University of Mumbai

Examination 2020 under cluster ___ (Lead College Shortname)

Program: Civil/MECH Engineering
Curriculum Scheme: Rev 2016
Examination: Second Year Semester IV
Course Code: CEC/ MEC 401 and Course Name: Applied Mathematics IV

Time: 1 hour Max. Marks: 50

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For the students:- All the Questions are compulsory and carry equal marks .

Q1.	Find eigen values of $A^2 - 6A^{-1} + 3I$, $A = \begin{bmatrix} 6 & 0 & 0 \\ -6 & 3 & 0 \\ 2 & -4 & 1 \end{bmatrix}$
Option A:	36,10,-2
Option B:	38,10,-2
Option C:	-38,11,-2
Option D:	38,10,2
Q2.	Find directional derivative of $\phi = x^2 + y^2 + z^2$ in the direction of $i - 2j + 2k$ at point (1,2,3).
Option A:	10/3
Option B:	2/3
Option C:	-2
Option D:	2
Q3.	Solve, Maximize $z = x_1 + 4x_2$ Subject to $2x_1 + x_2 \leq 3$ $3x_1 + 5x_3 \leq 9$ $x_1 + 3x_2 \leq 5$ $x_1, x_2 \geq 0$
Option A:	$x_1 = 0, x_2 = \frac{5}{3}, z_{max} = \frac{20}{3}$
Option B:	$x_1 = 0, x_2 = -\frac{5}{3}, z_{max} = \frac{20}{3}$
Option C:	$x_1 = 0, x_2 = \frac{5}{3}, z_{max} = \frac{21}{3}$
Option D:	$x_1 = 0, x_2 = \frac{4}{3}, z_{max} = \frac{20}{3}$

Q4.	Find mean and variance of Binomial distribution $(0.2+0.8)^{10}, q=0.2$
Option A:	2,1.6
Option B:	8,1.6
Option C:	7,16
Option D:	2,8
Q5.	Given $A = \begin{bmatrix} 3 & 1 & 4 \\ 0 & 2 & 6 \\ 0 & 0 & 5 \end{bmatrix}$, then
Option A:	A is derogatory and degree of minimal polynomial is 2
Option B:	A is non derogatory and degree of minimal polynomial is 3
Option C:	A is non derogatory and degree of minimal polynomial is 2
Option D:	A is derogatory and degree of minimal polynomial is 3
Q6.	If $\bar{F} = (3x+2y)i + (5y-4z)j + (az+x)k$ is solenoidal, find a
Option A:	-2
Option B:	8
Option C:	-8
Option D:	2
Q7.	Dual of following LPP Maximize $z = 2x_1 + 3x_2 + x_3$ Subject to $x_1 + 2x_2 + x_3 \le 12$ $2x_1 + x_3 \le 5$ $-x_1 + 2x_2 \le -6$ $x_1, x_2, x_3 \ge 0$
Option A:	Minimize $w = 12y_1 - 5y_2 - 6y_3$ Subject to $y_1 + 2y_2 - y_3 \ge 2$ $2y_1 + 2y_2 \ge 3$ $y_1 + y_2 \ge 1$ $y_1, y_2, y_3 \ge 0$
Option B:	Minimize $w = 12y_1 + 5y_2 + 6y_3$ Subject to $y_1 + 2y_2 - y_3 \ge 2$ $2y_1 + 2y_3 \ge 3$ $y_1 + y_2 \ge 1$ $y_1, y_2, y_3 \ge 0$
Option C:	Minimize $w = 12y_1 + 5y_2 - 6y_3$

	Subject to $y_1 + 2y_2 - y_3 \geq 2$ $2y_1 + 2y_3 \geq 3$ $y_1 + y_2 \geq 1$ $y_1, y_2, y_3 \geq 0$
Option D:	Minimize $w = 12y_1 - 5y_2 - 6y_3$ Subject to $y_1 + 2y_2 - y_3 \geq -2$ $2y_1 + 2y_3 \geq 3$ $y_1 + y_2 \geq 1$ $y_1, y_2, y_3 \geq 0$
Q8.	Find characteristic equation of , $A = \begin{bmatrix} 2 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & 2 & 2 \end{bmatrix}$
Option A:	$\lambda^3 + 5\lambda^2 + 7\lambda - 3 = 0$
Option B:	$\lambda^3 - 5\lambda^2 + 7\lambda - 3 = 0$
Option C:	$\lambda^3 - 5\lambda^2 + 7\lambda + 3 = 0$
Option D:	$\lambda^3 - 5\lambda^2 - 7\lambda - 3 = 0$
Q9.	X is a Poisson Variate such that $P[X = 2] = P[X = 3]$ then variance of X is
Option A:	0
Option B:	3
Option C:	1
Option D:	5
Q10.	Work done in moving a particles in a conservative field under the force $\bar{F} = (2xy + z^3)i + (x^2)j + (3z^2x)k$ from the point (1,-2,1) to (3,1,4) is
Option A:	200 units
Option B:	204 units
Option C:	202 units
Option D:	206 units
Q11.	A random variable X has a probability density function $f(x) = x^2e^{-x}\,; x \geq 0.$ Then Mean of X is
Option A:	12
Option B:	6
Option C:	3
Option D:	4
Q12.	Using Cayley Hamilton Theorem Find A^{-1}in terms of$A$, $A = \begin{bmatrix} 1 & 2 & 3 \\ 3 & 1 & -5 \\ 0 & 0 & 1 \end{bmatrix}$

Option A:	$\frac{1}{5}(A^2 + 3A + 3I)$
Option B:	$\frac{1}{5}(-A^2 - 3A + 3I)$
Option C:	$\frac{1}{5}(-A^2 + 3A - 3I)$
Option D:	$\frac{1}{5}(-A^2 + 3A + 3I)$
Q13.	Mean and standard deviation of marks obtained by 50 students of college A are 79 and 9 respectively. Those of 60 students of college B are 75 and 7 respectively. The test Statistic Z to test the significant difference between the means of the two samples $H_0: \mu_1 = \mu_2$ is
Option A:	2.562
Option B:	1.65
Option C:	13.33
Option D:	7.345
Q14.	Find eigen values of $A = \begin{bmatrix} 1 & 2 \\ 2 & 4 \end{bmatrix}$
Option A:	1,2
Option B:	0,5
Option C:	5,1
Option D:	0,1
Q15.	Two sample of size 9 and 8 gave the the sum of squares of deviations from the respective means as 160 and 91 respectively .The calculated value of F –statistic is
Option A:	0.65
Option B:	1.54
Option C:	1.563
Option D:	0.64
Q16.	A random variable X has a probability mass function $p(x) = kx^3\,; x = 1,2,3,4$. Then k is
Option A:	1/10
Option B:	1/30
Option C:	1/100
Option D:	1
Q17.	Four unbiased coins are tossed 160 times The expected frequencies of getting $\{0,1,2,3,4\}$ heads are respectively
Option A:	0,10,20,30,40
Option B:	20,40,60,80,40
Option C:	20,30,60,30,20
Option D:	10,40,60,40,10

Q18.	The number of car accidents in a city was found to be 8,5,20,16,14,17,12, 6,7,15 per month respectively. Using χ^2 test it was found that accidents do not occur equally during 10 months period. Find χ^2 value.
Option A:	20.33
Option B:	21.33
Option C:	19.33
Option D:	23.33
Q19.	Find k if probability distribution function is given as $f(x) = \begin{cases} k.x^2 for\ 0 \le x \le 2. \\ 0 \qquad\qquad otherwise \end{cases}$
Option A:	8/3
Option B:	8
Option C:	3/8
Option D:	¾
Q20.	Find 5^A, $A = \begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$
Option A:	$\begin{bmatrix} 5 & 0 \\ 0 & 5 \end{bmatrix}$
Option B:	$\begin{bmatrix} 5 & 0 \\ 0 & 25 \end{bmatrix}$
Option C:	$\begin{bmatrix} 5 & 1 \\ 0 & 25 \end{bmatrix}$
Option D:	$\begin{bmatrix} 25 & 0 \\ 0 & 5 \end{bmatrix}$
Q21.	Use Stoke's Theorem to evaluate $\int_C \bar{F}.d\bar{r}$ where $\bar{F} = x^2 i + xyj$ and C is boundary of rectangle $x = 0, x = 1, y = 0, y = 2$
Option A:	½
Option B:	2
Option C:	4
Option D:	6
Q22.	A sample of size 20 from a normal population has a mean 44 and standard deviation 6. Assuming the population mean as 42.the corresponding t-statistic is
Option A:	1.453
Option B:	6.67
Option C:	1.491
Option D:	6.33
Q23.	X is normally distributed variable with mean 30 and standard deviation 4, find P(X<40). (Given: Area between Z=0 to Z=2.5 is 0.4938.)
Option A:	0.9878
Option B:	0.4878

Option C:	0.9938
Option D:	0.0062
Q24.	Using Green's Theorem evaluate $\oint (x^2 - y)dx + (2y^2 + x)dy$ around the boundary of the region $y = x^2, y = x$
Option A:	1/3
Option B:	3
Option C:	1/6
Option D:	-1/3
Q25.	If S is any closed surface enclosing a volume V and $\bar{A} = (ax)i + (by)j + (cz)k$ then $\iint_S \bar{A}.\hat{n}ds$ is
Option A:	$(a + b + c)V$
Option B:	$a + b + c$
Option C:	$abcV$
Option D:	abc