FACULTY OF ENGINEEERING

B.E. (AICTE) III – Semester (Main) (New) Examination, March / April 2022
(Common for CIVIL, MECH, PROD, AE)

Subject: Mathematics - III (PDE, P&S)

Time: 3 Hours   **Max. Marks: 70**

Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each Questions carries 14 Marks.
(ii) Answer to each question must be written at one place only and in the same order as they occur in the question paper.
(iii) Missing data, if any, may be suitably assumed.

1 (a) Form the partial differential equation from $z = f\left(\frac{y}{x}\right)$ by eliminating the arbitrary function f.

(b) Classify the partial differential equation $u_{xx} + 2u_{xy} + 4u_{yy} = 0$.

(c) Find the moment generating function of uniform distribution.

(d) Write normal equations to fit a parabola $y = a + bx + cx^2$.

(e) Write any two applications of Chi-square test.

(f) Solve $px + qy = z$.

(g) Find the means of the variables when the lines of regression are $5y - 8x + 17 = 0$ and $2y - 5x + 14 = 0$.

2 (a) Solve $(z^2 - 2yz - y^2)p + (xy + xz)q = xy - xz$.

(b) Solve $px + qy = pq$ by Charpit's method.

3 A string of length 100cm is tightly stretched between $x = 0$ and $x = 100$ and is displaced from its equilibrium position by imparting to each of its points an initial velocity $f(x) = \begin{cases} x, & 0 \le x \le 50 \\ 100 - x, & 50 \le x \le 100 \end{cases}$. Determine the displacement at any subsequent time.

4 (a) In a normal distribution exactly 7% of the items are under 38 and 90% are under 65. Find the mean and standard deviation of the distribution.

(b) Find the variance of a Poisson distribution.

5 (a) Find the correlation coefficient and the equation of line of regression of x on y for the following data.

x	1	2	3	4	5
y	2	5	3	8	7

(b) In a big city 325 men out of 600 men were found to be smokers. Does this information support the conclusion that the majority of men in this city are smokers?

6 (a) A sample of 26 bulbs gives a mean life of 990 hours with a Standard deviation of 20 hours. The manufacturer claims that the mean life of bulbs is 1000 hours. Is the sample not upto the standard? (Given $t_{0.05}(25) = 1.708$).

(b) The nicotine contents in milligrams in two samples of tobacco were found to be as follows:

Sample A	24	27	26	21	25	-
Sample B	27	30	28	31	22	36

Can it be said that two samples came from same population variances.(Given $F_{0.05}(5,4) = 6.26$)

7 (a) Fit a Poisson distribution for the following data and calculate the expected frequencies.

x	0	1	2	3	4	5
$f(x)$	42	33	14	6	4	1

(b) Fit a straight line $y = a + bx$ to the following data.

x	1	2	3	4	6	8
y	2.4	3	3.6	4	5	6

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FACULTY OF ENGINEERING
B.E. (ECE) (AICTE) III - Semester (NEW) (Main) Examination, March / April 2022

Subject: Probability Theory and Stochastic Processes

Time: 3 Hours   **Max. Marks: 70**

Note: **(i) First Question is compulsory and answer any four questions from the remaining six questions. Each question carries 14 marks.**
      (ii) Answers to each question must be written at one place only and in the same order as they occur in the question paper.
      (iii) Missing data, if any, may suitably be assumed.

1 (a) A card is drawn at random from an ordinary deck of 52 cards. Find the probability of its being a six or a Heart.
   (b) For the given continuous probability density function $f_x(X) = kx\,e^{-x}$, $x \geq 0$. Find the value of k.
   (c) Derive joint density function and write its properties.
   (d) If X and Y are uncorrelated random variables, prove that Var(X +Y) = Var (X) + Var (Y).
   (e) Define mean-ergodic process and correlation-ergodic process.
   (f) Find the PSD of a stationary process X(t) whose ACF is $R_x(\tau) = a\,e^{-b|\tau|}$, where a and b are constants.
   (g) A continuous random variable X has pdf
      $f_x(X) = x\,(2 - x)$, $0 \leq x \leq 2$. Find E[X].

2 (a) A fair coin is tossed repeatedly until head is obtained. Find the probability that the coin is tossed atleast 4 times.
   (b) Box-1 contains 1 white and 999 red balls. Box-2 contains 1 red and 999 white balls. ball is selected from a randomly selected box. If the ball is white, what is the probability that it came from box-2.

3 (a) A certain random variable has the following density. $f_x(x) = a\,e^{-bx}$, for $x \geq 0$ where a and b are constant.
   (1) Determine the relation between a and b. (2) Determine the corresponding CDF.
   (b) Show that the mean and variance of a Poisson distributed random variable are same.

4 (a) X and Y are two random variables whose joint density function is given by $f_{XY}(x,y) = [xy / 9]$, $0 \leq x \leq 2$, $0 \leq y \leq 3$ .find the marginal pdf of X and Y and show that X and Y are statistically independent.
   (b) Find covariance and correlation coefficient of two random variables X and y if E[X] =2, E[Y] = 3, E[X,Y] = 10, $E[X^2]$ =9, $E[Y^2]$ =16.

5   (a) A random process X(t) is defined as X(t) = A Cos (Wt + θ) where W and θ are constants and "A" is a random variable uniformly distributed over the interval (0,2). Determine whether X(t) is WSS or not.

(b) Given that the autocorrelation function (ACF) for a stationary ergodic process with no periodic components as $R_{XX}(\tau) = 25 + \{4 / (1 + 6\tau^2)\}$. Find the mean and variance of the random variable X(t).

6   (a) X(t) is input to a LTI system with ACF $3\delta(\tau)$. Find the PSD and ACF of the output Y(t) if the system has transfer function 1 / (6+ Jw).

(b) Find the ACF of a random process whose PSD is 4 + [1 + W²/4].

7   (a) Three statistically independent random variables X, Y and Z have mean values 3,6 and -2 respectively. Find the mean of the following functions.
(1) g(X,Y,Z) = X +3Y + 4Z
(2) g(X,Y,Z) = XYZ
(3) g(X,Y,Z) = -2XY-3YZ+4ZX.

(b) For two random variables X and y, prove that the degree of correlation lies between −1 to +1.

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FACULTY OF ENGINEERING
BE (AICTE) (CSE) III - Semester (Main) (New) Examination, March / April 2022

Subject: OPERATIONS RESEARCH

Time: 3 Hours   **Max marks: 70**

Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each Questions carries 14 Marks.

      (ii) Answer to each question must be written at one place only and in the same order as they occur in the question paper.

      (iii) Missing data, if any, may be suitably assumed.

1. a) What are the advantages and limitations of LP problem?

   b) What is duality principle? Explain.

   c) Why VAM is popular in solving transportation problem? Apply NWCM to following problem and write the schedule.

	P	Q	R	Supply
A	5	3	2	60
B	4	2	1	40
Demand	20	30	50	

   d) Explain with examples for the failure mechanism of items.
   e) Briefly explain (i) pure strategy (ii) mixed strategy (iii) optimal strategy
   f) Explain the characteristics of waiting line models
   g) Gives a brief description of the various types of queues.

2. Solve the following LP Problem using simplex Method

   Maximize $Z = 5x_1 + 3x_2 + 7x_3$

   Subject to $x_1 + x_2 + 2x_3 \leq 22$

             $3x_1 + 2x_2 + x_3 \leq 26$

             $x_1 + x_2 + x_3 \leq 18$

          $x_1, x_2, x_3 \geq 0$

3. Solve the following LP problem using dual simplex method:

   Minimize $Z = 10x_1 + 6x_2 + 2x_3$

   Subject to $-x_1 + x_2 + x_3 \geq 1$

             $3x_1 + x_2 - x_3 \geq 2$

          $x_1, x_2, x_3 \geq 0$

4. Obtain IBFS by using VAM method for given Transportation Problem

	D_1	D_2	D_3	D_4	Supply
S_1	3	1	7	4	300
S_2	2	6	5	9	400
S_3	8	3	3	2	500
Demand	250	350	400	200	

5. Use dominance principle to solve the game whose pay off matrix is given by;

Firm-B

		B₁	B₂	B₃	B₄	B₅
Firm-A	A₁	4	6	5	10	7
	A₂	6	7	4	8	9
	A₃	9	8	10	9	8

6. Solve the problem by using following details.
   A Computer contains 20,000 resistors. When any resistor fails, it is placed. The cost of replacing resistor individually is Rs 10. If the all resistors are replaced at the same time the cost per resistor is reduced to Rs 4/- The percentage surviving at the end of month t, and the probability of failure during the month t are given below:

Month	0	1	2	3	4	5	6
Percent surviving at the end of t	100	96	90	65	35	20	0
Prob. Of failure during the month t	-	0.04	0.06	0.25	0.30	0.15	0.20

7. A child care shop dealing with children's requirements has one cashier who handles all customer's payment. The cashier takes an average of 4 minutes per customer. Customer's come to cashier's area in a random manner but on an average of 10 people per hour. The management received a large number of customer's complaints and decided to investigate the following questions:
   a) What is the average length of waiting line to be expected under the existing conditions?
   b) What portion of his time is the cashier expected to be idle?
   c) What is the average length of time that a customer would be expected to wait to pay for hi purchase?
   d) If it was decided that a customer would not tolerate a wait of more than 12 minutes, what is the probability that a customer would have to wait at least that length of time?

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FACULTY OF ENGINEERING
B.E. (CME/DS) (AICTE) III - Semester (Main) (New) Examination, March / April 2022

Subject: Operations Research

Time: 2 hours   Max. Marks: 70

Note: (i) First question is compulsory and answer any four questions from the remaining six questions.
(ii) Answer to each question must be written at one place only and in the Same order as they occur in the question paper.
(iii) Missing data, if any, may be suitably assumed.

1. a) Define the terms
      (i) Optimal Solution
      (ii) Infeasible Solution
   b) What is principal of duality in LP? Explain the advantages?
   c) Write the differences between dual and Primal variable.
   d) What is degeneracy in Transportation Problem?
   e) Write any two methods to solve Transportation Problem?
   f) Define Maximum and Minimax principle?
   g) Define Queuing Theory?

2. a) Define unbounded solution
   b) Solve the following LPP by Graphical method

   Maximize $Z = 3x_1 + 2x_2$

   Subject to $x_1 - x_2 \geq 1$

   $x_1 + x_2 \geq 3$

   $x_1, x_2 \geq 0$

3. Solve the following problem by using Simplex method

   Maximize $z = 6x_1 + 8x_2$

   Subject to $5x_1 + 10x_2 \leq 60$

   $4x_1 + 4x_2 \leq 40$; x_1 and $x_2 \geq 0$

4. Solve the following problem by using the result of its Dual problem

   Minimize $z = 40x_1 + 30x_2 + 25x_3$

   Subject to $4x_1 + 2x_2 + 5x_3 \geq 30$

   $3x_1 + 6x_2 + x_3 \geq 20$

   $x_1 + 3x_2 + 6x_3 \geq 36$;

   $x_1, x_2, \& x_3 \geq 0$

5. Solve the following Assignment Problem using Hungarian method

	Operator I	Operator II	Operator III	Operator IV
Machine A	10	5	13	15
Machine B	3	9	18	3
Machine C	10	7	3	2
Machine D	5	11	9	7

..2

6. Solve the following game graphically.

Player A	Player B	
	1	2
1	6	-7
2	1	3
3	3	1
4	5	-1

7. Find the Sequence of jobs that minimizes the total elapsed time to complete the following jobs on the machines.

Jobs	1	2	3	4	5	6
Machine A	3	12	5	2	9	11
Machine B	8	10	9	6	3	1

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FACULTY OF ENGINEEERING

B.E. (IT, EEE, EIE, AI&DS, AI&ML, IOT) (AICTE) III- Semester (New) (Main) Examination, March / April 2022

Subject: Mathematics - III (Probability & Statistics)

Time: 3 Hours   **Max. Marks: 70**

Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each Questions carries 14 Marks.
      (ii) Answer to each question must be written at one place only and in the same order as they occur in the question paper.
      (iii) Missing data, if any, may be suitably assumed.

1
     (a) State Baye's theorem.
     (b) If X is a Poisson variate such that $p(x = 1) = 24p(x = 3)$. Find $p(x = 0)$.
     (c) Write any two properties of normal distribution.
     (d) Define Rank correlation coefficient.
     (e) Write any two conditions of applicability of chi-square test.
     (f) Find the mean of Uniform distribution.
     (g) Write the normal equations to fit a straight line $y = ax + b$.

2   (a) State and prove Theorem of Total probability.
     (b) For the continuous probability function $f(x) = kx^2 e^{-x}$ when $x \geq 0$ find
        i) k, ii) Mean iii)Variance.

3   (a) Six dice are thrown 729 times. How many times do you expect at least three dice to show a five or six?
     (b) Data was collected over a period of 10 years, showing number of deaths from horse kicks in each of the 200 army corps. The distribution of deaths was as follows:

No of deaths	0	1	2	3	4
Frequency	109	65	22	3	1

     Fit a Poisson distribution to the data and calculate the theoretical frequencies.

4   (a) In a normal distribution, 31% of the items are under 45 and 8% are over 64. Find the mean and standard deviation of the distribution.
     (b) Find the mean and variance of Exponential distribution.

5   (a) Find the correlation coefficient and the equation of regression of x on y for the following data:

x	1	2	3	4	5
y	2	5	3	8	7

..2

(b) The average income of persons was Rs.210 with a standard deviation of Rs.10 in sample of 100 people of a city. For another sample of 150 persons, the average income was Rs.220 with S.D of Rs.12. The standard deviation of incomes of the people of the city was Rs.11. Test whether there is any significant difference between the average incomes of the localities.

6 (a) Two samples of size 9 and 8 give the sum of squares of deviations from their respective means equal to 160 and 91 respectively. Can they be regarded as drawn from the two normal populations with same variance? [F for 8 and 7 dof=3.73].

(b) The theory predicts the population of means in the four groups A, B, C, D should be 9:3:3:1. In an experiment among 1600, the numbers in the four groups were 882, 313, 287 and 118. Does the experimental result support the theory? ($\chi^2_{0.05}$ at 3 $dof =$ 7.815).

7 (a) The first four moments of a distribution about x=4 are 1, 4, 10, 45. Find the moments about the mean.

(b) Fit a curve $y = a + bx + cx^2$ to the following data:

x	-1	0	1	2	3	7
y	9	7	7	9	13	49

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FACULTY OF ENGINEERING
BE (CIVIL/ EEE/ EIE/CSE) (AICTE) III - Semester (Backlog) (Old) Examination, March / April 2022

Subject: Environmental Science

Time: 3 hours   **Max. Marks: 70**

(Missing data, if any, may be suitably assumed)

PART – A
Note: Answer all questions.   **(10 x 2 = 20 Marks)**

1   Write the Ethical basis of environmental education and awareness.
2   List out few reasons for Land degradation.
3   Write briefly about energy flow in an ecosystem.
4   What is Bio-magnification?
5   What is meant by Endangered and Endemic species?
6   What is thermal pollution?
7   What is meant by primary and secondary pollutants?
8   Why is it necessary to enact environmental laws?
9   Explain conservation and sustainable development.
10 "Rain water harvesting could be possible option for water conservation". Examine

PART – B
Note: Answer any five questions.   **(5 x 10 = 50 Marks)**

11 (a) What are the causes of environmental protection ignorance?
    (b) How can an individual conserve different natural resources?

12 (a) Explain the types of ecological pyramid in an ecosystem.
    (b) Explain the following: (i) Decomposers   (ii) food web.

13 (a) Write the measures to be taken to prevent depletion of ground water resources.
    (b) What is deforestation? Explain its causes and effects.

14 (a) Why does the construction of big dams often face opposition from the public? Justify your answer giving example.
    (b) Write about the adverse effects due to dam construction.

15 (a) Explain the causes of water pollution.
    (b) Write in detail about causes and effects of noise pollution.

16 (a) Write the salient features of Environmental Protection Act, 1986.
    (b) Explain about Solid waste management and mitigation.

17 (a) What is ozone hole? What are the causes of ozone hole formation?
    (b) Discuss the effects of Ozone layer depletion and its remedial measures.

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FACULTY OF ENGINEERING

B. E. (ECE/M/P/A/IT) (AICTE) III – Semester (Backlog) (Old) Examination,

March / April 2022

Subject: Indian Constitution

Time: 3 hours   Max. Marks: 70

(Missing data, if any, may be suitably assumed)

PART – A

Note: Answer all questions.   **(10 x 2 = 20 Marks)**

1. What is Preamble?

2. Role of Quit India Movement in the freedom struggle

3. Non-Cooperation movement.

4. Role of Council of Ministers.

5. What are the Fundamental Duties?

6. What is NITI Ayog?

7. NHRC composition

8. Role of Interstate council

9. Write about Electoral reforms.

10. What is the role of Election commission?

PART – B

Note: Answer any five questions.   **(5 x 10 = 50 Marks)**

11. (a) Write an essay on Evolution of the Indian Constitution.

    (b) Explain the basic ideals of the Indian Constitution.

12. (a) Explain the provisions of the Government of India Act 1935.

    (b) Explain the composition and working of the Constituent Assembly.

13. (a) Describe the powers and functions of the President of India.

    (b) Examine the powers and functions of the Prime Minister and Council of Ministers.

14. (a) Explain the Fundamental rights.

    (b) Write a critical appraisal of Fundamental Duties.

15. (a) Write an essay on the implementation of the Directive Principles.

    (b) What are the powers and functions of the Chief Ministers?

16. (a) Critically evaluate Union-State relations.

    (b) Explain the function of the Inter-state councils.

17. (a) Discuss the powers and functions of the Election Commission of India.

    (b) Explain the functioning of National Human Rights Commission in India.

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FACULTY OF ENGINEERING

B. E. (CME) (AICTE) III – Semester (Old) Examination, March / April 2022

Subject: Data Structures

Time: 3 hours   **Max. Marks: 70**

(Missing data, if any, may be suitably assumed)

PART – A

Note: Answer all questions.   **(10 x 2 = 20 Marks)**

1. What are the advantages of linked lists over the arrays?
2. List the applications of queues.
3. Differentiate linear and circular queues.
4. Write a code to search an element in linked list.
5. List the balanced search trees.
6. Give an example of AVL tree.
7. Differentiate breadth first search and depth first search.
8. Write the prim's algorithm.
9. Classify sorting algorithms.
10. When is Quicksort better than merge sort?

PART – B

Note: Answer any five questions.   **(5 x 10 = 50 Marks)**

11. Explain the various expression conversions and evaluation methods with the examples.

12. Distinguish between linear and non-linear data structure and their representations in the memory using array.

13. Implement a circular linked list of any five elements and perform all the operations.

14. List the applications of graphs and explain the working Dijkstra algorithm using appropriate example.

15. Explain the algorithms for minimum spanning tree.

16. How would you optimize Bubble Sort and explain with an example.

17. Write short notes on the hash table and Application – Text Compresssion.

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