BUILDING CONSTRUCTION APPLIED MECHANICS 1
7216

JUNE 2020   **ADVANCED LEVEL**

Specialty(Specialty Code)	CIVIL ENGINEERING -BUILDING CONSTRUCTION:CE-BC(F4-BA)
Centre No. & Name	
Candidate No.	
Candidate Name	

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

7216–BUILDING CONSTRUCTION APPLIED MECHANICS 1: MULTIPLE CHOICE QUESTION PAPER

1 hour 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 "Advance Level – 7216–BUILDING CONSTRUCTION APPLIED MECHANICS 1

4.   Insert the information required in the spaces above.

5.   Insert 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 Number.

Take care that you do not erase 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.   Each question has FOUR suggested answers: **A, B, C** and **D**. Decide which answer is correct. 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]

8.   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.

9.   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.

10.   Do all rough work in this booklet, using, where necessary, the blank spaces in the question booklet.

11.   **You must not take this booklet and the answer sheet out of the examination room. All question booklets and answer sheets will be collected at the end of the examination.**

Turn Over

1. The elastic limit of a material is the stress
   A   Beyond which there is complete ruining of the structure
   B   Beyond which the material becomes very fragile.
   C   That lies between the proportional limit and the upper yield point.
   D   That lies between the upper yield point and the lower yield point.

2. The difference between a vector and a scalar quantity is that a vector is defined by

   A   Magnitude and a direction while a scalar is defined by a single number (magnitude).
   B   A single number called a magnitude while a scalar is defined by a magnitude and a direction.
   C   Its components x,y,z while a scalar is defined by a single number (magnitude)
   D   A force while a scalar is defined by acceleration

3. On the figure below, the vertical reaction at **B** is equal to:

   A   1800daN
   B   1350daN
   C   900daN
   D   450daN

   $q=150daN/m$

   6 m
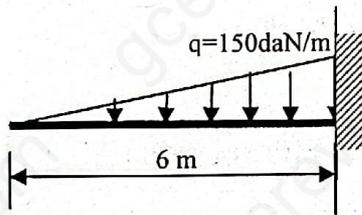
4. The friction force between two bodies depends on the following

   A   The contact surface and the normal pressure between the two surfaces.
   B   The slipping speed and the nature of the contact surfaces
   C   The normal pressure between the two surfaces and the nature of the contact surfaces.
   D   The area of contact and the slipping speed.

5. On the figure below, the sum of moments at **B** is equal to:

   $q=150daN/m$

   A   1800daNm
   B   900daNm
   C   600daNm
   D   450daNm

   6 m   **B**
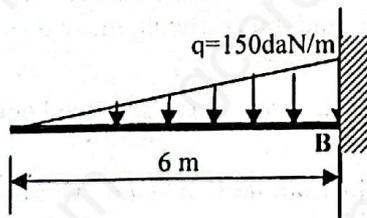
6. A vector is defined by the following 3 factors
   A   Point of application, sense and direction
   B   Point of application, magnitude and

2

direction
C   Line of support, line of action and sense
D   Magnitude, direction and line of action

7. The second moment of area (I_{xx}) of the beam section below about the X-X axis is equal to

   A $\frac{bh^3}{12} \cdot Sd$
   B $\frac{bh^3}{3}d$
   C $\frac{bh^3}{12} + bh.\frac{d^2}{2}$
   D $\frac{bh^3}{12} + bh.d^2$
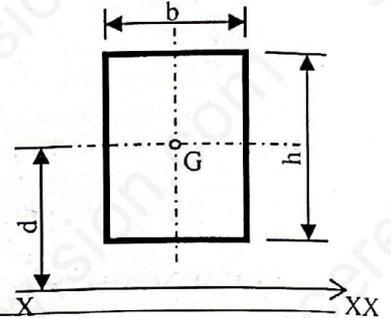
8. Hooks law states that:
   A   Stress is proportional to the strain causing it.
   B   Strain is proportional to the stress causing it within the range of proportionality.
   C   Stress is approximately equal to strain within the elastic limit.
   D   Stress is proportional to the constraint that is causing it

9. The difference between ultimate limit stress and permissible (allowable) stress is that:
   A   Ultimate stress is the limit beyond which there is complete rupture while permissible stress is simply a part of the ultimate stress.
   B   Ultimate stress is within the elastic limit while permissible stress is beyond the elastic range.
   C   Permissible stress is the limit of elasticity while ultimate limit stress defines the limit prior to rupture.
   D   Ultimate stress $= \frac{limitstress}{safetyfactor}$ while
       Permissible $= \frac{Load}{safetyfactor}$

10. The bolts maintaining these two pieces in place below are subjected to:

    A   Compression
    B   Tension
    C   Bending
    D   Shearing
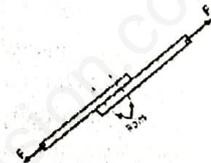
... of mass 2.5kg moved through a distance of 20m. What is the value of the work done to displace this object over this distance?

- A 500N
- B 1000N
- C -250N
- D 25N

12. Consider a cyclist riding a bicycle along a horizontal path, what kind of motion is been effected by the rider in relation to the path?

- A Circular motion
- B Translation motion
- C Rotation motion
- D Rectilinear motion

13. In uniform flow, the equation of continuity is:

- A $A = \dfrac{Q}{V}$
- B $\dfrac{p}{w} + \dfrac{V^2}{2g} + H = constant$
- C $V_1 A_1 = V_2 A_2$
- D $Q = AV$

14. The middle third of a cross section in combined bending is the portion of the

- A section within which the application of a compressive force will subject the section to simple tension.
- B section within which the application of a compressive force will subject the section to simple compression.
- C section within which compressive forces must be applied for a proper functioning of the section.
- D foundation footing within which forces must be applied in order for it to be in simple compression and tension.

15. The free body diagram of a structure is

- A A diagram showing the isolation of the body from its surroundings
- B A diagram showing all the external forces acting on the body
- C A diagram of the body free from all attachment
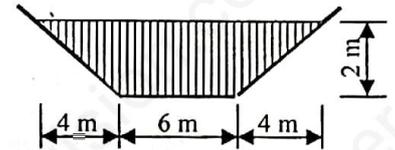- D The shear force and bending moment diagrams of the body

16. The component of the force F along the y-axis in the figure below is
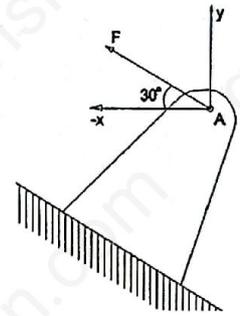
- A -F cos30°
- B -F sin 30°
- C Fsin30°
- D F tan 30°

17. A smooth concrete-lined gutter transporting water has the form here below. If the cross section A = 20 m² and the wetted perimeter P = 14.94 m the hydraulic radius R_h will be:

- A 3.54 m
- B 4.24 m
- C 1.339 m
- D 1.82 m

18. In a water supply network, the pressure is maximum at D_2 when D_2 is equal to
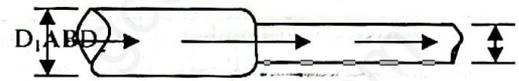
- A 63 mm
- B 40 mm
- C 50 mm
- D 32 m

19. The static frictional force is

- A the force acting against the sense of motion
- B the angle of friction
- C a force that helps to accelerate the body
- D a coefficient that increases the gravitational force of a body

20. Non-coplanar concurrent forces are:

- A Forces on the same plane
- B Forces having a meeting point in an orthogonal axis
- C Forces having a meeting point in space
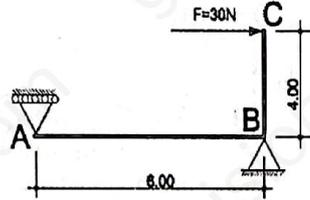- D Forces having no common meeting point

21. In simple and plane bending, beam sections are not subjected to:

- A Bending moment
- B Shearing forces
- C Deformation or deflection
- D Normal forces

Turn Over

22. The reaction at A (R_A) on the figure below shall be equal to

    A 120N
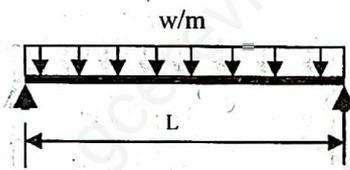   B 20N
    C 180N
    D 30N

23. If the equation of the bending moment in a given interval along a beam is

    $M(x) = \frac{x^3}{6} - 5x^2 + 24x$, the corresponding shear force equation is:

    A $T(x) = -\frac{x^2}{6} + 10x - 12$

    B $T(x) = -\frac{x^2}{2} + 10x - 24$

    C $T(x) = -\frac{x^3}{2} + 5x - 24$

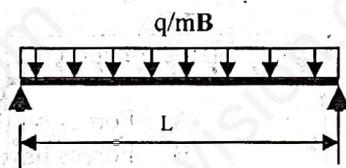   D $T(x) = -\frac{x^2}{4} + 10x - 6$

24. In the loading system below, the maximum bending moment will be:

    A $wL^2/4$
    B $wL^2/3$
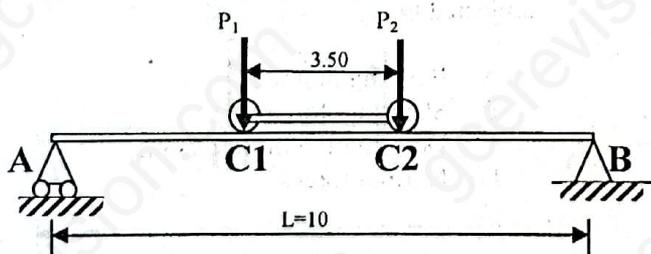   C $wL^2/2$
    D $wL^2/8$

25. With reference to the beam loading below, the maximum deflection in the span is

    A $\dfrac{5ql^4}{384EI}$

    B $\dfrac{5ql^4}{196EI}$

    C $\dfrac{5ql^4}{48EI}$

    D $\dfrac{5ql^4}{24EI}$

26. According to BARRE, the maximum shearing force occurs in the beam below when the:

    A resultant force is symmetrically situated about the mid-span.
    B an extreme wheel is situated on the

    support;
    C an extreme wheel issymmetrically situated about the mid-span;
    D resultant force is situated the support

27. The ratio of the effective length of a column and the minimum radius of gyration of its cross sectional area, is known as its:
    A compression factor
    B buckling factor
    C crippling factor
    D slenderness ratio

28. Negative area of steel obtained during the design of a concrete pillar indicates that:
    A concrete alone can support the applied load
    B concrete section of the pillar is too small
    C The adherence between the concrete and the steel is poor
    D The pillar shall collapse under the imposed load

29. The main longitudinal reinforcements at the intermediate supports of a continuous beam are placed
    A Towards the neutral axis of the section
    B Towards the uppermost fibre of the beam section
    C Towards the lowermost fibre of the section
    D Top and bottom of the beam

30. The stage at which the extension of a material takes place more quickly as compared to the increase in load, is called
    A elastic point of the material
    B breaking point of the material
    C plastic point of the material
    D yielding point of the material

31. A free body diagram of any rigid structure is said to be statically indeterminate when the number of unknowns is

    A Equal to the number of static equations
    B More than the number static equations.
   C Less than the number static equations
    D More than one

32. One characteristic of structural frame work is that the members are.
    A Either in compression or tension
    B Always in compression
    C Both in tension and compression
    D Neither in compression nor tension

33. Work done can be defined as the:

    A   mass of a body multiplied by distance covered

    B   Product of the distance moved by a mass and time

    C   The transfer of energy that occurs when the point of application of a force moves through a distance

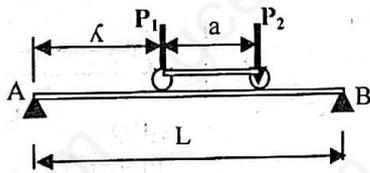   D   Product of the amount of energy in a mass and time.

34. With reference to the plane surface below, the x coordinate of the centre of gravity is;
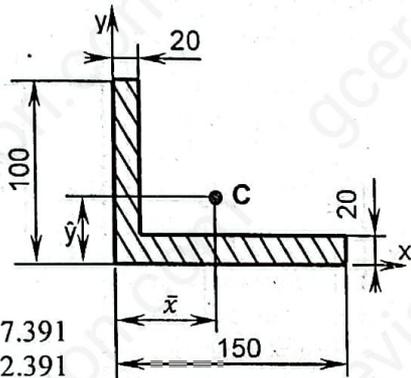
    A   27.391
    B   52.391
    C   45.391
    D   38.391

35. With reference to the diagram below, the maximum value of Λ for a maximum shear force at the point B is

    A $\dfrac{L}{2}$

    B $\dfrac{L+a}{2}$

    C $\dfrac{L-a}{2}$

    D $L-a$

36. A column is said to be eccentrically loaded when

    A   It is not placed directly on the axis of the foundation footing.

    B   It is over loaded

    C   The load is not directly on the axis of the column

    D   The load is applied within the middle third of the pillar section.

37. What is the allowable compressive strength of concrete if the characteristic compressive strength $f_{c28}=25\text{Mpa}$:

    A   15Mpa
    B   14.167Mpa
    C   2.10Mpa
    D   18.47Mpa

38. Strain can be defined as the

    A   increased in length of a body when stressed to the elastic limit

    B   alteration in shape of a material, due to the action of an external force

    C   increased in length of a body when stressed to the breaking point

    D   increased or decreased in length of a body when stressed to the breaking point.

39. A frame with m bars and j joints is said to be unstable if:

    A $m + 2 > 3j$
    B $m + 3 < 2j$
    C $m + 2 < 3j$
    D $m + 2 = 3j$

40. The relationship between the resistance of concrete to compressive stress and tensile stress after 28days is given by

    A $F_{t28} = 0.06F_{c28}$
    B $F_{t28} = F_{c28}+0.6$
    C $F_{t28} = 0.6+0.06F_{c28}$
    D $F_{t28} = 0.6F_{c28}-0.6$

41. A T-section beam is considered as rectangular during the calculation of longitudinal reinforcement at the ultimate limit state if:

    A   The table moment is less than the external moment

    B   A part of the web is in compression

    C   The web is both in tension and compression

    D   Only the table or part of it is in compression

42. At ultimate limit state the deformation of concrete ε_b (according to BAEL) is limited to

    A $2^0/_{00}$ in simple compression
    B $2^0/_{00}$ in simple tension
    C $2^0/_0$ in simple compression
    D $2^0/_{00}$ in simple bending

Turn Over

43. When the reduced moment during Reinforced concrete design; $\mu \geq 0.186$ (pivot B), indicate that

   A Concrete is stressed to its maximum $\varepsilon_{bc}=3.50‰$

   B Steel is stressed to maximum $\varepsilon_{st}=10‰$

   C Concrete and steel are in their ideal working conditions

   D Steel is over stressed.

44. In the design of tee section beams, with the ultimate moment M_u and the table ultimate moment M_{tu}. $M_u \leq M_{tu}$, implies that:

   A Only the rib or part of it is compressed

   B Only the table or part of it is compressed

   C Both the rib and the table are tensioned

   D Only the table or part of it is tensioned

45. Longitudinal rods for concrete elements in simple tension are designed at the service limit state when cracks are

   A harmful and rods are of high adherence class

   B harmful or rods are smooth bars

   C not harmful or rods are high adherence

   D not visible and rod are no exposed

46. A frame truss with 'm' bars and 'J' joints or knots is statically indeterminate if:

   A $m > 2j - 3$

   B $m > 3j - 2$

   C $m < 3j - 2$

   D $m = 3j + 2$

47. On the figure below, the centre of pressure is
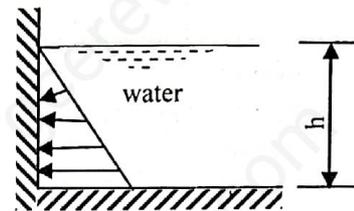
   A $h/2$ from the free surface of water

   B $h/3$ from the free surface of the water

   C $2h/3$ from the bottom

   D $4h/3$ from the bottom

48. In the BERNOULLI energy conservation equation of fluids below, $\frac{p_1}{\rho g}$ stands for

   A The dynamic head

   B The pressure head

   C The head loss

   D The change in altitude

49. In the formula $fbu = \frac{0.85 f_{c28}}{\gamma_b}$; γ_b stands for the:

   A compressive stress in the concrete

   B strain of concrete

   C safety coefficient to reduce the stress f_{c28}

   D safety coefficient to take care of concrete batching

50. With reference to the beam loading below, the moments at the point A (μ_A)is:

   A $ql^2/2$

   B $PL+qL^2/2$

   C PL
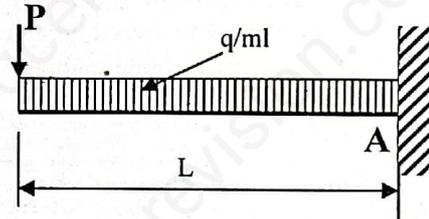
   D $PL-qL^2/2$

NOW GO BACK AND CHECK YOUR WORK