Reg. No. : | | | | | | | | | | | |

S 4043

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Second Semester

(Regulation 2004)

Civil Engineering

GE 1151 — ENGINEERING MECHANICS

(Common to All branches)

(Common to B.E. (Part–Time) First Semester – Reg. 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Using Lame's theorem calculate the forces in the member CA and CB for the system shown in Fig. Q. 1 .

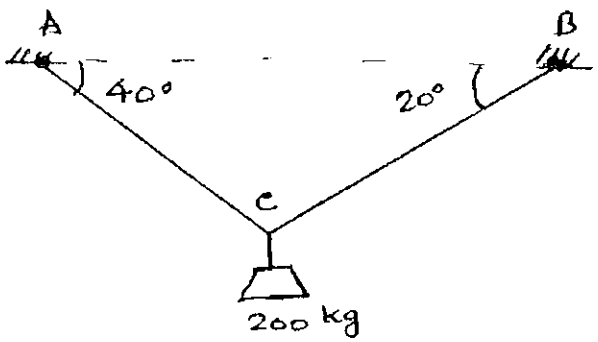

Fig. Q. 1

2. A force F has the components $F_x = 20$ N, $F_y = -30$ N, $F_2 = 60$ N. Find the angle 'θ_y' it forms with the coordinates axes y.

3. Explain with the help of sketches the Wrench resultant.

4. State Varignon's theorem, using this calculate the moment about '*O*' for the system shown in Fig. Q. 4.

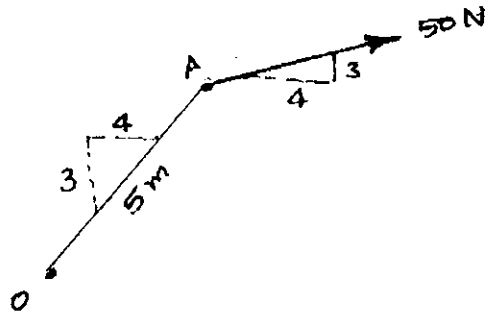

Fig. Q. 4

5. Calculate $\bar{y}$ for the shaded area shown in Fig. Q. 5

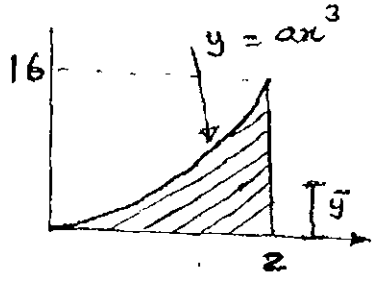

Fig. Q. 5

6. Calculate moment of inertia I_{XX} for plane area shown in Fig. Q. 6. All dimensions are in mm.

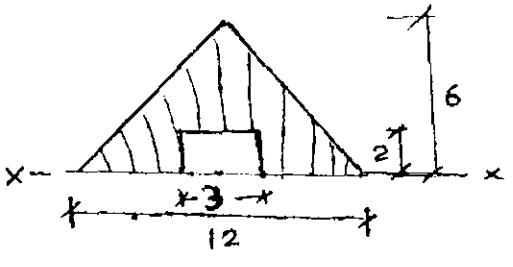

Fig. Q. 6

7. A golf ball is dropped from a height of 10 m on to a fixed steel plate. The coefficient of restitution is 0.85. Find the height to which the ball rebounds at the first bounce.

8. State principle of conservation of energy.

9. Define rolling resistance with a sketch.

10. Define instantaneous centre of rotation. Locate the instantaneous centre of rotation of the system shown in Fig. Q. 10.

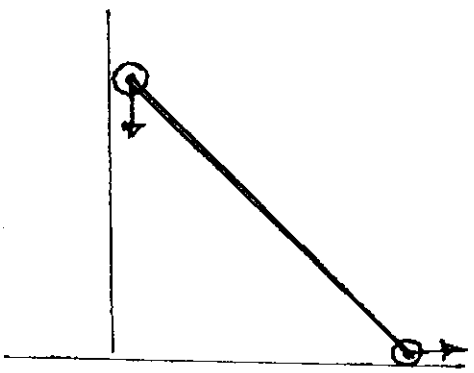

Fig. Q. 10

PART B — (5 × 16 = 80 marks)

11. (a) Calculate the moment of inertia about *XX* axis. (*XX* axis is the centroidal axis) for the plane figure shown in Fig. Q. 11 (a). Assume *AB* as the reference axis to locate *XX*. (16)

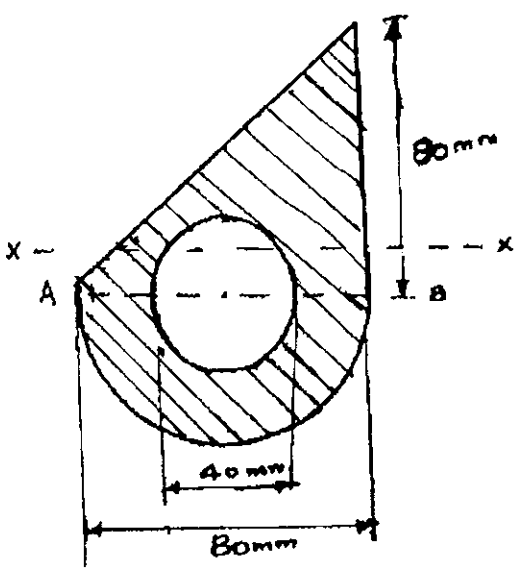

Fig. Q. 11 (a)

Or

(b) Locate the centroid for the following sections as shown in Fig. Q. 11 (b) (i) and (ii). $(2 \times 8 = 16)$

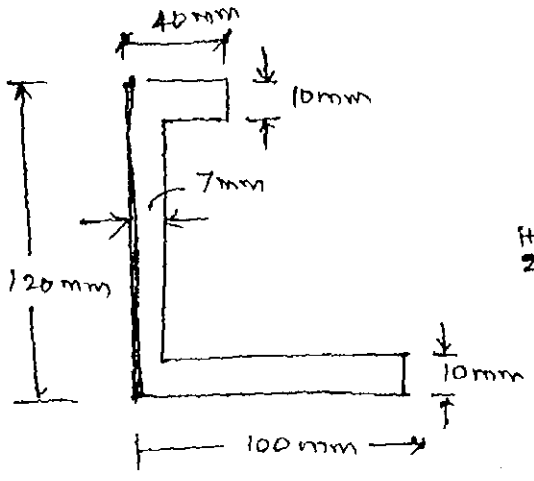

Fig. Q. 11 (b) (i)

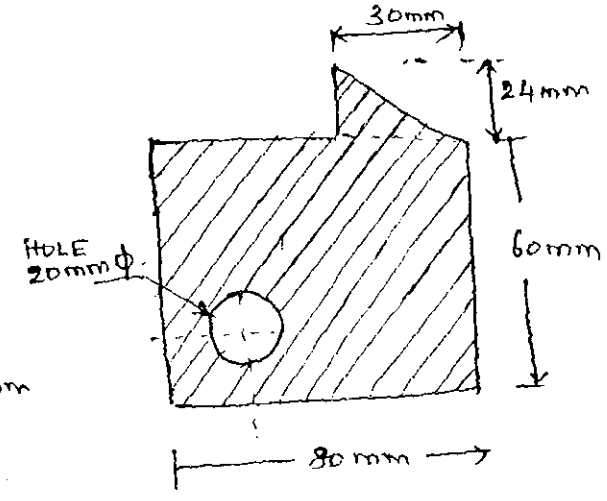

Fig. Q. 11 (b) (ii)

12. (a) Determine the resultant of the force system acting in plane shown in Fig. Q. 12 (a). Locate the distance from A where the resultant cuts the x axis.

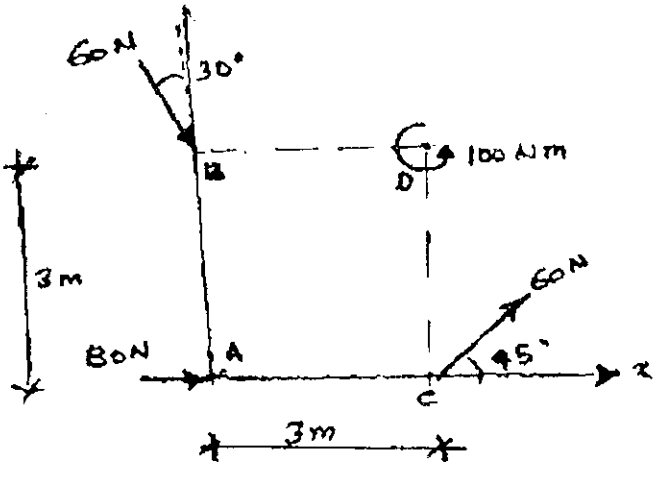

Fig. Q. 12 (a)

Or

(b) A container weighing 450 kN is suspended at P by using two cables PB and PA anchored as shown in Fig. Q. 12 (b). A horizontal force F keeps the Q. 12 (b) container in the current position. Find the magnitude of Force F and forces in cable PA and PB.

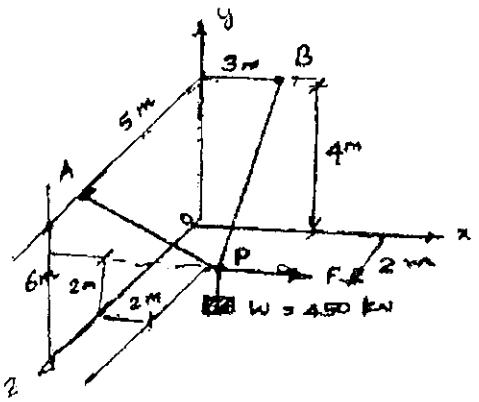

Fig. Q. 12 (b)

13. (a) Two identical rollers each of weight 5 kN rest in between an inclined wall and a vertical wall as shown in Fig. Q. 13 (a). Determine the reactions at the points of contact P, Q and R. Assume the wall surfaces to be smooth.

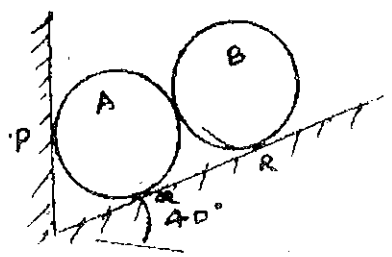

Fig. Q. 13 (a)

Or

(b) A shaft is subjected to forces in x, y and z direction as shown in Fig. Q. 13 (b). Replace these forces by a resultant R at origin O and a couple.

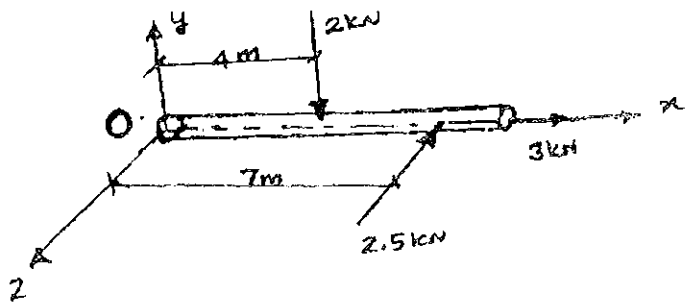

Fig. Q. 13 (b)

14. (a) A rod *CD* of 8 kg, length 0.8 m is welded to a uniform disc of mass 5 kg and radius 0.16 m. A spring of constant k = 100 N/mm is attached to a disc as shown in Fig. Q. 14 (a). When the rod *CD* is horizontal, the spring is unstretched. Assembly is released from rest from the position shown. What is angular velocity of the disc and rod if it has rotated through $\pi/2$ angle (use work energy principle).

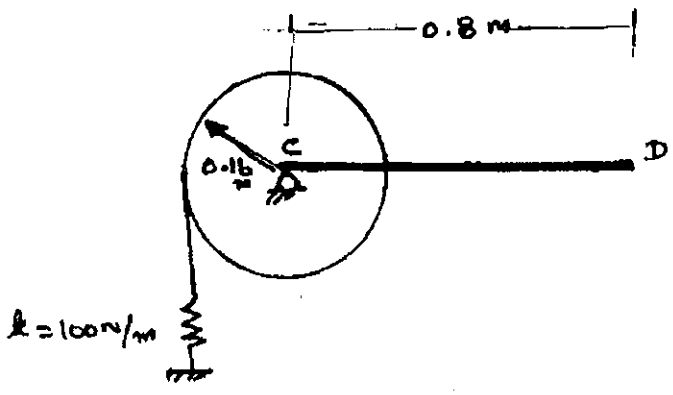

Fig. Q. 14 (a)

Or

(b) Two bodies of weights w_1 and w_2 respectively are connected by an inextensible string passing over a frictionless pulley. The coefficient of friction between w_1 and plane is 0.2. What is the velocity of the weights before w_1 reaches the top edge of plane. Calculate the velocity of weights after 2 secs if $w_1 = 100\,\text{N}$; $w_2 = 80\,\text{N}$; $\alpha = 30°$. Refer Fig. Q. 14 (b). (Use impulse momentum principle)

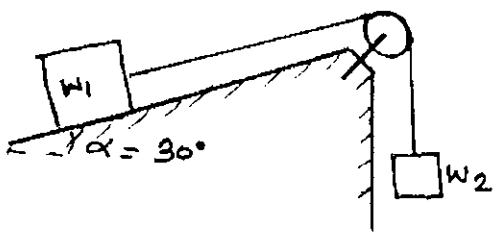

Fig. Q. 14 (b)

15. (a) A pulley assembly shown in Fig. Q. 15 (a) weighs 50 kg, with a radius of gyration of 0.35 m. The blocks A and B are connected through strings wrapped around the pulleys. Determine the acceleration of each block and tension in each string.

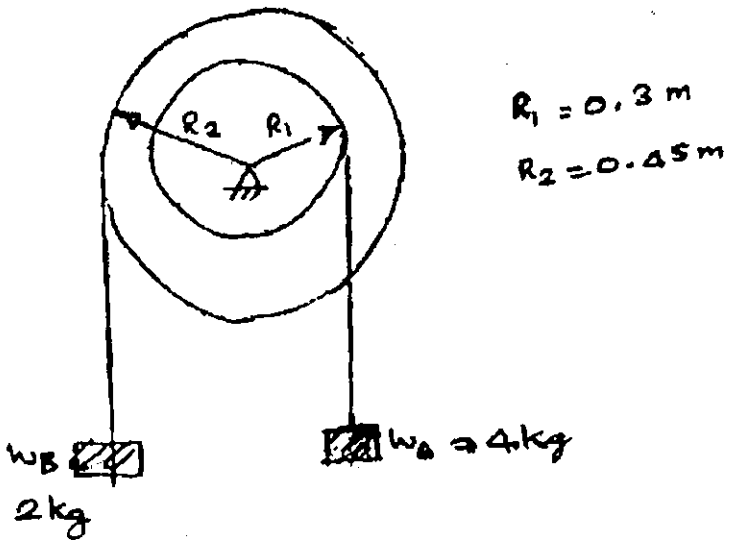

Fig. Q. 15 (a)

Or

(b) Blocks A and B connected through a cord rest on inclined planes as shown in Fig. Q. 15 (b). What is the tension in the cord is the friction at block A reaches the maximum value? State whether the system is at rest or motion. (16)

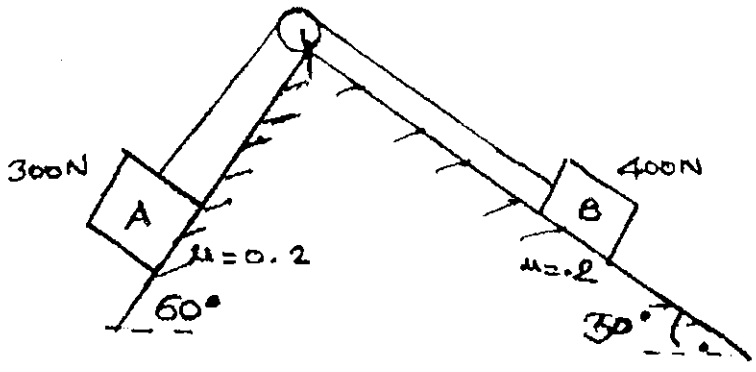

Fig. Q. 15 (b)