B E ComputerScience & Engineering First Year Second Semester, 2019 (Old)

Jadavpur University

Subject : Engineering Mechanics

Time : 3 hrs   Full Marks : 100

Answer any five questions

1. (a) Refer to Fig. A and find out the moments of the force about point O and ON axis.
   (b) Refer to Fig B and replace the system of forces and moments with a single force-moment
   system to be applied at A.   10 + 10

2. (a) Refer to Fig C and find out the support reactions and also the force developed at pin joint C.
   (b) Refer to Fig D and find out the force needed to move the upper block upward. Consider all
   the contact surfaces to be equally rough with coefficient of friction 0.25   10 + 10

3. Refer to Fig E and find out the support reactions and cable supports.   20

4. (a) Refer to Fig F and find out the coordinates of the centroid of the shaded area.
   (b) Refer to Fig G and find out the area moments of inertia about XX and YY axes.   10 + 10

5. (a) Deduce the expressions for acceleration and velocity for a particle executing a plane
   curvilinear motion in normal-tangential coordinate system.
   (b) A projectile is fired with an initial velocity of 30 m/s as shown (Fig H). Find out the distance
   along the slope where it will hit the slope.   8 + 12

6. Write short notes on any four :   5 X 4=20
   (a) Theorems of Pappus-Guldinus
   (b) Free Body Diagram
   (c) Two force member and three force member
   (d) Truss and Frame
   (e) Work Energy principle
   (f) Free vector, sliding vector and fixed vector

                                                                                    [Turn over

A $(1, 2, 10)$ m

$\bar{P}$ $|\bar{P}| = 100\,N$

O   Y

$60°$

$30°$

X   N $\cdot B(3, 4, 0)$ m

fig A.

10N

10N

A $(0, 4, 6)$ m

20Nm

10Nm

$\alpha = 45° = \beta$

α

O β 20N

X

fig B.

D

2m

$\downarrow$ 20N

C

1.5m   E   BE = 0·4 m

A

10N   B

fig C.

$45°$

$30°$

mass$_A$ = 100 kg

mass$_B$ = 20 kg.

A

B $\leftarrow$ P

fig D.

15°

A

B

1.5m

2m

X

2m $\downarrow$ W   A $(0, -2, 4)$ m

W = 2000N   B $(0, 2, 4)$ m

O $\approx$ B&S joint   fig E

Y

R

α

X

α

R

fig F.

Y

a

X   X

a

b

Y

fig G.

$v = 30$ m/s $\alpha = 20°$

$\beta = 20°$

α

β

Fig H.