

**Course Code: EST 100**  
**Course Name: ENGINEERING MECHANICS**  
**(2019 -Scheme)**

Max. Marks: 100

Duration: 3 Hours

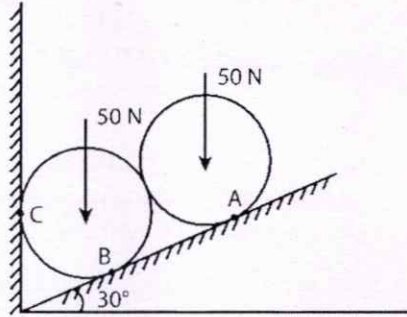
**PART A***Answer all questions, each carries 3 marks*

- |    |                                                                                                                                                                                                                            | Marks |
|----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1  | Explain Principle of transmissibility with neat sketch.                                                                                                                                                                    | (3)   |
| 2  | Two forces of magnitude 15 N and 12 N are acting at a point. If the angle between the two forces is $60^\circ$ , determine the resultant of the forces in magnitude and direction.                                         | (3)   |
| 3  | A body weighing 150 N is placed on a rough horizontal plane. If the coefficient of friction between the body and the horizontal plane is 0.4, determine the horizontal force required to just slide the body on the plane. | (3)   |
| 4  | List the Coulomb's laws of friction.                                                                                                                                                                                       | (3)   |
| 5  | Distinguish between centroid and centre of gravity.                                                                                                                                                                        | (3)   |
| 6  | A force $F=2i + 3j - 4k$ is applied at the point B (1,-1,2). Find the moment of the force about a point A (2,-1,3).                                                                                                        | (3)   |
| 7  | Define rectilinear translation. What are the assumptions taken during the study of the motion of connected bodies?                                                                                                         | (3)   |
| 8  | State and explain D'Alembert's principle.                                                                                                                                                                                  | (3)   |
| 9  | Define SHM. What are the general conditions for a periodic motion to be simple harmonic?                                                                                                                                   | (3)   |
| 10 | Illustrate the significance of instantaneous Centre in the analysis of rigid body undergoing rotational motion.                                                                                                            | (3)   |

**PART B***Answer one full question from each module, each question carries 14 marks.***MODULE 1**

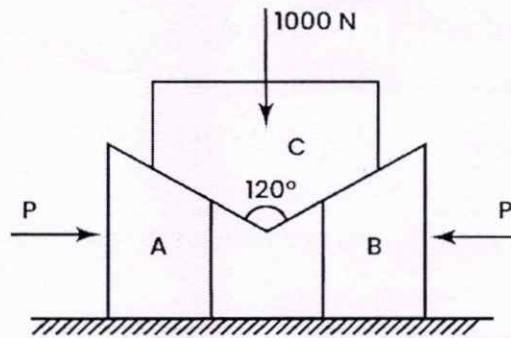
- 11 In a regular hexagon ABCDEF the forces 4,  $F_1$ ,  $F_2$ , 9 and 8 kN act along AB, CA, AD, AE and FA respectively and point A is in equilibrium. Determine the values of  $F_1$  and  $F_2$ . (14)

- 12 Two identical rollers, each weighing 50 N, are supported by an inclined plane and a vertical wall as shown in Fig. Find the reactions at the points of supports A, B and C. Assume all the surfaces to be smooth. (14)

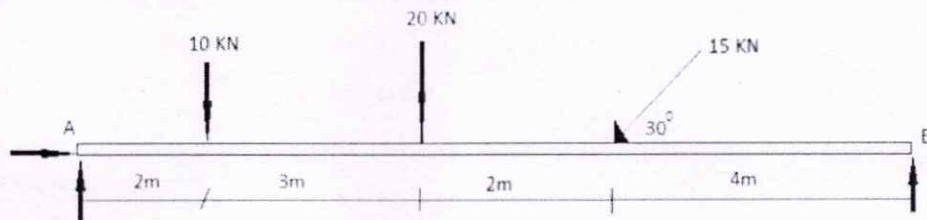


**MODULE 2**

- 13 Two wedges A and B are used to raise another block C weighing 1000 N as shown. Assuming the coefficient of friction as 0.25 for all the surfaces, determine the value of P for impending motion of block C. (14)



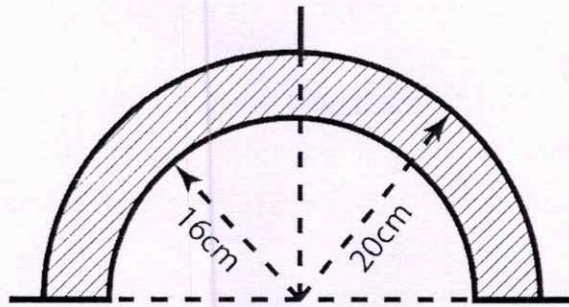
- 14 A beam is hinged at A and roller supported at B. It is acted upon by loads as shown below. Find the reactions at A & B. (14)



**MODULE 3**

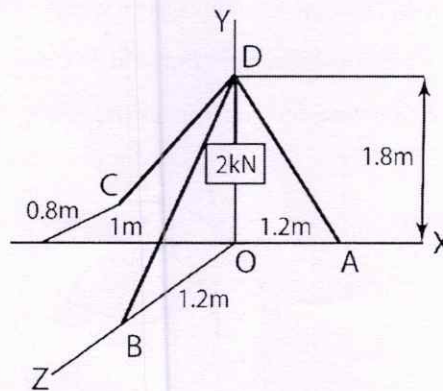
- 15 Calculate the Moment of Inertia of shaded area with respect to its centroidal axes. (14)





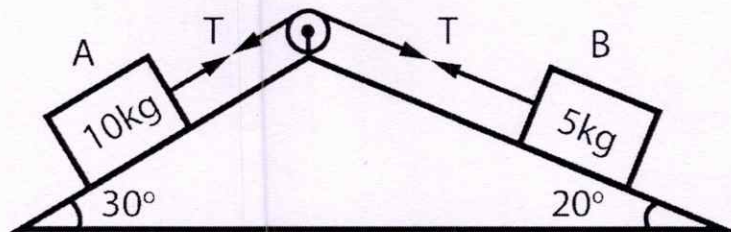
All dimensions are in cm.

- 16 A tripod supports a load of 2 kN as shown. The ends A, B and C are in the X-Z plane. Find the force in the three legs of the tripod. (14)



#### MODULE 4

- 17 Two smooth inclined planes whose inclinations with the horizontal are  $30^\circ$  and  $20^\circ$  (14) and are placed back-to-back. Two bodies of masses 10 kg and 5 kg are placed on them and are connected by a string. Calculate the tension in the string and the acceleration of the bodies.

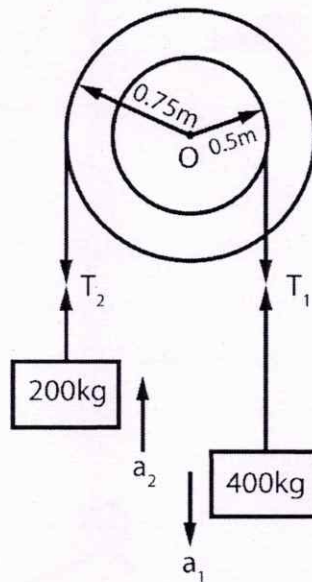


- 18 A car enters a curved portion of the road with a radius of 200 m travelling at a (14) constant speed of 36 kmph. Determine the component of velocity and acceleration

of the car in X and Y directions 15 seconds after it has entered the curved portion of the road.

### MODULE 5

- 19 The weight of an empty railway wagon is 24 kN. On loading it with goods (14) weighing 320 kN, its spring gets compressed by 80 mm.
- Calculate its natural frequency of vibration when the wagon is empty and loaded as above.
  - It is set into natural vibrations with an amplitude of 100 mm when empty. Calculate the velocity of the railway wagon when its displacement is 40 mm.
- 20 The composite pulley shown in the figure weighs 800 N and has a radius of (14) gyration of 0.6 m. The 200-kilogram and 400-kilogram blocks are attached to the pulley by strings. determine the tension in the string and angular acceleration of the pulley.



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