ROYAL CIVIL SERVICE COMMISSION
Civil Service Common Examination for Technical Graduates 2009

Paper III: Subject Specialization (Civil Engineering)

Date: 8ᵗʰ November 2009   Maximum Time - 150 min.
Roll No.:_____   Maximum Marks – 100

READ THE FOLLOWING INSTRUCTIONS CAREFULLY

1. Under the provision of Civil Service Common Examination for Technical Graduates Procedures, candidates shall write his/her **Roll No. only** on Question-cum Answer Book in the **space provided** only.

2. Use either **Blue or Black ink** only for written part and **Pencils** only for sketches.

3. No other particulars, which would indicate the identity of a candidate, shall be written on this. Any candidates found guilty of writing his particulars and making any identification marks on and/or in this book **shall be disqualified from consideration for future employment.**

4. This book is the property of RCSC and shall not be taken away from the examination hall. This book consists of **9 pages** and no page shall be removed or torn.

5. Candidates will not be allowed to carry any papers inside the Examination Hall except **Admit Card and Non-programmable Calculators.**

6. Candidates will be required to produce the Admit Card while entering the Examination Hall and as and when demanded by the concerned authorities.

7. Do not write anything during the first 15 minutes. This time is provided to read the Instructions carefully and verify the book.

8. This paper has two sections, namely **Section A** and **Section B,** each carrying 50 marks, **Section A** consists of 35 questions and you have **to answer all the questions. Section B** consists of two questions and you have **to answer only one question.**

9. All answer for **both Section A** and **Section B** should be written on the **Answer Sheets provided.** For multiple choice questions, first write the question number and then answer number in the answer sheet provided. No marks will be awarded for incorrect answer, no answer or more than one answer.

10. Once the examination begins, you will not be allowed to ask questions or borrow calculators/drawing instruments or leave the examination hall.

11. Any candidate who completes the examination before the stipulated time will be required to close the book and sit quietly, till you are allowed to leave the hall.
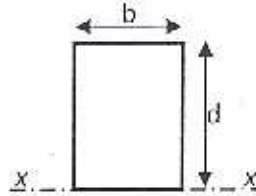

Answer all the questions: Questions 1 to 30 carry **ONE** mark each and Questions 31 to 35 carries **FOUR** marks each.

1. The grade of concrete of mix 1:1.5:3 is:
   a. M15 grade
   b. M20 grade
   c. M25 grade
   d. M30 grade

2. The moment of inertia of a section shown in the figure about an axis *xx* is:

   a. $bd^3/12$
   b. $bd^3/3$
   c. $bd^2/12$
   d. $bd^3/6$

3. When a nut is tightened on the bolt the nature of stress in the bolt is:
   a. Tensile
   b. Compressive
   c. Bending
   d. Shear

4. Bitumen found in natural state is known as:
   a. Asphalt
   b. Road Tar
   c. Emulsion
   d. Crude Tar

5. The process by which weathered rock particles get dissolved in water and are subsequently precipitated due to lowering of the temperature of water is:
   a. Organic Process
   b. Mechanical process
   c. Chemical process
   d. Physical process

6. The three-moment theorem was put forward by:
   a. Galileo
   b. Clapeyron
   c. Castigliano
   d. Maxwell

7. Defects in painting due excess of moisture is called:
   a. Wrinkling
   b. Exudation
   c. Blistering
   d. Chalking

8. The cross section of a crane hook is generally:
   a. Circular
   b. Square
   c. Trapezoidal
   d. Rectangular

9. For a masonry dam of base B, to avoid tension, the eccentricity of loading e should be:
   a. Less than $B/6$
   b. Equal to $B/6$
   c. More than $B/6$
   d. None of the above

10. A strut may be denoted as a member of a structure:
    a. Carrying a compressive load
    b. In any position carrying a compressive load
    c. Carrying a tensile load
    d. In any position carrying a tensile load

11. A beam - column may be defined as a column:
    a. Carrying transverse loads
    b. Carrying eccentric load
    c. Carrying axial and transverse load
    d. Carrying axial load

12. The ability of the material to deform plastically before fracture is called:
    a. Necking
    b. Yielding
    c. Ductility
    d. Malleability

13. The standard size of clay bricks that are commonly used in building constructions is:
    a. 230mm x 115mm x 50mm
    b. 230mm x 115mm x 70mm
    c. 200mm x 100mm x 50mm
    d. 200mm x 100mm x 75mm

14. To solve a truss by the method of joints the number of unknowns at a joint should not be:
    a. Less than 2
    b. More than 2
    c. Less than 3
    d. More than 3

15. Maximum length of opening in a masonry wall of a single storey building is limited to :

    a. 20% of wall length
    b. 30% of wall length
    c. 50% of wall length
    d. 65% of wall length

16. The chief constituent of cement is:
    a. Silica & Alumina
    b. Gypsum
    c. Lime stone
    d. Magnesia

17. Neutral axis of a beam is the axis at which:
    a. The moment of inertia is zero
    b. Bending stress is zero
    c. Bending stress is maximum
    d. The shear force is zero

18. Total strain energy per volume may be written as:

    a. $\frac{1}{E}[\sigma1^2 + \sigma2^2 + \sigma3^2 - 2\vartheta(\sigma1\sigma2 + \sigma2\sigma3 + \sigma3\sigma1)]$

    b. $\frac{1}{2E}[\sigma1^2 + \sigma2^2 + \sigma3^2 - \vartheta(\sigma1\sigma2 + \sigma2\sigma3 + \sigma3\sigma1)]$

    c. $\frac{2}{E}[\sigma1^2 + \sigma2^2 + \sigma3^2 - \vartheta(\sigma1\sigma2 + \sigma2\sigma3 + \sigma3\sigma1)]$

    d. $\frac{1}{2E}[\sigma1^2 + \sigma2^2 + \sigma3^2 - 2\vartheta(\sigma1\sigma2 + \sigma2\sigma3 + \sigma3\sigma1)]$

19. A concrete has been designed with water cement ratio of 0.45. If the quantity of water is increased by 250 ml, the corresponding quantity of cement to be increased is:

    a. 444.44g
    b. 555.55g
    c. 666.66g
    d. 777.77g

20. The ratio of Modulus of Elasticity for steel to the Modulus of Elasticity for concrete as per IS code is:

    a. $250/3\sigma_{cbc}$
    b. $280/3\sigma_{cbc}$
    c. $250/2\sigma_{cbc}$
    d. $280/2\sigma_{cbc}$

21. The compression of a saturated soil under a steady static pressure is known as:
    a. Settlement
    b. Stabilization
    c. Compaction
    d. Consolidation

22. In the design of a truss, when wind forces are considered the permissible increase in the stress is:
    a. 1.33
    b. 2.33
    c. 3.33
    d. 4.33

23. A reinforced concrete column is designed with 4 nos. of 25Φ bars. What would be the nearest number of bars required, if replaced by 16Φ bars:
    a. 8
    b. 10
    c. 12
    d. 14

24. In the design of buildings with live load of $4kN/m2$, what is the percentage of live load considered for computation of base shear:
    a. 25%
    b. 50%
    c. 75%
    d. 100%

25. Uniformly graded aggregate means:
    a. Particle size distribution over a limited range
    b. Particle size distribution over a wide range
    c. All of above
    d. None of above

26. Aeration of water is done to remove
    a. Suspended Impurities
    b. Colour
    c. Dissolved Salts
    d. Dissolved Gases

27. Camber on highway pavement is provided to take care of
    a. Centrifugal Force
    b. Drainage
    c. Sight Distance
    d. Off- Tracking

28. A cantilever beam of length I, width b and depth d is loaded with a concentrated vertical load at the tip. If yielding starts at a load P, the collapse load shall be
     a. 2.0 P
     b. 1.5 P
     c. 1.2 P
     d. P

29. The stress-strain diagram for two materials A and B is shown below:
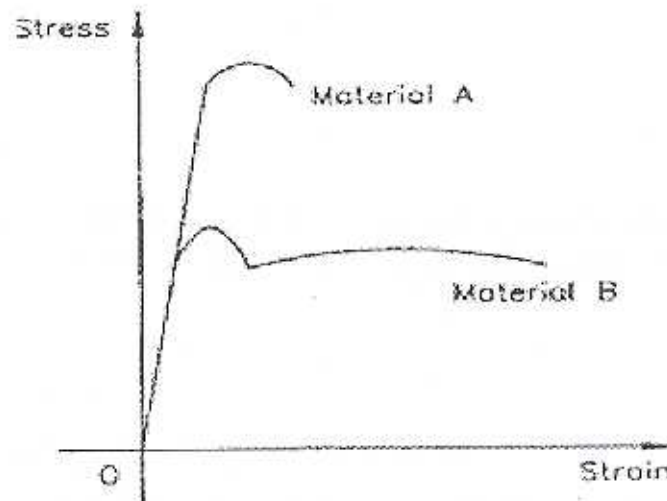
The following statements are made based on this diagram:

(1) Material A is more brittle than material B.
(2) The ultimate strength of material B is more than that of A.

With reference to the above statements, which of the following applies?

     a. Both the statements are false.
     b. Both the statements are true.
     c. 1 is true but 2 is false.
     d. 1 is false but 2 is true.

30. Bituminous materials are commonly use in highway construction because of their good:
   a. Tensile and compression properties.
     b. Binding and water proofing properties.
     c. Shear strength and tensile properties.
     d. Bond and tensile properties

31. A reinforced concrete column 50cm x 50 cm in section is reinforced with 4 steel bars of 2.5cm dia, one in each corner. The column is carrying a load of 200 tonnes. Find the stresses in the concrete and steel bars. *[Consider Young's modulus E for steel = 2.1x10⁶ kg/cm² and Young's modulus E for concrete = 0.14x10⁶ kg/cm²](10+10 marks)*

32. Determine the active pressure on the wall as shown below using Rankine's theory and compute the location at which it acts: *(2+2 marks)*

$\phi = 30°, \gamma = 19KN/m^3$

4m

15°
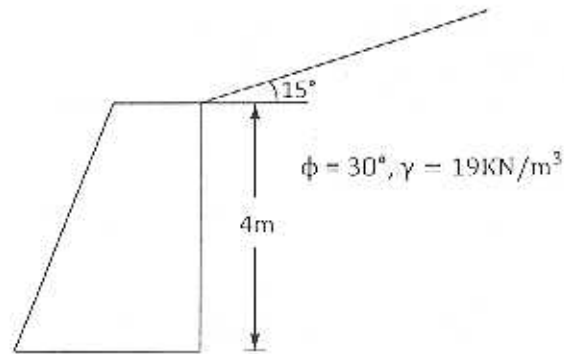
33. 1. Explain the term "Curing of Concrete" ? *(2 marks)*
    2. What are the different methods of curing of concrete? *(2 marks)*

34. Calculate the quantities of cement and sand required to produce 2 m³ of cement mortar 1:3 mix in m³ *(consider the factor of increase of dry volume as 30%): (2+2 marks)*

35. A rectangular beam 6cm x 4cm is 2m long and is simply supported at the ends. It carries a load of 1kN at mid span. Determine the maximum bending moment and maximum bending stress induced in the beam: *(2 + 2 marks)*


1KN

2m

400

600
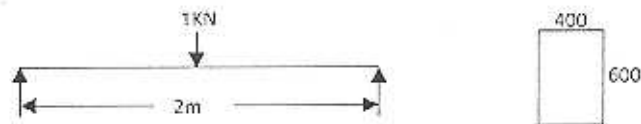
Question 1:

Part A): The contour map shown below is placed with a platform of size 20m x 10m where a building is proposed to be constructed. The excavated floor level is at 194.00m, you are required to compute the quantity of earthwork in filling and excavation throughout the length of platform *(from Sec A to Sec E)*.

Also find the total amount in filling and excavation if the rates are Nu. $55.00/m^3$ and $85.00/m^3$ respectively *(16+4 marks)*

You as the design engineer, give you own views as to how you are going to go about with the placement of platform considering the economy and safety. *(5 marks)*
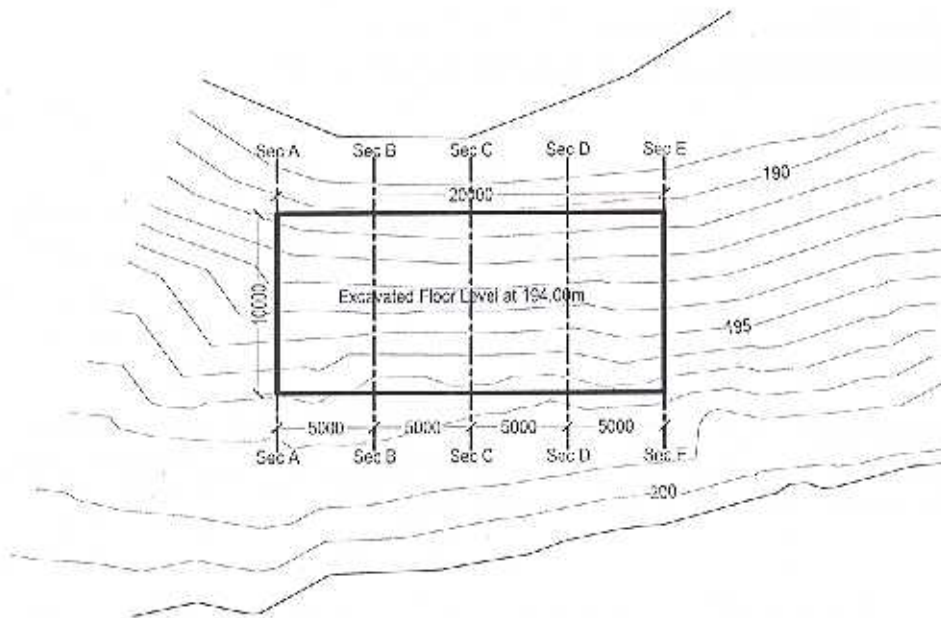
Part B):

1. The Royal Government had come up with the rules and regulations for the construction of attic in the urban areas and most of these attics are used as space for large water tanks.

   State the advantages and disadvantages of having large water tanks in the attic from structural stability point of view? *(10 marks)*

2. For the buildings already constructed without attic, there had been lot of proposals for vertical extension, you as the engineer explain in detail how you would proceed with the design of floor extension. Also give your views about its behavior during an earthquake. *(15 marks)*
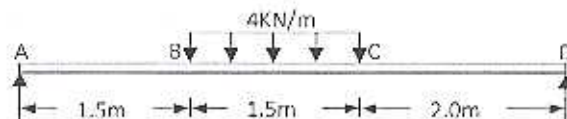
Question 2:

Part A):

The recent earthquake which struck our country on 21st September 2009 caused significant damage to number of buildings in eastern Bhutan. Many of these buildings were constructed with stone masonry in mud mortar with heights ranging from one to two storey.

a. Explain the various techniques and measures to improve the strength and performance of rural buildings using similar locally available materials such as stone, mud mortar and timber. *(15 marks)*

b. A stone masonry house during an earthquake has undergone heavy damage *(collapse stage)* while an ekra structure *(dakcha zhikor)* located in the vicinity showed no significant cracks. Explain with technical reasons why there is a difference in the magnitude of failure and state whether we can promote ekra construction in rural areas as substitute to stone masonry houses from earthquake point of view *(15 marks)*

Part B):

36. **Draw the shear force and bending moment diagram along with the magnitude of the beam as shown below:** *(10 + 10 marks)*

***** The End *****