SEMESTER END EXAMINATION (SEE) B.E. FIRST SEMESTER – DEC 2013
13CV101-ENGINEERING MECHANICS

Time: 3 hours	Answer all questions	Max marks: 100	
1a	Explain the principle of transmissibility of forces, with the aid of a sketch		4
1b	At what angle θ must the 800 N force be applied in order that the resultant R of the two forces has a magnitude of 2000 N? For this condition determine the angle β between R and the vertical.		8
1c	A 150N pull T is applied to a cord, which is wound securely around the inner hub of the drum. Determine the moment of T about the drum center C. At what angle θ should T be applied so that the moment about the contact point P is zero?		8
2a	State and explain the equations of equilibrium		4
2b	It is desired that a person be able to begin closing the van hatch from the open position shown with a 40 N vertical force P. As a design exercise, determine the necessary force in each of the two hydraulic struts AB. The mass center of the 40 kg door is 37.5 mm directly below point A. Treat the problem as two dimensional.		8
2c	A portable electric generator has a mass of 160 kg with mass center at G. Determine the upward force F necessary to reduce the normal force at A to one half its nominal (F=0) value.		8
3a	Determine the distance $\bar{h}$ from the base of a triangle of altitude h to the centroid of its area.		4
3b	Determine the x and y coordinates of the centroid of the shaded area		8
3c	Determine the moments of inertia of the Z section about its centroidal x_0 and y_0 axes.		8
4a	What are the different types of beams?		4
4b	Determine the force in each member of the loaded truss.		8
4c	Determine the reactions at points A and B of the beam subjected to the elliptical and uniform load distributions. At which surface, upper or lower, is the reaction at A exerted?		8
5a	Derive an expression for belt friction		4
5b	Determine the horizontal force P required to cause slippage to occur. The top block is free to move vertically.		8
5c	Determine the range of cylinder mass m over which the system is in equilibrium.		8

FIGURES

1b

1400 N

800 N

θ

1c

T = 150 N

θ

125 mm

C

200 mm

P

2b

A

550 mm

O Hinge axis

600 mm

175 mm

30°

B

Strut detail

1125 mm

A

O

B

P

2c

F

B

G

O

A

240 mm

325 mm

135 mm

3b

y

b

x = ky²

a

x

3c

80

20

20

120

20

DIMENSIONS IN 'MM'

20

80

4b

A

2 m

4 m

D

B

3 m

C

5 kN

15°

4c

4 m

3 kN/m

A

B

3 kN/m

2 m

5 m

1 m

2 m

5b

100 kg

P

50 kg

μ = 0.60

μ = 0.40

20 kg

μ = 0.30

5c

μ = 0.3

μ = 0.3

100 kg

20°

m

2