equilibrium if the resultant force of concurrent force system is
    A) Positive   B) Negative   C) Zero   D) None of these
  ii) Lami's equation can be applied when number of unknown forces are
    A) two   B) three   C) five   D) None of these
  iii) The necessary condition for equilibrium of coplanar non-concurrent force system is
    A) $\Sigma F_y = \Sigma F_x$ B) $\Sigma F_x = 0, \Sigma F_y = 0$
    C) $\Sigma Fx = 0, \Sigma Fy = 0, \Sigma M = 0$ D) $\Sigma M = 0$
  iv) Three forces acting on a body can keep it in equilibrium, only when they are
    A) Colinear   B) Coplanar and concurrent
    C) Co planar and parallel   D) Coplanar and non concurrent

  b. Define statically determinate beam. **(02 Marks)**
  c. Explain in brief the method of joints and method of sections used in the analysis of simple trusses. **(04 Marks)**
  d. The maximum allowable force (tension or compression) in AB, AF or FG is known to be 2.5 kN. Determine the maximum permissible load 'P' on the truss shown in Fig.Q.6(d). Determine the zero force members in the given truss. **(10 Marks)**

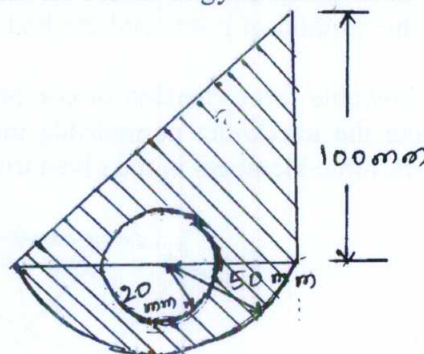Fig.Q.6(d)
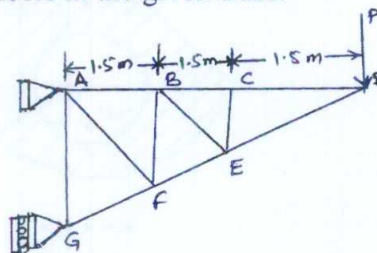
7 a. Choose correct answers for the following :   (04 Marks)
   i)   A reaction line at roller support with respect to plane of contact is
        A) Oblique   B) Obtuse   C) Perpendicular   D) None of these
   ii) When load acts at constant rate over given length of beam it is called
        A) Point load   B) UDL   C) UVL   D) None of these
   iii) The number of reaction components of a hinged end of a beam are
        A) 0   B) 2   C) 3   D) 1
   iv) If one end of a beam is fixed and the other is supported by a roller it is known as
        A) Cantilever   B) Fixed beam
        C) Propped cantilever beam   D) Over hanging beam
   b. Define i) Angle of repose ;   ii) Cone of friction.   (02 Marks)
   c. Explain the theory of solid dry friction.   (04 Marks)
   d. Find the minimum horizontal force P required to overcome static friction and begin to lift
       100N block 'A' shown in Fig.Q.7(d). The weight of 20° wedge B is 5N and the coefficient
       of static friction between all surfaces is 0.4.   (10 Marks)

   Fig.Q.7(d)
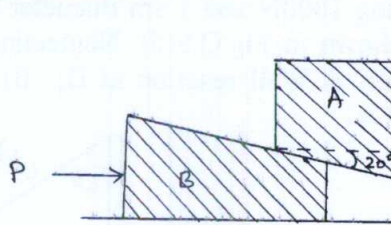
8 a. Choose the correct answers for the following :   (04 Marks)
   i)   The moment of inertia of circular section about centroidal axis is
        A) $\dfrac{\pi D^4}{48}$ B) $\dfrac{\pi D^4}{32}$ C) $\dfrac{\pi D^4}{64}$ D) $\dfrac{\pi D^4}{128}$
   ii) The unit of moment of inertia of an area is
        A) m^3 B) m^2 C) m^4 D) N/m^2
   iii) The radius of gyration of a triangular about its base is
        A) $\dfrac{b}{2\sqrt{3}}$ B) $\dfrac{b}{3\sqrt{2}}$ C) $\dfrac{h}{2\sqrt{3}}$ D) $\dfrac{h}{3\sqrt{2}}$
   iv) The moment of inertia about centroidal X-axis is given by I_{xx}
        A) $\int x^2 dA$ B) $\int y^2 dA$ C) $\int x\, dA$ D) $\int y\, dA$
   b. Define the terms: i) Polar second moment of the area; ii) Radius of gyration.   (02 Marks)
   c. Determine the second moment of area of a circle about its diametrical axis by the method of
       integration.   (06 Marks)
   d. Determine the moment of inertia about the horizontal centroidal axis for the shaded area as
       shown in Fig.Q.8(d). Also find the radius of gyration about the same axis.   (08 Marks)

   Fig.Q.8(d)

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