AJ Institute of Engineering and Technology Mangaluru.

VTU Question Papers

MATHEMATICS

III and IV Semester

2022 SCHEME

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AJ Institute of Engineering and Technology, Mangaluru.
NH-66, Kottara Chowki, Mangaluru – 575 006

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Third Semester

June/July 2024

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Supplementary Exam

CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **BCS301**

Third Semester B.E./B.Tech. Degree Examination, June/July 2024

Mathematics for Computer Science

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>Obtain the mean and variance of Poisson distribution.</td><td>06</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Out of 800 families with 4 children each, how many families would be expected to have (i) 2 boys and 2 girls (ii) atleast one boy (iii) at most 2 girls. Assume equal probabilities for boys and girls.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The length of telephone conversation in a booth has been an exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made from this booth (i) ends less than 5 minutes (ii) between 5 and 10 minutes.</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.2</td><td>a.</td><td>The probability distribution of a finite random variable X is given by
<table>
<tr><td>X</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(X)</td><td>0.1</td><td>k</td><td>0.2</td><td>2k</td><td>0.3</td><td>k</td></tr>
</table>
(i) Find the value of k (ii) Variance (iii) $P(x \le 2)$</td><td>06</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>The number of accidents in a year to taxi drivers in a city follows a Poisson distribution with mean 3. Out of 1000 taxi drivers find approximately number of drivers with (i) more than 3 accidents in a year (ii) at most 2 accidents in a year.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The marks of 1000 students in an exam follows normal distribution with mean 70 and standard deviation 5. Find the students whose marks will be (i) less than 65 (ii) between 65 and 75. A(1) = 0.3413.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">Module – 2</td></tr>
<tr><td>Q.3</td><td>a.</td><td>Given the following joint distribution of the random variables X and Y. Find the corresponding marginal distribution. Also compute the covariance.
<table>
<tr><td>X \ Y</td><td>1</td><td>3</td><td>9</td></tr>
<tr><td>2</td><td>1/8</td><td>1/24</td><td>1/12</td></tr>
<tr><td>4</td><td>1/4</td><td>1/4</td><td>0</td></tr>
<tr><td>6</td><td>1/8</td><td>1/24</td><td>1/12</td></tr>
</table></td><td>06</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>A salesmen's territory consists of 3 cities A, B and C. He never sells in the same city for 2 consecutive days. If he sells in city A, then the next day he sells in city B. However if he sells in either B or C then the next day he is twice as likely to sell in city A as in the other city. In the long run how often does he sell in each of the cities.</td><td>07</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Show that $P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is a regular stochastic matrix. Also find the associated unique fixed probability vector.</td><td>07</td><td>L2</td><td>CO2</td></tr>
</table>

		OR			
Q.4	**a.**	Define probability vector, regular stochastic matrix, fixed prob vector.	**06**	**L1**	**CO3**
	b.	The joint probability distribution of two discrete random variables X and Y is $f(x, y) = k(2x + y)$, where x and y are integers such that $0 \leq x \leq 2$, $0 \leq y \leq 3$. i) Find the value of the constant k. ii) Show that the random variables X and Y are dependent iii) Find $P(X \geq 1, Y \leq 2)$.	**07**	**L3**	**CO2**
	c.	A fair coin is tossed thrice. The random variables X and Y are defined as X = 0 or 1 according as head or tail occurs on the first toss, y-number of heads. Compute e(X, Y)	**07**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Define statistical hypothesis, null hypothesis, Type-I error and Type-II error.	**06**	**L1**	**CO4**
	b.	In 324 throws of a six faced die an even number turned up 181 times. Is it reasonable to think that the 'die' is an unbiased one at 99% level?	**07**	**L2**	**CO4**
	c.	Before an increase in excise duty on tea, 800 people out of sample of 1000 were consumers of tea. After the increase in duty, 800 people were consumers of tea in a sample of 1200 persons. Find whether there is significant decrease in the consumption of tea after the increase in duty at 1%. (One tailed test at 1% is 2.33).	**07**	**L3**	**CO4**
		OR			
Q.6	**a.**	A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased.	**06**	**L2**	**CO4**
	b.	In an exit poll enquiry it was revealed that 600 voters in one locality and 400 voters from another locality favoured 55% and 48% respectively a particular party to come to power. Test the hypothesis that there is a difference in the locality in respect of the opinion.	**07**	**L3**	**CO4**
	c.	A random sample for 1000 workers in company has mean wage of Rs.50 per day and standard deviation of Rs.15. Another sample of 1500 workers from another company has mean wage of Rs.45 per day and standard deviation of Rs.20. Does the mean rate of wages varies between the two companies at 95% confidence limit?	**07**	**L3**	**CO4**
		Module – 4			
Q.7	**a.**	The mean life time of a sample of 25 bulbs is found as 1550 hrs with standard deviation of 120 hours. The company manufacturing the bulbs claims that the average life of their bulbs is 1600 hrs. Is the claim acceptable at 5% level of significance?	**06**	**L3**	**CO4**
	b.	The two independent samples of eight and seven items respectively had the following values of the variable: Sample 1 9 11 13 11 15 9 12 14 Sample 2 10 12 10 14 9 8 10 Do the two estimates of population variance differ significantly at 5% level of significance? F at 5% $(V_1 = 7, V_2 = 6) = 4.21$.	**07**	**L3**	**CO4**
	c.	Table gives the number of aircraft accidents that occurred during the various days of a week. Test whether the accidents are uniformly distributed over the week. $\chi^2_{5\%}(\gamma = 5) = 11.07$. Day Mon Tue Wed Thur Fri Sat Number of accidents 15 19 13 12 16 15	**07**	**L3**	**CO4**

OR

Q.8 a. Two random samples gave the following data: 06 L2 CO4

	Size	Mean	Variance
Sample 1	8	9.6	1.2
Sample 2	11	16.5	2.5

Can we conclude that the two samples have been drawn from the same normal population? $F_{5\%}$ (10, 7) = 3.64.

b. The following data relate to the marks obtained by 11 students in two tests. Second test is after intense coaching. Do the data indicate that the students have benefited by coaching? 07 L3 CO4

Test 1	19	23	16	24	17	18	20	18	21	19	20
Test 2	17	24	20	24	20	22	20	20	18	22	19

($t_{5\%}$ ($\gamma = 10$) is 1.81)

c. The mean value of a random sample of 60 items was found to be 145 and standard deviation is 40. Find the 95% confidence limits for the population mean. 07 L2 CO5

Module – 5

Q.9 a. The following figures relate to production in kgs of three variables A, B, C of wheat sown on 12 plots. 10 L3 CO6

A	14	16	18		
B	14	13	15	22	
C	18	16	19	19	22

Apply one-way Annova using a 0.05 significance level in the production of the varieties. F_c at 5% (2, 9) d.f is 4.26.

b. Analyze and interpret the following statistics concerning output of wheat per field obtained as a result of experiment conducted to test four varieties of wheat viz., A, B, C and D under a Latin - Square design. 10 L3 CO6

C 25	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

OR

Q.10 a. Four doctors each test four treatments for a certain disease and observe the number of days each patient takes to recover. The results are as follows: 10 L3 CO6

Doctor/Treatment	T_1	T_2	T_3	T_4
D_1	10	14	19	20
D_2	11	15	17	21
D_3	9	12	16	19
D_4	8	13	17	20

Discuss the difference between doctors and treatments F_{at} 5% level (3, 9) is 3.86.

b. A study of the effect of different types of anesthesia on the length of post-operative hospital stay yielded for the following for cesarean patients. Group 'A' was given an epidural MS providing additional safety. Group 'B' was given an epidural and Group 'C' was given a spinal is considered to be less dangerous and Group 'D' was given general anesthesia is considered to be the most dangerous. Note that the data are in the form of distribution for each group.

	Length of Stay	Number of patients
Group A	3	6
	4	14
Group B	4	18
	5	2
Group C	4	10
	5	9
	6	1
Group D	4	8
	5	12

Test for the existence of an effect due to anesthesia type at 0.01. $F_{0.01} = 4.13$

10 L3 CO6

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CBCS SCHEME

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BMATEC301/BBM301

Third Semester B.E./B.Tech. Degree Examination, June/July 2024
AV Mathematics – III for EC/BM Engineering

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book and statistical table are permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>Find the Fourier series for $f(x)=\begin{cases}-K, & \text{in } (-\pi,0)\\ K & \text{in } (0,\pi)\end{cases}$ and hence deduce $\frac{\pi}{4}=1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+.......$</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Expand $f(x) = 2x - 1$ as a cosine half range Fourier series in $0 < x < 1$.</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Express y as a Fourier series upto the first harmonics given the following values:
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>y</td><td>4</td><td>8</td><td>15</td><td>7</td><td>6</td><td>2</td></tr>
</table></td><td>7</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.2</td><td>a.</td><td>Find the Fourier series for $f(x) = x - x^2$ in $-1 < x < 1$.</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Show that half range sine series of $f(x) = \pi x - x^2$ in the interval $(0, \pi)$ is $\frac{8}{\pi}\sum_{h=0}^{\infty}\frac{1}{(2n+1)^3}\sin(2n+1)x$</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Obtain the Fourier series of y upto 2nd harmonics f(x) is given by
<table>
<tr><td>x</td><td>0</td><td>$\pi/3$</td><td>$2\pi/3$</td><td>π</td><td>$4\pi/3$</td><td>$5\pi/3$</td><td>2π</td></tr>
<tr><td>f(x)</td><td>1.98</td><td>1.30</td><td>1.05</td><td>1.30</td><td>-0.88</td><td>-0.25</td><td>1.98</td></tr>
</table></td><td>7</td><td>L3</td><td>CO1</td></tr>
<tr><th colspan="6">Module – 2</th></tr>
<tr><td>Q.3</td><td>a.</td><td>Find the Fourier transform of $f(x)=\begin{cases}1-x^2, & |x|<1\\ 0 & |x|\ge 1\end{cases}$ and hence find the value of $\int_0^{\infty}\frac{x\cos x-\sin x}{x^3}dx$</td><td>6</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Find the Fourier sine and cosine transform of $f(x) = e^{-\alpha x}$, $\alpha > 0$.</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>Solve the integral equation $\int_0^{\infty} f(\theta)\cos\alpha\theta\, d\theta=\begin{cases}1-\alpha, & 0\le\alpha\le 1\\ 0, & \alpha>1\end{cases}$ and hence evaluate $\int_0^{\infty}\frac{\sin^2 t}{t^2}dt$.</td><td>7</td><td>L3</td><td>CO2</td></tr>
</table>

		OR			
Q.4	**a.**	Find the Fourier transform of $e^{-a^2x^2}$, $a > 0$.	**6**	**L2**	**CO2**
	b.	Find the Fourier sine transform of $f(x) = e^{-\|x\|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx,\ m > 0$	**7**	**L2**	**CO2**
	c.	Find the discrete Fourier transform of the sequence $\{1, 2, 1, 3\}^T$.	**7**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Obtain the Z-transform i) Cosnθ ii) Sinnθ.	**6**	**L2**	**CO3**
	b.	Find the inverse Z-transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$	**7**	**L2**	**CO3**
	c.	Solve by using Z-transforms : $y_{n+2} + 2y_{n+1} + y_n = n$ with $y_0 = 0 = y_1$.	**7**	**L3**	**CO3**
		OR			
Q.6	**a.**	Find the Z-transform of $2n + \sin\left(\frac{n\pi}{4}\right) + 1$	**6**	**L2**	**CO3**
	b.	Find the inverse Z-transform of $\frac{4z^2-2z}{(z-1)(z-2)^2}$.	**7**	**L2**	**CO3**
	c.	If $\bar{u}(z) = \frac{2z^2+3z+12}{(Z-1)^4}$ find the value of u_0, u_1, u_2.	**7**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Solve $(D^4 + 8D^2 + 16)\, y = 0$.	**6**	**L1**	**CO4**
	b.	Solve $\frac{d^2y}{dt^2} - 4\frac{dy}{dt} + 13y = e^{3t} \cosh 2t$.	**7**	**L2**	**CO4**
	c.	Solve $x^3 + x^2y'' + xy' + 8y = 65 \cos(\log x)$.	**7**	**L3**	**CO4**
		OR			
Q.8	**a.**	Solve $y'' + 9y = \cos 2x \cos x$.	**6**	**L2**	**CO4**
	b.	Solve $(2x+1)^2 y'' - 2(2x+1)y' - 12y = 6x + 5$.	**7**	**L2**	**CO4**
	c.	In an LCR circuit, the charge q on a plate of a condenser is given by $L\frac{d^2q}{dt^2} + R\frac{dq}{dt} + \frac{q}{c} = E \sin pt$. Solve the equation for q.	**7**	**L3**	**CO4**

<table>
<tr><td colspan="6">Module – 5</td></tr>
<tr><td>Q.9</td><td>a.</td><td>Fit a straight line for the following data:
<table><tr><td>x</td><td>50</td><td>70</td><td>100</td><td>120</td></tr><tr><td>y</td><td>12</td><td>15</td><td>21</td><td>25</td></tr></table></td><td>6</td><td>L1</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Obtain the lines of regression and hence find the coefficient of correlation for the data:
<table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr><tr><td>y</td><td>9</td><td>8</td><td>10</td><td>12</td><td>11</td><td>13</td><td>14</td></tr></table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>Compute the rank correlation coefficient for the following data:
<table><tr><td>x</td><td>68</td><td>63</td><td>75</td><td>50</td><td>62</td><td>80</td><td>78</td><td>40</td><td>55</td><td>60</td></tr><tr><td>y</td><td>62</td><td>58</td><td>68</td><td>45</td><td>81</td><td>60</td><td>68</td><td>48</td><td>50</td><td>70</td></tr></table></td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.10</td><td>a.</td><td>An experiment on life time ‘t’ of cutting tool at different cutting speeds v(units) are given below
<table><tr><td>Speed (v)</td><td>350</td><td>400</td><td>500</td><td>600</td></tr><tr><td>Life (t)</td><td>61</td><td>26</td><td>7</td><td>2.6</td></tr></table>Fit a relation of the form $v = at^b$.</td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>The following data gives the age of husband (x) and the age of wife (y) in years. Form the 2 regression lines and calculate the age of husband corresponding to 16 years of age of wife.
<table><tr><td>x</td><td>36</td><td>23</td><td>27</td><td>28</td><td>28</td><td>29</td><td>30</td><td>31</td><td>33</td><td>35</td></tr><tr><td>y</td><td>29</td><td>18</td><td>20</td><td>22</td><td>27</td><td>21</td><td>29</td><td>27</td><td>29</td><td>28</td></tr></table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>If the coefficient of correlation between the variables x and y is 0.5 and the acute angle between their lines of regression is $\tan^{-1}(3/5)$. Show that $\sigma_y = 2\sigma_x$.</td><td>7</td><td>L3</td><td>CO5</td></tr>
</table>

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2024/Jan.2025

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Express the complex number $\frac{(3+i)(1-3i)}{2+i}$ in the form x + iy **(06 Marks)**

b. Find the modulus and amplitude of the complex number $\frac{(1+i)^2}{3+i}$. **(06 Marks)**

c. i) Define a complex number
ii) If x + iy = (1 + 3i) (1 + i) then find the values of x and y. **(08 Marks)**

2 a. Find the nth derivative of $\frac{1}{ax+b}$ **(06 Marks)**

b. Find the nth derivative of sin4x sin3x. **(06 Marks)**

c. If y = cos (m log x) prove that $x^2y_{n+2} + (2n+1)\,xy_{n+1} + (m^2+n^2)\,y_n = 0$. **(08 Marks)**

3 a. Find the angle between the radius vector and the tangent to the curve r = a (1 - cosθ). **(06 Marks)**

b. Obtain the Maclaurin's series expansion of the function sinx upto the term containing x4. **(06 Marks)**

c. With usual notation prove that
i) p = rsinϕ
ii) $\frac{1}{p^2} = \frac{1}{r^2} + \frac{1}{r^4}\left(\frac{dr}{d\theta}\right)^2$ **(08 Marks)**

4 a. Find $\frac{\partial t}{\partial x}$ and $\frac{\partial t}{\partial y}$ when $f = \log(x^3+y^3)$. **(06 Marks)**

b. If $u = \tan^{-1}\left(\frac{x^3+y^3}{x+y}\right)$ prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$ **(06 Marks)**

c. If $u = x^2 - 2y$ two spaces $V = x + y$ then find $\frac{\partial(u,v)}{\partial(x,y)}$ **(08 Marks)**

PART – B

5 a. Evaluate $\int_{x=0}^{x=1}\int_{y=x}^{y=\sqrt{x}} xy\,dy\,dx$ **(06 Marks)**

b. Evaluate $\int_0^{\pi/6} \sin^6(3x)\,dx$ **(06 Marks)**

c. Obtain the reduction formula for $\int \cos^n x\,dx$, where n is a positive integer. **(08 Marks)**

6 a. Evaluate $\int_0^1\int_0^1\int_0^y xyz\,dxdydz$ **(06 Marks)**

b. Evaluate $\iint_R (x^2+y^2)\,dxdy$ where R is the triangle region bounded by the lines y = 0, y = x and x = 1. **(06 Marks)**

c. Define Gamma function and prove that $\Gamma(n+1) = n\,\Gamma(n)$. **(08 Marks)**

7 a. Solve $\sec^2 x \tan y\,dx + \sec^2 y \tan x\,dy = 0$ **(06 Marks)**

b. Solve $(2x + y + 1)\,dx + (x + 2y + 1)\,dy = 0$ **(06 Marks)**

c. Solve $\frac{dy}{dx} = \frac{y}{x} + \sin\frac{y}{x}$ **(08 Marks)**

8 a. Solve $\frac{d^3y}{dx^3} - 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} - 6y = 0$ **(06 Marks)**

b. Solve $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0$ **(06 Marks)**

c. Solve $\frac{d^3y}{dx^3} + \frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 4y = 0$ **(08 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **BCS/BAD/BAI/BDS301**

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

Mathematics – III for Computer Science Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Mathematics Hand Book is permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	A random variable x has the following prob. density function for various values of x. $\begin{array}{\|c\|c\|c\|c\|c\|c\|c\|c\|c\|}\hline x & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ \hline P(x) & 0 & k & 2k & 2k & 3k & k^2 & 2k^2 & 7k^2+k \\ \hline\end{array}$ Find the value of k and evaluate $P(x < 6)$, $P(3 < x \leq 6)$ and $(x \geq 6)$.	**07**	**L2**	**CO1**
	b.	Derive the mean and variance of Poisson distribution.	**06**	**L2**	**CO2**
	c.	In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last for? (i) less than 10 minutes (ii) more than 10 minutes and (iii) between 10 and 12 minutes.	**07**	**L3**	**CO2**
		OR			
Q.2	**a.**	The probability density function of $f(x) = \begin{cases} Kx^2, & -3 < x < 3 \\ 0, & \text{elsewhere} \end{cases}$ Find the value of K and evaluate (i) $P(x < 2)$, $P(x > 1)$ (ii) $P(1 \leq x \leq 2)$	**07**	**L3**	**CO1**
	b.	When a coin is tossed 4 times, find the probability of getting (i) exactly one head (ii) atleast three heads and (iii) less than two heads.	**06**	**L2**	**CO2**
	c.	The marks of 1000 students in an examination follows a normal distribution with mean > 0 and S.D 5. Find the number of students whose marks will be (i) less than 65 (ii) more than 75 and (iii) between 65 and 75.	**07**	**L2**	**CO2**
		Module – 2			
Q.3	**a.**	If the joint probability distribution of x and y is given by $f(x, y) = \frac{1}{30}(x + y)$, for $x = 0, 1, 2, 3$; $y = 0, 1, 2$ Find (i) $P(x \leq 2, y = 1)$ (ii) $P(x > y)$	**07**	**L2**	**CO2**
	b.	Find the unique fixed probability vector of $P = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$	**06**	**L2**	**CO3**
	c.	Three boys A, B and C are throwing a ball to each other. A always throw the ball to B. B always throw the ball to A and C is just as likely to throw the ball to A as to B. Find the probability that C has the ball after three throws, if C starts the game.	**07**	**L3**	**CO3**

<table>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.4</td><td>a.</td><td>The joint prob. distribution for the following data, find E(x) and E(y).
<table>
<tr><th>Y / X</th><th>-2</th><th>-1</th><th>4</th><th>5</th></tr>
<tr><td>1</td><td>0.1</td><td>0.2</td><td>0.0</td><td>0.3</td></tr>
<tr><td>2</td><td>0.2</td><td>0.1</td><td>0.1</td><td>0</td></tr>
</table></td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Show that the matrix $$P = \begin{bmatrix} 0 & 0 & 1 \\ 1/2 & 0 & 1/2 \\ 0 & 1 & 0 \end{bmatrix}$$ is a regular stochastic matrix.</td><td>06</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>A gambler's luck follows pattern. If he wins a game the prob. of winning the next game is 0.6. However, if he loses a game, the prob. of losing the next game is 0.7. There is an even chance of the gambler winning the first game. What is the prob. of he winning the second game.</td><td>07</td><td>L3</td><td>CO3</td></tr>
<tr><td colspan="6">Module – 3</td></tr>
<tr><td>Q.5</td><td>a.</td><td>Define (i) Null hypothesis (ii) A statistic (iii) Standard error (iv) Level of significance (v) Test of significance.</td><td>07</td><td>L1</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>A coin was tossed 400 times and head turned up 216 times. Test the hypothesis that the coin is unbiased at 5% LOS.</td><td>06</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant at 5% significance level?</td><td>07</td><td>L3</td><td>CO5</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Explain the following terms:
(i) Type-I and Type-II errors
(ii) Statistical hypothesis
(iii) Critical region
(iv) Alternate hypothesis</td><td>07</td><td>L1</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>The average marks in Engg. Maths of a sample of 100 students was 51 with S.D 6 marks. Could this have been a random sample from a population with average marks 50?</td><td>06</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>One type of aircraft is found to develop engine trouble in 5 flights out of a total of 100 and another type in 7 flights out of a total of 200 flights. Is there a significance difference in the two types of aircrafts so far as engine defects are concerned? Test at 0.05 significance level.</td><td>07</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6">Module – 4</td></tr>
<tr><td>Q.7</td><td>a.</td><td>State central limit theorem. Use the theorem to evaluate $P(50 < \bar{x} < 56)$ where $\bar{x}$ represents the mean of a random sample of size 100 from an infinite population with mean $\mu = 53$ and variance $\sigma^2 = 400$.</td><td>07</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Suppose that 10, 12, 16, 19 is a sample taken from a normal population with variance 6.25. Find 95% confidence interval for the population mean. Given that Z(0.15) = 0.0596.</td><td>06</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>Fit a Poisson distribution to the following data and test for goodness of fit at 5% LOS.
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>f</td><td>419</td><td>352</td><td>154</td><td>56</td><td>19</td></tr>
</table></td><td>07</td><td>L3</td><td>CO5</td></tr>
</table>

<table>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>Height of a random sample of 50 college student showed a mean of 174.5 cms and a S.D 6.9 cms. Construct 99% confidence limits for the mean height of all college students.</td><td>07</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>A random sample of 10 boys had the following I.Q : 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. DO these data support the assumption of a population mean I.Q of 100 (at 5% LOS)?</td><td>06</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>The theory predicts the propositions of beans in the four groups, G_1 , G_2 , G_3 , G_4 should be in the ratio 9 : 3 : 3 : 1. In experiment with 1600 beans the numbers in the groups were 882, 313, 287 and 118. Does the experimental support the theory.</td><td>07</td><td>L3</td><td>CO5</td></tr>
<tr><td colspan="6">Module – 5</td></tr>
<tr><td>Q.9</td><td>a.</td><td>The varieties of wheat A, B, C were shown in four plots each and the following yields in quintals per acre were obtained.
<table>
<tr><td>A</td><td>8</td><td>4</td><td>6</td><td>7</td></tr>
<tr><td>B</td><td>7</td><td>6</td><td>5</td><td>3</td></tr>
<tr><td>C</td><td>2</td><td>5</td><td>4</td><td>4</td></tr>
</table>
Test the significance of difference between the yields of varieties, given that 5% tabulated value of F = 4.26 with (2, 9) d.f. Set up one-way ANOVA and using direct method.</td><td>10</td><td>L3</td><td>CO6</td></tr>
<tr><td></td><td>b.</td><td>Present your conclusion after doing ANOVA to the following results of the Latin-square design conducted in respect of five fertilizers which were used on plots of different fertility.
<table>
<tr><td>A(16)</td><td>B(10)</td><td>C(11)</td><td>D(9)</td><td>E(9)</td></tr>
<tr><td>E(10)</td><td>C(9)</td><td>A(14)</td><td>B(12)</td><td>D(11)</td></tr>
<tr><td>B(15)</td><td>D(8)</td><td>E(8)</td><td>C(10)</td><td>A(18)</td></tr>
<tr><td>D(12)</td><td>E(6)</td><td>B(13)</td><td>A(13)</td><td>C(12)</td></tr>
<tr><td>C(13)</td><td>A(11)</td><td>D(10)</td><td>E(7)</td><td>B(14)</td></tr>
</table></td><td>10</td><td>L3</td><td>CO6</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.10</td><td>a.</td><td>Set up two-way ANOVA table for the data given below, using coding method subtracting 40 from the given numbers.
<table>
<tr><td rowspan="2">Pieces of land</td><td colspan="4">Treatment</td></tr>
<tr><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>P</td><td>45</td><td>40</td><td>38</td><td>37</td></tr>
<tr><td>Q</td><td>43</td><td>41</td><td>45</td><td>38</td></tr>
<tr><td>R</td><td>39</td><td>39</td><td>41</td><td>41</td></tr>
</table></td><td>10</td><td>L3</td><td>CO6</td></tr>
<tr><td></td><td>b.</td><td>There are three main brands of a certain power. A set of its 120 sales is examined and found to be allocated among four groups (A, B, C, D) and brands (I, II, III) as follows:
<table>
<tr><td rowspan="2">Brands</td><td colspan="4">Groups</td></tr>
<tr><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>I</td><td>0</td><td>4</td><td>8</td><td>15</td></tr>
<tr><td>II</td><td>5</td><td>8</td><td>13</td><td>6</td></tr>
<tr><td>III</td><td>18</td><td>19</td><td>11</td><td>13</td></tr>
</table>
Is there any significant difference in brands preference? Answer at 5% level, using one-way ANOVA. Take 10 as the code value to subtract it from all given values.</td><td>10</td><td>L3</td><td>CO6</td></tr>
</table>

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CBCS SCHEME

USN | | | | | | | | | |

BMATEC301/BEC301/BBM301

Third Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025

AV Mathematics III for EC/ BM Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Statistical table and Mathematics formula handbook are allowed.
3. M : Marks , L: Bloom's level , C: Course outcomes.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>Obtain the Fourier series of $f(x)=\frac{\pi-x}{2}$ in $0<x<2\pi$. Hence deduce that $1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+.....=\frac{\pi}{4}$.</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Find the Fourier series of $f(x)=|x|$ in $(-\ell, \ell)$. Hence show that $\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+......=\frac{\pi^2}{8}$.</td><td>7</td><td>L3</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Expand $f(x) = 2x – 1$ as a cosine half range Fourier series in $0 < x < 1$.</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.2</td><td>a.</td><td>Find the Fourier series of $f(x)=\begin{cases}1+\frac{2x}{\pi} & \text{in } -\pi<x<0\\ 1-\frac{2x}{\pi} & \text{in } 0<x<\pi\end{cases}$. Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+......$.</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Obtain the sine half range series of,
$f(x)=\begin{cases}\frac{1}{4}-x & \text{in } 0<x<\frac{1}{2}\\ x-\frac{3}{4} & \text{in } \frac{1}{2}<x<1\end{cases}$</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Determine the constant term and the first cosine and sine terms of the Fourier series expansion of y from the following data :
<table>
<tr><td>x° :</td><td>0</td><td>45</td><td>90</td><td>135</td><td>180</td><td>225</td><td>270</td><td>315</td></tr>
<tr><td>y:</td><td>2</td><td>$\frac{3}{2}$</td><td>1</td><td>$\frac{1}{2}$</td><td>0</td><td>$\frac{1}{2}$</td><td>1</td><td>$\frac{3}{2}$</td></tr>
</table></td><td>7</td><td>L1</td><td>CO1</td></tr>
<tr><th colspan="3">Module – 2</th><th></th><th></th><th></th></tr>
<tr><td>Q.3</td><td>a.</td><td>Find the Fourier transform of the function,
$f(x)=\begin{cases}1 & \text{for } |x|\le a\\ 0 & \text{for } |x|>a\end{cases}$. Hence evaluate $\int_0^\infty \frac{\sin x}{x}dx$.</td><td>6</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Find the Fourier sine and cosine transforms of $f(x)=e^{-\alpha x}$, $\alpha>0$.</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a>0$.</td><td>7</td><td>L3</td><td>CO2</td></tr>
</table>

		OR			
Q.4	**a.**	If $f(x)=\begin{cases}1-x^2, & \lvert x\rvert<1\\ 0, & \lvert x\rvert\geq 1\end{cases}$, find the Fourier transform of f(x) and hence find the value of, $\int_0^\infty \frac{x\cos x-\sin x}{x^3}dx$.	**6**	**L2**	**CO2**
	b.	Find the Fourier sine transform of $f(x)=e^{-\lvert x\rvert}$ and hence evaluate $\int_0^\infty \frac{x\sin mx}{1+x^2}dx,\ m>0$.	**7**	**L3**	**CO2**
	c.	Find the Discrete fast fourier of signal = $(0, 1, 49)^T$	**7**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Find the z-transform of, (i) $\cosh n\theta$ (ii) $\sinh n\theta$	**6**	**L1**	**CO3**
	b.	If $V(z)=\frac{2z^2+3z+12}{(z-1)^4}$, evaluate u_0, u_1 and u_2	**7**	**L2**	**CO3**
	c.	Find the inverse z-transform of, $\frac{z}{(z-1)(z-2)}$.	**7**	**L2**	**CO3**
		OR			
Q.6	**a.**	Solve by using z-transforms, $y_{n+2}+2y_{n+1}+y_n=n$ with $y_0=0=y_1$	**6**	**L3**	**CO3**
	b.	Find $z_T^{-1}\left[\frac{5z}{(3z-1)(2-z)}\right]$.	**7**	**L2**	**CO3**
	c.	Solve by using z-transforms $u_{n+2}-5u_{n+1}+6u_n=2^n$ with $u_0=0=u_1$.	**7**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Solve $\frac{d^3y}{dx^3}+6\frac{d^2y}{dx^2}+11\frac{dy}{dx}+6y=0$.	**6**	**L1**	**CO4**
	b.	Solve $(D^2+1)y=x^2+4x-6$.	**7**	**L2**	**CO4**
	c.	Using the method of variation of Parameters of $\frac{d^2y}{dx^2}-6\frac{dy}{dx}+9y=e^{3x}$.	**7**	**L3**	**CO4**
		OR			
Q.8	**a.**	Solve $6\frac{d^2y}{dx^2}+17\frac{dy}{dx}+12y=e^{-x}$.	**6**	**L2**	**CO4**
	b.	Solve the Cauchy's differential equation, $x^2\frac{d^2y}{dx^2}+x\frac{dy}{dx}+8y=65\cos(\log x)$.	**7**	**L2**	**CO4**
	c.	The charge q in a series circuit containing an Inductance L, Capacitance C, emf E satisfy the differential equation, $L\frac{d^2q}{dt^2}+\frac{q}{C}=E$. Express q in terms of t.	**7**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Fit a second degree parabola $y=a+bx+cx^2$ into least square sense for the data and estimate y at x = 6. x: 1 | 2 | 3 | 4 | 5 y: 10 | 12 | 13 | 16 | 19	**6**	**L1**	**CO5**

<table>
<tr><td></td><td>b.</td><td>Find a correlation coefficient for the two variables x and y.<table><tr><td>x:</td><td>92</td><td>89</td><td>87</td><td>86</td><td>83</td><td>77</td><td>71</td><td>63</td><td>53</td><td>50</td></tr><tr><td>y:</td><td>86</td><td>83</td><td>91</td><td>77</td><td>68</td><td>85</td><td>52</td><td>82</td><td>37</td><td>57</td></tr></table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>Ten students got the following percentage of marks in two subjects x and y. Compute the rank correlation coefficient.<table><tr><td>x:</td><td>78</td><td>36</td><td>98</td><td>25</td><td>75</td><td>82</td><td>90</td><td>62</td><td>65</td><td>39</td></tr><tr><td>y:</td><td>84</td><td>51</td><td>91</td><td>60</td><td>68</td><td>62</td><td>86</td><td>58</td><td>53</td><td>47</td></tr></table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.10</td><td>a.</td><td>If θ is the angle between the lines of regression show that $\tan\theta = \frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}\left(\frac{1-r^2}{r}\right)$.</td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Obtain the lines of regression and hence find the coefficient of correlation for the data,<table><tr><td>x:</td><td>1</td><td>3</td><td>4</td><td>2</td><td>5</td><td>8</td><td>9</td><td>10</td><td>13</td><td>15</td></tr><tr><td>y:</td><td>8</td><td>6</td><td>10</td><td>8</td><td>12</td><td>16</td><td>16</td><td>10</td><td>32</td><td>32</td></tr></table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>If $8x-10y+66=0$ and $40x-18y=214$ are the two regression lines. Find $\bar{x}$, $\bar{y}$ and r. Find σ_y if $\sigma_x=3$.</td><td>7</td><td>L2</td><td>CO5</td></tr>
</table>

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USN ☐☐☐☐☐☐☐☐☐☐ **MATDIP301**

Third Semester B.E. Degree Examination, June/July 2025
Advanced Mathematics – I

Time: 3 hrs. Max. Marks: 100

Note : 1. ***Answer any FIVE full questions.***
2. ***Mathematics Formulae Handbook is permitted.***

Important Note : 1. On completing your answe ompulsorily draw diagonal cross lines on the remaining nk pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. Express the complex number $\frac{1+i}{1-i}$ in the form of $x + iy$. **(06 Marks)**

b. Obtain the modulus and amplitude of the complex number $1 + i\sqrt{3}$. **(06 Marks)**

c. Define complex number and find the value of x & y, if $(x - iy)(3 + 5i) = -6 + 24i$. **(08 Marks)**

2 a. Express the complex number $\frac{1}{3+2i}$ in the form of $x + iy$. **(06 Marks)**

b. Find the modulus and amplitude of the complex number 7-5i. **(06 Marks)**

c. Find the i) addition of two complex numbers $(5 + 2i) + (7 + 3i)$
ii) Multiplication between two complex numbers $- 6i(2-3i)$ **(08 Marks)**

3 a. Find the nth order derivative of $\sin(ax + b)$. **(06 Marks)**

b. Find the angle of intersection between the polar curves $r = 2\sin\theta$, $r = \sin\theta + \cos\theta$. **(06 Marks)**

c. With usual notation prove that $\tan\phi = r\frac{d\theta}{dr}$, where θ is the angle between radius vector (R) and the tangent. **(08 Marks)**

4 a. Find the nth order derivative of e^{ax}. **(06 Marks)**

b. Find the angle between the radius vector and the tangent for the polar curve $r = a(1 - \cos\theta)$. **(06 Marks)**

c. Obtain the Maclausin's series expansion of the function cos x. **(08 Marks)**

5 a. Find $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ when $f = \log(x^2 + y^2)$. **(06 Marks)**

b. If $u = f(x - y, y - z, z - x)$, then show that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. **(06 Marks)**

c. If $u = x + y$, $v = y + z$, $w = z + x$, then find the value of $\frac{\partial(u,v,w)}{\partial(x,y,z)}$. **(08 Marks)**

6 a. If $u = \log\left[\frac{x^2+y^2}{x+y}\right]$ then show that $x\,u_x + y\,u_y = 1$. **(06 Marks)**

b. If $x = r\cos\theta$, $y = r\sin\theta$, then find the value of $\frac{\partial(x,y)}{\partial(r,\theta)}$. **(06 Marks)**

c. If $u = x^3 - 3xy^2 + x + e^x\cos y + 1$, then show that $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$. **(08 Marks)**

7 a. Obtain the reduction formula for $\int \sin^n x\, dx$, where n is positive integer. **(06 Marks)**

b. Evaluate $\int_{y=0}^{y=1} \int_{x=0}^{x=6} xy\ dx\ dy$. **(06 Marks)**

c. Show that the relation between Beta and Gamma function is

$$\beta(m,n)=\frac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}.$$ **(08 Marks)**

8 a. Obtain the reduction formula for $\int \cos^n x\, dx$, where n is positive integer. **(06 Marks)**

b. Evaluate $\int_{z=-1}^{z=1} \int_{y=-2}^{y=2} \int_{x=-3}^{x=3} dx\ dy\ dz$. **(06 Marks**

c. Define Gamma function. Prove that $\Gamma\left(\frac{1}{2}\right)=\sqrt{\pi}$. **(08 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

BCS301/BAD301/BAI301/BDS301

Third Semester B.E./B.Tech. Degree Examination, June/July 2025

Mathematics for Computer Science

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>The probability density function of a variate X is given by the following table :
<table>
<tr><td>X</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>P(X)</td><td>K</td><td>3K</td><td>5K</td><td>7K</td><td>9K</td><td>11K</td><td>13K</td></tr>
</table>
(i) For what value of K, does this represent a valid probability distribution?
(ii) Find $P(X<4)$
(iii) Find $P(3<X\leq 6)$</td><td>06</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>2% fuses manufactured by a firm are found to be defective. Find the probability that the box containing 200 fuses contains.
(i) No defective fuses
(ii) 3 or more defective fuses.
(iii) Atleast one defective fuse.</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The length in time (minutes) that a certain lady speaks on a telephone is a random variable with probability density function.
$$f(x)=\begin{cases} Ae^{-x/5} & \text{for } x>0 \\ 0 & \text{elsewhere} \end{cases}$$
Find the value of the constant A. What is the probability that she will speak over the phone for,
(i) More than 10 minutes
(ii) Less than 5 minutes
(iii) Between 5 and 10 minutes</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.2</td><td>a.</td><td>Find the constant K such that the function $f(x)=\begin{cases} Kx^2 & \text{for } 0<x<3 \\ 0 & \text{otherwise} \end{cases}$ is a probability density function. Also compute $P(1<x<2), P(x\leq 1)$.</td><td>06</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Obtain the mean and variance of Binomial distribution.</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students whose marks will be, (i) Less than 65 (ii) More than 75 (iii) between 65 and 75, Given $A(1) = 0.3413$, where $A(Z)$ is the area under standard normal curve from 0 to Z.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">Module – 2</td></tr>
<tr><td>Q.3</td><td>a.</td><td>Define (i) Probability vector (ii) Regular stochastic matrix
(iii) Absorbing state of Markov chain.</td><td>06</td><td>L1</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>A students study habits are as follows : If he studies one night, he is 70% sure not to study the next night. On the other hand if he does not study one night, he is 60% sure not to study the next night. In the long run how often does he study?</td><td>07</td><td>L3</td><td>CO3</td></tr>
</table>

<table>
<tr><td></td><td>c.</td><td>The joint probability distribution for two random variables X and Y is given below :
<table>
<tr><td>X \ Y</td><td>-2</td><td>-1</td><td>4</td><td>5</td></tr>
<tr><td>1</td><td>0.1</td><td>0.2</td><td>0</td><td>0.3</td></tr>
<tr><td>2</td><td>0.2</td><td>0.1</td><td>0.1</td><td>0</td></tr>
</table>
Determine :
(i) The marginal distribution of X and Y.
(ii) E[X], E[Y], E[XY]
(iii) COV(X, Y)</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.4</td><td>a.</td><td>Find the fixed probability vector of the regular stochastic matrix $\underline{P}=\begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ \frac{1}{2} & \frac{1}{2} & 0\end{bmatrix}$.</td><td>06</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>A habitual gambler is a member of two clubs A and B. He visits either of the clubs every day for playing cards. He never visits club A on two consecutive days. But if he visits club B on a particular day then the next day he is as likely to visit club B or club A. If the person had visited club B on Monday, find the probability that he visits club A on Thursday.</td><td>07</td><td>L3</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>The joint probability distribution of two discrete random variable X and Y is given by, f(x, y) = K(2x+y) where x, y are integers such that $0 \le x \le 2$, $0 \le y \le 2$. Find
(i) K (ii) Marginal probability distribution of X and Y
(iii) $P(X \ge 1, Y \le 2)$</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td colspan="6">Module – 3</td></tr>
<tr><td>Q.5</td><td>a.</td><td>Define : (i) Null hypothesis (ii) Significance level
(iii) Type I and Type II errors</td><td>06</td><td>L1</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>A die was thrown 1200 times and the number 6 was obtained 236 times. Can the die be considered fair at 1% level of significance?</td><td>07</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>One type of aircraft is found to develop engine trouble in 5 flights out of a total of 100 and another type in 7 flights out of a total of 200 flights. Is there a significance difference in the two types of aircrafts so far as engine defects are concerned?</td><td>07</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Explain (i) Sampling distribution (ii) Statistical hypothesis
(iii) Testing of hypothesis</td><td>06</td><td>L1</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased at 1% level of significance.</td><td>07</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>In an exit poll enquiry it was revealed that 600 voters in one locality and 400 voters from another locality favoured 55% and 48% respectively a particular party to come to power. Test the hypothesis that there is a difference in the locality in respect of the opinion at 5% level of significance.</td><td>07</td><td>L3</td><td>CO4</td></tr>
</table>

<table>
<tr><td colspan="6">Module – 4</td></tr>
<tr><td>Q.7</td><td>a.</td><td>(i) State central limit theorem.
(ii) What is 95% and 99% confidence limits for unknown mean μ of a random sample of size n?</td><td>06</td><td>L1</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Certain tubes manufactured by a company have mean life of 800 hours and standard deviation of 60 hours. Using central limit theorem, find the probability that a random sample of 16 tubes taken from the group will have mean life time.
(i) Between 790 hours and 810 hours.
(ii) Less than 785 hours
(iii) More than 820 hours
Given A(0.67) = 0.2486, A(1) = 0.3413, A(1.33) = 0.4082</td><td>07</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Two Samples of sizes 9 and 8 give the sum of squares of deviations from their respective means equal to 160 inches^2 and 91 inches^2 respectively. Can these be regarded as drawn from the same normal population? Use 5% points of significance for F.</td><td>07</td><td>L2</td><td>CO4</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>A random sample of 400 items choosen from an infinite population is found to have a mean of 82 and a standard deviation of 18. Find the 95% confidence limits for the mean of the population from which the sample is drawn.</td><td>06</td><td>L1</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>A mechanist is making engine parts with axle diameter of 0.7 inch. A random sample of 10 parts shows mean diameter 0.742 inch with standard deviation of 0.04 inch. On the basis of this sample, would you say that the work is interior, given $t_{0.05} = 2.262$ for degrees of freedom = 9.</td><td>07</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>A set of five similar coins is tossed 320 times and result is,
<table>
<tr><td>Number of heads</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>Frequency</td><td>6</td><td>27</td><td>72</td><td>112</td><td>71</td><td>32</td></tr>
</table>
Test the hypothesis that the data follows Binomial distribution,
(Given : $\chi^2_{0.05} = 11.07$ for d.f = 5)</td><td>07</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6">Module – 5</td></tr>
<tr><td>Q.9</td><td>a.</td><td>Set up ANOVA table for the following information relating to three drugs testing to judge the effectiveness in reducing blood pressure for three different groups of people.
<table>
<tr><td>Group of people</td><td colspan="3">Drug</td></tr>
<tr><td></td><td>X</td><td>Y</td><td>Z</td></tr>
<tr><td>A</td><td>14
15</td><td>10
9</td><td>11
11</td></tr>
<tr><td>B</td><td>12
11</td><td>7
8</td><td>10
11</td></tr>
<tr><td>C</td><td>10
11</td><td>11
11</td><td>8
7</td></tr>
</table>
Do the drugs act differently?
Are the different groups of people affected differently? Is the interaction term significant?
Answer the above questions taking a significant level of 5%. Given F(2, 9) = 4.26, F(4, 9) = 3.63</td><td>10</td><td>L3</td><td>CO6</td></tr>
</table>

b. Present your conclusions after doing analysis of variance to the following results of the Latin square design experiment conducted in respect of fiver fertilizers which were used on plots of different fertility. Given — 10 — L3 — CO6

A 16	B 10	C 11	D 9	E 9
E 10	C 9	A 14	B 12	D 11
B 15	D 8	E 8	C 10	A 18
D 12	E 6	B 13	A 13	C 12
C 13	A 11	D 10	E 7	B 14

OR

Q.10 a. It is desired to compare three hospitals with regards to the number of deaths per month. A sample of death records were selected from the records of each hospital and the number of deaths was as given below. From these data, use ANOVA and suggest a difference in the number of deaths per month among the three hospitals. Given at 5% level, $F_{2,12} = 3.89$. — 10 — L3 — CO6

Hospitals		
A	B	C
3	6	7
4	3	3
3	3	4
5	4	6
0	4	5

b. Analyze and interpret the following statistics concerning output of wheat per field obtained as a result of experiment conducted to test four varieties of wheat viz. A, B, C and D under a Latin square design. — 10 — L3 — CO6

C 25	B 23	A 20	D 20
A 19	D 19	C 21	B 18
B 19	A 14	D 17	C 20
D 17	C 20	B 21	A 15

* * * * *

CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

BMATEC301/BEC301/BBM301

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
AV Mathematics III for EC/ BM Engineering

Time: 3 hrs.

Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of Statistical table and Formula hand book is permitted.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Find the Fourier Series expansion of the function $f(x)=\|x\|$ in $(-\pi,\pi)$.	**06**	**L2**	**CO1**
	b.	Find the half range Fourier sine series for function, $f(x)=\begin{cases}\frac{1}{4}-x & \text{in } 0<x<\frac{1}{2}\\ x-\frac{3}{4} & \text{in } \frac{1}{2}<x<1\end{cases}$	**07**	**L2**	**CO1**
	c.	Find the constant term and the first co-efficients of cosine and sine terms in the Fourier series expansion for the following data : x: 0, 1, 2, 3, 4, 5 y: 9, 18, 24, 28, 26, 20	**07**	**L3**	**CO1**
		OR			
Q.2	**a.**	Obtain the Fourier series of the square wave given by, $f(x)=\begin{cases}-K & \text{in } -\pi<x<0\\ K & \text{in } 0<x<\pi\end{cases}$	**06**	**L2**	**CO1**
	b.	Obtain the half range cosine series for $f(x)=(x-1)^2$ in $0\le x\le 1$.	**07**	**L2**	**CO1**
	c.	Obtain the constant term and coefficients of first cosine and sine terms in the expansion of 'y' from the following table : x°: 0, 60°, 120°, 180°, 240°, 300° y: 7.9, 7.2, 3.6, 0.5, 0.9, 6.8	**07**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Find the Fourier transform of $f(x)=\begin{cases}1-\|x\|, & \|x\|\le a\\ 0, & \|x\|>a\end{cases}$. Hence evaluate $\int_0^{\infty}\frac{\sin^2 t}{t^2}dt$.	**06**	**L3**	**CO2**
	b.	Find the Fourier cosine transform of the function $f(x)=e^{-\alpha x}$. Evaluate $\int_0^{\infty}\frac{\cos mx}{\alpha^2+x^2}dx$	**07**	**L2**	**CO2**
	c.	Find the DFT of a sequence $x(n)=\{1,1,0,0\}$ and also find the IDFT of $Y(K)=\{1,0,1,0\}$.	**07**	**L3**	**CO2**
		OR			

Q.4	a.	Find the Fourier transform of $f(x)=\begin{cases}1-x^2, & \lvert x\rvert<1\\ 0, & \lvert x\rvert\ge 1\end{cases}$	06	L2	CO2
	b.	Find the Fourier cosine transform of $f(x)=\begin{cases}4x, & \text{for } 0<x<1\\ 4-x, & \text{for } 1<x<4\\ 0, & \text{for } x>4\end{cases}$	07	L1	CO2
	c.	Find the Fourier sine transform of $f(x)=e^{-\lvert x\rvert}$ and hence evaluate $\int_0^\infty \frac{x\sin mx}{1+x^2}dx,\ m>0.$	07	L3	CO2
		Module – 3			
Q.5	a.	Find the z-transform of : (i) $(n+1)^2$ (ii) $\sinh n\theta$.	06	L2	CO3
	b.	Find the inverse z-transform of $\frac{z}{(z-1)(z-2)}$.	07	L3	CO3
	c.	Solve the difference equation of $y_{n+2}-4y_n=0$, given that $y_0=0$ and $y_1=2$ using Z-transform.	07	L3	CO3
		OR			
Q.6	a.	Find the z-transform of $\sin(3n+5)$.	06	L2	CO3
	b.	Obtain the inverse z-transform of $\frac{2z^2+3z}{(z+2)(z-4)}$.	07	L3	CO3
	c.	If $U(z)=\frac{2z^2+3z+4}{(z-3)^3}$, evaluate u_2 and u_3.	07	L3	CO3
		Module – 4			
Q.7	a.	Solve $(D^3-3D^2+3D-1)y=0$.	06	L2	CO4
	b.	Solve $\frac{d^2y}{dx^2}-4y=\cosh(2x-1)+3^x$	07	L2	CO4
	c.	Solve $x^2\frac{d^2y}{dx^2}-x\frac{dy}{dx}+2y=\sin(\log x)$	07	L3	CO4
		OR			
Q.8	a.	Solve $\frac{d^2y}{dx^2}+4\frac{dy}{dx}+4y=3\sin x$.	06	L2	CO4
	b.	Solve $(3x+2)^2y''+3(3x+2)y'-36y=4(3x+2)^2$	07	L2	CO4
	c.	In an LCR circuit the charge 'q' on a plate of a condenser is given by, $L\frac{d^2q}{dt^2}+R\frac{dq}{dt}+\frac{q}{c}=E\sin pt$. Solve the above equation.	07	L3	CO4
		Module – 5			
Q.9	a.	Find a least square straight line for the following data : $\begin{array}{\|c\|c\|c\|c\|c\|c\|}\hline x & 5 & 10 & 15 & 20 & 25\\ \hline y & 16 & 19 & 23 & 26 & 30\\ \hline\end{array}$	06	L2	CO5
	b.	Compute $\bar{x}$, $\bar{y}$ and r from the following equation of the regression lines $2x+3y+1=0;\ x+6y-4=0$.	07	L3	CO5

c. Ten students got the following percentage of marks in two subjects say x and y, compute their rank correlation co-efficient. **07** **L3** **CO5**

x	78	36	98	25	75	82	90	62	65	39
y	84	51	91	60	68	62	86	58	53	47

OR

Q.10 **a.** Fit a parabola $y = ax^2 + bx + c$ by the method of least squares for the following data : **06** **L2** **CO5**

x	2	4	6	8	10
y	3.07	12.85	31.47	57.38	91.29

b. Find the correlation co-efficient between x and y for the following data : **07** **L3** **CO5**

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

c. Find the two regression lines from the following data : **07** **L3** **CO5**

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

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USN ☐☐☐☐☐☐☐☐☐☐

BCS/BAD/BAI/BDS301

Third Semester B.E./B.Tech. Degree Examination, June/July 2025

Mathematics for Computer Science

Time: 3 hrs.

Max. Marks: 100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Statistical Tables and Mathematics formula Handbooks are allowed.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>1</td><td>a.</td><td>Derive Mean and Variance of Poisson Distribution.</td><td>6</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$, if 12 such pens are manufactured. What is the probability that :
i) Exactly two are defective
ii) Atleast two are defective
iii) None of them are defective</td><td>7</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students whose marks will be:
i) Less than 65
ii) More than 75
iii) Between 65 and 75
[Given $\phi(1) = 0.3413$]</td><td>7</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.2</td><td>a.</td><td>The p.d.f of a variate X is given by the following table:
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>p(x)</td><td>k</td><td>3k</td><td>5k</td><td>7k</td><td>9k</td><td>11k</td><td>13k</td></tr>
</table>
For what value of K, this represents a valid probability distribution?
Also find $p(x \geq 5)$ and $p(3 < x \leq 6)$.</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>The number of accidents in a year to taxi drivers in a city follows a poission distribution with mean 3. Out of 1000 taxi drivers find approximately the number of the drivers with
i) No accident in a year
ii) More than 3 accidents in a year.</td><td>7</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>If x is a normal variate with mean 30 and standard deviation 5 find the probability that
i) $26 \leq x \leq 40$
ii) $x \geq 45$</td><td>7</td><td>L2</td><td>CO2</td></tr>
</table>

Module – 2

Q.3	**a.**	The joint distribution of two random variables X and Y is as follows: $\begin{array}{c ccc} X \backslash Y & -4 & 2 & 7 \\ \hline 1 & 1/8 & 1/4 & 1/8 \\ 5 & 1/4 & 1/8 & 1/8 \end{array}$ Compute the following : E(X), E(Y), E(XY), COV(X,Y).	6	L2	CO3
	b.	Prove that the Markov Chain whose t.p.m is $P=\begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ Is irreducible. Find the corresponding stationary probability vector.	7	L2	CO4
	c.	Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B as to A. If C was the first person to throw the ball find the probabilities that after three throws, B has the ball.	7	L3	CO4

OR

Q.4	**a.**	Define: i) Probability Vector ii) Stochastic Matrix iii) Regular Stochastic Matrix.	6	L1	CO4
	b.	The joint probability distribution of two discrete random variables X and Y is given by f(x, y) = K(2x + y). Where x and y are integers such that $0 \le x \le 2,\ \ 0 \le y \le 3$. i) Find the value of K ii) P(X = 1, Y = 2) iii) P(X = 2, Y = 1) iv) $P(X \ge 1, Y \le 2)$	7	L2	CO3
	c.	The t.p.m of a Markov Chain is given by $P=\begin{bmatrix} 1/2 & 0 & 1/2 \\ 1 & 0 & 0 \\ 1/4 & 1/2 & 1/4 \end{bmatrix}$ and the initial probability distribution is $P^{(0)} = (1/2, 1/2, 0)$. Find $P_1^{(2)}$	7	L2	CO4

Module – 3

Q.5	**a.**	Define the following: i) Standard Error ii) Null Hypothesis iii) Critical values of Z-test.	6	L1	CO4
	b.	A 'die' is thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Show that the die cannot be regarded as an unbiased one.	7	L3	CO4

c. In an elementary school examination the mean grade of 32 boys was 72 with a standard deviation of 8, while the mean grade of 36 girls was 75 with a standard deviation of 6. Test the hypothesis that the performance of girls are better than boys. 7 L3 CO4

OR

Q.6

a. Define : 6 L1 CO5

i) Type 1 error
ii) Type 2 error
iii) Significance level

b. One type of aircraft is found to develop engine trouble in 5 flights out of a total of 100 and another type in 7 flights out of total of 200 flights. Is there a significant difference in the two types of aircrafts so far as engine defects are concerned? 7 L3 CO4

c. A sample of 900 days was taken in a coastal town and it was found that on 100 days the weather was very hot. Obtain the probable limits of the percentage of very hot weather. 7 L3 CO5

Module – 4

Q.7

a. A random sample of size 64 is taken from an infinite population having mean 112 and variance 144. Using central limit theorem, find the probability of getting the sample mean $\overline{X}$ greater than 114.5 $(\phi(1.66) = 0.4515)$. 6 L2 CO5

b. Fit a poisson distribution for the following data and test the goodness of fit given that $(\Psi^2_{0.05} = 7.815$ for 3d.f) 7 L2 CO4

x	0	1	2	3	4
f	122	60	15	2	1

c. Ten individuals are choosen at random from a population and their heights in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that the mean height of the universe is 66 inches: 7 L3 CO4

$(t_{0.05} = 2.262$ for 9 d.f)

OR

Q.8

a. Suppose that 10, 12, 16, 19 is a sample taken from a normal population with variance 6.25. Find at 95% confidence interval for the population mean. $(z = 1.96$ at 95%) 6 L2 CO5

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results: 7 L3 CO4

Horse A :	28	30	32	33	33	29	34
Horse B :	29	30	30	24	27	29	

Test whether you can discriminate between the two horses $(t_{0.05} = 2.2$ for 11 df)

c. Two random samples drawn from two normal populations are: — 7 — L2 — CO4

Sample – I	20	16	26	27	22	23	18	24	19	25	-	-
Sample – II	27	33	42	35	32	34	38	28	41	43	30	37

Obtain the estimates of the variance of the population and test 5% level of significance whether the two populations have the same variance [$F_{11,9} = 3.10$]

Module – 5

Q.9 a. Three types of fertilizers are used on three groups of plants for 6 weeks. We want to check if there is a difference in the mean growth of each group. Using the data given below apply a one-way ANOVA test at 0.05 significance level. — 10 — L3 — CO6

Fertilizer 1	6	8	4	5	3	4
Fertilizer 2	8	12	9	11	6	8
Fertilizer 3	13	9	11	8	7	12

(Given F(2, 15) = 3.68)

b. The following data show the number of worms quarantined from the areas of four graphs of muskrats in a carbon tetrachloride anthelmintic study. Conduct a two-way ANOVA study. — 10 — L3 — CO6

I	II	III	IV
33	41	12	38
32	38	35	43
26	40	46	25
14	23	22	13
30	21	11	26

(F(4, 12) = 3.26, F(3, 12) = 3.49)

OR

Q.10 a. A trial was run to check the efforts of different diets. Positive numbers indicate weight loss and negative number indicate weight gain. Check if there is an average difference in the weight of people following different diets using an ANOVA table: — 10 — L3 — CO6

Low fat	Low calorie	Low protein	Low carbohydrate
8	2	3	2
9	4	5	2
6	3	4	-1
7	5	2	0
3	1	3	3

(F(3, 16) = 3.24 at 5%)

b. Present your conclusions after doing analysis of variance to the following results of the latin-square design experiment conducted in respect of five fertilizers which were used on plots of different fertility: — 10 — L3 — CO6

A 16	B 10	C 11	D 9	E 9
E 10	C 9	A 14	B 12	D 11
B 15	D 8	E 8	C 10	A 18
D 12	E 6	B 13	A 13	C 12
C 13	A 11	D 10	E 7	B 14

(F(4, 12) = 3.26)

CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | |

BMATEC301/BEC301/BBM301

Third Semester B.E/B.Tech. Degree Examination, June/July 2025
AV Mathematics – III for EC/BM Engineering

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, choosing ONE full question from each module.*
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of Statistical table and hand book permitted.

<table>
<tr><th></th><th></th><th>Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>1</td><td>a.</td><td>Find the Fourier Series expansion of the function $f(x)=|x|$ in $-\pi \le x \le \pi$.
Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+........$</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Find the cosine half range series for $f(x)=x(\ell-x)$ in $0 \le x \le \ell$.</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Compute the first two harmonics of the Fourier series of f(x) given the following table :
<table>
<tr><td>x</td><td>0</td><td>$\frac{\pi}{3}$</td><td>$\frac{2\pi}{3}$</td><td>π</td><td>$\frac{4\pi}{3}$</td><td>$\frac{5\pi}{3}$</td><td>2π</td></tr>
<tr><td>f(x)</td><td>1.0</td><td>1.4</td><td>1.9</td><td>1.7</td><td>1.5</td><td>1.2</td><td>1.0</td></tr>
</table></td><td>7</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>2</td><td>a.</td><td>Find a Fourier series to represent $f(x)=x-x^2$ from $x=-\pi$ to $x=\pi$.</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Obtain the cosine half range series of $f(x)=x\sin x$ in $0 < x < \pi$. Hence shown that $\frac{1}{1.3}-\frac{1}{3.5}+\frac{1}{5.7}-......=\frac{\pi-2}{4}$</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Obtain the first three coefficients in the Fourier cosine series for y, where y is given in the following table :
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>y</td><td>4</td><td>8</td><td>15</td><td>7</td><td>6</td><td>2</td></tr>
</table></td><td>7</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6">Module – 2</td></tr>
<tr><td>3</td><td>a.</td><td>Find the Fourier transform of,
$f(x)=\begin{cases}1-x^2, & |x|\le 1\\ 0, & |x|>1\end{cases}$, Hence evaluate $\int_0^\infty \frac{x\cos x-\sin x}{x^3}\cos\frac{x}{2}dx$.</td><td>6</td><td>L3</td><td>CO2</td></tr>
</table>

	b.	Find the Fourier cosine transform of the function, $f(x)=\begin{cases}4x, & 0<x<1\\ 4-x, & 1<x<4\\ 0, & x>4\end{cases}$	7	L2	CO2
	c.	Find the Discrete Fourier Transform of the sequence $x(n)=\{1,1,0,0\}$, $N=4=L$.	7	L3	CO2
		OR			
4	a.	Find the Fourier transform of, $f(x)=\begin{cases}x^2, & \lvert x\rvert<a\\ 0, & \lvert x\rvert>a\end{cases}$, where 'a' is a positive constant.	6	L3	CO2
	b.	Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a>0$	7	L2	CO2
	c.	Solve the integral equation $\int_0^\infty f(\theta)\cos\alpha\theta = \begin{cases}1-\alpha, & 0\le\alpha\le1\\ 0, & \alpha>1\end{cases}$. Hence evaluate $\int_0^\infty \frac{\sin^2 t}{t^2}dt$.	7	L3	CO2
		Module – 3			
5	a.	Find the z-transform of $\cos\left(n\frac{\pi}{2}+\frac{\pi}{4}\right)$.	6	L2	CO3
	b.	Find the inverse z-transform of $\frac{3z^2+2z}{(5z-1)(5z+2)}$.	7	L3	CO3
	c.	Solve the difference equation, $y_{n+2}+2y_{n+1}+y_n=n$ with $y_0=0=y_1$, using z-transforms.	7	L3	CO3
		OR			
6	a.	Find the z-transform of (i) $(n+1)^2$ (ii) $\sin(3n+5)$	6	L2	CO3
	b.	Find the inverse z-transform of $\frac{z^3-20z}{(z-2)^3(z-4)}$	7	L3	CO3
	c.	Solve the difference equation, $y_{n+2}+6y_{n+1}+9y_n=2^n$ with $y_0=0=y_1$	7	L3	CO3
		Module – 4			
7	a.	Solve $4\frac{d^4y}{dx^4}-8\frac{d^3y}{dx^3}-7\frac{d^2y}{dx^2}+11\frac{dy}{dx}+6y=0$.	6	L2	CO4
	b.	Solve $\frac{d^2y}{dx^2}-4y=\cosh(2x-1)$	7	L2	CO4
	c.	Solve $x^2y''+xy'+9y=3x^2+\sin(3\log x)$	7	L3	CO4
		OR			
8	a.	Solve $(D^3+8)y=x^4+2x+1$	6	L2	CO4
	b.	Solve $(1+x)^2y''+(1+x)y'+y=\sin[2\log(1+x)]$	7	L2	CO4
	c.	The damped LCR circuit governed by the equation $L\frac{d^2q}{dt^2}+R\frac{dq}{dt}+\frac{q}{C}=0$, where L, R, C are positive constants. Find the positive solution.	7	L3	CO4

<table>
<tr><th colspan="6">Module – 5</th></tr>
<tr><td>9</td><td>a.</td><td>Find a curve of best fit of the form, $y = ax^b$ to the following data :
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>y</td><td>0.5</td><td>2</td><td>4.5</td><td>8</td><td>12.5</td></tr>
</table></td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Compute the coefficient of correlation and the equation of the lines of regression for the data :
<table>
<tr><td>x</td><td>10</td><td>14</td><td>18</td><td>22</td><td>26</td><td>30</td></tr>
<tr><td>y</td><td>18</td><td>12</td><td>24</td><td>6</td><td>30</td><td>36</td></tr>
</table></td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>Three judges A, B, C the following ranks given. Find which pair of judges has common approach.
<table>
<tr><td>A</td><td>1</td><td>6</td><td>5</td><td>10</td><td>3</td><td>2</td><td>4</td><td>9</td><td>7</td><td>8</td></tr>
<tr><td>B</td><td>3</td><td>5</td><td>8</td><td>4</td><td>7</td><td>10</td><td>2</td><td>1</td><td>6</td><td>9</td></tr>
<tr><td>C</td><td>6</td><td>4</td><td>9</td><td>8</td><td>1</td><td>2</td><td>3</td><td>10</td><td>5</td><td>7</td></tr>
</table></td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><th colspan="6">OR</th></tr>
<tr><td>10</td><td>a.</td><td>Fit a Parabola of the form $y = a + bx + cx^2$ to the following data :
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>y</td><td>1</td><td>3</td><td>7</td><td>13</td><td>21</td><td>31</td></tr>
</table></td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>If θ is the angle between the lines of regression, then shown that $\tan\theta = \frac{\sigma_x\sigma_y}{\sigma_x^2+\sigma_y^2}\left(\frac{1-r^2}{r}\right)$. Explain the significance when $r = 0$, $r = \pm 1$.</td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>The scores for 10 students in English and Maths as follows. Compute the rank of students in 2 subjects and also the correlation coefficient.
<table>
<tr><td>English</td><td>56</td><td>75</td><td>45</td><td>71</td><td>62</td><td>64</td><td>58</td><td>80</td><td>76</td><td>61</td></tr>
<tr><td>Maths</td><td>66</td><td>70</td><td>40</td><td>60</td><td>65</td><td>56</td><td>59</td><td>77</td><td>67</td><td>63</td></tr>
</table></td><td>7</td><td>L3</td><td>CO5</td></tr>
</table>

* * * * *

CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **BCS/BAD/BAI301**

Third Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

Mathematics – III for CSE Stream

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Statistical tables and Mathematics Formula Hand Book are permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>A random variable X has the following probability function for various values of x.
<table>
<tr><td>X</td><td>-3</td><td>-2</td><td>-1</td><td>0</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td>P(X = x)</td><td>k</td><td>2k</td><td>3k</td><td>4k</td><td>3k</td><td>2k</td><td>k</td></tr>
</table>
i) Find the value of k.
ii) Find mean and variance and standard deviation.</td><td>06</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>During a laboratory experiment, the average number of radioactive particles passing through a counter in 1 milli second is 4, using Poisson distribution, find the probability that :
i) 6 particles enter the counter in a given millisecond
ii) at least 2 particles enter the counter in a given millisecond
iii) at most 3 particles enter the counter in a given millisecond.</td><td>07</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>The life of a tube manufactured by a company is known to have mean 200 months. Assuming that the life of tube has an exponential distribution, find the prob that the life of a tube manufactured by a company is
i) less than 200 months ii) between 100 and 300 months iii) more than 200 months.</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><th colspan="6">OR</th></tr>
<tr><td>Q.2</td><td>a.</td><td>A random variable X has the p.d.f
$$f(x) = \begin{cases} K(1-x^2) & \text{for } 0 < x < 1 \\ 0 & \text{otherwise} \end{cases}$$
i) Find K ii) Find $P(0.1 < x < 0.2)$ iii) $P(x > 0.5)$</td><td>06</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Find mean and variance of Binomial distribution.</td><td>07</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>A manufacturer of air-mail envelopes knows from experience that the weight of the envelopes is normally distributed with mean 1.95gm and S.D 0.05gm. About how many envelops weighing.
i) 2 gm or more ii) 2.05 gm or more iii) between 2 and 2.5 gm.
In a lot of 100 envelops (Given A(1) = 0.3413 , A(2) = 0.4772)</td><td>07</td><td>L3</td><td>CO2</td></tr>
<tr><th colspan="3">Module – 2</th><th></th><th></th><th></th></tr>
<tr><td>Q.3</td><td>a.</td><td>The joint distribution of two r.vs X and Y is as follows :
<table>
<tr><td>X \ Y</td><td>-4</td><td>2</td><td>7</td></tr>
<tr><td>1</td><td>1/8</td><td>1/4</td><td>1/8</td></tr>
<tr><td>5</td><td>1/4</td><td>1/8</td><td>1/8</td></tr>
</table>
Compute the following :
i) E(X) and E(Y) ii) E(XY) iii) COV(X, Y)</td><td>06</td><td>L2</td><td>CO2</td></tr>
</table>

	b.	Prove that the Markov chain whose t.p.m. is $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is irreducible. Find the corresponding stationary probability vector.	**07**	**L2**	**CO3**
	c.	A standard study habits are as follows. If he studies one night, he is 70% sure not to study the next night.. On the other hand if he does not study one night, he is 60% sure not study the next night. In the long run how often does he study?	**07**	**L3**	**CO3**
		OR			
Q.4	**a.**	Suppose X and Y are independent random variables, X takes values 2, 5, 7 with probability ½ , ¼ , ¼ respectively. Y takes values 3, 4, 5 with probability 1/3, 1/3, 1/3. i) Find the joint probability distribution of X and Y. ii) Show that COV(X, Y) is equal to zero.	**06**	**L2**	**CO1**
	b.	Explain Regular Stochastic matrix. Show that the matrix $\begin{bmatrix} 1 & 1 & 0 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/4 & 1/4 \end{bmatrix}$ is a regular stochastic matrix.	**07**	**L2**	**CO3**
	c.	A gambler's luck follows a pattern. If he wins a game, the probability of winning the next game is 0.6. However if he loses a game, the probability of losing the next game is 0.7. There is an even chance of gambler winning the first game. If so, i) What is the probability of he winning the second game. ii) What is the probability of he wining the third game.	**07**	**L3**	**CO3**
		Module – 3			
Q.5	**a.**	Explain the following terms: i) Null hypothesis ii) Hypothesis iii) Level of significance	**06**	**L1**	**CO2**
	b.	A die is thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Show that the die cannot be regarded as an unbiased one at 5% l.o.s.	**07**	**L3**	**CO3**
	c.	A machine part out 16 defective articles in a sample of 500. After the machine is repaired, it put out 3 defective articles in a sample of 100. Has the machine been improves? Test at hypothesis level of significance.	**07**	**L3**	**CO3**
		OR			
Q.6	**a.**	Define : i) Test of significance ii) Critical region of a statistical test iii) Confidence interval	**06**	**L1**	**CO4**
	b.	A sample of 100 days is taken from metrological records of a certain district and 10 of them are found to be foggy. What are the probable limits of the percentage of foggy days in the district? Test at 1% significance level.	**07**	**L3**	**CO4**
	c.	In a city A. 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proposing significant? Test at 5% significance level.	**07**	**L3**	**CO4**
		Module – 4			
Q.7	**a.**	An unknown distribution has a mean of 45 and a S.D. of 8, samples at size 30 are drawn randomly from the population. Find the probability that the sample mean is between 42 and 50. (Given A(2.053) = 0.4798, A(3.42) = 0.4997)	**06**	**L2**	**CO5**

b. A group of boys and girls are given an intelligence test. The mean score, S.D. score and no. in each group are as follows: — **07 L3 CO5**

	Boys	Girls
Mean	124	121
S.D	12	10
n	18	14

Is the mean score of boys significantly different from that of girls?
(Given $t_{0.05}$ (df = 30) = 2.04)

c. A die is thrown 60 times and the frequency distribution for the number appearing on the face x is given by the following table: — **07 L3 CO4**

x	1	2	3	4	5	6
Frequency	15	6	4	7	11	17

Test the hypothesis that the die is unbiased. Given $\chi^2_{0.05}(\text{df} = 5) = 11.07$

OR

Q.8 **a.** A random sample of 1000 men from North India shows that their mean wage is Rs. 5 per day with a S.D of Rs.1.50. A sample of 1500 men from South India gives a mean wage of Rs. 4.50 per day with a S.D of Rs.2. Does the mean rate of wages varies as between the two regions. (Test at 5% l.o.s.) — **06 L2 CO5**

b. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, -1, 3, 0, 6, -2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure?
($t_{0.05}$ for 11 d.f = 2.201) — **07 L3 CO5**

c. Two samples of sizes 9 and 8 give the sum of squares of deviations from their respective means equal to 160 inches and 91 inches respectively. Can these be required as drawn from the same normal population? ($F_{8,7} = 3.73$). — **07 L2 CO4**

Module – 5

Q.9 **a.** Three samples each of size 5 were drawn from three uncorrelated normal populations with equal variances. Test the hypothesis that the population means are equal at 5% level. — **10 L3 CO6**

Sample 1	10	12	9	16	13
Sample 2	9	7	12	11	11
Sample 3	14	11	15	14	16

Apply one-way ANOVA using 0.05 significance level.

b. Present your conclusions after doing analysis of variance to the following results of the Latin – square design experiment conducted in respect of five fertilizers which were used on plots of different fertilizers. — **10 L3 CO6**

A 16	B 10	C 11	D 9	E 9
E 10	C 9	A 14	B 12	D 11
B 15	D 8	E 8	C 10	A 18
D 12	E 6	B 13	A 13	C 12
C 13	A 11	D 10	E 7	B 14

OR

Q.10 **a.** Set an analysis of variance table for the following data at 5% significant level. **10** **L3** **CO6**

A	6	7	3	8
B	5	5	3	7
C	5	4	3	4

b. Perform a two-way ANOVA on the data given below. **10** **L3** **CO6**

Plot of land	Treatment			
	A	B	C	D
I	38	40	41	39
II	45	42	49	36
III	40	38	42	42

i) Is there any significant difference between the treatment?

ii) Is there any significant difference between the plots?

* * * * *

CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **BMATEC301/BEC301/BBM301**

Third Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

AV Mathematics-III for EC/BM Engineering

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. VTU Formula Hand Book and Statistical table are permitted.
3. M : Marks , L: Bloom's level , C: Course outcomes.

<table>
<tr><th colspan="3">Module – 1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td>Q.1</td><td>a.</td><td>Obtain the Fourier Series expansion of $f(x) = x^2$ in $[-\pi \quad \pi]$.</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Obtain half range Fourier sine series for $f(x) = x(\ell - x)$ in $(0, \ell)$.</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Find the constant term and the first harmonics of the Fourier Series of $y = f(x)$, given that
<table>
<tr><td>x</td><td>0</td><td>$\frac{\pi}{3}$</td><td>$\frac{2\pi}{3}$</td><td>π</td><td>$\frac{4\pi}{3}$</td><td>$\frac{5\pi}{3}$</td><td>2π</td></tr>
<tr><td>y</td><td>7.9</td><td>7.2</td><td>3.6</td><td>0.5</td><td>0.9</td><td>6.8</td><td>7.9</td></tr>
</table></td><td>6</td><td>L3</td><td>CO1</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.2</td><td>a.</td><td>Obtain Fourier Series expansion of $f(x) = \frac{1}{4}(\pi - x)^2$ in $(0, 2\pi)$.</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Obtain half range Fourier Cosine series for $f(x) = 2x - 1$ in $(0, 1)$</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Find the constant term and the first harmonics in the Fourier Series of $y = f(x)$, given by
<table>
<tr><td>x</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>y</td><td>1.98</td><td>1.3</td><td>1.05</td><td>1.3</td><td>-0.88</td><td>-0.25</td><td>1.98</td></tr>
</table></td><td>6</td><td>L3</td><td>CO1</td></tr>
<tr><th colspan="6">Module – 2</th></tr>
<tr><td>Q.3</td><td>a.</td><td>Find the complex Fourier transform of,
$f(x) = \begin{cases} 1 & \text{for } |x| \le 1 \\ 0 & \text{for } |x| < 1 \end{cases}$, and hence evaluate $\int_0^\infty \frac{\sin x}{x} dx$.</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Find the Fourier sine transform of $f(x) = \frac{e^{-ax}}{x}$, where 'a' is positive real.</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>Find the descrete Fourier transform of the sequence $\{1, 2, 1, 3\}$</td><td>6</td><td>L3</td><td>CO2</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.4</td><td>a.</td><td>Find the Fourier Transform of $f(x) = e^{-a|x|}$.</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Solve the integral equation,
$\int_0^\infty f(x)\cos(ux)dx = \begin{cases} 1-u & \text{for } 0 \le u \le 1 \\ 0 & \text{for } u > 1 \end{cases}$</td><td>7</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>Solve the Integral equation, $\int_0^\infty f(\theta)\cos\alpha\theta = \begin{cases} 1-\alpha, & 0 \le \alpha \le 1 \\ 0, & \alpha > 1 \end{cases}$. Hence evaluate $\int_0^\infty \frac{\sin^2 t}{t^2} dt$.</td><td>6</td><td>L3</td><td>CO2</td></tr>
</table>

<table>
<tr><th colspan="6">Module – 3</th></tr>
<tr><td>Q.5</td><td>a.</td><td>Find the z-transform of, (i) $\sin(n\theta)$ (ii) $\cosh(n\theta)$</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>Find the inverse z-transform of $\frac{z^2 - z}{(z-3)^2}$</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Solve $y_{n+2} - 4y_{n+1} + 3y_n = 1$, given that $y_0 = 0$, $y_1 = 1$</td><td>6</td><td>L3</td><td>CO3</td></tr>
<tr><th colspan="6">OR</th></tr>
<tr><td>Q.6</td><td>a.</td><td>Find the z-transform of, $\cos\left(\frac{n\pi}{4}\right) + 3^n n^2$</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>If $z\{u_n\} = \frac{2z^2 + 3z + 4}{(z-3)^3}$; then find u_0, u_1 and u_2.</td><td>7</td><td>L2</td><td>CO3</td></tr>
<tr><td></td><td>c.</td><td>Solve $y_{n+2} + 2y_{n+1} + y_n = n$, given $y_0 = 0$, $y_1 = 0$.</td><td>6</td><td>L3</td><td>CO3</td></tr>
<tr><th colspan="6">Module – 4</th></tr>
<tr><td>Q.7</td><td>a.</td><td>Solve $y'' + 5y' + 6y = e^{-2x} + \sin x$</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Solve $2\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + 3y = x^2 + 2x - 1$</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Solve $(2x+1)^2 y'' - 2(2x+1)y' - 12y = 6x + 5$</td><td>6</td><td>L3</td><td>CO4</td></tr>
<tr><th colspan="6">OR</th></tr>
<tr><td>Q.8</td><td>a.</td><td>Solve $(D^3 - 6D^2 + 11D - 6)y = e^{-2x} + \cos x$</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Solve $x^2y'' - 3xy' + 5y = 3\sin(\log x)$</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>An emf of $E\sin(pt)$ is applied at $t = 0$ to a circuit containing capacitance C and inductance L, the current i satisfies.
$L\frac{di}{dt} + \frac{1}{C}\int i\,dt = E\sin(pt)$
If $p^2 = \frac{1}{LC}$ and initially current and charge q are zero, then find the current i at any time t.</td><td>6</td><td>L3</td><td>CO4</td></tr>
<tr><th colspan="6">Module – 5</th></tr>
<tr><td>Q.9</td><td>a.</td><td>Fit a parabola $y = a + bx + cx^2$ by the method of least squares for the following data:
<table>
<tr><td>x</td><td>2</td><td>4</td><td>6</td><td>8</td><td>10</td></tr>
<tr><td>y</td><td>3.07</td><td>12.85</td><td>31.47</td><td>57.38</td><td>91.29</td></tr>
</table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Obtain the lines of regression for the data, also find co-efficient correlation.
<table>
<tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
<tr><td>y</td><td>9</td><td>8</td><td>10</td><td>12</td><td>11</td><td>13</td><td>14</td></tr>
</table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>Compute the rank correlation co-efficient for the data :
<table>
<tr><td>x</td><td>68</td><td>64</td><td>75</td><td>50</td><td>64</td><td>80</td><td>75</td><td>40</td><td>55</td><td>64</td></tr>
<tr><td>y</td><td>62</td><td>58</td><td>68</td><td>45</td><td>81</td><td>60</td><td>68</td><td>48</td><td>50</td><td>70</td></tr>
</table></td><td>6</td><td>L3</td><td>CO5</td></tr>
</table>

<table>
<tr><th colspan="6">OR</th></tr>
<tr><td>Q.10</td><td>a.</td><td>Fit a least square curve $y = ax^b$ for the data :<table><tr><td>x</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr><tr><td>y</td><td>0.5</td><td>2</td><td>4.5</td><td>8</td><td>12.5</td></tr></table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Given the regression lines $x = 19.13 - 0.87y$ and $y = 11.64 - 0.5x$. Compute mean of data x and mean of data y, also find co-efficient of correlation.</td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>Ten competitors in a music contest are ranked by 3 judges A, B and C in the following order. Find the pair of judges have the nearest approach to common taste of music.<table><tr><td>A</td><td>1</td><td>6</td><td>5</td><td>10</td><td>3</td><td>2</td><td>4</td><td>9</td><td>7</td><td>8</td></tr><tr><td>B</td><td>3</td><td>5</td><td>8</td><td>4</td><td>7</td><td>10</td><td>2</td><td>1</td><td>6</td><td>9</td></tr><tr><td>C</td><td>6</td><td>4</td><td>9</td><td>8</td><td>1</td><td>2</td><td>3</td><td>10</td><td>5</td><td>7</td></tr></table></td><td>6</td><td>L3</td><td>CO5</td></tr>
</table>

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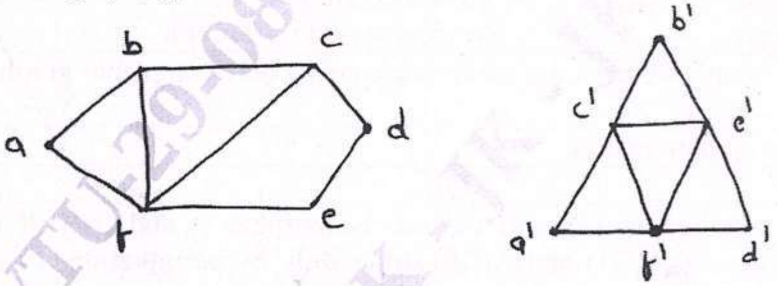
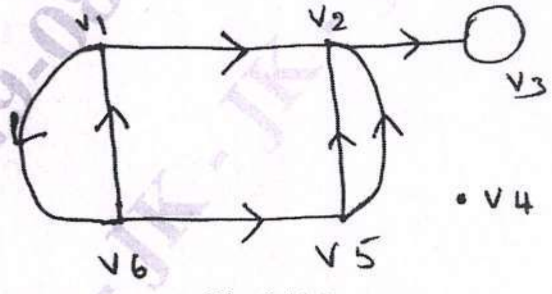
CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **BCS405B**

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2024
Graph Theory

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Define graph. List and explain the types of graph.	**08**	**L1**	**CO1**
	b.	Prove that the number of vertices of odd degree in a graph is always even.	**06**	**L2**	**CO1**
	c.	Define isomorphic graph and verify the following graphs are isomorphic or not. [Refer Fig.Q1(c)]  Fig.Q1(c)	**06**	**L2**	**CO1**
		OR			
Q.2	**a.**	Explain the following graphs: (i) Bi-partile graph (ii) Sub graphs (iii) WALK (iv) Path	**10**	**L1**	**CO1**
	b.	Prove that a simple graph with n vertices and K components can have at most (n – K)(n – K + 1)/2 edges.	**10**	**L2**	**CO1**
		Module – 2			
Q.3	**a.**	State and prove necessary condition of a graph to be a Euler graph.	**10**	**L2**	**CO2**
	b.	List and explain the different operations on graph.	**10**	**L2**	**CO2**
		OR			
Q.4	**a.**	Define diagraph. Find the indegree and outdegree of the following graph [Fig.Q4(a)].  Fig.Q4(a)	**08**	**L2**	**CO2**
	b.	Illustrate the travelling salesman problem using a graph.	**06**	**L2**	**CO2**
	c.	List and explain different digraphs and binary relations.	**06**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Define a tree. Prove that in a graph G there is one and only one path between every pair of vertices, G is a tree.	**06**	**L1**	**CO3**

	b.	Explain the following: (i) Cut-edge (ii) Cut-vertex (iii) Cut-set	06	L1	CO3
	c.	Find and construct the following: (i) Minimum possible height of 11 vertex binary tree (ii) A binary tree for a given 11 such that the farthest vertex is as far as possible from the root that must have exactly 2 vertices at each level, except at zero level.	08	L2	CO3
		OR			
Q.6	a.	Prove that every circuit has an even number of edges in common with any cut set.	10	L2	CO3
	b.	Prove that ring 50 m of any two cut-sets in a graph is either a third cut-set or an edge disjoint union of cut-sets.	10	L2	CO3
		Module – 4			
Q.7	a.	Define the following: (i) Planar graph (ii) Embedding (iii) Non-planar (iv) Kuratowski's 2 graph	08	L2	CO4
	b.	Explain the simple observation mode relationship between planar graph and dual G*.	08	L2	CO4
	c.	Write a note on path matrix.	04	L1	CO4
		OR			
Q.8	a.	Prove that two graphs G1 and G2 are isomorphic if and only if their incidence matrices A(G1) and A(G2) differ only by permutations of rows and columns.	10	L2	CO5
	b.	Describe the observations that can be made about circuit matrix B(G) 01 and graph G.	10	L2	CO5
		Module – 5			
Q.9	a.	Prove that every tree with two or more vertices is 2 - chromatic.	10	L2	CO5
	b.	Explain the following for chromatic polynomial: (i) Finding a maximal independent set (ii) Finding all maximal independent set.	10	L2	CO5
		OR			
Q.10	a.	Prove that the vertices of every planar graph can be properly colored with five colors.	10	L2	CO5
	b.	Explain the Greedy colouring algorithm.	10	L2	CO5

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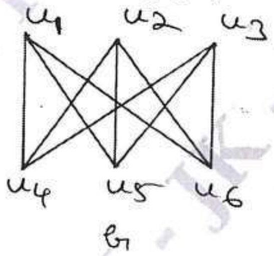
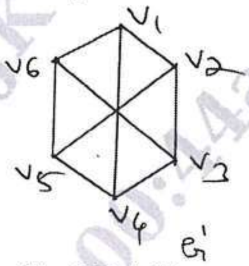
CBCS SCHEME

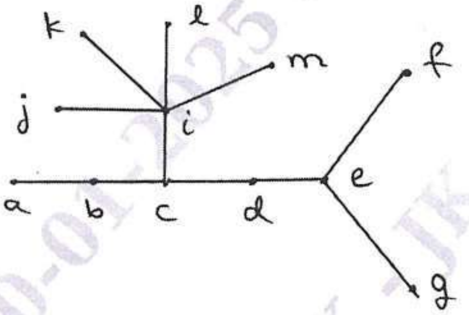
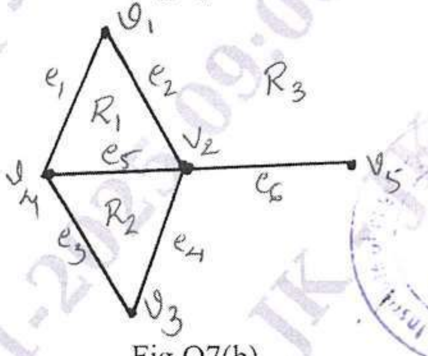
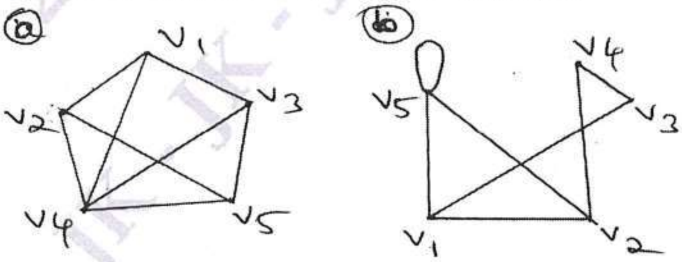
USN ☐☐☐☐☐☐☐☐☐☐ **BCS405B**

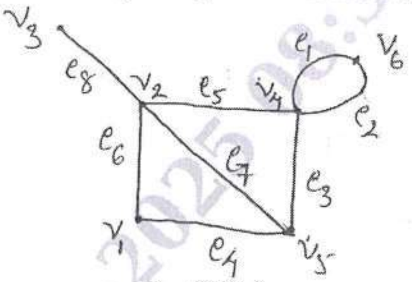
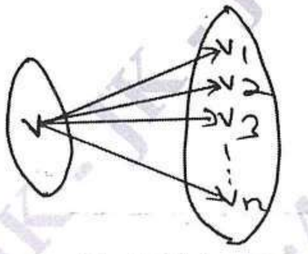
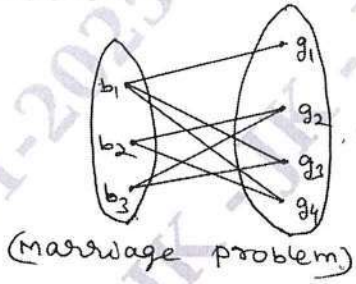
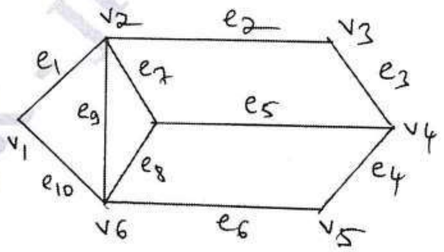
Fourth Semester B.E./B.Tech. Degree Examination, Dec.2024/Jan.2025
Graph Theory

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following with an example: i) Regular graph ii) Complete graph iii) Complete Bipartite graph	06	L1	CO1
	b.	Show that the number of vertices of odd degree is always even.	07	L3	CO1
	c.	Find the number of vertices for the graph G = (V, E) in the following cases: i) G has 9 edges and all the vertices of degree 3 ii) G is a cubic graph with 9 edges. iii) G has 10 edges with 2 vertices of degree 4 and others of degree 3.	07	L2	CO1
		OR			
Q.2	a.	Define the following : i) walk ii) open walk iii) path iv) circuit v) cycle vi) Trail	06	L1	CO1
	b.	Explain Konigsberg Bridge problem of graph theory.	07	L2	CO1
	c.	Show that the following graphs are isomorphic:  Fig.Q2(c)(i)  Fig.Q2(c)(ii)	07	L2	CO1
		Module – 2			
Q.3	a.	Define the following with an example: i) Euler circuit ii) Euler trail iii) Euler graph	06	L1	CO2
	b.	If all the vertices in a connected graph G are of even degree then show that G is Eulerian graph.	07	L3	CO2
	c.	Define Hamilton cycle and Hamilton path. In a complete graph with n vertices, where n is odd and ≥ 3, show that $\left(\frac{n-1}{2}\right)$ edge-disjoint Hamilton cycles exist.	07	L3	CO2
		OR			
Q.4	a.	Define Hamilton graph. By specifying the walk draw a graph which contains the following : i) Both Euler circuit and Hamilton cycle. ii) Euler circuit but no Hamilton cycle. iii) Hamilton cycle but no Euler circuit. iv) Neither a Hamilton cycle nor an Euler circuit.	06	L2	CO2
	b.	Explain Travelling – Salesman problem of graph theory.	07	L3	CO2
	c.	i) Define directed graph and draw a diagraph with 5 vertices and 10 edges. ii) Prove that in any diagraph the sum of the outdegrees of all the vertices is equal to sum of their indegrees and this sum is equal to the number of edges in the diagraph.	07	L3	CO2

		Module – 3			
Q.5	**a.**	Define tree and show that a tree with n vertices has n – 1 edges.	**06**	**L3**	**CO3**
	b.	Define rooted tree and binary tree. Draw all rooted trees with four vertices.	**07**	**L2**	**CO3**
	c.	Show that for any graph G, the vertex connectivity cannot exceed the edge connectivity and the edge connectivity cannot exceed the degree of the vertex with the smallest degree in G.	**07**	**L3**	**CO3**
		OR			
Q.6	**a.**	For the following graph shown in Fig.Q6(a), find the eccentricities of any three vertices. Also find its centre radius and diameter.  Fig.Q6(a)	**06**	**L3**	**CO3**
	b.	Define spanning tree. Show that every connected graph has atleast one spanning tree.	**07**	**L2**	**CO3**
	c.	Explain the problem of counting structural isomers by using counting trees.	**07**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	i) Define planar and nonplanar graphs. ii) Show that the complete graph k_5 is nonplanar	**06**	**L1**	**CO4**
	b.	i) Define geometric dual of a graph G. ii) Draw the geometric dual of the graph G.  Fig.Q7(b)	**07**	**L2**	**CO4**
	c.	i) Define adjacency matrix. ii) Find the adjacency matrices for the following graphs:  Fig.Q7(c)	**07**	**L2**	**CO4**

		OR			
Q.8	**a.**	Show that Kuratowski's second graph is a nonplanar graph.	**06**	**L3**	**CO4**
	b.	Show that a connected planar graph G with n vertices and m edges has $m - n + 2$ regions.	**07**	**L3**	**CO4**
	c.	i) Define path matrix and circuit matrix of a graph. ii) Find the path matrix from V_3 to V_5 for the following graph.  Fig.Q8(c)	**07**	**L2**	**CO4**
		Module – 5			
Q.9	**a.**	Prove that a graph of order $(n \geq 2)$ consisting of a single circuit is 2 chromatic if n is even and 3 chromatic if n is odd.	**06**	**L2**	**CO5**
	b.	Define chromatic number and chromatic polynomial of a graph. Find the chromatic number and chromatic polynomial for following graph.  Fig.Q9(b)	**07**	**L1**	**CO5**
	c.	State and prove Five color theorem.	**07**	**L2**	**CO5**
		OR			
Q.10	**a.**	Prove that every tree with two or more vertices is 2 chromatic.	**06**	**L2**	**CO5**
	b.	Define matching and complete matching. Find all the possible sets of matching for the following graph.  Fig.Q10(b)	**07**	**L1**	**CO5**
	c.	Define covering and minimal covering of a graph. Find the minimal vertex covering and minimal edge covering of the following graph.  Fig.Q10(c)	**07**	**L1**	**CO5**

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USN ☐☐☐☐☐☐☐☐☐☐

MATDIP401

Fourth Semester B.E. Degree Examination, Dec.2024/Jan.2025

Advanced Mathematics – II

Time: 3 hrs. Max. Marks:070

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1 a. If ℓ, m, n are the direction consines of a line then prove that $\ell^2 + m^2 + n^2 = 1$. **(06 Marks)**

b. Show that the angle between any two diagonals of a cube is $\cos^{-1}\left(\frac{1}{3}\right)$. **(07 Marks)**

c. Find the projection of AB on the line CD where A = (1, 2, 3), B = (1, 1, 1), C = (0, 0, 1) and D = (2, 3, 0). **(07 Marks)**

2 a. Find the angle between the planes $x - y + 2z = 9$ and $2x + y + z = 7$. **(06 Marks)**

b. Find the image of the point (1, 1, 2) in the plane $2x + y + z - 3 = 0$. **(07 Marks)**

c. Find the shortest distance and the equation between the line $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and the x–axis and equation of shortest distance between them. **(07 Marks)**

3 a. Find the value of λ so that the vectors $\vec{a} = 2i - 3j + k$, $\vec{b} = i + 2j - 3k$ and $\vec{c} = j + \lambda k$ are Coplanar. **(06 Marks)**

b. Find $\vec{a} \cdot (\vec{b} \times \vec{c})$ and $\vec{b} \cdot (\vec{a} \times \vec{c})$ where $\vec{a} = i + j - k$ $\vec{b} = 2i - j + 2k$ and $\vec{c} = 3i - j - k$. **(07 Marks)**

c. Prove that $\vec{a} \times (\vec{b} \times \vec{c}) = (\vec{a} \cdot \vec{c})\vec{b} - (\vec{a} \cdot \vec{b})\vec{c}$. **(07 Marks)**

4 a. A particle moves along the curve $x = 1 - t^3$, $y = 1 + t^2$ and $z = 2t - 5$ where t is the time. Find the velocity and acceleration at $t = 1$. **(06 Marks)**

b. Find the unit tangent vector to the space curve $x = \cos t \; t^2$, $y = \sin t^2$ and $z = 0$. **(07 Marks)**

c. Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$ and $z = x^2 + y^2 - 3$ at the point (2, –1, 2). **(07 Marks)**

5 a. Find the directional derivative of $x^2 y z^3$ at (1, 1, 1) in the directions of $i + j + 2k$. **(06 Marks)**

b. Find curl curl $(\text{curl}\,\vec{A})$ given that $\vec{A} = xyi + y^2zj + z^2yk$. **(07 Marks)**

c. Find the constants a, b, c such that the vector $\vec{F} = (\sin y + az)i + (bx\cos y + z)j + (x + cy)k$ is irrotational. **(07 Marks)**

6 a. Find Laplace transform of t^n, where n is a positive integer. **(06 Marks)**

b. Find Laplace transform of the following : i) $\sin^2 t$ ii) t cos at. **(07 Marks)**

c. Find Laplace transform of $\frac{e^{-at} - e^{-bt}}{t}$. **(07 Marks)**

7 Find the inverse Laplace transform of the following :

i) $\frac{s+2}{s^2+8s+25}$ **(05 Marks)**

ii) $\frac{2s-1}{s^2-5s+6}$ **(05 Marks)**

iii) $\frac{s}{(s+2)^3}$ **(05 Marks)**

iv) $\log\frac{s+a}{s+b}$. **(05 Marks)**

8 a. Solve using Laplace transforms $\frac{d^2y}{dt^2}-\frac{3dy}{dt}+2y=e^{3t}$, given that $y(0)=0$ and $y'(0)=0$. **(10 Marks)**

b. Solve the simultaneous equations using Laplace transforms :
$\frac{dx}{dt}+y=\sin t$, $\frac{dy}{dt}+x=\cos t$ given that $x(0)=0$ and $y(0)=0$. **(10 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

BCS405A

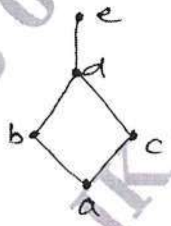
Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025

Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define Tautology, show that $[(p\vee q)\wedge\{(p\to r)\wedge(q\to r)\}]\to r$	6	L1	CO1
	b.	Prove the following using the laws of logic : $\neg[\{(p\vee q)\wedge r\}\to\neg q]\Leftrightarrow\neg[\neg[(p\vee q)\wedge r]\vee.\neg q]\Leftrightarrow q\wedge r$.	7	L2	CO1
	c.	Give i) a direct proof ii) an Indirect proof for the following statement "If n is an odd integer then n + 9 is an even integer".	7	L2	CO1
		OR			
Q.2	a.	Define i) an open statement ii) quantifiers.	6	L2	CO1
	b.	Test the validity of the following arguments. i) $\begin{array}{c} p\wedge q \\ \underline{p\to(q\to r)} \\ \therefore r \end{array}$ ii) $\begin{array}{c} P \\ P\to\sim q \\ \underline{\sim q\to\sim r} \\ \therefore\sim r \end{array}$	7	L2	CO1
	c.	For the following statements the universe comprises all non – zero integers. Determine the truth value of each statement. i) $\exists x, \exists y\ [xy = 1]$ ii) $\exists x, \forall y\ [xy = 1]$ iii) $\forall x, \exists y\ [xy = 1]$ iv) $\exists x, \exists y\ [(2x + y = 5)\wedge(x - 3y = -8)]$ v) $\exists x, \exists y\ [(3x - y = 17)\wedge(2x + 4y = 3)]$.	7	L2	CO1
		Module – 2			
Q.3	a.	Define the well ordering principle. By Mathematical induction, prove that $1+2+3+\ldots..+n=\frac{1}{2}n(n+1)$, $n\in z^{+}$.	6	L2	CO2
	b.	Prove that $F_n=\frac{1}{\sqrt{5}}\left[\left(\frac{1+\sqrt{5}}{2}\right)^n-\left(\frac{1-\sqrt{5}}{2}\right)^n\right]$. For F_0 , F_1, F_2 , …. are the Fibonacci numbers.	7	L2	CO2
	c.	Find the number of permutations of the letters of the word 'MASSASAUGA'. In how many of these all four A's are together? How many of them begin with S's?	7	L3	CO2
		OR			

Q.4	**a.**	Prove that $4n < n^2 - 7$ for all positive integers $n \geq 6$.	6	L2	CO3
	b.	Find the co-efficients of $x^9 y^3$ in the expansion of $(2x - 3y)^{12}$.	7	L3	CO3
	c.	Let $a_0 = 1$, $a_1 = 2$, $a_3 = 3$ and $a_n = a_{n-1} + a_{n-3}$ for $n \geq 3$, prove that $a_n \leq 3^n$ for all +ve integers n.	7	L2	CO3
		Module – 3			
Q.5	**a.**	State Pigeon hole principle. Prove that if 30 dictionaries in a library contains a total of 61,327 pages then atleast one of dictionaries must have atleast 2045 pages.	6	L2	CO3
	b.	Define power set. For any sets A, B, $C \leq U$, prove that $A \times (B \cup C) = (A \times B) \cup (A \times C)$.	7	L2	CO3
	c.	Let f and g be functions from R to R defined by $f(x) = ax + b$ and $g(x) = 1 - x + x^2$ if $(gof)(x) = 9x^2 - 9x + 3$, determine a & b.	7	L3	CO3
		OR			
Q.6	**a.**	Let $f : R \to R$ be defined by $f(x) = \begin{cases} 3x - 5, \text{if } x > 0 \\ 1 - 3x, \text{if } x \leq 0 \end{cases}$ Find f^1 (-5, 5) and f^1(- 6, 5).	6	L2	CO3
	b.	Let N be the set of Natural numbers. Let a relation R be defined by $R = \{(a, b) / a \in N , b \in N , a - b$ is divisible by $5\}$. Prove that R is an equivalence relation.	7	L2	CO3
	c.	For A = { a, b, c, d, e}, the Hasse diagram for the poset(A, R) is as shown below : i) Determine the relation matrix for R ii) Construct the diagraph for R.  	7	L3	CO3
		Module – 4			
Q.7	**a.**	Determine the number of integers between 1 and 250 that are divisible by 3 and not divisible by 5 and 7.	6	L3	CO4
	b.	Solve the recurrence relation $F_{n+2} = F_{n+1} + F_n$, where $n \geq 0$ and $F_0 = 0$, $F_1 = 1$.	7	L2	CO4
	c.	Define Derangement. Find the number of derangement of 1, 2, 3, and 4.	7	L3	CO4
		OR			

Q.8	a.	Find the Rook polynomial for the chess board contain 4 squares as shown in the Fig.Q8(a). 1 2 3 4 Fig.Q8(a)	6	L3	CO4
	b.	Solve the recurrence relation $a_n = 5a_{n-1} + 6a_{n-2}$, $n \geq 2$, $a_0 = 1$, $a_1 = 3$.	7	L2	CO4
	c.	Find the distinct numbers which are multiples of at least one of 15, 40 and 35 not exceeding 1000.	7	L3	CO4
		Module – 5			
Q.9	a.	Define group and subgroup with example each.	6	L1	CO5
	b.	State and prove Lagrange's theorem.	7	L2	CO5
	c.	Define Klein 4 group. Verify A = {e, a, b, c} is a Klein 4 group.	7	L2	CO5
		OR			
Q.10	a.	Prove that the intersection of two subgroup of a group is a subgroup of the group.	6	L2	CO5
	b.	Prove that the cube roots of unity form a group under the multiplication.	7	L2	CO5
	c.	Let G = S_4, the symmetric group of order 4, for $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 1 \end{pmatrix}$, find the subgroup H = < a >, determine the number of left cosets of H in G.	7	L3	CO5

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USN ☐☐☐☐☐☐☐☐☐☐ **MATDIP401**

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025

Advanced Mathematics – II

Time: 3 hrs. Max. Marks: 100

Note:1. ***Answer any FIVE full questions.***
2. ***Mathematics formulae handbook is allowed.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

1	a.	Find the sine of the angle between $\vec{a} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{b} = \hat{i} - 2\hat{j} + 2\hat{k}$.	**(06 Marks)**
	b.	Find the constant a so that the vectors $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} + 2\hat{j} - 3\hat{k}$ and $3\hat{i} + a\hat{j} + 5\hat{k}$ are coplanar.	**(06 Marks)**
	c.	Prove that $\left[\vec{a} - \vec{b}, \vec{b} - \vec{c}, \vec{c} - \vec{a}\right] = 0$.	**(08 Marks)**
2	a.	Find the unit normal vector to both the vectors $4\hat{i} - \hat{j} + 3\hat{k}$ and $-2\hat{i} + \hat{j} - 2\hat{k}$.	**(06 Marks)**
	b.	Show that the four points whose position vectors are $3\hat{i} - 2\hat{j} + 4\hat{k}$, $6\hat{i} + 3\hat{j} + \hat{k}$, $5\hat{i} + 7\hat{j} + 3\hat{k}$ and $2\hat{i} + 2\hat{j} + 6\hat{k}$ are coplanar.	**(06 Marks)**
	c.	Show that the position vectors of the vertices of a triangle $2\hat{i} - \hat{j} + \hat{k}$, $\hat{i} - 3\hat{j} - 5\hat{k}$ and $3\hat{i} - 4\hat{j} - 4\hat{k}$ from a right angled triangle.	**(08 Marks)**
3	a.	A particle moves along the curve $x = t^3 + 1$, $y = t^2$, $z = 2t + 3$ where t is the time. Find the components of velocity and acceleration at t = 1 in the direction of $i + j + 3k$.	**(06 Marks)**
	b.	Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point (1, -2, -1) along $2\vec{i} - \vec{j} - 2\vec{k}$.	**(06 Marks)**
	c.	Find the constants a, b, c so that the vector field, $\vec{F} = (x + 2y + az)\vec{i} + (bx - 3y - z)\vec{j} + (4x + cy + 2z)\vec{k}$ is irrotational.	**(08 Marks)**
4	a.	Find the angle between the surfaces $x^2 + y^2 + z^2 = 9$, $x^2 + y^2 - z = 3$ at the point (2, -1, 2).	**(06 Marks)**
	b.	If $\vec{F} = (x + y + 1)\vec{i} + \vec{j} - (x + y)\vec{k}$ then prove that $\vec{F}.\text{curl}\,\vec{F} = 0$.	**(06 Marks)**
	c.	Find div $\vec{F}$ and curl $\vec{F}$ where $\vec{F} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$.	**(08 Marks)**

5	a.	Solve : $(D^3-2D^2+4D-8)y=0$, where $D=\frac{d}{dx}$.	**(06 Marks)**
	b.	Solve $\frac{d^3y}{dx^3}-3\frac{d^2y}{dx^2}+4\frac{dy}{dx}-2y=e^x$.	**(06 Marks)**
	c.	Solve $(D^2+5D+6)y=\sin x$, where $D=\frac{d}{dx}$.	**(08 Marks)**
6	a.	Solve : $(D^2+6D+9)y=0$, where $D=\frac{d}{dx}$.	**(06 Marks)**
	b.	Solve $\frac{d^2y}{dx^2}+4\frac{dy}{dx}-12y=e^{-2x}$.	**(06 Marks)**
	c.	Solve $\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=\cos 3x$.	**(08 Marks)**
7	a.	Find the rank of the matrix by elementary row transformation $\begin{bmatrix}1&1&1\\2&2&2\\3&3&3\end{bmatrix}$.	**(06 Marks)**
	b.	Solve $3x-y+2z=12$, $2x+2y+3z=11$, $2x-2y-z=2$ by Gauss Elimination Method.	**(06 Marks)**
	c.	Test for consistency and solve $5x+3y+7z=4$, $3x+26y+2z=9$, $7x+2y+10z=5$	**(08 Marks)**
8	a.	Find the rank of the matrix by elementary row transformation $\begin{bmatrix}1&2&3\\1&4&2\\2&6&5\end{bmatrix}$.	**(06 Marks)**
	b.	Solve $2x+5y+7z=52$, $2x+y-z=0$, $x+y+z=9$ by Gauss Elimination Method.	**(06 Marks)**
	c.	Find the Eigen values and one Eigen Vector of the matrix $\begin{bmatrix}5&4\\1&2\end{bmatrix}$.	**(08 Marks)**

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CBCS SCHEME - Make-Up Exam

USN ☐☐☐☐☐☐☐☐☐☐ **BCS405A**

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Discrete Mathematical Structures

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	**a.**	Define Tautology and Contradiction. Show that for any proposition p and q the compound proposition $[p \to (p \vee q)]$ is a tautology and the compound proposition $[p \wedge (\sim p \wedge q)]$ is a contradiction by using truth table.	**06**	**L2**	**CO1**
	b.	Prove the following logical equivalence without using truth table: i) $[(p \to q) \wedge \{\sim q \wedge (r \vee \sim q)\}] \Leftrightarrow \sim(q \vee p)$ ii) $\{[\sim p \wedge (\sim q \wedge r)] \vee (q \wedge r) \vee (p \wedge r)\} \Leftrightarrow r$	**07**	**L2**	**CO1**
	c.	Prove the following is a valid argument : $p \to (q \wedge r)$ $r \to s$ $\sim(q \wedge s)$ $\therefore \sim p$	**07**	**L3**	**CO1**
		OR			
Q.2	**a.**	For inverse of all real numbers, let p(x): $x \geq 0$, q(x) : $x^2 \geq 0$, r(x) : x^2-3x-4=0 s(x) : $x^2 - 3 > 0$. Determine the truth values of the following : (i) $\exists x, p(x) \wedge q(x)$ (ii) $\forall x, p(x) \to q(x)$ (iii) $\forall x, q(x) \to s(x)$ (iv) $\forall x, r(x) \vee s(x)$	**06**	**L2**	**CO1**
	b.	Test the validity of the following arguments: If a triangle has two equal sides, then it is isosceles If a triangle is isosceles, then it has two equal angles The triangle ABC does not have two equal angles ∴ ABC does not have two equal sides	**07**	**L3**	**CO1**
	c.	Give indirect proof for the following statement: (i) For all integers k and l, if kl is odd, then both k and l are odd. (ii) For all integers k and l, if k + l is even, then k and l are both even or both odd.	**07**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Prove by Mathematical induction, for all integers $n \geq 1$ $1.2 + 2.3 + 3.4 + \ldots\ldots + n(n+1) = \frac{1}{3}n(n+1)(n+2)$	**06**	**L2**	**CO2**
	b.	A sequence $\{a_n\}$ is defined recursively by $a_0 = 1$ $a_1 = 1$ $a_2 = 1$ and $a_n = a_{n-1} + a_{n-3}$ for all $n \geq 3$. Prove that $a_{n+2} \geq (\sqrt{2})^n$ for all integer $n \geq 0$.	**07**	**L2**	**CO2**

Q.3	**c.**	Find the number of permutations of the letters of word MASSASAUGA. In how many of these, all four A's are together? How many of them begin with S?	**07**	**L3**	**CO2**
		OR			
Q.4	**a.**	From seven consonants and five vowels, how many sets consisting of four different consonants and three different vowels can be formed?	**06**	**L2**	**CO2**
	b.	Find the coefficient of $a^2b^3c^2d^5$ in the expansion of $(a + 2b - 3c + 2d + 5)^{16}$	**07**	**L3**	**CO2**
	c.	In how many ways can 10 identical pencils be distributed among 5 children in the following case: (i) There are no restrictions (ii) Each child gets atleast one pencil (iii) The youngest child gets atleast two pencils	**07**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Let A = {1, 2, 3, 4} and B = {1, 2, 3, 4, 5 , 6} (i) Find how many functions are there from A to B. How many of these are one to one? (ii) Find how many functions are there from B to A. How many of these are onto? How many are one to one?	**06**	**L2**	**CO3**
	b.	State Pigeonhole Principle. How many persons must be chosen in order that at least five of them will have birthdays in the same calendar month?	**07**	**L3**	**CO3**
	c.	Prove that "A function f : A → B is invertible if and only if it is one to one and onto".	**07**	**L2**	**CO3**
		OR			
Q.6	**a.**	Let A = {1, 2, 3, 4} and R be the relation on A defined by xRy if and only if "x divides y", written as x/y. (i) Write down R as a set of ordered pairs. (ii) Draw the digraph of R, matrix M(R) (iii) Determine the indegree and outdegree of the vertices in the digraph.	**06**	**L2**	**CO3**
	b.	Let A = {1, 2, 3, 4, 5}. Define a relation R on A × A by (x_1 , y_1) R (x_2 , y_2) if and only if $x_1 + y_1 = x_2 + y_2$. (i) Verify that R is an equivalence relation on A×A (ii) Determine the equivalence classes of [(1, 3)] (iii) Determine the partition of A×A induced by R	**07**	**L3**	**CO3**
	c.	Let s = {1, 2, 3} and P(S) be the power set of S. On P(S) define the relation R by XRY if and only of X ≤ Y. Show that this relation is a partial order on P(S). Draw its Hasse diagram.	**07**	**L2**	**CO3**

		Module – 4			
Q.7	**a.**	Define Derangement. Find the number of derangements of 1, 2, 3, 4. List them.	**06**	**L2**	**CO4**
	b.	Find the number of permutations of the letters a, b, c,…..x, y, z in which none of the patterns spin, game, path or net occurs.	**07**	**L3**	**CO4**
	c.	Four persons P_1, P_2, P_3, P_4 who arrive late for a dinner party find that only one chair at each of five tables T_1, T_2, T_3, T_4 and T_5 is vacant. P_1 will not sit at T_1 or T_2 , P_2 will not sit at T_2, P_3 will not sit at T_3 or T_4 and P_4 will not sit at T_4 or T_5 . Find the number of ways they can occupy the vacant chairs.	**07**	**L3**	**CO4**
		OR			
Q.8	**a.**	Out of 30 students in a hostel, 15 study History, 8 study Economics and 6 study Geography. It is known that 3 students study all these subjects. Show that 7 or more students study none of these subjects.	**06**	**L3**	**CO4**
	b.	Solve the recurrence relation $a_n - 3a_{n-1} = 5 \times 3^n$ for $n \geq 1$ given that $a_0 = 2$.	**07**	**L2**	**CO4**
	c.	Determine the number of positive integers n such that $1 \leq n \leq 100$ and n is not divisible by 2, 3 or 5.	**07**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	If $*$ is an operation on z defined by $x * y = x + y + 1$, prove that (z, $*$) is an abelian group.	**06**	**L2**	**CO5**
	b.	The symmetric group S_4 consists of all the permutations of the set $A = \{1, 2, 3, 4\}$. What is the order of S_4? What is the identity element in S_4? If $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 2 & 4 & 3 & 1 \end{pmatrix}$ and $\beta = \begin{pmatrix} 1 & 2 & 3 & 4 \\ 4 & 2 & 1 & 3 \end{pmatrix}$ Verify the $(\alpha\ \beta)^{-1} = \beta^{-1}\ \alpha^{-1}$	**07**	**L3**	**CO5**
	c.	Let G be a group and let $J = \{x \in G \ / \ xy = yx \text{ for all } y \in G\}$ Prove that J is a subgroup of G.	**07**	**L2**	**CO5**
		OR			
Q.10	**a.**	Prove that the group $(z_4 , +)$ is cyclic. Find all its generators.	**06**	**L3**	**CO5**
	b.	Prove the theorem "There exists a one to one correspondence between the elements of a subgroup and the elements of the left (right) coset thereof".	**07**	**L2**	**CO5**
	c.	State and prove Lagrange's theorem.	**07**	**L2**	**CO5**

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CBCS SCHEME - Make-Up Exam

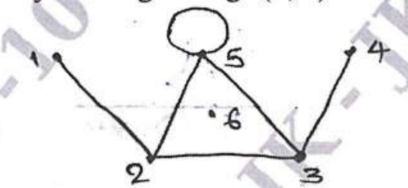
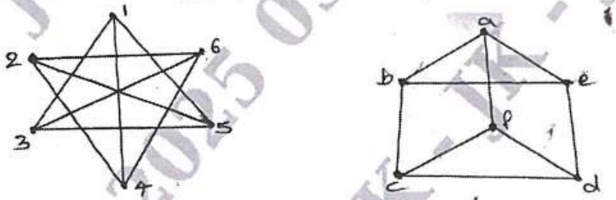
USN ☐☐☐☐☐☐☐☐☐☐ **BCS405B**

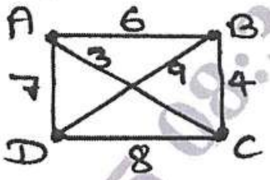
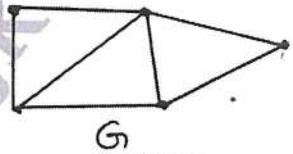
Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025

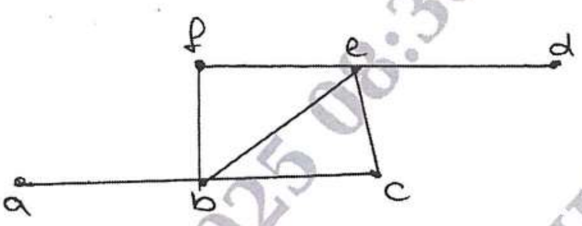
Graph Theory

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Consider the following graph G. i) What is the order of the graph G? ii) What is the size of the graph G? iii) Draw two spanning subgraphs of G iv) Draw the graph by deleting the vertex 3 in G v) Draw the graph by deleting an edge (3, 4) in G.  Fig Q1(a)	6	L2	CO1
	b.	State and prove hand shaking property.	7	L3	CO1
	c.	Show that a simple graph with n vertices and K components can have atmost $\frac{(n-k)(n-k+1)}{2}$ edges.	7	L3	CO1
		OR			
Q.2	**a.**	Define complete graph, complete bipartite graph. Write graph of K_4, $K_{2,3}$.	6	L2	CO1
	b.	Verify whether the following graphs are isomorphic or not  Fig Q2(b)	7	L2	CO1
	c.	If a graph connected or disconnected has exactly two vertices of odd degree there must be a path joining these two vertices.	7	L3	CO1
		Module – 2			
Q.3	**a.**	Explain Travelling Salesman problem.	6	L1	CO2
	b.	If all the vertices in a connected graph G are of even degree, then show that G is Eulerian.	7	L3	CO2
	c.	How many edge disjoint Hamilton cycles exist in a complete graph with 7 vertices? Draw the graph to show and specify the cycles.	7	L2	CO2

		OR			
Q.4	**a.**	Show that a connected graph G has an Eulerian trial if and only if there are exactly two vertices of odd degree in G.	**6**	**L3**	**CO2**
	b.	Define Hamiltonian cycle. Find three distinct Hamiltonian cycles in the given graph with different weights  Fig Q4(b)	**7**	**L2**	**CO2**
	c.	Let A = {1, 2, 3, 4}, Let R be a relation on A defined by xRy if and only if 'x divides y'. Write down R as i) ordered pairs ii) Write matrix of R iii) Draw diagraph of R iv) Write out degree of all vertices of R.	**7**	**L2**	**CO2**
		Module – 3			
Q.5	**a.**	Define tree, rooted tree, binary tree and give one example for each.	**6**	**L1**	**CO3**
	b.	Show that a tree with n vertices has n-1 edges.	**7**	**L3**	**CO3**
	c.	A tree has 2n vertices of degree 1, 3n vertices of degree 2 and n vertices of degree 3. Find the number of vertices and edges in the tree.	**7**	**L3**	**CO3**
		OR			
Q.6	**a.**	i) Prove that with respect to any of its spanning trees a connected graph of an vertices and e edges has n – 1 tree branches and e – n + 1 chords. ii) Find the number of tree branches and chords in the following graph.  Fig Q6(a)	**6**	**L3**	**CO3**
	b.	i) Show that the number of vertices in a binary tree is always odd. ii) Find the number of pendant vertices in a binary tree with n vertices	**7**	**L3**	**CO3**
	c.	Show that for any graph G the vertex connectivity can't exceed the edge connectivity and the edge connectivity can't exceed the degree of the vertex with the smallest degree in G.	**7**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Define : i) Planar graph ii) dual of a planar graph. Give one example for each.	**6**	**L1**	**CO4**
	b.	Draw geometrical dual of the graph.  Fig Q7(b)	**7**	**L2**	**CO4**

		OR			
Q.10	**a.**	Prove that a graph of n vertices is a complete graph if and only if its chromatic polynomial is $P_n(\lambda) = \lambda(\lambda - 1)(\lambda - 2)\ldots\ldots(\lambda - n + 1)$	**6**	**L2**	**CO5**
	b.	Define minimal covering of a graph. Obtain two minimal coverings for the given graph.  	**7**	**L2**	**CO5**
	c.	State and prove five color problem.	**7**	**L2**	**CO5**

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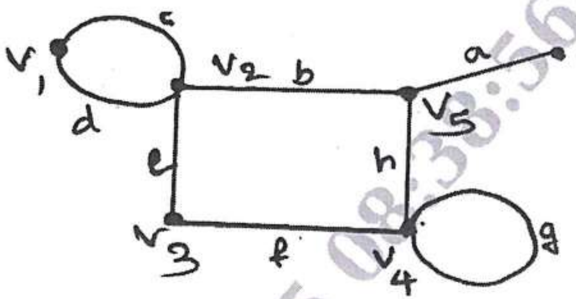
<table>
<tr><td></td><td>c.</td><td>Define path matrix. Write down the path matrix given graph between the vertices V_6 and V_2


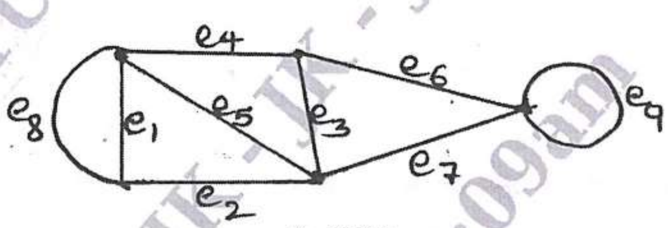
Fig Q7(c)</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>Show that a connected planar graph with n vertices, e – edges and f-faces satisfies e – n + 2 = f.</td><td>6</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Draw a complete graph with 4 vertices. Show that the complete graph with 5 vertices is non-planar.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Check the planarity of the following graph by the method of elementary reduction.


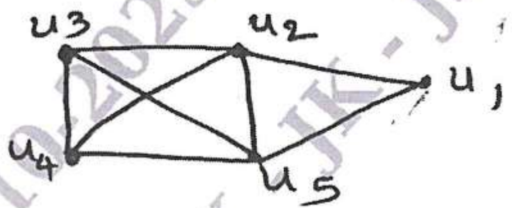
Fig Q8(c)</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td colspan="6">Module – 5</td></tr>
<tr><td>Q.9</td><td>a.</td><td>Prove that a graph with at least one edge is 2-chromatic if and only if it has no circuits of odd length.</td><td>6</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Find chromatic polynomial for the given graph.


Fig Q9(b)</td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>For 3 applications u, v, w 4 jobs a, b, c, d are available. Such that
i) u is eligible for a, c, d
ii) v is eligible for b, d
iii) w is eligible for b, c
Can every applicant get the job? Find 5 possible sets of applicants and job.</td><td>7</td><td>L3</td><td>CO4</td></tr>
</table>

CBCS SCHEME

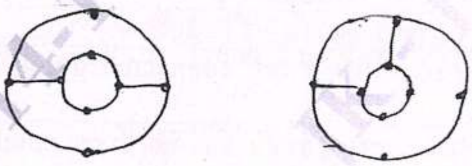
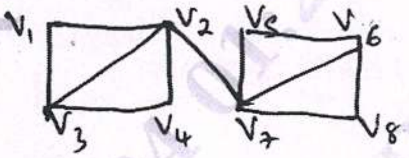
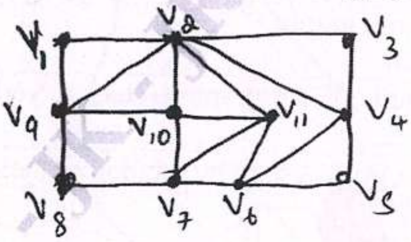
USN ☐☐☐☐☐☐☐☐☐☐ **BCS405B**

Fourth Semester B.E./B.Tech. Degree Supplementary Examination, June/July 2024

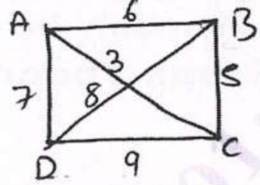
Graph Theory

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Define connected graph. Let G = (V, E) be a connected graph, what is the largest possible value of $\lvert V\rvert$, if $\lvert E\rvert = 19$ and $\deg(V) \geq 4$ for all $v \in V$?	**06**	**L2**	**CO1**
	b.	Define isomorphism of two graphs. Show that the two graphs are not isomorphic. 	**07**	**L2**	**CO1**
	c.	Show that in a graph G, the number of odd degree vertices is even.	**07**	**L3**	**CO1**
		OR			
Q.2	**a.**	Show that the maximum number of edges in a simple graph with n vertices is $\frac{n(n-1)}{2}$.	**06**	**L3**	**CO1**
	b.	In the given graph, identify the different paths from V_1 to V_8. How many of these path have length 5? 	**07**	**L2**	**CO1**
	c.	Show that a simple graph with n vertices and K components can have atmost $\frac{(n-K)(n-K+1)}{2}$ edges.	**07**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	Define Euler circuit. Find the Euler circuit in the graph below. 	**06**	**L2**	**CO2**
	b.	Prove that in a complete graph with n vertices, where $n \geq 3$, there are $\frac{(n-1)}{2}$ edge disjoint Hamiltonian cycles.	**07**	**L3**	**CO2**
	c.	Write a note on "Konigsberg bridge problem".	**07**	**L3**	**CO2**

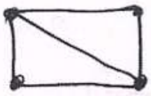
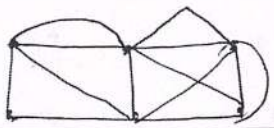
OR

Q.4	**a.**	Explain travelling salesman problem. Solve the travelling salesman problem for the weighted graph shown in Fig.Q4(a).  Fig.Q4(a)	**06**	**L2**	**CO2**
	b.	Define Hamilton cycle. How many edge disjoint Hamilton cycles exist in the complete graph with seven vertices? Also draw the graph to show these Hamilton cycle.	**07**	**L3**	**CO2**
	c.	Define complete symmetric digraph with an example. Prove that in any digraph, the sum of indegree of all vertices is equal to sum of outdegree and this sum is equal to number of edges.	**07**	**L3**	**CO2**

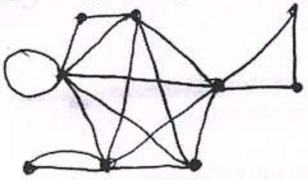
Module – 3

Q.5	**a.**	Prove that a tree with n vertices has (n – 1) edges.	**06**	**L3**	**CO3**
	b.	Define spanning tree. Prove that every connected graph has atleast one spanning tree.	**07**	**L3**	**CO3**
	c.	Define cut set. Prove that every circuit has an even number of edges in common with any cut set.	**07**	**L3**	**CO3**

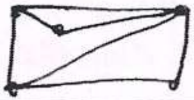
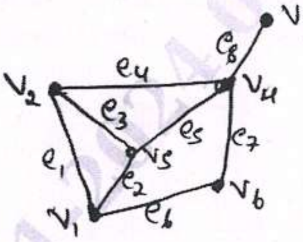
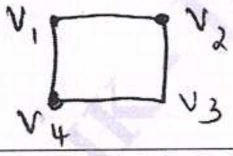
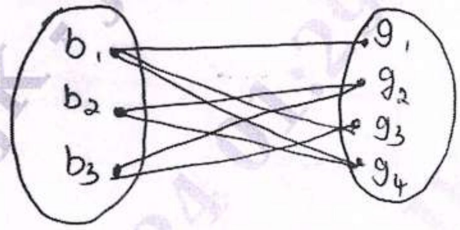
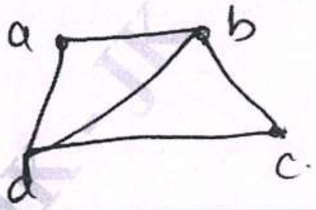
OR

Q.6	**a.**	Define binary tree. If a tree T has 4 vertices of degree 2, 1 vertex of degree 3, 2 vertices of degree 4 and 1 vertex of degree 5, find the number of leaves in T.	**06**	**L2**	**CO3**
	b.	(i) Find all the spanning tree of the below graph.  (ii) Find the number of tree branches and chords in the following graph with 7 vertices and 14 edges. 	**07**	**L3**	**CO3**
	c.	Define edge connectivity and vertex connectivity. Show that edge connectivity of graph G cannot exceed the degree of the vertex with the smallest degree in G.	**07**	**L3**	**CO3**

Module – 4

Q.7	**a.**	Define: (i) Planar graph (ii) Complete bipartite graph (iii) Dual of a planar graph. Give one example for each.	**06**	**L2**	**CO4**
	b.	Prove that in a connected planar graph G has n vertices, e edges and r regions then n – e + r = 2.	**07**	**L3**	**CO4**
	c.	Check the planarity of the given graph by method of elementary reduction. 	**07**	**L3**	**CO4**

OR

Q.8	**a.**	Define complete graph with an example. Show that Peterson graph is non-planar.	**06**	**L3**	**CO4**
	b.	Draw the geometric dual of the given graph: 	**07**	**L2**	**CO4**
	c.	Define adjacency matrix and incidence matrix. Write down the adjacency matrix for the given graph G. 	**07**	**L3**	**CO4**
		Module – 5			
Q.9	**a.**	Define chromatic polynomial of a graph. Find the chromatic polynomial of the graph. 	**06**	**L2**	**CO5**
	b.	Prove that a graph with atleast one edge is 2-chromatic iff it has no circuits of odd length.	**07**	**L3**	**CO5**
	c.	Define complete matching. Obtain 3 complete matching from the given graph. 	**07**	**L3**	**CO5**
		OR			
Q.10	**a.**	Prove that a graph with atleast one edge is 2-chromatic if and only if it has no circuits of odd length.	**06**	**L2**	**CO5**
	b.	Define covering of a graph. Obtain two minimal coverings of the graph. 	**07**	**L3**	**CO5**
	c.	Prove that a covering of a graph is minimal if and only if g contains no paths of lengths three or more.	**07**	**L3**	**CO5**

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