NTK/KW/15 – 7293

Second Semester B. E. Examination

ENGINEERING MECHANICS

Time : Two Hours] [Max. Marks : 40

N. B. : (1) All questions carry marks as indicated.
(2) Solve Question 1 OR Question No. 2.
(3) Solve Question 3 OR Question No. 4.
(4) Solve Question 5 OR Question No. 6.
(5) Solve Question 7 OR Question No. 8.
(6) Due credit will be given to neatness and adequate dimensions.
(7) Assume suitable data wherever necessary.
(8) Illustrate your answers wherever necessary with the help of neat sketches.
(9) Use of non programmable calculator is permitted.

1. (a) State and Explain Varignon's Theorem. 3

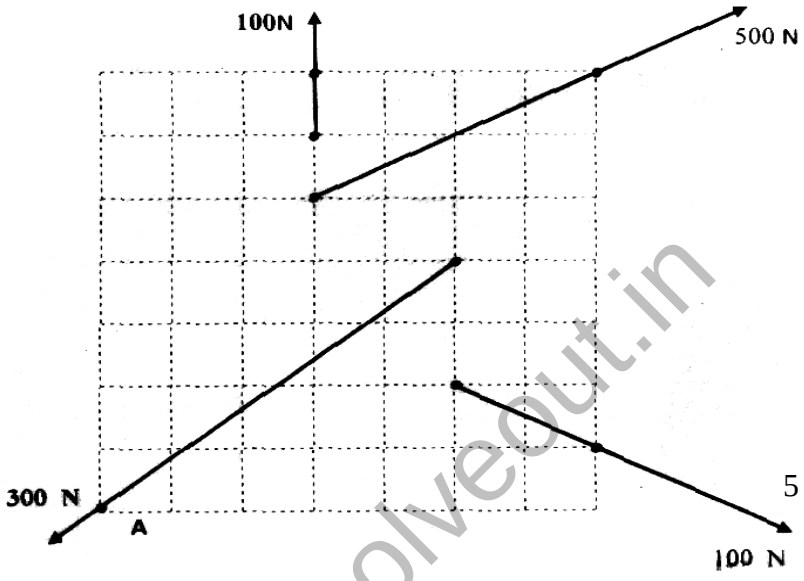
(b) Find the Component of Force P along Force Q and angle between two forces P and Q.

Force P = –2i + 5j – 6k

Force Q = 3i – 6j – 2k 7

OR

2. (a) Determine Resultant of the force system and its location. Fig–1



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(b) State characteristics of **Couple**. 2

(c) Explain the term **WRENCH**. 3

3. (a) A beam has been loaded and supported as shown in Fig. 2 given below. Determine the reactions at the support points A and B.

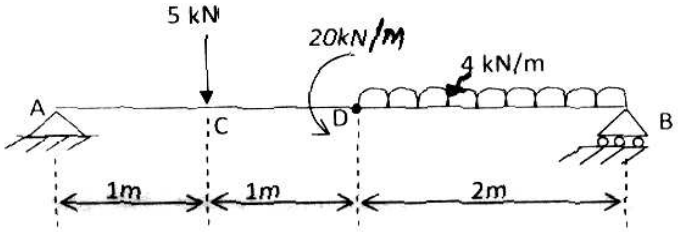

Fig. 2

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(b) Two identical rollers each of weight Q=100 N are supported by an inclined plane and a vertical wall as shown in Fig. 3. Assuming smooth surface, find the reactions at A, B, and C.

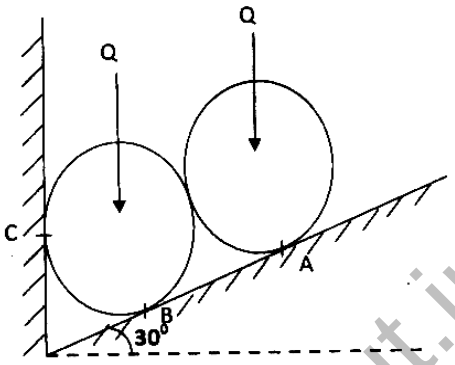

Fig. 3

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OR

4. (a) Determine support reaction and the force in members **AC** and **BE**, of a truss as shown in Fig. 4

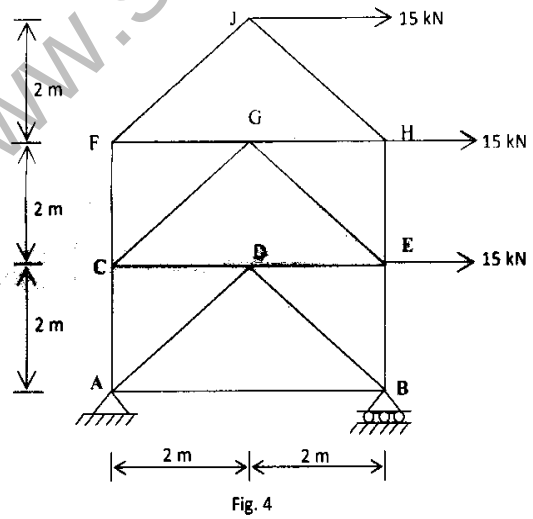

Fig. 4

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(b) Consider a system of three blocks resting upon one another as shown in Fig. 5. The blocks A and C weighs 150 N and B weighs 100 N. The coefficients of friction are 0.3 between A and B, 0.2 between B and C, and 0.1 between C and the ground. Determine the least horizontal force P necessary to start motion of any part of the system.

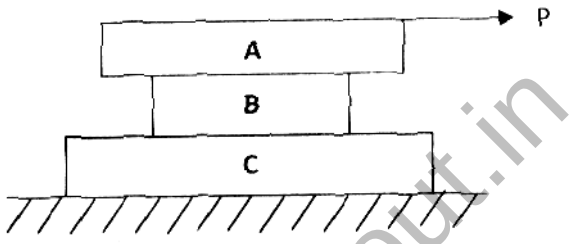

Fig. 5 5

5. (a) Find Moment of Inertia about X–axis For the shaded area shown in Fig. 6

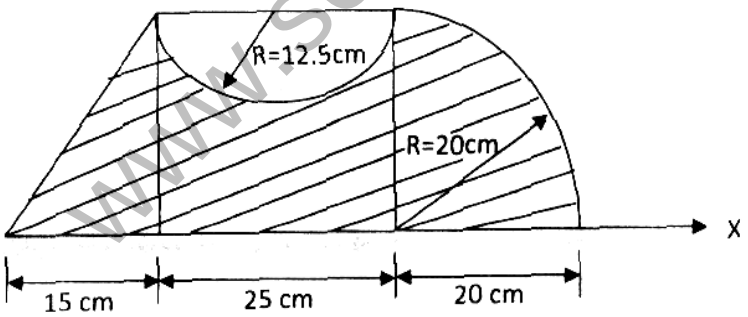

Fig. 6 5

(b) Explain the **principle of virtual work**. 2

(c) Determine support reactions by virtual work method Refer fig. 7

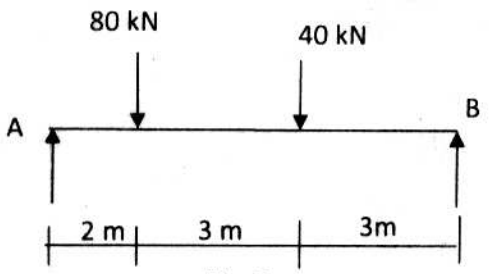

Fig. 7

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OR

6. (a) Find Centroid of the shaded area shown in Fig. 6 w.r.t. X–axis. 5

(b) Using the method of virtual work, determine the values of θ_1, θ_2 and θ_3 at the equilibrium position of three homogeneous links, each weighing 100 N and each 2 m long and are held in the equilibrium position by the 150 N horizontal force as shown in Fig. 8

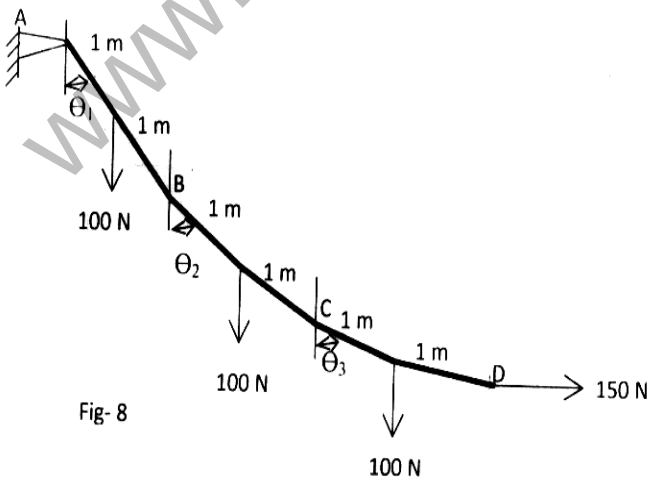

Fig- 8

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7. (a) Find the displacement of block A for fig. 9 after 5 seconds starting from rest Take $\mu = 0.1$

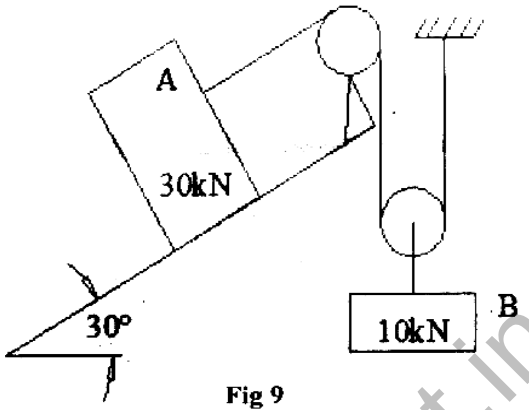

Fig 9

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(b) Explain the term :—

(1) "Elastic Impact". 2

(2) D' Alembert's principle. 3

OR

8. (a) Two weights 800 N and 200 N are connected by a thread and they move along a rough horizontal plane under the action of a force of 400 N applied to the 800 N weight as shown in fig. 10. The coefficient of friction between the sliding surface of the weights and the plane is 0.3 using D' Alembert's principle determine the acceleration of weight and tension in thread.

Fig-10

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(b) Two blocks A and B, each of 1 kg mass and resting on a rough inclined plane are released from the position as shown in Fig. 11. The static friction between block A and surface of incline is 0.12, and that between block B and surface of incline is 0.3. Make calculations. Find the time at which impact would occur, and the velocity of blocks immediately after impact. Coefficient of restitution equal to 0.75.

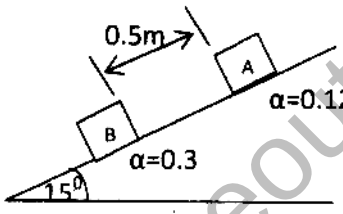

Fig. 11 5