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BTECH
(SEM II) THEORY EXAMINATION 2021-22
ELEMENTARY MATHEMATICS –II

Time:3 Hours

Total Marks:100

Notes-

- Attempt all sections and assume any missing data.
- Appropriate marks are allotted to each question, answer accordingly.

SECTION -A	Attempt all of following question in brief	Marks (10×2=20)	CO
Q.1(a)	Find $\int \cos^3 x e^{\log \sin x} dx$		1
Q.1(b)	Evaluate $\int_{-1}^1 x^{17} \cos^4 x dx$.		1
Q.1(c)	Form the differential equation of the family of circles touching the x-axis at origin.		2
Q.1(d)	In a bank, principal increases continuously at of 5% per year. In how many years Rs 1000 double itself?		2
Q.1(e)	Write all the unit vectors in XY-plane.		3
Q.1(f)	Find the value of x for which $x(\hat{i} + \hat{j} + \hat{k})$ is a unit vector.		3
Q.1(g)	Find the coordinate of the point where the line through the points A (3, 4, 1) and B (5, 1, 6) crosses the xy -plane.		4
Q.1(h)	Find the direction cosines of the sides of the triangle whose vertices are (3, 5,-4), (-1,1, 2) and (-5,-5,-2).		4
Q.1(i)	Three cards are drawn successively, without replacement from a pack of 52 well shuffled cards. What is the probability that first two cards are kings and the third card drawn is an ace?		5
Q.1(j)	Two cards are drawn successively with replacement from a well-shuffled deck of 52 cards. Find the probability distribution of the number of aces.		5

SECTION -B	Attempt any three of the following questions	Marks (3×10=30)	CO
Q.2(a)	Find the area lying above x – axis and included between the circle $x^2 + y^2 = 8x$ and inside of the parabola $y^2 = 4x$.		1
Q.2(b)	Find the equation of a curves passing through the point (0, 1). If the slope of the tangent to the curve at any point (x, y) is equal to the sum of x – coordinate (abscissa) and the product of the x – coordinate and y – coordinate (ordinate) of the point.		2
Q.2(c)	Show that the points A (1,-2,-8), B (5, 0,-2) and C (11, 3, 7) are collinear, and find the ratio in which B divides \overline{AC} .		3
Q.2(d)	Find the distance of the point (-1,-5,-10) from the point of intersection of the line $\vec{r} = (2\hat{i} - \hat{j} + 2\hat{k}) + \lambda(3\hat{i} + 4\hat{j} + 2\hat{k})$ And the plane $\vec{r} \cdot (\hat{i} - \hat{j} + \hat{k}) = 5$.		4
Q.2(e)	Bag I contains 3 red and 4 black balls while another Bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the bag and it is found to be red .Find the probability that it was drawn from Bag II.		5



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SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.3(a)	Evaluate: $\int_{-1}^{3/2} x \sin \pi x dx$.		1
Q.3(b)	Evaluate: $\int_0^{\pi} \frac{x dx}{a^2 \cos^2 x + b^2 \sin^2 x}$.		1

SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.4(a)	Solve differential equation $(x dy - y dx) y \sin\left(\frac{y}{x}\right) = (y dx + x dy) x \cos\left(\frac{y}{x}\right)$.		2
Q.4(b)	Find the particular solution of the differential equation $\frac{dy}{dx} + y \cot x = 2x + x^2 \cot x$, $(x \neq 0)$ given that $y = 0$ when $x = \frac{\pi}{2}$.		2

SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.5(a)	If with reference to the right handed system of mutually perpendicular unit vectors \hat{i}, \hat{j} and \hat{k} , $\vec{\alpha} = 3\hat{i} - \hat{j}$, $\vec{\beta} = 2\hat{i} + \hat{j} - 3\hat{k}$, then express $\vec{\beta}$ in the form $\vec{\beta} = \vec{\beta}_1 + \vec{\beta}_2$, where $\vec{\beta}_1$ is parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$.		3
Q.5(b)	The scalar product of the vector $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum of vectors $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\lambda\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to one. Find the value of λ .		3

SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.6(a)	Find the shortest distance between the lines $\frac{x+1}{7} = \frac{y+1}{-6} = \frac{z+1}{1}$ and $\frac{x-3}{1} = \frac{y-5}{-2} = \frac{z-7}{1}$.		4
Q.6(b)	Find the equation of the plane which contains the line of intersection of the planes $\vec{r} \cdot (\hat{i} + 2\hat{j} + 3\hat{k}) = 4$, $\vec{r} \cdot (2\hat{i} + \hat{j} - \hat{k}) = -5$ and which is perpendicular to the plane $\vec{r} \cdot (5\hat{i} + 3\hat{j} - 26) = -8$		4

SECTION -C	Attempt any one of the following questions	Marks (1×10=10)	CO
Q.7(a)	Two cards are drawn simultaneously without replacement from a well shuffled pack of 52 cards. Find the mean, variance and standard deviation of the number of kings.		5
Q.7(b)	A and B throw a die alternatively till one of them gets a '6' and wins the game. Find their respective probabilities of winning, if A starts first.		5