I B.Tech II Semester Supplementary Examinations Dec./Jan. – 2015/2016
ENGINEERING MECHANICS
(Common to ECE, EEE, EIE, Bio-Tech, E Com E, Agri E)

Time: 3 hours   **Max. Marks: 70**

Question Paper Consists of **Part-A** and **Part-B**
Answering the question in **Part-A** is Compulsory,
Three Questions should be answered from **Part-B**
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PART-A

1. (a) Find the unit vector of the force F= 4 i -5 j + 8 k.
   (b) What is the principle of transmissibility?
   (c) Use Pappus theorem to find the volume of a sphere of radius r.
   (d) State the Parallel axis theorem.
   (e) State the condition for the dynamic equilibrium of a body under translation.
   (f) What is instantaneous centre of rotation in plane motion?

                                                                    [4+3+4+4+3+4]

PART-B

2. (a) A block weighing 1000 N is kept on a rough plane inclined at 40^0 to the horizontal. The coefficient of friction between the block and the plane is 0.4. Determine the smallest (least) force inclined at 15^0 to the plane required just to move the block up the plane.
   (b) A frame is loaded as shown in Fig. 1. Find the support reactions.
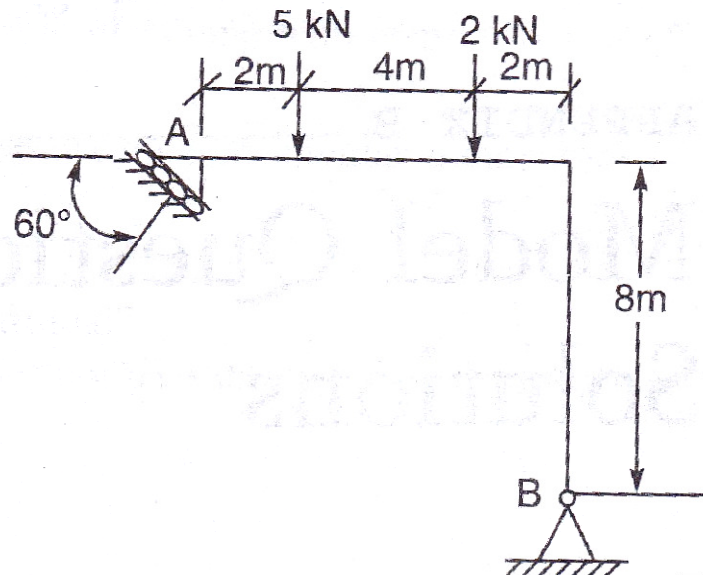
                                                                          [8+8]

Fig.1

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3. (a) Forces 32 kN, 24 kN, 24 kN, and 120 kN, are concurrent at the origin and are respectively directed through the points whose coordinates are A (2,1,6), B(4,-2-5), C(-3,-2,1), and D(5,1,-2). Determine the resultant.
   (b) State and prove Varignon's theorem.

[8+8]

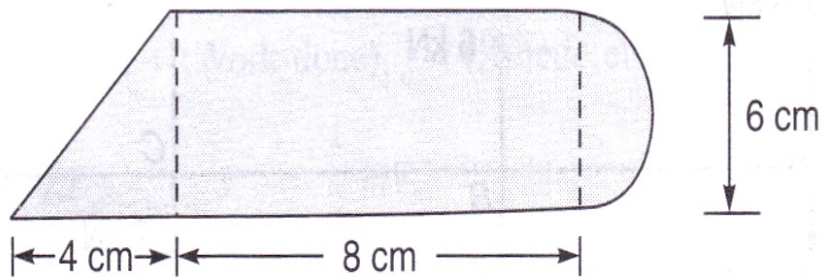4. (a) Calculate the moment of inertia of the section shown in Fig. 2 about its centroidal xx and yy axis.

Fig.2

   (b) State and prove perpendicular axis theorem.

[8+8]

5. (a) Find the mass moment of inertia of a thin circular disc (I_{xx}, I_{yy}, and I_{zz}).
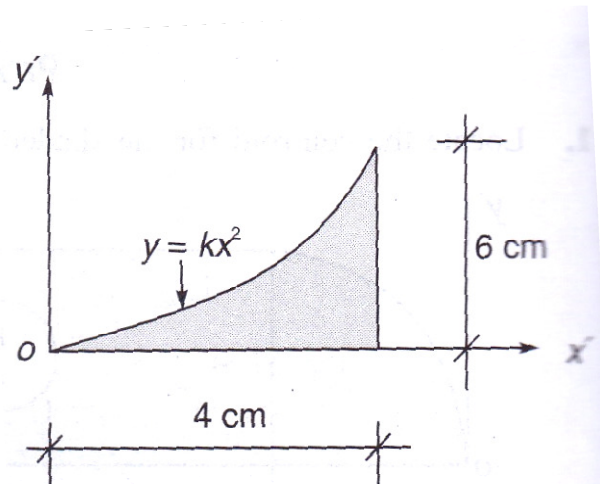   (b) Locate the centroid for the area shown in Fig.3.   [10+6]

Fig.3

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6. (a) Two cars A and B are travelling in adjacent highway lanes. At an instant of time, their positions and speeds are as shown in Fig.4. If car A has constant acceleration of 0.8 m/s^2 and car B has a constant deceleration of 0.5 m/s^2, determine

(i) When and where car A will overtake car B and

(ii) The speed of each car at that time.

$V_A = 40$ km/h $V_B = 60$ km/h

A   B

50 m
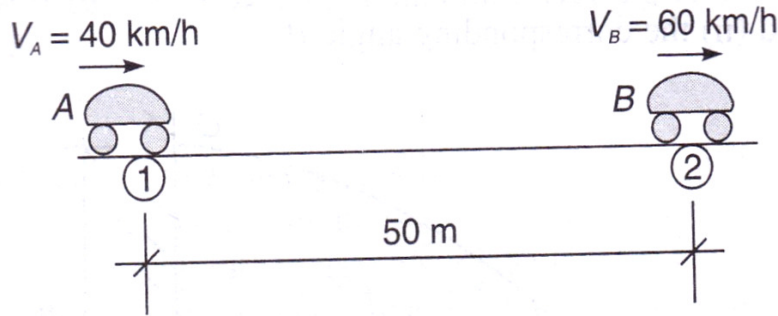
Fig.4

(b) What is the angle turned by a wheel while it starts from rest and accelerates at a constant rate of 3 rad/s^2 for an interval of 20 sec. ?

[12+4]

7. (a) Define impulse-momentum principle.

(b) Define work energy equation.

[8+8]

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