Indian Institute of Engineering Science and Technology, Shibpur

B.Tech (AE, CE, ME, MT, MN, CST, ETC, IT, EE) 2nd Semester Mid-Semester Examination, February, 2024

Mechanics (AM 1201)

Full marks: 30

Time: 2 Hours

All notations have their usual meanings

(i) Take g = 9.81 m/s^2. (ii) Assume suitable data not given in the question.

(iii) Answer any **Four (04)** questions

2 marks are reserved for neatness and handwriting

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1. The uniform *50-kg* bar with end rollers is supported by the horizontal and vertical surfaces and by the wire AC shown in **Fig. 1**. Calculate the tension **T** in the wire and the reactions against the rollers at A and at B. [7]

2. Calculate the horizontal force P on the light *10*° wedge necessary to initiate movement of the *45-kg* cylinder as shown in **Fig. 2**. The coefficient of static friction for both pairs of contacting surfaces is *0.30*. Also determine the friction force FB at point B. [7]
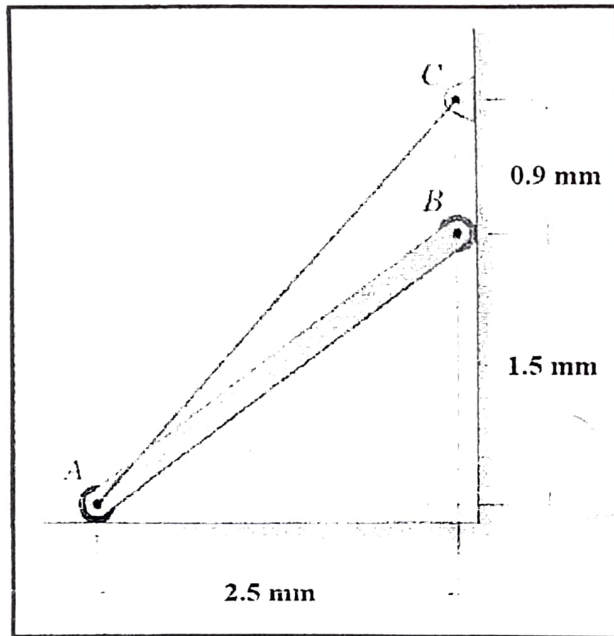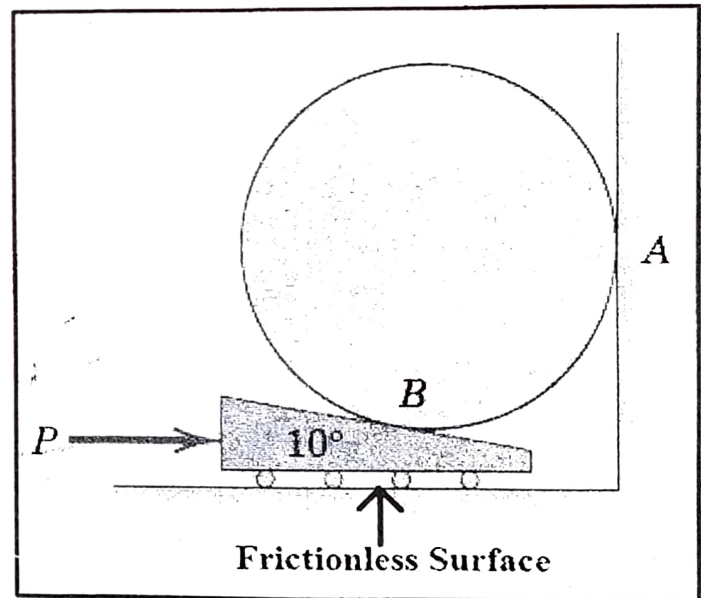

Fig. 1

Fig. 2

3. A lifting device for transportation *155-kg* steel drums is as shown in **Fig. 3**. Calculate the magnitude of the force exerted on the drum at E and F. [7]

4. Determine the forces in members BC, CI and HI of the truss structure loaded as shown in **Fig. 4**. [7]

5. The thickness of the triangular plate shown in **Fig. 5** varies linearly with y from a value t_0 along its base $y = 0$ to $2t_0$ at $y = h$. Determine the y coordinate of the center of the mass of the plate considering (a) uniform density (b) linearly varying density with y from a value ρ_0 along its base $y = 0$ to $2\rho_0$ at $y = h$. [5+2]
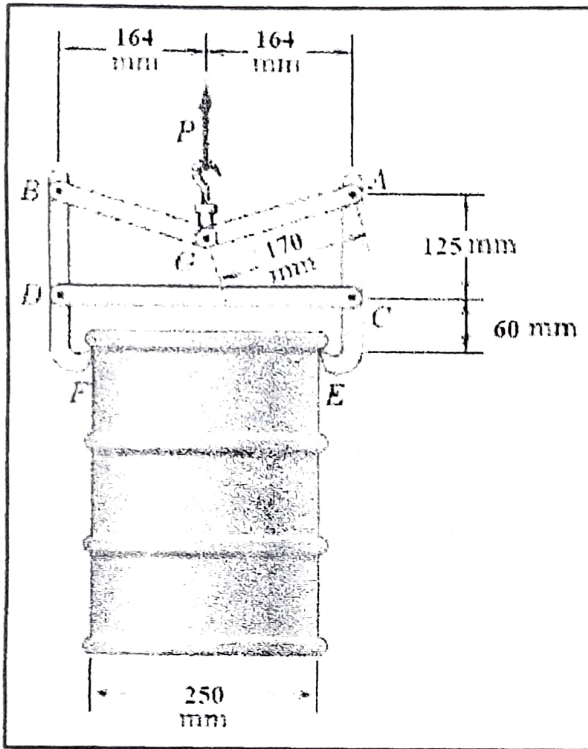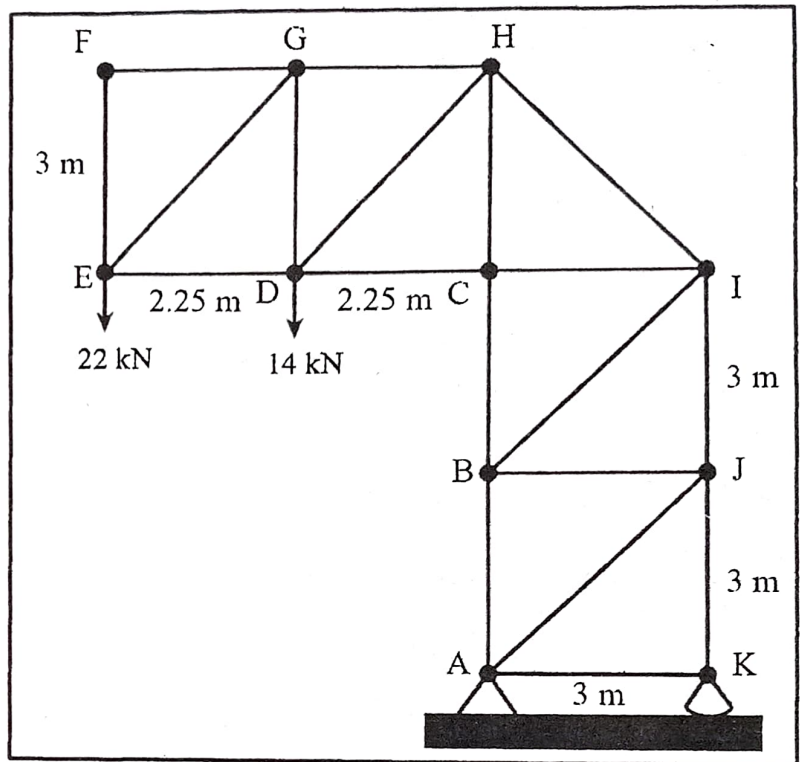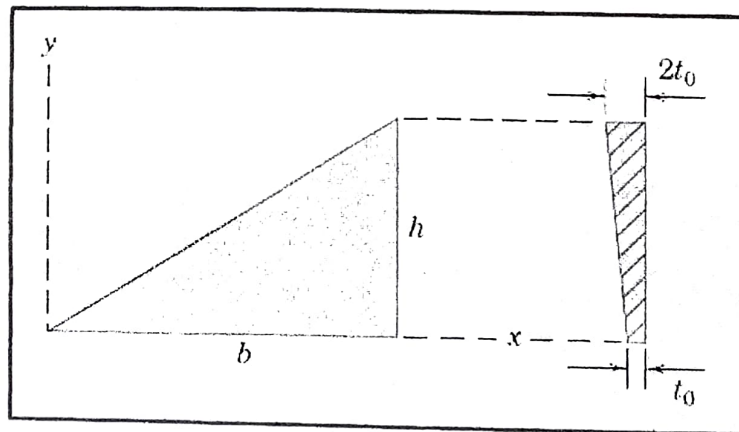

Fig. 3

F   G   H

3 m

E   2.25 m   D   2.25 m   C   I

22 kN   14 kN   3 m

B   J

3 m

A   K
3 m

Fig. 4

y

$2t_0$

h

b   x

t_0

$P BL)$

FCI

Fig. 5