U.S.N. ☐☐☐☐☐☐☐☐☐☐

BMS College of Engineering, Bangalore-560019

(Autonomous Institute, Affiliated to VTU, Belgaum)

December 2016 Semester End Main Examinations

Course: ENGINEERING MECHANICS	**Duration: 3 hrs**
Course Code: 14CV1ICENM	**Max Marks: 100**
	Date: 21.12.2016

Instructions: Question No. 1 is compulsory.
          Answer any 4 full questions from question No. 2 to question No. 6.
          Assume missing data suitably.

1 a) Explain principle of transmissibility of forces and principle of superposition.   **5x4=20**
   b) State and prove Lami's theorem
   c) State and prove parallel axes theorem.
   d) Derive the expression to describe the path of a projectile with usual notation.
   e) State laws of dry friction.

2 a) State and prove Varignon's theorem.   **04**
   b) Determine the resultant of concurrent forces shown in Fig Q.2(b)   **06**
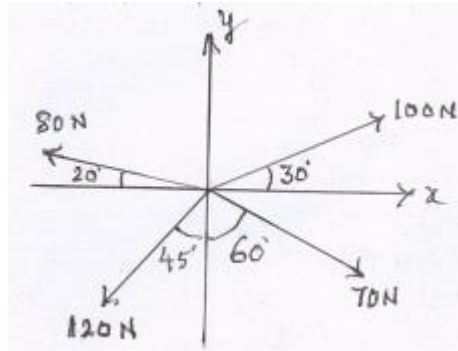

Fig Q.2(b)

   c) A system of forces acting on a pole is as shown in Fig Q.2(c). Determine magnitude,   **10**
       direction, x and y intercept and position vector of the resultant.(Use vector approach
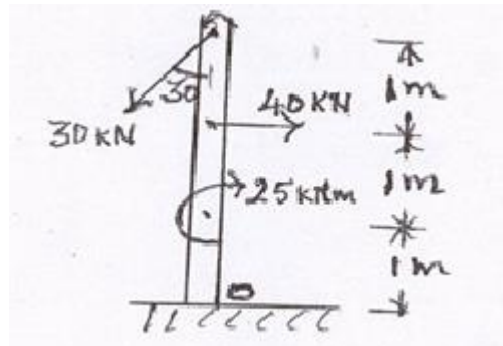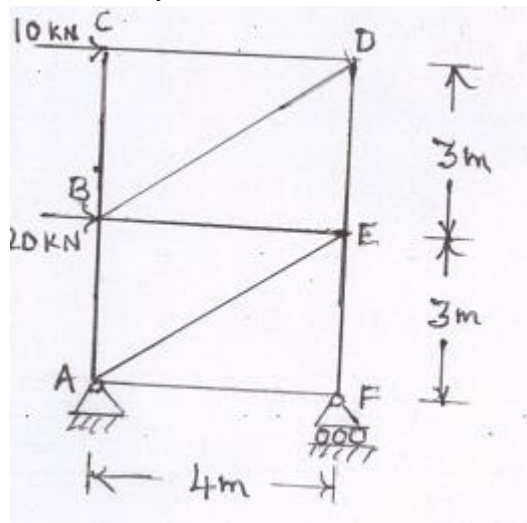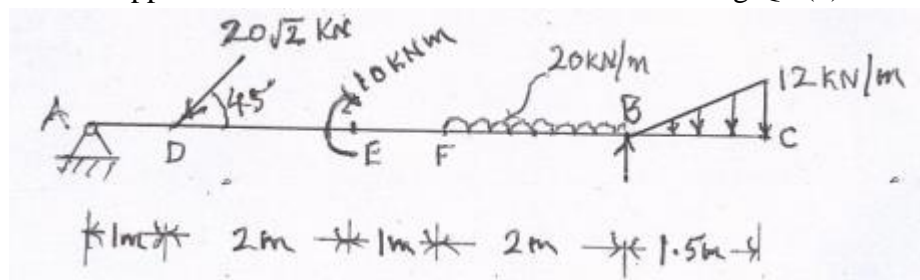   only).

Fig Q.2(c)

3   a)   Analyse the truss as shown in the Fig Q.3(a) by method of joints. Check the forces   **12**
             in the members AB,EA and EF by the method of section.


Fig Q.3(a)

   b)   Calculate the support reactions for the beam as shown in the Fig Q.3(b)   **08**

Fig Q.3(b)

4   a)   Explain cone of friction.   **04**

   b)   A block of 100N is to be pulled to the right by a horizontal force P. Over the block   **04**
             another block of 50N is placed which is attached to the wall by a string. If the
             coefficient of friction between all contact surfaces is 0.25, determine the value of P,
             for which the motion is impending. Also determine the tension in the string.

   c)   A uniform ladder 3m long weighs 180N.It is placed against a wall making an angle   **12**
             60^0 with the floor. The coefficient of friction between the wall and ladder is 0.25 and
             that between the floor and the ladder is 0.35.The ladder in addition to its own weight
             has to support a man weighing 900N at its top. Calculate

        i) Horizontal force to be applied to the ladder at the floor to prevent slipping.
       ii) If the horizontal force is not applied, what should be the minimum inclination of
           the ladder with the horizontal so that it does not slip, with the man at the top.

5 a) Determine an expression for centroid of a semi-circle from first principles. **08**
   b) Determine the moments of inertia of the shaded area as shown in the Fig Q.5(b) **12**
       about its horizontal and vertical centroidal axes.
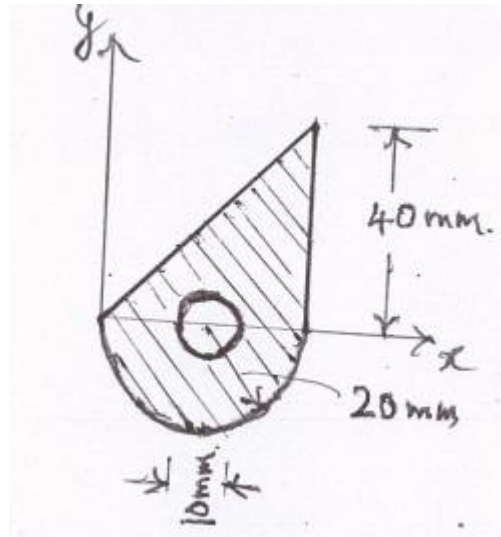
Fig Q.5(b)

6 a) State and explain D'Alembert's principle. **04**
   b) A bullet with a velocity of 330m/s penetrates through a plank. The bullet has a **06**
       velocity of286m/s the moment it comes out of the plank. Determine the number of
       planks through which it can penetrate before it comes to rest.
   c) A ball is thrown from top of the building of 20m height with a velocity of 30m/s at **10**
       an angle of 45^0 to the horizontal. Determine its velocity at t=2s. How high does it
       rise? Determine the horizontal distance it will travel before it strikes the ground.
       Also determine its velocity when it strikes the ground.

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