VERSION CODE

A1

Maximum Marks : 100
Total Duration : 150 Minutes
Maximum Time For Answering : 120 Minutes
Subject : **ENVIRONMENTAL ENGINEERING**

MENTION YOUR PGCET NUMBER

Serial Number : **118025**

Subject Code **P-ES**

DOs:

1. This question booklet is issued to you by the invigilator **after 02.20 pm.**
2. Check whether the PGCET Number has been entered and shaded in the respective circles on the OMR answer sheet.
3. The version code and serial number of this question booklet should be entered on the OMR answer sheet and the respective circles should also be shaded completely.
4. The Version Code and Serial Number of this question booklet should be entered on the Nominal Roll without any mistakes.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DON'Ts:

1. The timing and marks printed on the OMR answer sheet should not be damaged / mutilated / spoiled.
2. The 3rd Bell rings at 2.30 p.m., till then;
   - Do not remove the seal present on the right hand side of this question booklet.
   - Do not look inside this question booklet or start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. In case of usage of signs and symbols in the questions, the regular textbook connotation should be considered unless stated otherwise.
2. This question booklet contains 75 questions and each question will have one statement and four different options / responses & out of which you have to choose one correct answer.
3. After the 3rd Bell is rung at 02.30 pm, remove the paper seal on the right hand side of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.
4. Completely **darken / shade** the relevant circle with a **blue or black ink ballpoint pen against the question number on the OMR answer sheet.**

ಸರಿಯಾದ ಕ್ರಮ CORRECT METHOD	ತಪ್ಪು ಕ್ರಮಗಳು WRONG METHOD										
Ⓐ ● Ⓒ Ⓓ	ⓧ Ⓑ Ⓒ Ⓓ	Ⓐ Ⓑ Ⓒ ⊘	Ⓐ ● ● Ⓓ
	◉ Ⓑ Ⓒ Ⓓ	Ⓐ ◉ Ⓒ Ⓓ	

5. Please note that even a minute unintended ink dot on the OMR answer sheet will also be recognized and recorded by the scanner. Therefore, avoid multiple markings of any kind on the OMR answer sheet.
6. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
7. **Last bell will ring at 4.30 pm, stop marking on the OMR answer sheet.**
8. Hand over the **OMR answer sheet** to the room invigilator as it is.
9. After separating the top sheet (KEA copy), the invigilator will return the bottom sheet replica (candidate's copy) to you to **carry home for self-evaluation.**
10. Only **Non-programmable** calculators are allowed for "M.E. / M.Tech / M.Arch." examination.

Marks Distribution	PART-1 : 50 QUESTIONS CARRY ONE MARK EACH (1 TO 50)
	PART-2: 25 QUESTIONS CARRY TWO MARKS EACH (51 TO 75)

ENVIRONMENTAL ENGINEERING

PART – 1

Each question carries one mark. $(50 \times 1 = 50)$

1. The Reaeration rate constant 'K$_r$' as given by O'Conner and Dobbins is

   (A) $K_r = 9u^{3/2}/H^{1/2}$

   (B) $K_r = 3.9u^{1/2}/H^{3/2}$

   (C) $K_r = 3u^{3/2}/H^{5/2}$

   (D) $K_r = 3.9u^{3/2}/H^{1/2}$

2. The significant rate of photosynthesis will take place at a depth of greater than 100m in

   (A) Eutrophic lake

   (B) Oligotropic lake

   (C) Both the lakes

   (D) Mesotropic lake

3. The basic equations governing the flow through porous media is

   (A) Henry's formula

   (B) Bazin's formula

   (C) Darcy's formula

   (D) Kutter's formula

4. The per capita consumption of water in a locality is affected by

   (I) Climatic condition

   (II) Quality of water

   (III) Distribution pressure

   (A) Only (I)

   (B) Both (I) and (II)

   (C) Both (I) and (III)

   (D) All of the above

5. Which of the following causes decrease in per capita consumption of water?

   (A) Use of water meter

   (B) good quality water

   (C) better standard of living

   (D) hotter climate

6. The distribution mains are always designed for

   (A) Maximum daily demand

   (B) Maximum hourly demand

   (C) Average daily demand

   (D) Maximum hourly demand on maximum day

Space For Rough Work

7. As compared to geometric increase method of population forecasting, the arithmetic increase method gives

   (A) Lesser value

   (B) Higher value

   (C) Same value

   (D) accurate value

8. The depression of water table in a well due to pumping will be maximum

   (A) At a distance R from the well

   (B) Close to the well

   (C) At a distance R/2 from the well

   (D) None of these

9. The type of valve which is commonly provided on suction pipe in a tubewell is

   (A) Air relief valve

   (B) reflex valve

   (C) Pressure relief valve

   (D) None of these

10. The most common cause of acidity in water is

    (A) Oxygen

    (B) Carbon-di-oxide

    (C) Hydrogen

    (D) Nitrogen

11. The turbidity is measured on

    (A) std. silica scale

    (B) std. cobalt scale

    (C) std. platinum scale

    (D) std. platinum-cobalt scale

12. The concentration of residual chlorine to be maintained in public water supply for safety against pathogens will be in the range of

    (A) 0.1-0.05ppm

    (B) 0.05-0.5ppm

    (C) 0.5-0.8ppm

    (D) 0.8-1.5ppm

Space For Rough Work

13. The dissolved oxygen level in mg/L in natural unpolluted water at normal temperature is found to be in the order of

(A) 1

(B) 10

(C) 100

(D) 1000

14. The length of rectangular sedimentation tank should not be more than the width 'B' of the tank by

(A) B

(B) 2B

(C) 4B

(D) 8B

15. The overflow rate in $1/hr/m^2$ for a plain sedimentation tank is about

(A) 500-750

(B) 1000-1250

(C) 1250-1500

(D) 1500-2000

16. The settling velocity of a particle in a sedimentation tank depends on

(A) depth of the tank

(B) surface area of the tank

(C) both (A) and (B)

(D) none of these

17. Air binding phenomena in rapid sand filters occur due to

(A) Excessive negative head

(B) mud ball formation

(C) higher turbidity

(D) low temperature

18. Disinfection of water results in

(A) removal of turbidity

(B) removal of hardness

(C) destruction of pathogenic organisms

(D) sterilization of water

Space For Rough Work

19. Hardy Cross method of pipe network analysis

(I) involves successive trails

(II) take economic aspects into account

(III) time consuming

(A) only (I)

(B) only (I) and (II)

(C) only (I) and (III)

(D) all of the above

20. The correct relation between theoretical oxygen demand (TOD), bio-chemical oxygen demand (BOD) and chemical oxygen demand (COD) is

(A) TOD>BOD>COD

(B) TOD>COD>BOD

(C) BOD>COD>TOD

(D) COD>BOD>TOD

21. The permissible standards of air quality in India for residential area w.r.t. SPM, SO_x, NO_x, and CO in microgram/m^3 respectively are

(A) 500,120,120,5000

(B) 200,180,180,2000

(C) 100,30,30,1000

(D) 1600,80,100,10000

22. For laminar flow in a circular pipe the Darcy's friction factor 'f' is equal to

(A) $16/R_e$

(B) $32/R_e$

(C) $64/R_e$

(D) none of these

23. If 'n' parallel pipes of same diameter 'd' are to be laid in place of a single pipe of diameter 'D', then the diameter of parallel pipes 'd' is

(A) $d = D/n^{2/5}$

(B) $D = d/n^{2/5}$

(C) $d = D/n^{2/3}$

(D) $d = D/n^{1/2}$

24. Sodium Adsorption Ratio (SAR) is defind by

(A) $Na^+ / \sqrt{(Ca^{++} + Mg^{++})}$

(B) $Na^+/2 \sqrt{(Ca^{++} + Mg^{++})}$

(C) $Na^+/\sqrt{((Ca^{++}/2) + Mg^{++}/2)}$

(D) $2Na^+/\sqrt{(Ca^{++} + Mg^{++})}$

Space For Rough Work

25. If the error in the measurement of head in a V-notch is 1%, then the error in the measuremnt of discharge will be

(A) 1%

(B) 1.5%

(C) 2%

(D) 2.5%

26. If P and A are the perimeter and area of the drainage basin, then its compactness co-efficient is

(A) $P^2/(2\pi A)$

(B) $P/(2\pi A)$

(C) $P/(2\sqrt{(\pi A)})$

(D) $P^2/(\pi^2 A)$

27. The area of the drainage basin whose axial length is 100Km is 2500 sq.Km. Then, its form factor is

(A) 25

(B) 0.2

(C) 0.25

(D) 0.3

28. Imhoff cone is used to determine

(A) total solids

(B) suspended solids

(C) settable solids

(D) dissolved solids

29. The average annual rainfall at any station is the average annual rainfall averaged over a period of

(A) 10 years

(B) 15 years

(C) 25 years

(D) 35 years

30. A sample of domestic waste water is digested with silver sulphate, sulphuric acid, potassium dichromate and mercury sulphate for COD test. The digested sample is then titrated with std. Ferrous Ammonium Sulphate (FAS) to determine unreacted amount of

(A) mercury sulphate

(B) potassium dichromate

(C) silver sulphate

(D) sulphuric acid

31. Consider the following unit processes commonly used in water treatment: Rapid Mixing(RM), Flocculation(F), Primary Sedimentation(PS), Secondary Sedimentation(SS), Chlorination(C), Rapid Sand Filters(RSF). The order of these unit processes from first to last is

(A) $PS \rightarrow RSF \rightarrow F \rightarrow RM \rightarrow SS \rightarrow C$

(B) $PS \rightarrow F \rightarrow RM \rightarrow RSF \rightarrow SS \rightarrow C$

(C) $PS \rightarrow F \rightarrow SS \rightarrow RSF \rightarrow RM \rightarrow C$

(D) $PS \rightarrow RM \rightarrow F \rightarrow SS \rightarrow RSF \rightarrow C$

Space For Rough Work

32. According to the Noise Pollution (Regulation and Control) Act, 2000 of the Ministry of Environment and Forest, Government of India, the day time and night time noise level limits in the ambient air for the residential area expressed in dB(A) L_{eq} are

    (A) 50 and 40

    (B) 55 and 45

    (C) 65 and 55

    (D) 75 and 70

33. The dispersion of pollutants in the atmosphere is maximum when

    (A) environmental lapse rate is greater than adiabatic lapse rate

    (B) environmental lapse rate is less than adiabatic lapse rate

    (C) environmental lapse rate is equal to adiabatic lapse rate

    (D) maximum mixing depth is equal to 100m

34. A body originally at 60°C cools down to 40°C in 15 minutes when kept in air at a temperature of 25°C. What will be the temperature of the body at the end of 30 minutes?

    (A) 35.2°C

    (B) 31.5°C

    (C) 28.7°C

    (D) 15°C

35. The total Kjeldhal nitrogen is a measure of

    (A) total organic nitrogen

    (B) total organic and inorganic nitrogen

    (C) total ammonia nitrogen

    (D) total inorganic and ammonia nitrogen

36. The use of poly-electrolytes in water treatment reduces the alum usage by

    (A) 10%

    (B) 20%

    (C) 30%

    (D) 40%

37. The rate of change in concentration of a dissolved gas in a liquid environment is given by

    (A) $dC/dt = K_L.(A/V).(C^* - C)$

    (B) $dC/dL = K_L.(A/B).(C^* - C)$

    (C) $dC/dL = K_s.(A/B).(C^* - C)$

    (D) $dC/dt = K_z.(A/V).(C - C^*)$

38. The industries are classified into the following 3 categories depending on the pollution potential as

    (A) red, yellow, orange

    (B) red, yellow, green

    (C) green, orange, white

    (D) red, orange, green

Space For Rough Work

39. The air is said to be extremely polluted, if the value of co-efficient of Haze is

(A) less than 2

(B) greater than 2

(C) equal to zero

(D) greater than 4

40. Under natural conditions, organisms like plants, animals and micro organisms etc. live together affecting each other life which is known as

(A) community ecology

(B) auto ecology

(C) synecology

(D) population ecology

41. For an average Indian city, the calorific value of municipal solid waste in the range of

(A) 100-150Kcal/Kg

(B) 200-300Kcal/Kg

(C) 800-1000Kcal/Kg

(D) 2000-3000Kcal/Kg

42. The presence of the following living characteristics are seen in the viruses

(A) RNA

(B) DNA

(C) protein

(D) all of these

43. The volume of water of one cumec-day is equal to

(A) 8.64 ha-m

(B) 86400m^3

(C) 24 cumec-hrs

(D) all of these

44. Which one of the following Acts or Rules has a provision for **"No Right To Appeal"**?

(A) Environmental (Protection) Act, 1986

(B) The Hazardous Waste (Management and Handling) Rules, 1989

(C) Solid Waste (Management and Handling) Rules, 1986

(D) All of these

Space For Rough Work

45. Which one of the following test employs ferron indicator?

   (A) COD

   (B) ammonia nitrogen

   (C) hardness

   (D) fluoride

46. For proper slow mixing in a flocculator of a water treatment plant the temporal mean velocity gradient 'G' per second needs to be in the order of

   (A) 5-10

   (B) 20-80

   (C) 100-200

   (D) 250-350

47. For the design of storm sewer in a drainage area of a city, if the time of concentration is 30 mins then the duration of rainfall will be taken as

   (A) 10 mins

   (B) 20 mins

   (C) 30 mins

   (D) 40 mins

48. Which of the following pairs is not correctly matched?

   (A) BOD: biodegradability

   (B) COD: strength of waste water

   (C) nitrate: methaemoglobinemia

   (D) methane: aerobic digestion

49. A solid waste sample has been segregated and characterized for its elements shows the presence of 'C' 40%, 'H' 6%, 'O' 44% and 'N' 0.3%. What is the likely waste component?

   (A) food waste

   (B) paper and pulp

   (C) plastic waste

   (D) leather waste

50. The hardness of water is determined by titration with Ethylene Diamine Tetraacetic Acid (EDTA) using

   (A) ferroin indicator

   (B) starch indicator

   (C) erichrome black T indicator

   (D) methyl orange indicator

Space For Rough Work

PART – 2

Each question carries two marks.   (25 × 2 = 50)

51. A Waste water sample has ultimate BOD of 300mg/L at 20°C, the five-day BOD was 200mg/L and reaction rate constant was 0.22 per day. The BOD_5 of this waste at 25°C is

    (A) 270mg/L   (B) 210mg/L

    (C) 225mg/L   (D) 290mg/L

52. A phosphorous limited lake with surface area 80sq.km is fed by a discharge of 15m³/s through a stream that has phosphorous concentration of 0.01mg/L, in addition an effluent from a point source adds 1 gm/s of phosphorous. The phosphorous settling rate is estimated to be 10m/yr. The average total phosphorous concentration in the lake could be

    (A) 0.3mg/L   (B) 0.08mg/L

    (C) 0.028mg/L   (D) 0.018mg/L

53. A city has to supply water of 15000m³/day is treated with chlorine dosage of 0.5ppm using bleaching powder having available chlorine 25%. The required quantity of bleaching powder would be

    (A) 300kg   (B) 75kg

    (C) 30kg   (D) 7.5kg

54. The waste water sample has initial DO 10mg/L and the final DO after 5 days of incubation at 20°C is 20mg/L with dilution ratio 1%. The BOD of the sample is

    (A) 8mg/L   (B) 10mg/L

    (C) 500mg/L   (D) 800mg/L

55. A venturimeter having a throat diameter of 0.1m is used to estimate the flow rate of a horizontal pipe of diameter 0.2m for an observed pressure head difference of 2m of water and coefficient of discharge equal to unity, neglecting losses. The flow rate in m³/s through the pipe is

    (A) 0.5   (B) 0.15

    (C) 0.05   (D) 0.015

56. An effluent at a discharge of 2670m³/day from a waste water treatment plant is to be disinfected. The laboratory data of disinfection studies with chlorine dosage of 15mg/L yield the model $N_i = N_0{*}e^{-0.1451}$, where N_i is the number of microorganisms surviving at time 't' minutes, N_0 is the number of microorganisms present initially at t = 0. The volume of disinfection unit in m³ required to achieve 98% destruction of microorganisms will be

    (A) 45   (B) 50

    (C) 60   (D) 80

Space For Rough Work

57. The elevation and temperature data for a place are tabulated below

Elevation in m	4	444
Temperature in °c	21.25	15.70

Based on the above data, the lapse rate can be referred to as

(A) super adiabatic

(B) neutral

(C) subadiabatic

(D) inversion

58. Anaerobically treated effluent has MPN of total coliform bacteria as 10^6/100mL after chlorination the MPN value declines to 10^2/100mL. The per cent removal (%R) and log removal (logR) of total coliform MPN is

(A) %R = 99.90;logR = 4

(B) %R = 99.9;logR = 2

(C) %R = 99.99;logR = 4

(D) %R = 99.99;logR = 2

59. Two observation wells penetrated into a confined aquifer and located 1.5km apart in the direction of flow indicate head of 45m and 20m. If the coefficient of permeability of the aquifer is 30m/day and the porosity is 0.25, the time of travel of an inert tracer from one well to the other is

(A) 416.7 days

(B) 500 days

(C) 750 days

(D) 3000 days

60. A city has the present population of 2.5 lakh which is estimated to increase geometrically to 3 lakh in next 15 years. The existing treatment plant capacity is 50MLD and the rate of input to the treatment plant is 150 LPD. For how long the treatment plant be adequate?

(A) 10 years

(B) 20 years

(C) 24 years

(D) 30 years

61. The height of water on upstream and downstream, of submerged weir of length 3m are 20cm and 10cm respectively. If C_d for free and drowned portion are 0.6 and 0.8 respectively, the total discharge over the weir in m³/s will be

(A) 0.1

(B) 0.2

(C) 0.4

(D) 0.5

62. A waste water sample of 2ml is made upto 300ml in BOD bottle with distilled water, initial DO of the sample is 8mg/L and after 5 days it is 2mg/L, what is its BOD?

(A) 894mg/L

(B) 900mg/L

(C) 300mg/L

(D) 1200mg/L

Space For Rough Work

63. Water samples X and Y collected from two different sources were brought to the laboratory for the measurement of Dissolved Oxygen (DO) using modified Winkler's method. Samples were transferred to 300ml BOD bottles, 2ml of $MnSO_4$ solution and 2ml of alkali iodide azide reagent were added and mixed. Sample X developed brown precipitates while sample Y developed white precipitates. With these observations the inference is

(A) both samples were devoid of DO

(B) sample X was devoid of DO, sample Y contains DO

(C) sample X contains DO while sample Y devoid of DO

(D) both the samples contained DO

64. For a water treatment plant having flow rate of 432m³/hour, what is the required plan area of type 1 settling tank to remove 90% of the particles having settling velocity of 0.12cm/s is

(A) 120m²

(B) 111m²

(C) 90m²

(D) 100m²

65. The Ca^{2+} and Mg^{2+} concentration in a water sample are 160mg/L and 40mg/L as their ions respectively. The total hardness of the water sample in terms of $CaCO_3$ in mg/L is equal to

(A) 120

(B) 200

(C) 460

(D) 567

66. The DO in an unseeded sample are diluted industrial waste water having an initial DO of 9.5mg/L is measured to be 3.5mg/L after 5 days at 20°C. If the dilution factor is 0.03, the 5-day BOD at 20°C of the industrial waste water in mg/L is equal to

(A) 100

(B) 200

(C) 300

(D) 400

67. According to Indian Standards the minimum number of rain gauge stations for an area of 5200sq.km in plain region should be

(A) 10

(B) 20

(C) 50

(D) 70

Space For Rough Work

68. The height of chimney required for effective disposal of 27kg/hour of SO_2 from an industrial emission is

(A) 42m

(B) 30m

(C) 22m

(D) 81m

69. Fresh sludge has moisture of 99% and after thickening its moisture content is reduced to 96%. The reduction in volume of the sludge is

(A) 30%

(B) 50%

(C) 75%

(D) 97%

70. The drainage area of a town is 12 hectares. 405 of the area has hard pavement with K = 0.85, 40% of the area is unpaved streets with K = 0.2 the remaining area is wooded with K = 0.15 assuming the time of concentration for the area has 30 minutes and using the formula intensity of precipitation P_i = 900/(t + 60). The maximum rate of runoff in cumecs will be

(A) 0.1

(B) 0.12

(C) 0.15

(D) 0.2

71. An industrial waste water discharges at the maximum flow rate of 1 lakh m^3/day to which ETP has been designed. There were four secondary settling tanks each of 31.2m diameter can treat 25200m^3/day, then the weir loading rate of the secondary settling tank in m^3/m-day will be

(A) 100

(B) 150

(C) 260

(D) 320

72. A cogeneration plant of a sugar industry produces methane at the rate of 5800m^3/day which is equivalent to 35800kJ/m^3/day. Then the power generated in Mega watts will be

(A) 1

(B) 2

(C) 2.5

(D) 3

73. A 150mm diameter pipe reduces to 10cm abruptly in an industrial water supply pipe. If the pipe carries water at 30L/s, the loss of pressure head across the contraction assuming coefficient of contraction C_c=0.6, will be

(A) 0.6m

(B) 0.75m

(C) 0.95m

(D) 1.25m

Space For Rough Work

74. The pressure of 200kpa is equivalent to a head of 'X' m of CCl_4 of relative density 1.59 where X is equal to

(A) 11.6m

(B) 11.9m

(C) 12.8m

(D) 13.1m

75. The biotransformation of an organic compound having concentration 'x' can be modelled using an ordinary differential equation $dx/dt = -kx^2$, where k is the reaction rate constant. If x = a, at t = 0, the solution of the equation is

(A) $x = a*e^{-kt}$

(B) $1/x = 1/a + kt$

(C) $x = a(1 - e^{-kt})$

(D) $x = a + kt$

———————————

Space For Rough Work

A1