KATHMANDU UNIVERSITY
End Semester Examination
July/August 2024

Marks Scored:

Level : B.Arch.
Year : II

Course : CIEG 231
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 11 AUG 2024

SECTION "A"

[20Q. × 0.5 = 10 marks]

Choose and encircle the most appropriate option from each set of choices

1. A force of 50 N acting tangentially to a circle of radius 6 m. Its moment about diametrically opposite point will be
   a. 150 Nm b. 600 Nm c. 60 Nm d. 300 Nm

2. Four forces 18 N, 36 N, 54 N and 72 N are acting along sides AB, BC, CD and DA of a rectangle ABCD of side (2× 3) m as shown in **Figure 1.** Their resultant forces is 150 N. Calculate position of resultant w.r.t. 'A'
   a. 1.56m
   b. 15.60m
   c. 156m
   d. 0.156m

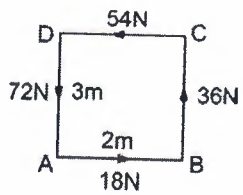

Figure 1.

3. If the sum of all the forces acting on a body is zero, then the body may be in equilibrium provided the forces are
   a. Unlike Parallel b. Parallel c. Like Parallel d. Concurrent

4. A body was thrown vertically downwards from the top of a tower and traverses a distance of 40 meters during its 4th second of its fall. Find the initial velocity of the body
   a. 5.7m b. 6.7m c. 7m d. 7.5m

5. Three forces 7 N, 14 N and 28 N act along three sides of an equilateral triangle AB, BC and CA. Side AB being horizontal. The resultant of system is
   a. 18.15N b. 31.77N c. 23.71N d. 71.31N

6. _____ support allows rotation & lateral movement but no vertical movement.
   a. Fixed b. Roller c. Pin d. Free

7. Uniformly varying load between two sections in shear force diagram is represented by
   a. cubic curve b. inclined line c. horizontal line d. parabolic curve

8. If the reaction of a beam, at one of its supports is the resultant of horizontal and vertical forces, then it is a
   a. Simply supported end b. Roller supported end
   c. Hinged end d. Fixed end

9. For a cantilever beam, bending moment is zero at
   a. One fourth form the free end
   b. Fixed end
   c. Center of beam
   d. Free end

10. The center of gravity of an equilateral triangle with each side (b) is ____ from any of the three sides.
   a. $b\sqrt{3}/2$
   b. $b\sqrt{2}/3$
   c. $b/(3\sqrt{2})$
   d. $b/(2\sqrt{3})$

11. Two masses of 10 kg and 15 kg are connected to two ends of an inextensible rope and passing over a smooth pulley. The 10 kg mass is lying over a rough plane, which is inclined at an angle of 25° with the horizontal. If this angle is made 30°, then
   a. tension in the string will increase
   b. tension in the string will decrease
   c. tension in the string will not change
   d. Acceleration of the system will remain the same.

12. The moment of inertia of a circular section of diameter (d) is given by the relation
   a. $\frac{\pi d^4}{16}$
   b. $\frac{\pi d^4}{32}$
   c. $\frac{\pi d^4}{64}$
   d. $\frac{\pi d^4}{96}$

13. The maximum height of a projectile on a horizontal range is
   a. $u^2 \sin 2\alpha/2g$
   b. $u^2 \sin \alpha/2g$
   c. $u^2 \sin^2 2\alpha/2g$
   d. $u^2 \sin^2 \alpha/2g$

14. A lever AB = 2 m long is inclined at 35° with horizontal. A forces of 180 N is acting at B vertically downwards. The moment about 'A' is
   a. 29.5 Nm
   b. 295 Nm
   c. 2950 Nm
   d. 2.95 Nm

15. The shear force diagram of a loaded beam is shown in **Figure 2**. The maximum bending moment in this beam is

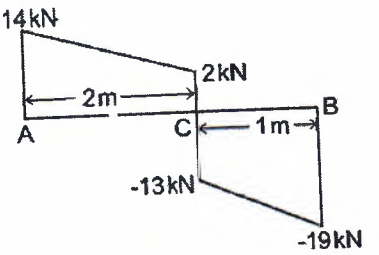

Figure 2

   a. 16 kNm
   b. 11 kNm
   c. 28 kNm
   d. 8 kNm

16. The moment of inertia of a triangular section of base (b) and height (h) about an axis passing through its vertex and parallel to the base is _____ as that passing through its C.G. and parallel to the base.
   a. 12 times
   b. 9 times
   c. 6 times
   d. 4 times

17. The motion of particle is defined by relation $x=t^2-10t+20$, where x is in m and t is sec. Find time when velocity is zero?
   a. 4 sec
   b. 5 sec
   c. 6 sec
   d. 7 sec

18. **Figure 3** below shows the reactions produced at the supports. Choose the correct option.

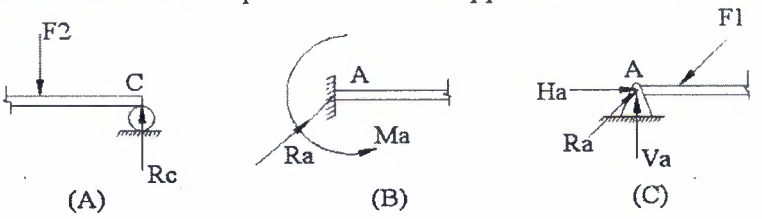

Figure 3

a. A, B,C are wrong
b. A, B, C are correct
c. A, B are wrong
d. A,C are correct

19. The beam is shown in **Figure 4** by a hinge at A and a roller at B. The reaction RA of the hinged support A of the beam is

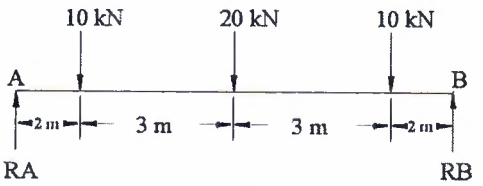

Figure 4

a. 1.8 kN
b. 10.7 kN
c. 20 kN
d. 30 kN

20. A particle starts from rest and moves in a straight line whose equation of motion is given as $S = 2t^3 - t^2 - 1$. The acceleration of particle after one second will be

a. $4\,m/s2$
b. $6\,m/s2$
c. $8\,m/s2$
d. $10\,m/s2$

6. Two rough planes inclined at 30° and 15° to the horizontal and of the same height are placed back to back. Two bodies of masses of 15 kg and 5 kg are placed on the faces and connected by a string over the top of the planes as shown in **Figure 5**. If the coefficient of friction be 0.3 and taking g = 9.8 m/s2,

- Find from fundamental concept (No direct formula), the resulting acceleration.
- Tension in the string &
- Pulley reaction

[5]

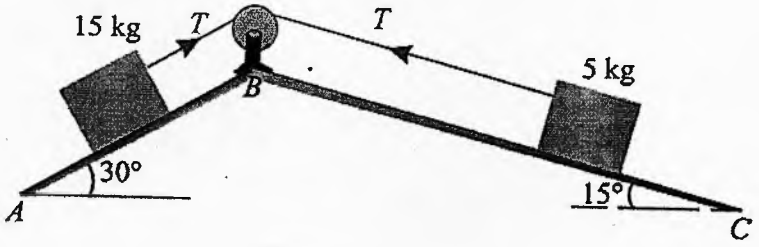

Figure 5

7. Two electric trains A and B leave the same station on parallel lines. The train A starts from rest with a uniform acceleration of 0.2 m/s2 and attains a speed of 45 km/h. which is maintained constant afterwards. The train B leaves 1 minute after with a uniform acceleration of 0.4 m/s2 to attain a maximum speed of 72 km/h. which is maintained constant afterwards. When will the train B overtake the train A? [4]

OR

A particle starting from origin is subjected to acceleration such that $\mathbf{a_x=-3\ m/s^2}$ and $\mathbf{a_y=-11 m/s^2}$. If the initial velocity is 80 m/s directed at a slope of 4:3 as shown in **Figure 6**, compute the radius of curvature of path after 4 seconds. Also find position at the end of 4 sec. [4]

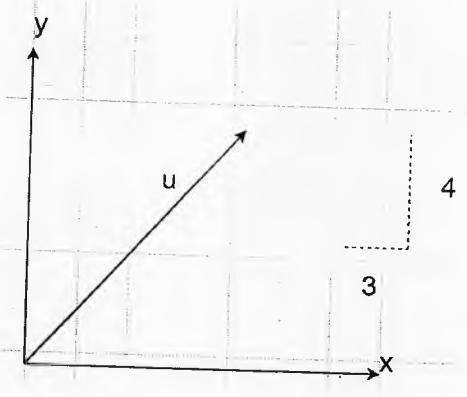

Figure 6

8. Draw the Shear Force Diagram and Bending Moment Diagram for the beam in **Figure 7**. 'A' is pinned and 'D' is roller support. Also determine the point of contraflexure and the point of zero shear if present. [7]

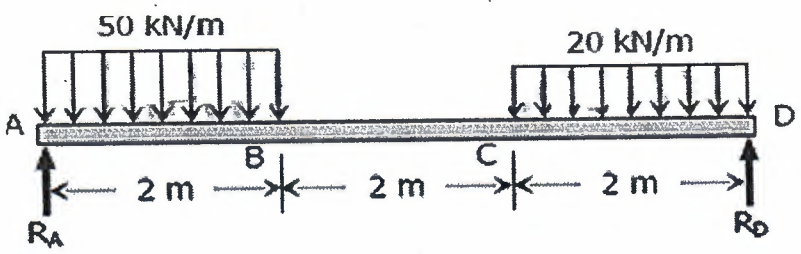

Figure 7