



Total No. of Printed Pages – 4

AEUD
CIVIL ENGINEERING
PAPER – II
SUBJECT CODE : 09

Full Marks : 200

Time : 3 Hours

Instructions For Candidates :

Please read each of the following instructions carefully before attempting questions.

- (1) *Answers must be written in **ENGLISH** only.*
- (2) *The question paper contains a total of 8 questions in **TWO** Sections : Section-A and Section-B. (**FOUR** questions in each section)*
- (3) *Question No. 1 of Section 'A' and Question No. 5 of Section 'B' are compulsory.*
- (4) *Candidates have to attempt another **THREE** questions from remaining **SIX** questions choosing atleast **ONE** question from each section.*
- (5) *Assume suitable data if found necessary.*
- (6) *Wherever any assumption be made for answering a question, they must be clearly indicated.*
- (7) *Marks carried by a question / section is indicated against it.*
- (8) *Unless struck off, attempt of question shall be counted even if attempted partly.*
- (9) *Any page or portion of the page left blank in the Answer Booklet must be clearly struck off.*

SECTION – A

Marks

(5 × 8 = 40)

1. (i) Differentiate between the following set of fluid properties :
 - (a) Specific weight and mass density
 - (b) Cohesion and adhesion
 - (c) Surface tension and capillarity
 - (d) Dynamic viscosity and kinematic viscosity
- (ii) A pipeline carrying water has surface roughness of average height 1.165 mm. If the shear stress developed is 3.6 N/m^2 , what is the nature of the pipe surface ? Find the shear velocity.



- (iii) Define recurrence interval and return period of a storm.
- (iv) Describe in brief the various types of cross-drainage works.
- (v) Enumerate the merits and demerits of rapid and slow sand filters.
2. (a) A block of wood of specific gravity 0.7 floats in water. Determine the meta-centric height of the block if its size is $2\text{ m} \times 1\text{ m} \times 0.8\text{ m}$. (20)
- (b) Design a regime channel according to Lacey's silt theory for discharge of $35\text{ m}^3/\text{s}$ with silt factor 1.0 by taking side slopes as 0.5 H : 1 V. (20)
3. (a) Derive Bernoulli's equation of motion from Euler's equation. (10)
- (b) Define Most Probable Number (MPN) and Coliform Index (CI). Discuss membrane filtration technique. (15)
- (c) Design a rectangular primary sedimentation tank for treating 1 million litres of water per day (MLD) for the given design data :
 Detention period = 2.5 hours
 Velocity of flow = 8 cm/minute and
 Depth of water = 3 m (15)
4. (a) At an energy dissipater structure below a low spillway, the discharge is $19\text{ m}^3/\text{s}$ and the energy loss is 1 m at the hydraulic jump forming therein. Determine the depth of flow at both ends of the jump by assuming a rectangular section. (20)
- (b) Design a turbine from the given data :
 Head = 120 m
 Power produced = $5 \times 120\text{ MW}$
 Nos. of turbines = 5
 Head loss due to friction = 3% of gross head
 Length of each penstock = 1300 m
 Overall efficiency = 0.87
 Nos. of pairs of poles = 18
 Speed = 166.7 rpm
 Breadth to diameter ratio = 0.3
 Darcy Weisbach (f) = 0.02
 Determine the diameter of the penstock runner and type of turbine for speed ratio ' ϕ ' of 0.75. (20)



SECTION – B

5. (i) Describe the method of garbage disposal from a town.
(ii) Explain the pollutants responsible for air and noise pollution.
(iii) Discuss in brief the consistency limits along with their significance.
(iv) What are the principles of surveying ? Explain.
(v) Indicate the limitations of plate load test and how these are resolved.
6. (a) Explain the various zones of pollution in river stream with the importance of re-oxygenation, de-oxygenation and oxygen deficit in the problems of stream sanitation. (20)
(b) A 10 m thick clay layer with single drainage settles by 100 mm in 2 years. The coefficient of consolidation for this clay was found to be $5 \times 10^{-3} \text{ cm}^2/\text{sec}$. Calculate the ultimate consolidation settlement and find its time to undergo 90% of this settlement. (20)
7. (a) Following bearings have been taken on a closed compass traverse : (20)
- | <u>Line</u> | <u>F.B.</u> | <u>B.B.</u> |
|-------------|-------------|-------------|
| AB | 80°10' | 259°0' |
| BC | 120°20' | 310°50' |
| CD | 170°50' | 350°50' |
| DE | 230°10' | 49°30' |
| EA | 310°20' | 130°15' |
- Calculate the interior angles and correct them for observational errors. Considering the observed bearing of the line CD to be correct, adjust all other side bearings.
- (b) In a pair of overlapping vertical photographs, the mean distance between two principal points both of which lie on the datum is 6.375 cm. At the time of taking photograph, the air-craft was 600 m above the datum. The camera's focal length is 150 mm. In the common overlap a tall chimney 120 m high with its base in the datum surface is observed. Find out the difference of parallax for top and bottom of chimney. (20)

**Marks**

8. (a) A national highway passes through a rolling terrain having a horizontal curve of radius 600 m. Design the length of the transition curve and compute the shift using the following data :
- Design speed, $V = 80$ kmph
Normal pavement width = 7 m
No. of lanes, $N = 2$
Wheel base width, $l = 6$ m
Allowable rate of distribution of super elevation = 1 in 150
Allowable rate of change of centrifugal acceleration, $C = 0.507$ (20)
- (b) Find out the maximum permissible speed on a curve of high speed B.G. track having the following data :
- Degree of the curve = 1°
Amount of superelevation = 8 cm
Length of transition curve = 130 m
Maximum speed of the section likely to be sanctioned = 153 km/hour (20)
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