BUILDING CONSTRUCTION APPLIED MECHANICS 1
7216

GENERAL CERTIFICATE OF EDUCATION BOARD

Technical and Vocational Education Examination

JUNE 2022 **ADVANCED LEVEL**

Specialty Name and Acronym	**CIVIL ENGINEERING-BUILDING CONSTRUCTION - CE-BC (F4-BA)**
Centre No.	
Centre Name	
Candidate No.	
Candidate Name	

Mobile phones are **NOT** allowed in the examination room

7216 BUILDING CONSTRUCTION APPLIED MECHANICS 1: MULTIPLE CHOICE QUESTION PAPER

01hour 30 minutes

INSTRUCTIONS TO CANDIDATES

Read the following instructions carefully before you start answering the questions in this paper. Make sure you have a soft HB pencil and an eraser for this examination.

1. USE A SOFT HB PENCIL THROUGHOUT THE EXAMINATION.
2. DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO.

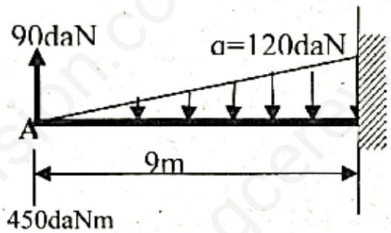
Before the examination begins:

3. Check that this question booklet is headed **Advanced Level– 7216 BUILDING CONSTRUCTION APPLIED MECHANICS 1**
4. Fill in the information required in the spaces above.
5. Fill in the information required in the spaces provided on the answer sheet using your HB pencil: **Candidate Name, Exam Session, Subject Code, Centre Number and Candidate Identification Number.** Take care that you do not crease or fold the answer sheet or make any marks on it other than those asked for in these instructions.
   How to answer the questions in this Examination
6. Answer **ALL** the 50 questions in this examination. All questions carry equal marks.
7. Non programmable calculators are allowed.
8. Each question has FOUR suggested answers: **A, B, C** and **D**. Decide which answer is appropriate. Find the number of the question on the Answer Sheet and draw a horizontal line across the letter to join the square brackets for the answer you have chosen.
   For example, if **C** is your correct answer, mark **C** as shown below:
   [A] [B] ~~[C]~~ [D]
9. Mark only one answer for each question. If you mark more than one answer, you will score a zero for that question. If you change your mind about an answer, erase the first mark carefully, then mark your new answer.
10. Avoid spending too much time on any one question. If you find a question difficult, move on to the next question. You can come back to this question later.
11. Do all rough work in this booklet using the blank spaces in the question booklet.
12. **At the end of the examination, the invigilator shall collect the answer sheet first and then the question booklet. DO NOT ATTEMPT TO LEAVE THE EXAMINATION HALL WITH IT.**

1. A point subjected to many forces is said to be in equilibrium if
   - A All the forces are parallel and opposite.
   - B The algebraic sum of moment of the forces about a point is equal to zero
   - C All the forces are perpendicular and opposite.
   - D The algebraic sum of moment of the forces about a point is different from zero.

2. The main bar of a column in a reinforced concrete structure should have a minimum diameter of
   - A 12mm
   - B 6mm
   - C 10mm
   - D 8mm

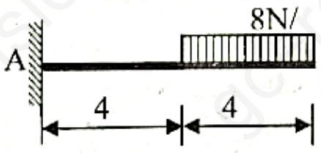
3. On the cantilever beam below, the maximum bending moment is



   - A 450daNm
   - B 810daNm
   - C 120daNm
   - D 90daNm

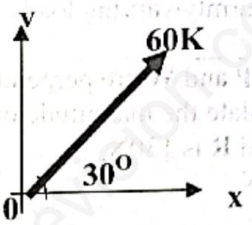
4. The coefficient of statics friction of a body sliding on another one is 0.2, calculate the equivalent force if the horizontal force that causes it to just start moving is 30N
   - A 30N
   - B 150N
   - C 6N
   - D 60N

5. In the figure below, the reaction at **A** is



   - A 8N
   - B 32N
   - C 192N
   - D 16N

6. The diagram below shows a resultant force of 60kN in the x-y plane. Its magnitude on the y axis is



   - A 30KN
   - B 51.96KN
   - C 60KN
   - D 34.64KN

7. State the factor that determines the coefficient of friction between two objects.
   - A Effect of applied forces on one of the object.
   - B Effect of applied forces of the two objects
   - C Nature of surfaces.
   - D Area of contact

8. A mechanical body that does not regain its original shape after the removal of the applied load that has produced deformation is said to be
   - A Elastic
   - B Plastic
   - C Rigid
   - D Flexible.

9. Four rivets having a diameter of 20mm is subjected to a shear force of 600N. Calculate the shear stress on the rivets.
   - A $3/2\pi$
   - B $6/\pi$
   - C $3/8\ \pi$
   - D $8/3\ \pi$

10. Concrete slabs were lifted up at once to a height of 6m. The weight of a slab is 50kg, calculate the work done in lifting the slabs, taking the value of the acceleration due to gravity to be $10m/s^2$
    - A 30KNm
    - B 3000Nm
    - C 30Nm
    - D 300KNm

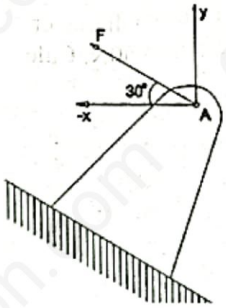
11. The force exerted by the wheels of a moving trailer on a bridge is an example of
    A horizontal loads
    B Uniformly distributed loads
    C Rolling loads
    D Uniformly varying loads

12. Two forces **P** and **W** are perpendicular to each other. Calculate the magnitude of **W** knowing that **P** is 50N and **R** is 130N
    A 120N
    B 70N
    C 100N
    D 60N

13. A hoop has a mass of 2kg and a radius of 4m is sliding with a linear velocity of 8m/s and an angular velocity of 5rad/s. what is its total kinetic energy?
    A 75J
    B 420J
    C 89J
    D 464J

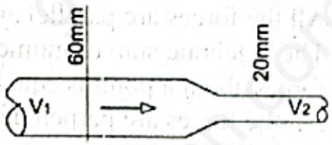
14. The rate of change of angular momentum is equal to
    A Energy.
    B Torque.
    C Force.
    D Impulse.

15. The expression of the component of the force F along the y-axis in figure below is



    A Fy = Fsin30
    B Fy = -F sin 30
    C Fy = -F cos30
    D Fy = Ftan30

16. A volume of water flows with a velocity of V_1 through a pipe as shown in the diagram below. What is the velocity V_2 at the outlet ?



    A $V_2 = \frac{1}{3}V_1$
    B $V_2 = \frac{2}{3}V_1$
    C $V_2 = \frac{V_1}{3}$
    D $V_2 = 3V_1$

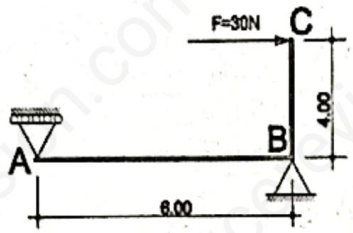
17. A particle moves in a straight line and its position is defined by the equation $x = 6t^2 - t^3$. The maximum velocity during the movement will be
    A 6m/s
    B 24m/s
    C 12m/s
    D 48m/s

18. Which of the following is not a vector quantity?
    A Energy.
    B Force.
    C Acceleration.
    D Momentum.

19. A ladder placed against a vertical wall and resting on a floor will not be in equilibrium if
    A Both floor and wall are rough.
    B Floor is smooth and wall is rough.
    C Both floor and wall are smooth
    D Floor is rough and wall is smooth.

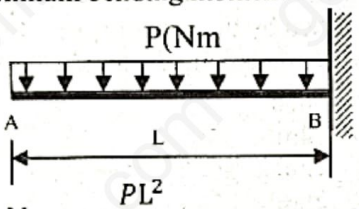
20. In determining the forces in the members of a framework by method of section, the framework is divided into two parts by an imaginary section. When more than two members of unknown forces are cut, we say the framework is
    A Rigid.
    B Isostatic.
    C Flexible.
    D Hyperstatic.

21. The reaction at A (R_A) on the given figure is equal to



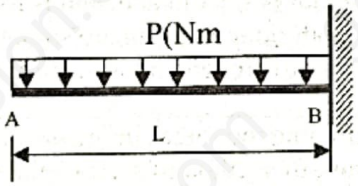
A 120N
B 160N
C 20N
D 30N

22. The maximum bending moment at B is



A $M_{max} = \frac{PL^2}{3}$
B $M_{max} = \frac{PL^2}{8}$
C $M_{max} = \frac{PL^2}{4}$
D $M_{max} = \frac{PL^2}{6}$

23. Where will the maximum deflection occur in the beam shown below?



A At the point B.
B At the distance L/2.
C At the distance L/3.
D At the point A.

24. A non-concurrent force system is said to be in equilibrium when
A Only the force polygon is closed.
B Both force and funicular polygons are closed.
C Only the funicular polygon is closed.
D Both force and funicular polygons are opened.

25. The bending stress at the neutral axis is
A Minimum
B Maximum
C Constant
D Zero

26. The calculated surface area of longitudinal rods in a rectangular beam is 3.14 cm^2. Choose a suitable number of bars for this beam.
A 1HA20
B 4HA10
C 3HA10
D 2HA14

27. The ratio of the speed of a rolling cylinder to a sliding cylinder is
A Less than one.
B Equal to one.
C Greater than two.
D Equal to two.

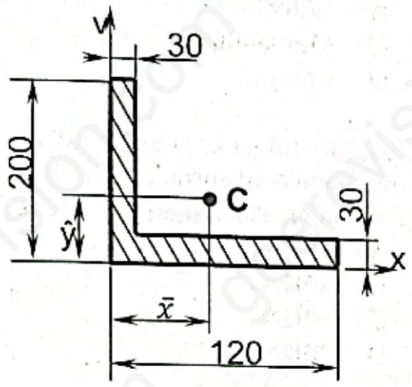
28. Calculate the safe stress (**fbu**) of concrete having fc_{28}= 25 Mpa and $\gamma_b = 1.5$
A 11.33Mpa
B 141.7Mpa
C 113.3Mpa
D 14.17Mpa

29. At the instantaneous center, the velocity of a moving lamina at any time is
A Varying.
B Zero.
C Constant.
D Maximum.

30. In a suspended cable with supports at both ends, the minimum pull is equal to
A Support reactions.
B Horizontal thrust.
C Tension at the support.
D Vertical support.

31. A particle is dropped from a height of 100m at the same time with another particle that is projected vertically upward with a velocity of 10m/s. The two particles will meet after
A 10 minutes.
B 15 minutes.
C 15 seconds.
D 10 seconds.

32. With reference to the plane surface below, the x and y coordinates of the centre of gravity are;



A C(73.62, 28.97)
B C(60, 100)
C C(28.97, 73.62)
D C(100, 60)

33. The expression of the maximum shear stress in cross section of a beam is

A $\tau = \frac{Q_{max}}{bd}$

B $\tau = \frac{2}{3}Q_{max}$

C $\tau = \frac{3Q_{max}}{2bd}$

D $\tau = \frac{Q_{max}}{3bd}$

34. When column loads are not placed directly on the axis of the foundation footing, we say that the loading is
A Uniform.
B Eccentric.
C Axial.
D Uneven.

35. Using the principle of "BAEL", calculate the linear load at serviceable limit state **Pser** of a reinforced concrete beam knowing that the permanent and exploitation loads per linear meter are 60daN and 40daN respectively .
A 100dan/m
B 141dan/m
C 20dan/m
D 144daN/m

36. A circular disc rotates at n rpm. The angular velocity of a circular ring of same mass and radius as the disc will have the same angular momentum is
A N rpm
B 2n rpm.
C n/4 rpm.
D n/2 rpm

37. The diagram showing both the point of application and line of action of forces in the same plane is
A Funicular diagram.
B Vector diagram.
C Space diagram.
D Polar diagram.

38. The hydrostatic pressure on a water tank depends on its
A Depth
B Width
C Length
D Area.

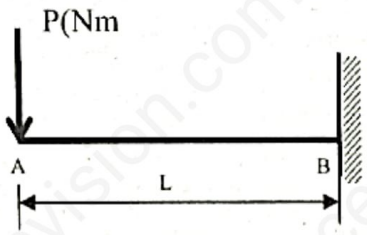
39. It is a graphical method of determining the forces in the members of a truss
A Culman's method.
B Method of section.
C Ritter's method.
D Method of joint.

40. In the 3 pivot deformation diagram, Pivot A corresponds to an extension of "BAEL"
A $10^0/_{00}$
B $2^0/_{00}$
C $3.5^0/_{00}$
D $0^0/_{00}$

41. We use stirrups in reinforcement to fight against
A Compression
B Bending
C Shearing
D Tension

42. Calculate the stress in a natural steel of feE40 knowing that $\gamma_s = 1.15$
A $\sigma_{st} = 460Mpa$
B $\sigma_{st} = 34.88Mpa$
C $\sigma_{st} = 46Mpa$
D $\sigma_{st} = 384.83Mpa$

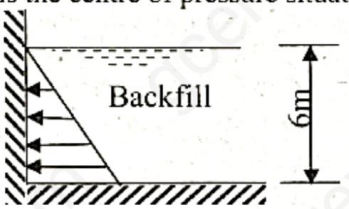
43. At what point in the loading below is the deflection of the beam zero?



A Point A.
B L/3 from point B
C Point B
D L/3 from point A

44. The cover of a drainage gutter in reinfor concrete has a mass of 100kg and a volume oı 0.2m3. Its density will be
A 200kg
B 500kg
C 50kg
D 2500kg

45. This is the active earth pressure on a retaining wall. Where is the centre of pressure situated?



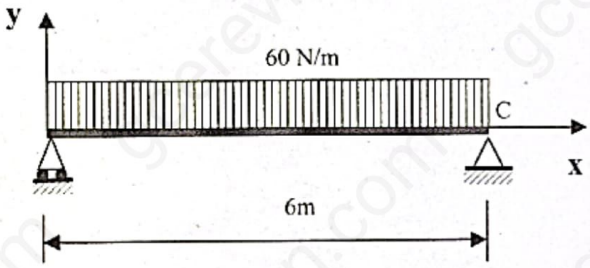
A 3m from the top.
B 2m from the top.
C 3m from the bottom
D 2m from the bottom

46. The pressure at the bottom of a dam is 90Kpa and the section of the submerged wall is 27.30m^2. The resultant force on the wall is
A F_R = 12,150KN
B F_R = 6075KN
C F_R = 4,050KN
D F_R = 3,037.5KN

47. Joule is the S.I unit for measuring
A Power.
B Work.
C Momentum.
D Energy.

48. After isolating a knot on a roof structure. the component F is given as Fx = 30KN Fy = 40KN. The magnitude of F is
A 45KN
B 80KN
C 50KN
D 20KN.

49. With reference to the beam loading below, establish the equation of the bending moment between A and C. Take RA= 180N



A $M(x) = 30X - 180X^2$
B $M(x) = 30X - 180X^2$
C $M(x) = -30X^2 - 180X$
D $M(x) = 30X^2 - 180X$

50. A vehicle of weight 20 tonnes moving on a plane horizontal surface at a speed of 5m/s will cover a distance of 60 m in how many seconds?
A 4 s
B 12 s
C 100 s
D 300 s

STOP

NOW GO BACK AND CHECK YOUR WORK