

# WBCS MADE EASY

MWC(O)-CE-II/2023

2023  
CIVIL ENGINEERING  
PAPER-II

Time Allowed — 3 Hours

Full Marks — 200

*If the questions attempted are in excess of the prescribed number, only the questions attempted first up to the prescribed number shall be valued and the remaining ones ignored.*

*Answer may be given either in English or in Bengali but all answers must be in one and same language.*

## Group-A

Answer any four questions.

32×4=128

1. (a) Discuss the resource smoothing and allocations.
- (b) The techniques of CPM and PERT for resource smoothing the load.
- (c) Discuss the following with examples (i) Looping and Dangling in network activities (ii) Dummy activity in network (iii) Float of an activity (iv) Slacks of events.
- (d) Draw network and find the critical path and its standard deviation. From specifications of a project from a construction company, PERT network along with 3 times (a, m, b) estimate in week were found out from table shown below:

4+4+8+16

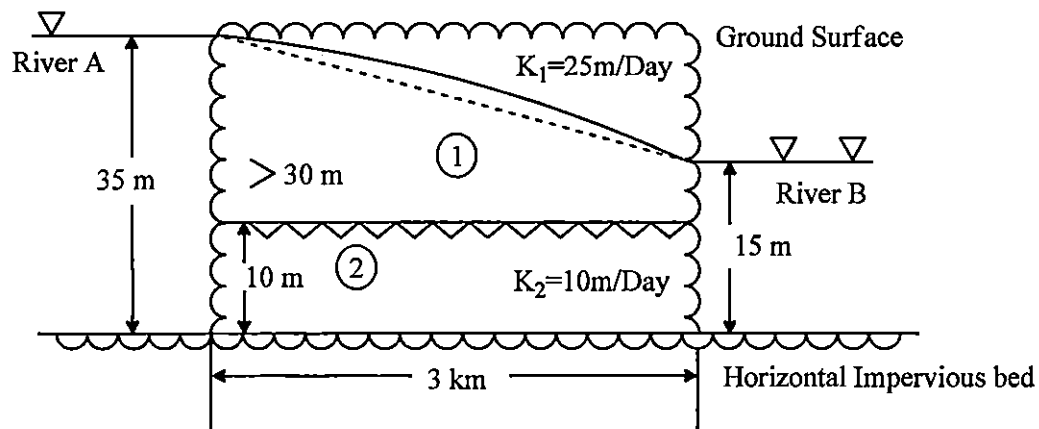
| Activity | Estimated Times |     |    |
|----------|-----------------|-----|----|
| (ij)     | a,              | m,  | b  |
| 1-2      | 2,              | 4,  | 7  |
| 2-3      | 1,              | 1,  | 2  |
| 3-5      | 1,              | 2,  | 3  |
| 5-7      | 3,              | 5,  | 6  |
| 7-9      | 4,              | 6,  | 10 |
| 9-10     | 5,              | 7,  | 10 |
| 10-11    | 1,              | 1,  | 2  |
| 2-4      | 2,              | 4,  | 5  |
| 4-6      | 1,              | 2,  | 3  |
| 6-8      | 7,              | 10, | 13 |
| 8-10     | 4,              | 7,  | 9  |

# WBCS MADE EASY

MWC(O)-CE-II/2023

(2)

2. (a) What are the tests to which a stone should be subjected before it is selected for building purposes?  
(b) Define water cement ratio. How does it influence concrete strength? What do you mean workability of concrete?  
(c) What are the corrections needed in linear measurement? Discuss them.  
(d) What is the basic principle in photogrammetry?  
(e) Draw a neat horizontal and vertical cross-section of a highway.  
(f) Discuss distortion of a photograph. 4+6+6+4+6+6
3. (a) What do you mean remote sensing? What do you mean by spectral response curve? How you can find out a typical spectral reflectance curves? Discuss a remote sensing programme, its advantages and limitations.  
(b) Discuss illuminance of any photograph. What are the factors which depends on illuminance of a photograph.  
(c) How do you find out the scale of a photograph? What are the different types of scale in photography?  
(d) A photographic film is optimally exposed with an f-stop setting of f-4 and a shutter speed of  $\frac{1}{500}$  sec. What is the correct f-stop setting if shutter speed is changed to  $\frac{1}{1000}$  sec? 12+6+4+10
4. (a) What do you mean by transition curve? Name different types of transition curves and its used.  
(b) Determine the ultimate B.O.D. of a waste water sample which was subjected to the B.O.D. determine as follows 6ml of waste water containing no dissolved oxygen (D.O.) was mixed with 294ml of dilution water containing 8.6mg/litre of D.O. After incubation at 20°C for 5 days, the D.O. of mixture was 5.4mg/L. The B.O.D. rate constant  $K$  to the base  $e$  is  $(-0.217)$ .  
(c) Two parallel rivers A and B are separated by a land mass as shown in Fig. below. Estimate the seepage discharge from river A to river B per unit length of the rivers. 6+11+15



# WBCS MADE EASY

(3)

MWC(O)-CE-II/2023

5. (a) Design an irrigation channel in alluvial soil according to Lacey's Silt theory for the following data: (i) Full Supply discharge =  $50 \text{ m}^3/\text{s}$  (ii) Lacey's Silt factor = 1.0 (iii) Side slope = 1 : 2
- (b) Design a rectangular sedimentation tank to remove spherical particles of size equal to and greater than  $50 \mu\text{m}$  (micrometer) with specific gravity of 2.3 from 100 WMLD (million litre/day) of turbid water. Also determine the detention time of the tank. Assume (i) stoke's law (ii) length to width ratio is 3 : 1 for the tank (iii) depth of tank is 3.0 m (iv) kinetic viscosity of water is  $1.01 \times 10^{-6} \text{ m}^2/\text{sec}$ . 17+15

## Group-B

Answer any two questions.

36×2=72

6. (a) Draw a sketch of flexible pavement cross-section and show the component parts. Enumerate the functions and importance of each component of the pavement.
- (b) What are the various factors to be considered in pavement design? Discuss the significance of each.
- (c) What is a unit hydrograph? Why is base flow separated from the flood hydrograph in the processes of developing a unit hydrograph?
- (d) A line 2.7 km long was measured in catenary with a tape of 90.0 m which was standardised under no pull at  $30^\circ\text{C}$ . The tape in use was  $\frac{1}{7}$  cm wide and  $\frac{1}{20}$  cm thick. The line is measured at a temperature of  $45^\circ\text{C}$  and with a pull of 5 kg. Find the correction on length, given that
- (i)  $\alpha$  (Coefficient of expansion) =  $11.4 \times 10^{-6}/^\circ\text{C}$
- (ii) Wt. of one cubic cm of tape material = 7.7 gms
- (iii) Modulus of elasticity of tape material =  $2.1 \times 10^6 \text{ kg/cm}^2$  10+10+6+10
7. (a) The gross commanded area for an irrigation canal is 15,000 hectares out of which 80 per cent is cultural commanded area. The irrigation is 50 per cent for rabi. If the core period is 4 weeks for rabi, then determine the (i) outlet discharge. The outlet factor for rabi may be assumed as 1800 hectares/cumes, (ii) also calculate the delta for rabi.
- (b) Given the following 2-hr unit hydrograph for a drainage basin, determine the hourly ordinates of the 4-hr unit hydrograph given that—

| Time (hr)                   | 0 | 1  | 2  | 3  | 4  | 5  | 6 |
|-----------------------------|---|----|----|----|----|----|---|
| Q ( $\text{m}^3/\text{s}$ ) | 0 | 20 | 60 | 80 | 50 | 20 | 0 |

- (c) Discuss the advantage of plane table survey with chain survey. Discuss three point problem in plane table survey.
- (d) Write down the construction steps for water bound macadam road. 10+8+12+6
8. (a) The area of the plan of an old survey plotted to a scale of 10 metres to 1 cm measures now as 90.5 sq.cm as found by a planimeter. The plan is found to have a shunk so that a line originally 10 cm long now measures 9.5 cm only. These was also a note on the plane that 20 m chain used was 9 cm too short. Find the true area of the survey.

# WBCS MADE EASY

MWC(O)-CE-II/2023

(4)

- (b) Design a circular settling tank unit for the secondary treatment of sewage @13.5 million litres per day. The detention period is to be about 2 hours, and the surface loading 40,000 litres per sq.m of the tank area per day.
- (c) Calculate the deflection at the surface of a pavement due to a wheel load of 40 kN and a tyre pressure of  $0.5 \text{ MN/m}^2$ . The value of Young's modulus (E) and subgrade may be assumed to be uniformly equal to  $20 \text{ MN/m}^2$ .
- (d) Discuss confined aquifer and unconfined aquifer with neat sketches. 10+10+10+6
9. (a) A 30 cm diameter well completely penetrates a confined aquifer of permeability 45 m/day. The length of the strainer is 20 m under steady state of pumping the draw down at the well was found to be 3.0 m and the radius of influence was 300.0 m. Calculate the discharge.
- (b) Design a dowel bar system for cement concrete slab for the following conditions:
- (i) Design wheel load = 4100 kg
  - (ii) Design load transfer = 40%
  - (iii) Slab thickness  $h = 20 \text{ cm}$
  - (iv) Joint width  $z = 2.0 \text{ cm}$
  - (v) Permissible flexural stress in dowel bar =  $1400 \text{ kg/cm}^2$
  - (vi) Permissible shear stress in dowel bar =  $1000 \text{ kg/cm}^2$
  - (vii) Permissible bearing stress in concrete =  $100 \text{ kg/cm}^2$
  - (viii) 'K' value of subgrade  $8 \text{ kg/cm}^2$ , K is the subgrade reaction
  - (ix)  $E = 3 \times 10^5 \text{ kg/cm}^2$  Young's modulus
  - (x)  $\mu = 0.15$  Poisson's ratio. Assumed any other value as per IRC
- (c) Discuss the factors which is responsible for air pollutions. What do you mean by primary and secondary pollutants in air? How do you find the pollutants in air? 10+16+10

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**For guidance of WBCS Prelims , Main Exam and Interview by WBCS Gr A Officers/ Toppers & Experts, WBCS Prelims and Main Mock Test (Classroom At Kolkata, Siliguri & Other Places & Online), Optional Subjects, Study Materials, Correspondence Course, etc. Call WBCSMadeEasy™ at 8274048710 / 85858543673 / 9674493673 (Sir) or mail us at [mailus@wbcsmadeeasy.in](mailto:mailus@wbcsmadeeasy.in). Download WBCS MADE EASY app from play store. Miscellaneous Service, Clerkship & other WBPSC Courses & Mock Test available from WBCS MADE EASY. Visit [www.wbcsmadeeasy.in](http://www.wbcsmadeeasy.in)**