Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course: Probability and Statistics for Engineers **Semester: III**
Program: B.Tech. (CSE)(Hons.) **Time: 03 hrs.**
Course Code: CSEG 2036P **Max. Marks: 100**

Instructions: Attempt all the questions. Q. No. 11 has internal choice.

SECTION A
(5Qx4M=20Marks)

S. N.		Marks	CO
Q 1	The probabilities that students A, B, C, and D solve a problem are 1/3, 2/5, 1/5, and 1/4, respectively. If all of them try to solve the problem, find the probability that the problem is solved.	**4**	**CO1**
Q 2	Suppose that the number of cars X that pass through a car wash between 4:00P.M. and 5:00 P.M. on any sunny Friday has the following probability distribution: x: 4, 5, 6, 7, 8, 9 $P(X = x)$: $\frac{1}{12}$, $\frac{1}{12}$, $\frac{1}{4}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{6}$ Let $g(X) = 2X-1$ represent the amount of money, in rupees, paid to the attendant by the manager. Find the attendant's expected earnings for this period. Also obtain the variance of the attendant's earnings.	**4**	**CO2**
Q 3	Determine the value c so that the following function can serve as a probability distribution of the discrete random variable X: $f(x) = c\,(x^2 + 4)$, for $x = 0, 1, 2, 3$;	**4**	**CO2**
Q 4	The probability of a man hitting a target is 1/3. How many times must he try so that the probability of hitting the target at least once is more than 90%?	**4**	**CO3**
Q 5	Find the probability that a person flipping a coin gets the third head on the seventh flip.	**4**	**CO3**

SECTION B **(4Qx10M= 40 Marks)**			
Q 6	The joint probability mass function of a bivariate random variable (X, Y) is given by $$P(X = x, Y = y) = \begin{cases} k(2x + y) & x = 1, 2 \text{ and } y = 1, 2 \\ 0, & otherwise \end{cases}$$ where k is a constant. Find (a) Value of k and (b) $P(X = x \mid Y = 2)$.	**10**	**CO2**
Q 7	Diameter of an electric cable, say X, is given by the density function $$f(x) = \begin{cases} 6x(1 - x) & 0 \le x \le 1 \\ 0, & otherwise \end{cases}$$ Determine the value of b such that $P(X < b) = P(X > b)$.	**10**	**CO3**
Q 8	(a) State and explain the expression for negative binomial distribution. (b) The average number of phone calls per minute coming into a switch board between 2 pm and 4 pm is 2.5. Determine the probability that during one particular minute there will be (i) 4 or fewer calls (ii) more than 6 calls.	**10**	**CO3**
Q 9	A research scientist reports that mice will live an average of 40 months when their diets are sharply restricted and then enriched with vitamins and proteins. Assuming that the lifetimes of such mice are normally distributed with a standard deviation of 6.3 months, find the probability that a given mouse will live (a) less than 28 months; (b) between 37 and 49 months.	**10**	**CO4**
SECTION-C **(2Qx20M=40 Marks)**			
Q 10	A semiconductor manufacturer produces controllers used in automobile engine applications. The customer doesn't prefer that the process fallout or fraction defective at a critical manufacturing greater than or equal to 0.05. The semiconductor manufacturer takes a random sample of 200 devices and finds out that 4 of them are defective. Can the manufacturer demonstrate process capability for the customer? Test at 5% level of significance.	**20**	**CO4**
Q 11	A study was made on the amount of converted sugar in a certain process at various temperatures. The data were coded and recorded as follows:	**20**	**CO5**

	<table><tr><th>Temperature, x</th><th>Converted Sugar, y</th></tr><tr><td>1.0</td><td>8.1</td></tr><tr><td>1.1</td><td>7.8</td></tr><tr><td>1.2</td><td>8.5</td></tr><tr><td>1.3</td><td>9.8</td></tr><tr><td>1.4</td><td>9.5</td></tr><tr><td>1.5</td><td>8.9</td></tr><tr><td>1.6</td><td>8.6</td></tr><tr><td>1.7</td><td>10.2</td></tr><tr><td>1.8</td><td>9.3</td></tr><tr><td>1.9</td><td>9.2</td></tr><tr><td>2.0</td><td>10.5</td></tr></table> (a) Estimate the linear regression line. (b) Estimate the mean amount of converted sugar produced when the coded temperature is 1.75. (c) Plot the residuals versus temperature.		
	OR		
	Explain the following: (a) Classification and Clustering. (b) Decision Trees. (c) ANOVA (d) Uniform Distribution	**20**	**CO5**