# 1(CCEM)0
## Civil Engineering
## (06)
## Paper—II

Time : Three Hours]  [Maximum Marks : 300

Note :— (i) Answers must be written in English.

(ii) Number of marks carried by each question are indicated at the end of the question.

(iii) Part/Parts of the same question must be answered together and must not be interposed between answers to other questions.

(iv) The answer to each question or part thereof should begin on a fresh page.

(v) Your answers should be precise and coherent.

(vi) Candidates should attempt any **two** Sections out of **four** Sections, selecting any **two** questions from each Section.

(vii) Assume missing data suitably.

(viii) If you encounter any typographical error, please read it as it appears in the text-book.

## SECTION–A

1. (a) Enumerate the bonds in brick masonry. Describe English bond, Single and double Flemish bond and Dutch bond in brick masonry.

   25

   (b) What is meant by building plastering ? State the objectives of plastering and the requirements of good plastering material.

   25

   (c) List the principles that govern the planning of buildings. Explain aspect, grouping, and circulation principles for building planning.

   25

2. (a) Write notes on :
   (i) Fly ash use in building construction
   (ii) Functions of ingredients of cement mortar
   (iii) Reinforced masonry
   (iv) Seasoning of timber. 30
   (b) Prepare a preliminary estimate of building project with a total plinth area of the buildings of 2000 m². Use the following details for the estimates :
   (i) Plinth area rate = Rs. 650/- per m²
   (ii) Extra for water supply and sanitary installations : 5% of the building cost
   (iii) Extra for special architectural treatment = 1½% of building cost
   (iv) Extra for electrical installations = 12.5% of building cost
   (v) Extra for interiors = 14% of building cost
   (vi) Extra for services = 5% of building cost
   (vii) Contingencies = 3%
   and supervisory charges for the buildings in the project = 5%.
   30

   (c) List the factors to be considered for the selection of flooring. Describe each of the factors in brief. 15

3. (a) The network shown in the figure below has the estimated duration for each activity marked. Determine the total float for each activity and establish the critical path : Duration is in days.
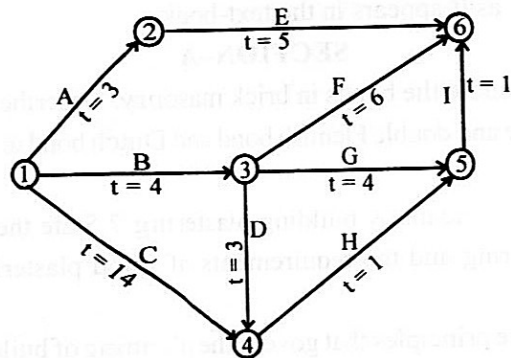


   Also determine free float and independent float for each activity. Adopt CPM method. 30

   (b) What are factors that should be considered in the design of a library building and an assembly room in a school ? Describe each in brief. 20

   (c) (i) Explain, in detail, the damp proofing of flat R.C.C. slab roofs. 10

   (ii) What are the fundamental types of pitched roofs ? Describe the King post roof truss and Queen post roof truss. 15

## SECTION–B
### (Transportation Engineering)

4. Answer any **three** of the sub-divisions :

   (a) (i) Why bearing plates are used in the rail track ? What are various advantages and disadvantages of using bearing plates in rail lines ? 10

   (ii) Determine the tractive effort developed by an engine from the following data :

   | | | |
   |---|---|---|
   | Wheel load | = | 6.1 tonne |
   | Difference in pressure 'p' | = | 2.815 kg/cm² |
   | Diameter of piston 'd' | = | 28 cm |
   | Length of stroke | = | 40.5 cm |
   | Diameter of the wheel | = | 1.525 m |

   Also state whether the working of engine is satisfactory or not. 15

   (b) (i) How minimum depth of ballast section is determined ? Explain why and how the ballast is periodically renewed. 10

   (ii) A broad gauge track has a sleeper density of (n+6), where n is the length of rail in meters. If the track is laid with welded rails of 26 m length, determine the number of sleepers on rail length. 15

(c) (i) What is meant by road marking ? Describe pavement and kerb markings. 5

(ii) A van of weight 3 tonne hits a parked vehicle of 0.8 tonne weight and both the vehicles skid together through a distance of 4.2 metres before coming to stop. Calculate the initial speed of van if it does not apply brakes before collision and when it applies brakes and skids through a distance of 2.8 metres before collision. 20

(d) (i) Derive an equation for the determination of superelevation required, if the design coefficient of lateral friction is 'f'. 20

(ii) What are the limitations of CBR method of pavement design ? 5

(e) Using Westergaard's stress equations, calculate the stresses at interior, edge and corner regions of a cement concrete pavement for the following data :

Wheel load = 4500 kg; Pavement thickness = 18 cm.

Modulus of Elasticity of cement concrete = $3 \times 10^5$ kg/cm$^2$.

Poisson's ratio of concrete = 0.15;

Radius of contact area = 16 cm.

Modulus of subgrade reaction = 7.0 kg/cm$^3$. 25

5. (a) (i) What are the engineering principles of signalling ? Explain the working principles of modified lower quadrant semaphore signals used in railways. 15

(ii) Determine the curve resistance when a curve of 9° is situated on a broad gauge rail line and a train with a total weight of 1220 t is moving over it. 10

(b) (i) Why a turn-table is required in a railway station yard ? What is its working principle ? Discuss the advantages and disadvantages of turn-table in a railway station yard. 15

(ii) What is creep of a rail ? State the effects of creep and the measures that can be taken to prevent creep in rail. 10

(c) (i) Deduce a relationship between super elevation (e), with gauge, speed, and radius of curve of a rail line. 10

(ii) What are important simple track junctions in railways ? Explain the design detail of simple crossovers between two parallel tracks of railways. 15

6. (a) (i) List the road patterns generally adopted in India. Describe the salient features of various road patterns. 15

(ii) How the speed and delay studies of highways are carried out ? Explain the riding check method and vehicle number method of speed and delay studies of highways. 10

(b) Determine the safe overtaking right distance and specify the minimum and desirable length of overtaking zones for the speed of overtaken and overtaking vehicles of 50 kmph and 80 kmph respectively. The two vehicles are running on a two-way traffic road. Assume that the acceleration of overtaking vehicle is 0.98 m/sec$^2$. 20

(c) Define ruling, maximum and exceptional gradients. Explain the stages in urban transportation planning process. 15

(d) Calculate the maximum allowable speed on a horizontal curve of radius 350 m, if the maximum allowable values of lateral coefficient of friction is 0.15 and rate of super-elevation is 0.07. 15

## SECTION–C

### (Irrigation Engineering)

7. Answer any **three** of the following :

   (a) In a given catchment a storm commenced at 7 am in the morning. The ordinates of the rainfall mass curve of this storm recorded in millimeters by a recording gauge at 15 minutes interval are 0, 9.5, 17, 27, 40, 49, 63, 84, 95, 102, 112, and 112. Construct the hyetograph of this storm for a uniform interval of 15 minutes. Also compute the maximum rainfall intensities for durations of 15, 30, 45, 60, 90, 120, and 180 minutes and plot the intensity duration graph. 25

   (b) (i) Define unit hydrograph. What are the processes (steps) to determine the storm runoff hydrograph from rainfall input using the unit hydrograph approach ? 10

   (ii) A 30 cm diameter well fully penetrates 50 m below the static water table (unconfined aquifer). After long period of pumping at a rate of 1800 liters per minute, the drawdowns measured in two observation wells located at distances of 15 m and 45 m from the pumping well were 1.7 m and 0.80 m respectively. It is also observed insignificant drawdown at a distance of 300 m from the pumping well. Determine the transmissivity of the aquifer. Also compute the drawdown at the pumping well. 15

   (c) (i) Define safe yield. Explain the method of calculating the storage-firm yield in water resources reservoir development project in its planning and early design phase. 15

   (ii) Define trap efficiency. How do you estimate the possible life of a reservoir ? Discuss various methods of reservoir sediment control. 10

   (d) (i) A 12-hour storm rainfall with following depth in cm occurred over the basin :

   2.0, 2.5, 7.6, 3.8, 10.6, 5.0, 7.0, 10, 6.4, 3.8, 1.4 and 1.4
   The surface runoff resulting from the above storm is equivalent to 25.5 cm of depth over the basin. Determine the average infiltration index for the basin. 10

   (ii) Evaluate the infiltration and cumulative infiltration depth using Green-Ampt method for a Silty Clay Soil at 0.5 h increments upto 6 hours from begining of infiltration. Assume an initial effective saturation of 20% and continuous ponding. Consider for a Silty Soil the Green-Ampt. parameters as $\theta_e = 0.423$, $\psi = 29.22$, and $k = 0.05$ cm/hour. 15

   (e) (i) On the basis of Isofluvial maps, 50 year 24 hour maximum rainfall of Bangalore is found to be 16 cm. Determine the probability of 24-hour rainfall of magnitude equal to or greater than 16 cm occurring at Bangalore, at least once in 10 successive years, two times in 10 successive years and once in 10 successive years. 15

   (ii) What is meant by 'Design Flood' ? What is its importance ? What are the methods of estimating the design flood of a catchment ? 10

8. (a) What are the ill-effects and causes of water-logging ? Describe various methods adopted as anti-waterlogging measures. 25

   (b) (i) Discuss critically the quality standards required for irrigation water. 10

   (ii) During a particular stage of the growth of a crop, consumptive use of water is 2.8 mm/day. Determine the intensity in days between irrigations and depth of water to be applied when the amount of water available in soil is 25%, 50%, 75% and 100% of the maximum depth of available water in the root zone which is 80 mm. Assume irrigation efficiency to be 65%. 15

(c) Design an irrigation channel by Kennedy's theory to carry 50 m³/s of discharge with base width to depth ratio as 2.5. The critical velocity ratio is 1.1. Assume the rugosity coefficient as 0.025 and side slopes of the channel as 0.5 Horizontal to 1 vertical. **25**

9 (a) Design a suitable section for the overflow portion of a concrete gravity dam having the downstream face sloping at a slope of 0.7 horizontal to 1 vertical. The design discharge for the spillway is 8000 cumecs. The height of the spillway crest is kept at RL of 203 m. The average river bed level at the site is 100 m. The spillway length consists of six spans having a clear width of 10 m each. Thickness of each pier may be taken as 2.5 m. **25**

(b) (i) What is meant by 'river training' ? What are the different objectives served by it ? **10**

(ii) Design a regime channel to carry a discharge of 100 cumecs, in a soil having silt factor of 1.1, using Lacey's theory. Assume side slopes of 0.5 horizontal to 1 vertical. **15**

(c) Discuss various types of cross drainage works used in canal system. What considerations govern the selection of different types of works mainly depending upon the levels of the canal and the drainage ? **25**

## SECTION–D

### (Environmental Engineering)

10. Attempt any **three** of the following subdivisions :

(a) (i) Enumerate the methods used for determining the yield of an open well. Explain the Recuperation test to find the yield of an open well. **15**

(ii) Distinguish between the centrifugal and reciprocating pumps used for lifting water in a water supply system. **10**

(b) (i) Using Hazen-William's equation, design a circular conduit to supply an average water flow of 5 million litres a day to a municipality. The maximum daily demand is 1.5 times the average daily demand. The hydraulic gradient to be maintained is 1 in 1200. Hazen-William's constant is 115. **15**

(ii) Differentiate between one-pipe and two-pipe house plumbing systems. **10**

(c) (i) What is presumptive and confirmed test in bacteriological examination of water ? How the results of these tests were useful in water quality characterisation ? **10**

(ii) Describe the appurtenances; check valve, sluice valve and air relief valve used in water distribution system of a city. **15**

(d) (i) Compare the combined and separate sewerage systems of urban wastewater management. **10**

(ii) Write informative note on :

(i) Wet weather flow, (ii) Dry weather flow, (iii) Co-efficient of Run-off. **15**

(e) (i) What are the problems generally encountered in Trickling filters during its operation ? Discuss the causes and remedial measures. **10**

(ii) Name the functional elements in solid waste management system along with their interrelationship. Describe the collection system based on their mode of operation. **15**

11. (a) (i) Differentiate between slow sand filter and rapid sand filter used in conventional water treatment. **15**

(ii) Determine the terminal settling velocity of a spherical particle with a diameter of 0.3mm and a specific gravity of 2.65. The viscosity of water is $1 \times 10^{-3} N.5/m^2$ at 20°C. The temperature of water is 20°C. The mass density of water is 1000 kg/m³. 10

(b) (i) What is meant by disinfection ? Discuss chlorination process of disinfection along with the reactions and relative effectiveness of the components of free available chlorine. 15

(ii) What is mass inflow curve ? Explain the method of estimating the capacity of a storage reservoir for water using a mass curve and demand curve. 10

(c) (i) Explain the Hardy-Cross method for solving pipe distribution network by balancing flows by correcting assumed heads. 15

(ii) The 3 day BOD of wastewater measured at 15°C is 250 mg/l. The reaction rate constant at 20°C is 0.23/day (for base e). Determine the 6 day BOD of the same wastewater at 25°C. 10

12. (a) (i) Name the methods of wastewater disposal. Describe the zones of pollution in a river when it undergoes self purification after disposal of wastewater into it. 10

(ii) What is meant by septic tank ? Describe the soak-pit and cess-pool used for disposal of effluent from the septic tank. 15

(b) (i) Compute the volume of the aeration tank, F/m ratio and overall efficiency of a complete mix activated sludge process required to treat the wastewater with a flow rate of 0.1 m³/sec and the $BOD_s$ at 20°C of the influent to the activated sludge process is 250 mg/l. The effluent $BOD_s$ of activated sludge process should not exceed 30 mg/l. Assume that the MLVSS is 3000 mg/l. The solids retention time is 8 days. The yield coefficient and decay coefficient are estimated as 0.5 and 0.05 per day. 20

(ii) Explain the significance of BOD and COD in design of wastewater treatment systems. 5

(c) (i) Describe aqua privy and trench or earth privy provided in rural areas for sewage management. 10

(ii) What is composting ? Discuss the important design considerations for aerobic composting process of municipal solid waste. 10

(iii) Discuss salient features of Water Pollution Control Act 1974 of India. 5