

GENERAL CERTIFICATE OF EDUCATION BOARD
 Technical and Vocational Education Examination

BUILDING CONSTRUCTION APPLIED MECHANICS 1
 7216

JUNE 2021

ADVANCED LEVEL

Specialty(Specialty Code)	CIVIL ENGINEERING BUILDING CONSTRUCTION CE-BC (F4-BA)
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Mobile phones are NOT allowed in the examination room

7216 BUILDING CONSTRUCTION APPLIED MECHANICS 1: MULTIPLE CHOICE QUESTION PAPER

One and a half hours

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.

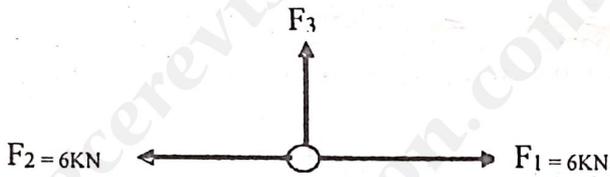
For example, if **C** is your correct answer, mark **C** as shown below:

[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. At which point does the weight of a body concentrate ?
- A Centre of curvature.
 - ~~B~~ Centre of gravity.
 - C Centre of mass.
 - D Centre of weight.

2. After isolating a node, the following forces are acting on it as shown. What is the value of the force F_3 ?

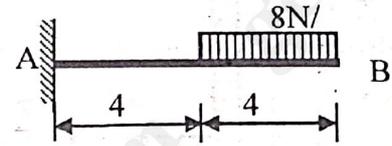


- ~~A~~ 0kN
- B 12kN
- C 6kN
- D -6kN

3. 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 $48m/s$

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

5. On the figure below, the embedded moment at A is



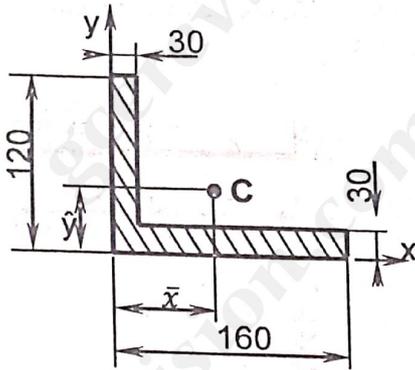
- A 192Nm
- ~~B~~ 128Nm
- C 32Nm
- D 48Nm

6. 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 opened.
 - C Only the funicular polygon is closed.
 - D Both force and funicular polygons are closed.

7. When can a ladder placed against a vertical wall and resting on a floor not be in equilibrium?
- 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.

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

9. With reference to the plane surface below, the y coordinate of the centre of gravity is

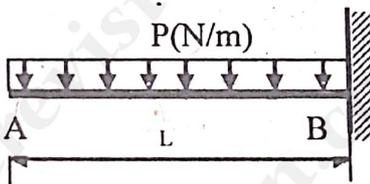


- A 28.92
- ~~B 36.80~~
- C 73.62
- D 56.80

10. Three parallel forces are in equilibrium when one of them

- A Is equal and opposite to the sum of two others.
- B Is equal and opposite to two others.
- ~~C Must meet at a common point.~~
- D Must not be equal and opposite to the sum of two others.

11. Write the bending moment equation between A and B of the beam loading below.



- A $M(x) = PLx^2/4$
- B $M(x) = RA - PLx$
- ~~C $M(x) = Px^2/2$~~
- D $M(x) = RA + PLx$

12. The position of a particle moving along a straight line is given as $S = (3t^3 + 2t^2)$ m. Write the equation of its velocity after time t.

- A $V(t) = 3t + 2t$
- B $V(t) = 5t$
- ~~C $V(t) = 9t^2 + 4t$~~
- D $V(t) = 3t^4 + 2t^3$

13. Two forces P and W are perpendicular to each other. Calculate the magnitude of P knowing that W is 40N and R is 120N

- ~~A 80N~~
- B 126.49N
- C 50N
- D 113.14N

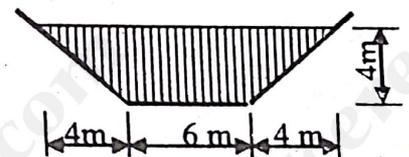
14. If the bending moment of a beam is $M(x) = 8(2 - x)^3$, write the deflection equation of the said beam.

- A $Y_{EI} = -2(2 - x)^4 + Ax + B$
- B $Y_{EI} = (2 - x)^4 + Ax^2 + B$
- C $Y_{EI} = 8(2 - x)^3 + A$
- ~~D $Y_{EI} = -8(2 - x)^3 + A$~~

15. The rate of change of angular momentum is equal to

- A Energy.
- ~~B Torque.~~
- C Force.
- D Impulse.

16. A smooth concrete gutter transporting water has the form here below. If the cross section $A = 60$ m² and the wetted perimeter $P = 17.32$ m what will be the hydraulic radius R_h ?



- A 34.641
- ~~B 3.464~~
- C 2.891
- D 0.289

17. Calculate the safe stress of concrete f_{bu} given that $F_{c28} = 22$ Mpa In the formula $f_{bu} = \frac{0.85 f_{c28}}{\gamma_b}$

- A 11.33Pa
- ~~B 12.47MPa~~
- C 13.60MPa
- D 14.17Pa

18. A beam is subjected to a permanent load of 80KN and a live load of 40KN. What is the service load of the beam?

- A $P_{ser} = 176.4KN$
- ~~B $P_{ser} = 120KN$~~
- C $P_{ser} = 165.6KN$
- D $P_{ser} = 72KN$

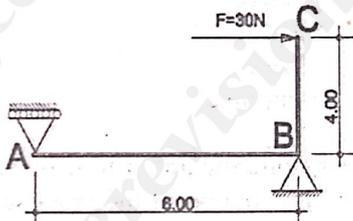
19. Which of the following is a scalar quantity?

- A Energy.
- B Force.
- C Acceleration.
- ~~D Momentum.~~

20. A disc of mass 2kg and radius 4m slides with a linear velocity of 5m/s and an angular velocity of 5rad/s. Determine the total kinetic energy of the disc.

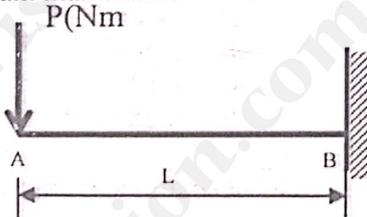
- A 89J
- B 400J
- C 464J
- D 64J

21. What is the value of the reaction RA from the figure below?



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

22. At what point in the loading below is the deflection of the beam maximum?

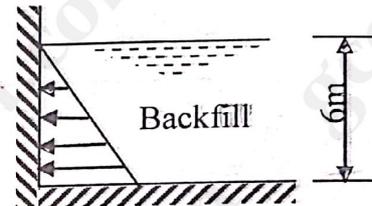


- A Point A.
- B L/3 from point B
- C Point B
- ~~D L/3 from point A~~

23. 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 si

- A N rpm
- ~~B 2n rpm.~~
- C n/4 rpm.
- D n/2 rpm

24. This is the active earth pressure on a retaining wall. Where will the minimum pressure be situated?



- ~~A At the top.~~
- B At 2m from the top.
- C At the bottom
- D At 2m from the bottom

25. Stirrups in reinforcement are used to fight against

- ~~A Shearing~~
- B Torsion.
- C Compression.
- D Tension

26. 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 10 seconds~~
- C 15 seconds.
- D 15 minutes.

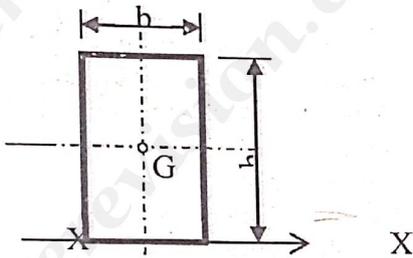
27. The calculated surface area of longitudinal rods in a rectangular beam is 3.14 cm². A suitable number of bars for this beam is

- A 1HA20
- B 2HA14.
- ~~C 3HA10~~
- D 4HA10

28. 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.

29. Calculate the stress in a natural steel of feE40 knowing that $\gamma_s = 1.15$
- A $\sigma_{st} = 460\text{Mpa}$
 - ~~B~~ $\sigma_{st} = 34.88\text{Mpa}$
 - C $\sigma_{st} = 46\text{Mpa}$
 - D $\sigma_{st} = 348.83\text{Mpa}$

30. State the formula for the calculation of the second moment of area (I_{xx}) of the figure below.



- A $\frac{bh^3}{3}$
- B $\frac{bh^3}{8}$
- ~~C~~ $\frac{8bh^3}{12}$
- D $\frac{12bh^2}{3}$

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

32. 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 $\tau = \frac{Q_{max}}{3bd}$

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

34. Using the principle of 'BAEL', calculate the linear load at ultimate limit state P_U of a reinforced concrete beam knowing that the permanent and exploitation loads per linear meter are 60daN and 40daN respectively.

- A 100daN/m
- B 20daN/m.
- C 141daN/m
- ~~D~~ 144daN/m

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

36. The S.I unit of work done is
- ~~A~~ Joule.
 - B Newton.
 - C Kilowatt.
 - D Kilometer.

37. It is a graphical method used for 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.

6

38. In the 3 pivot deformation diagram, Pivot A corresponds to an extension of _____ according to (BAEL)
- A $10^{0/00}$
 - B $2^{0/00}$
 - ~~C~~ $3,5^{0/00}$
 - D $0^{0/00}$

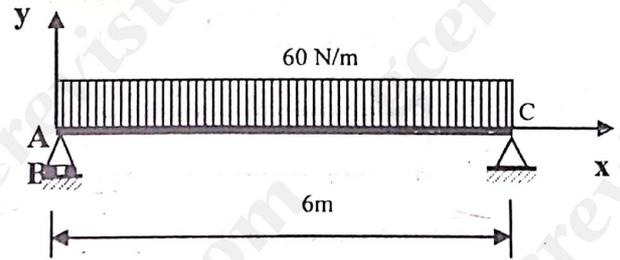
39. The cover of a drainage gutter in reinforced concrete has a mass of 100kg and a volume of 0.2m^3 . Its density will be
- A 200kg
 - B 2500kg
 - C 150kg
 - ~~D~~ 500kg

40. 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 $F_R = 12,150\text{KN}$
 - B $F_R = 6075\text{KN}$
 - C $F_R = 4,050\text{KN}$
 - ~~D~~ $F_R = 3,037.5\text{KN}$

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

42. After isolating a knot on a roof structure, the component of the force F is given as $F_x = 40\text{KN}$ and $F_y = 30\text{KN}$. The magnitude of F is
- A 45KN
 - B 20KN
 - C 80KN
 - ~~D~~ 50KN

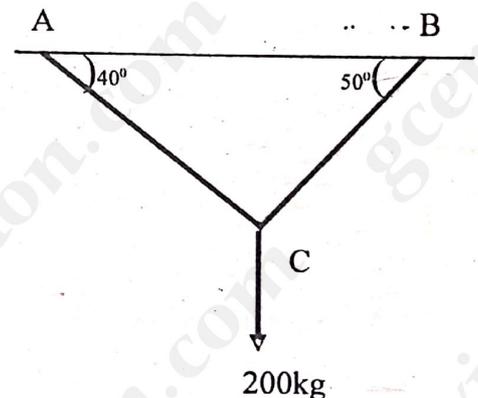
43. With reference to the beam loading below, write the equation of the shear force between A and C. Take $R_A = 180\text{N}$



- A $T(x) = -30X - 180$
- B $T(x) = 30X - 180$
- ~~C~~ $T(x) = -180 - 60X$
- D $T(x) = 180 - 60X$

44. A motorcycle of weight 5 tonnes moving on a plane horizontal surface at a speed of 2m/s will cover a distance of 100 m in
- A 500 s
 - B 50s
 - ~~C~~ 100s
 - D 200s

45. Consider the loading below and calculate the tension on the cable AC.

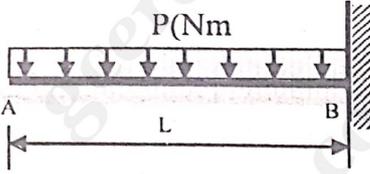


- A 128.56
- B 153.21
- C 238.35
- ~~D~~ 167.82

46. Four rivets having a diameter of 20mm is subjected to a shear force of 600N. Calculate the shear stress on the rivets.

- ~~A~~ $\frac{3}{8} \pi$
- B $\frac{3}{2} \pi$
- C $\frac{6}{\pi}$
- D $\frac{8}{3} \pi$

47. Where will the maximum value of the shear force occur in the beam shown below?

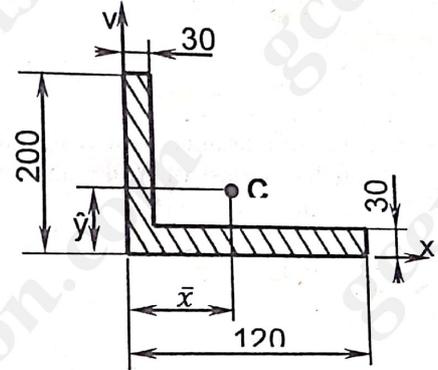


- A At the point B.
- ~~B~~ At the distance $L/8$.
- C At the point A.
- ~~D~~ At the distance $L/4$.

48. A material point subjected to many forces is said to be in equilibrium when

- A All the forces are parallel and opposite.
- ~~B~~ Algebraic sum of moment of the forces about a point is equal to zero
- C All the forces are perpendicular and opposite.
- D Algebraic sum of moment of the forces about a point is different from zero.

49. 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)

50. At the instantaneous center, the velocity of a moving lamina at any time is

- A Varying.
- B Zero.
- ~~C~~ Constant.
- D Maximum.

STOP

GO BACK AND CHECK YOUR WORK