

EVENING

25 JUN 2022

Please check that this question paper contains 09 questions and 03 printed pages within first ten minutes.

[Total No. of Questions: 09]
Uni. Roll No.

[Total No. of Pages: 03]

Program: B.Tech. (Batch 2018 onward)
Semester: 4th
Name of Subject: Materials, Testing and Evaluation
Subject Code: PCEE-106
Paper ID: 16177

Time Allowed: 03 Hours

Max. Marks: 60

NOTE:

- 1) Parts A and B are compulsory
- 2) Part-C has Two Questions Q8 and Q9. Both are compulsory, but with internal choice
- 3) Any missing data may be assumed appropriately

Part - A

[Marks: 02 each]

- Q1.
- a) Illustrate the difference between a brittle, ductile and a plastic material with a help of a typical load-deformation curve.
 - b) Differentiate resilience and toughness of a material. Discuss the importance of each parameter.
 - c) The abstract is considered to be an important part of a research report. Justify.
 - d) A concrete circular disk of size 150-mm diameter and 64 mm high is tested as per the provisions of ASTM C418-05. The height of the sample is measured as 62.5 mm after the test. Compute the value of abrasion coefficient.
 - e) Illustrate the role of steel fibers (and its aspect ratio) in concrete with a help of a stress-strain curve.
 - f) Explain why it is vital to restrict the quantity of cement content in the concrete. Also give the maximum cement content as prescribed in the code.

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Part - B

[Marks: 04 each]

- Q2. What are the various sections that are essentially a part of every report? Also give the vital points that should be avoided while writing a report.
- Q3. What are the various characteristics that may be required in the *High-Performance Concrete*? Also enlist at least four materials that may be employed to obtain high performance in comparison with the other types of concretes along with their purpose of use in the mix.
- Q4. What are the different material attributes that needs to be evaluated while selecting them for some project? Discuss.
- Q5. A standard disk of 150 mm diameter and 150 mm height is used to determine the permeability of the concrete specimen. It is tested under a pressure of 10 kg/cm². Under this pressure, 1320 ml of water passes through the specimen in 100 h. Determine the coefficient of permeability of the test specimen.
- Q6. Differentiate between strain-softening and strain-hardening response exhibited by materials. Explain in detail with a help of a suitable example.
- Q7. A set of twenty standard concrete cubes have been sampled randomly from a construction site, and these are tested at 28 days. The compressive strength (in MPa) of these cubes is as given below.
24.99, 30.23, 26.86, 23.12, 23.22, 27.11, 23.56, 24.00, 20.11, 21.36, 25.89, 24.33, 26.67, 27.56, 19.11, 21.78, 24.44, 26.67, 28.89, 30.56
What should be the safe value of the compressive strength that can be taken in the design of the concrete member for this concrete lot? (Take $k = 1.68$)

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Q8. Differentiate between *load-controlled testing* and *displacement-controlled testing*. Enlist pros and cons of each of the testing technology. Also discuss the significance of data acquisition system.

OR

- a) What do you mean by characteristic strength of a material? Illustrate with the help of an example. How does this parameter help the engineers to design and build the structures confidently? (6)
- b) If the reported concrete test data shows a large scatter in the compressive strength values, what can be the possible factors that may have influenced the concrete strength? In such cases of huge variation in the reported results, is it always best to declare the material unfit for use as a structural material? Comment in detail. (6)

Q9. A 75-mm-thick concrete slab having plan dimensions of 1.5 m × 2.5 m is cast using M 30 concrete. It is water cured for 7 days and then left for air curing. Determine the change in the dimensions that will occur after 28 days from the casting date. The RH during these days can be taken as 50%. (Take autogenous strain = 35×10^{-6} and drying shrinkage strain = 512×10^{-6} , for M30 concrete).

OR

A 150 mm concrete cube is cast using M30 concrete. It is water cured for 7 days and then left for air curing. At the age of 14 days, it is placed under a compressive force of 75 kN for many days. Determine the change in the dimensions of the cube that will occur at 90 days from the casting date. The RH during these days can be taken as 50%. (Take creep coefficient = 2.4, autogenous strain = 35×10^{-6} and drying shrinkage strain = 512×10^{-6} for M30 concrete).
