KATHMANDU UNIVERSITY
End Semester Examination
March/April 2017

Marks Scored:

Level : B.E.
Year : II
Course : CIEG 203
Semester: I
Exam Roll No. :
Time : 30 mins.
F.M. : 10
Registration No.:
Date APR 10 2017

SECTION "A"
[20 Q.×0.5=10 marks]

1. The unit of a couple is
a) N/m^2 b) N/m c) N-m d) N

2. The resultant of two forces P and Q acting at an angle θ makes an angle β with P. Then β is given by
a) $\tan\beta=(Q \sin\theta)/(P + Q \cos\theta)$
b) $\tan\beta=(P \sin\theta)/(P + Q \cos\theta)$
c) $\tan\beta=(P \sin\theta)/(P - Q \cos\theta)$
d) $\tan\beta=(Q \sin\theta)/(P - Q \cos\theta)$

3. The resultant of three coplanar concurrent forces can be determined using
a) Lami's theorem
b) Polygon of forces
c) Parallelogram law
d) Triangle law

4. A block of 60 N is placed on a horizontal plane. The block is about to slide when a horizontal force of 20 N is applied to the block. The angle of friction is
a) 19.80 b) 21.80 c) 23.50 d) 25.50

5. A ladder rests on a smooth ground against a rough wall. The force of friction acts
a) away from the wall at the upper end
b) towards the wall at the upper end
c) upward at the upper end
d) downward at the upper end

6. The area moment of inertia of a plane is the
a) First moment of area
b) Second moment of inertial mass
c) Third moment of inertial mass
d) Second moment of area

7. A slender bar is kept along x-axis. Its mass MI about y-axis is
a) ML/2 b) $ML^2/2$ c) $ML^2/12$ d) ML/36

8. The centre of gravity of a quadrant of a circle lies along its central radius at a distance of
a) 0.3 R b) 0.4 R c) 0.5 R d) 0.6 R

9. A body falls down from a height h under the action of gravity. The velocity attained by it is
a) gh b) 2gh c) $\sqrt{(2gh)}$ d) $\sqrt{(gh)}$

10. Acceleration is a
    a) Scalar quantity
    b) constant quantity
    c) vector quantity
    d) variable quantity

11. If a rigid body is acted upon by a couple, the motion is said to be
    a) Translation
    b) Plane motion
    c) Translatory rotation
    d) Rotation

12. The equation of motion of a particle in rectilinear motion is $s = 3t^3-1$,'s' is in metre and 't' is in second. The velocity of the particle after one second is
    a) 2 m/s
    b) 3 m/s
    c) 9 m/s
    d) 18 m/s

13. D' Alembert's principle is a principle of
    a) Static equilibrium
    b) Dynamic equilibrium
    c) Kinetics of rigid bodies
    d) Kinematics

14. A railway engine weighing 600 kN moves on a circular track of radius 1000 m at a speed of 10 m/s. The force exerted on the rails towards the centre of the track is
    a) 3116 N
    b) 4116 N
    c) 5116 N
    d) 6116 N

15. The work done on a body is equal to the kinetic energy that the body has gained. This is called the principle of
    a) work energy
    b) work power energy
    c) work kinetic energy
    d) power gain

16. In a direct impact, a 10 kg ball moving at 2 m/s strikes a 2 kg stationary ball.The moving ball comes to rest after collision. The velocity of the second ball is
    a) 10 m/s
    b) 12m/s
    c) 20m/s
    d) 2m/s

17. In a Simple Harmonic Motion, the number of cycles per second is known as
    a) oscillation
    b) amplitude
    c) frequency
    d) periodic time

18. If two springs are connected in series,
    a) They share load equally
    b) Their extensions are equal
    c) Their stiffness are equal
    d) Their tensions are equal

19. Power can be expressed as
    a) work/energy
    b) work/time
    c) work * time
    d) work / distance

20. A particle executes a simple harmonic motion. While passing through the mean position, the particle posses
    a) Maximum Kinetic Energy and minimum Potential Energy
    b) Maximum Kinetic Energy and maximum Potential Energy
    c) Minimum Kinetic Energy and maximum Potential Energy
    d) Minimum Kinetic Energy and minimum Potential Energy

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SECTION "B"

Attempt ALL questions.

1.a) Two forces act on the hook shown in figure (a) below. Specify the magnitude of F_2 and its coordinate direction angles of F_2 that the resultant force F_R acts along the positive y axis and has magnitude of 800 N. [4]

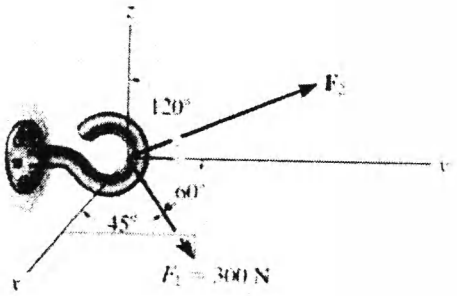


figure (a)

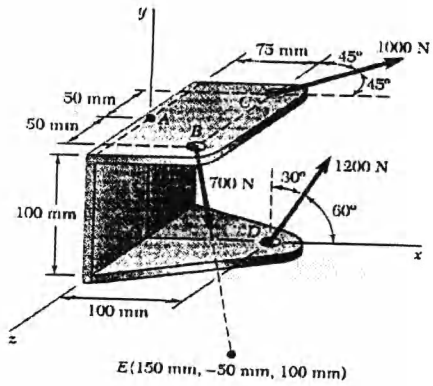
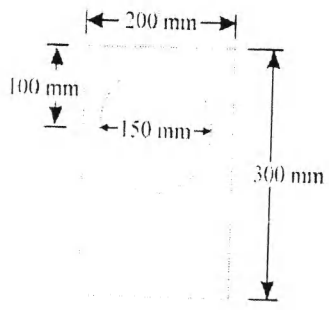
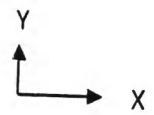


figure (b)

b) Three cables are attached to the bracket as shown in figure (b). Replace the forces with an equivalent force-couple system at *A*. [4]

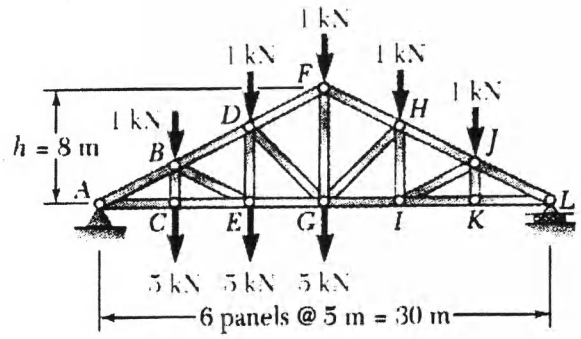
2.a) Find the moment of inertia of a hollow section shown in figure below about an axis passing through its centre of gravity or parallel X-X axis. [4]





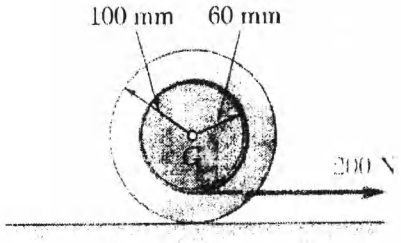
c) An effort of 200 N is required just to move a certain body up an inclined plane of angle 15° the force acting parallel to the plane. If the angle of inclination of the plane is made 20° the effort required, again applied parallel to the plane, is found to be 230 N. Find the weight of the body and the coefficient of friction. [4]

3.a) Determine the force in members *FH*, *GH*, and *GI* of a truss shown in figure below. [4]



b) Draw the bending moment and shear force diagrams for a simply supported beam of span 5m. It carries two concentrated loads at a distance of 1.5 m from each end. [4]

4. A cord is wrapped around the inner hub of a wheel and pulled horizontally with a force of 200 N as shown in figure below. The wheel has a mass of 50 kg and a radius of gyration of 70 mm. Knowing $m_s = 0.20$ and $m_k = 0.15$, determine the acceleration of *G* and the angular acceleration of the wheel. [8]



5. A block of mass 45 kg is carried by two parallel springs, both hung from a ceiling. The spring constants of springs are 3 kN/m and 4 kN/m respectively. The block is pulled down by a distance 2.5 cm from its position of equilibrium and released. Determine the period of vibration, maximum velocity of the block and maximum acceleration of the block. Repeat the problem when the springs are connected in series.Also draw the free body diagrams in each case. [8]