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UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2021

Programme Name: BCA	Semester : I
Course Name : Mathematics	Time : 3 Hrs
Course Code : MATH1037	Max. Marks : 100
Nos. of page(s) : 2	

SECTION A
(Answer all the questions. Each question carries 4 marks)

Q1	Find the integral value of x , if $\begin{vmatrix} x^2 & x & 1 \\ 0 & 2 & 1 \\ 3 & 1 & 4 \end{vmatrix} = 28$.	4M	CO2
Q2	Determine the value of k for which the following function is continuous at $x = 3$. $f(x) = \begin{cases} \frac{x^2 - 9}{x - 3}, & x \neq 3 \\ k, & x = 3 \end{cases}$	4M	CO3
Q3	Define Chain rule and using it, evaluate $\frac{dy}{dx}$ if $y = \sqrt{3x^2 + 4x - 1}$.	4M	CO3
Q4	If the probabilities of solving a problem by two students A and B are $\frac{1}{2}$ and $\frac{1}{3}$ respectively then what is the probability of the problem to be solved.	4M	CO4
Q5	Solve the equation $3x^2 = 15 - 4x$ by completing the square method.	4M	CO1

SECTION B
(Answer all the questions. Each question carry 10 marks)

Q6	The probabilities of X, Y and Z becoming managers are $\frac{4}{9}, \frac{2}{9}$, and $\frac{1}{3}$ respectively. The probability that the bonus scheme will be introduced if X, Y and Z becomes managers are $\frac{3}{10}, \frac{1}{2}$, and $\frac{4}{5}$ respectively. (i) What is the probability that bonus scheme will be introduced? (ii) If the bonus scheme has been introduced, what is the probability that the manager appointed was X ?	10 M	CO4
Q7	If $A = \begin{bmatrix} \cos x & -\sin x & 0 \\ \sin x & \cos x & 0 \\ 0 & 0 & 1 \end{bmatrix}$, prove that $A(\text{adj } A) = (\text{adj } A)A = A I_3$.	10M	CO2
Q8	Evaluate $\int \frac{2x^2 - 9x - 35}{(x+1)(x-2)(x+3)} dx$ using the technique of partial fractions.	10M	CO3

<p>Q9</p>	<p>Determine the values of λ and μ such that the system $2x - 5y + 2z = 8$, $2x + 4y + 6z = 5$, $x + 2y + \lambda z = \mu$ has (i) no solution (ii) unique solution (iii) infinitely many solutions. Also, find the unique solution of the system.</p> <p style="text-align: center;">(OR)</p> <p>Solve the following homogeneous system for its non-trivial solutions (if any) $x + 3y + 2z = 0$, $2x - y + 3z = 0$, $3x - 5y + 4z = 0$, $x + 17y + 4z = 0$.</p>	<p>10M</p>	<p>CO2</p>
<p>SECTION C (Answer all the questions. Each question carries 20 marks)</p>			
<p>Q10</p>	<p>(i) Find the maximum and minimum values of the function $f(x) = x^3 - 6x^2 + 9x + 1$.</p> <p>(ii) Use logarithmic differentiation to find $\frac{dy}{dx}$ if $f(x) = (5 - 3x^2)^7 \sqrt{6x^2 + 8x - 12}$.</p> <p style="text-align: center;">OR</p> <p>(i) Evaluate $\int e^{ax} \sin bx \, dx$ using Integration by parts technique.</p> <p>(ii) Define Implicit function. Evaluate $\frac{dy}{dx}$ at $x = 3$ if $2y^3 + 4x^2 - y = x^6$.</p>	<p>20M</p>	<p>CO3</p>
<p>Q11</p>	<p>a) Define the Rank of a matrix. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ by reducing it into its normal form.</p> <p style="text-align: right;">[10 Marks]</p> <p>(b) Solve the following system of equations by Cramer's rule. $3x + y + z = 2$; $2x - 4y + 3z = -1$; $4x + y - 3z = -11$</p> <p style="text-align: right;">[10 Marks]</p>	<p>20M</p>	<p>CO2</p>