CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **BCM301**

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024
Mathematics for Computer & Communication 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 is permitted.
3. Use of Normal, t-distribution, χ^2 - tables permitted.
4. 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 a cosine series for $f(x)=(x-1)^2$, $0\le x\le 1$.</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>Obtain the first three co-efficients 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><th colspan="6">OR</th></tr>
<tr><td>Q.2</td><td>a.</td><td>Expand the function f(x) = xsinx as a Fourier series in the interval $-\pi\le x\le\pi$.</td><td>6</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>b.</td><td>Obtain the Fourier series for the function,
$$f(x)=\begin{cases}1+\frac{4x}{3} & \text{in } -\frac{3}{2}<x\le 0\\ 1-\frac{4x}{3} & \text{in } 0\le x<\frac{3}{2}\end{cases}$$
Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+....$</td><td>7</td><td>L2</td><td>CO1</td></tr>
<tr><td></td><td>c.</td><td>The following table gives the variations of a periodic current A over a period T.
<table>
<tr><td>t(sec)</td><td>0</td><td>$\frac{T}{6}$</td><td>$\frac{T}{3}$</td><td>$\frac{T}{2}$</td><td>$\frac{2T}{3}$</td><td>$\frac{5T}{6}$</td><td>T</td></tr>
<tr><td>A(amp)</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>
Show that there is a constant of 0.75 amp in the current A and also obtain the amplitude of the first harmonic.</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 $f(x)=xe^{-|x|}$.</td><td>6</td><td>L3</td><td>CO2</td></tr>
<tr><td></td><td>b.</td><td>Find the Fourier sine transform of $\frac{e^{-ax}}{x}$, $a>0$.</td><td>7</td><td>L2</td><td>CO2</td></tr>
<tr><td></td><td>c.</td><td>Obtain the z-transform of $\cosh n\theta$ and $\sinh n\theta$.</td><td>7</td><td>L2</td><td>CO2</td></tr>
</table>

OR

Q.4 **a.** Find the Fourier sine transform of $f(x)=\begin{cases} x, & 0<x<2 \\ 0, & \text{else where} \end{cases}$ — 6 — L2 — CO2

b. Compute the inverse z-transform of $\dfrac{3z^2+2z}{(5z-1)(5z+2)}$. — 7 — L3 — CO2

c. Solve by using z-transforms, $y_{n+2}+2y_{n+1}+y_n=n$ with $y_0=0=y_1$. — 7 — L3 — CO2

Module – 3

Q.5 **a.** Fit a straight line y = ax + b for the following data : — 6 — L2 — CO3

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

b. The following data gives the age of husband (X) and the age of wife (y) in years. Form the two regression lines and calculate the age of husband corresponding to 16 years age of wife. — 7 — L2 — CO3

x	36	23	27	28	28	29	30	31	33	35
y	29	18	20	22	27	21	29	27	29	28

c. Fit an exponential curve of the form $y=ae^{bx}$ by the method of least squares for the following data : — 7 — L2 — CO3

No. of petals	5	6	7	8	9	10
No. of flowers	133	55	23	7	2	2

OR

Q.6 **a.** Obtain the lines of regression and hence find the coefficient of correlation for the data : — 6 — L3 — CO3

x	1	3	4	2	5	8	9	10	13	15
y	8	6	10	8	12	16	16	10	32	32

b. Find the values of a, b, c if the equation $y=a+bx+cx^2$ is to fit most closely to following observations. — 7 — L2 — CO3

x	-2	-1	0	1	2
y	-3.150	-1.390	0.620	2.880	5.378

c. Ten students got the following percentage of marks in two subjects x and y. Compute their rank correlation coefficient. — 7 — L3 — CO3

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

Module – 4

Q.7 **a.** Find the value of K such that the following distribution represents a finite probability distribution. Hence find its mean and standard deviation. Also find $P(x\le 1)$, $P(x>1)$ and $P(-1<x\le 2)$. — 6 — L2 — CO4

x	-3	-2	-1	0	1	2	3
P(x)	k	2k	3k	4k	3k	2k	k

b. Derive the mean and standard deviation of Poisson distribution. — 7 — L1 — CO4

c. In a quiz contest of answering 'Yes' or 'No', what is the probability of guessing atleast 6 answers correctly out of 10 questions asked. Also find the probability of the same if there are 4 options for a correct answer. — 7 — L3 — CO4

<table>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>Find the value of C such that $f(x)=\begin{cases}\frac{x}{6}+C, & 0\le x\le 3\\ 0, & \text{Otherwise}\end{cases}$ is a p.dif. Also find $P(1\le x\le 2)$.</td><td>6</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>The sales per day in a ship is exponentially distributed with the average sale amounting to Rs.100 and net profit is 8%. Find the probability that the net profit exceeds Rs.30 on two consecutive days.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>In a normal distribution 31% of the items are under 45 and 8% of the items are over 64. Find the mean and S.D. of the distribution.</td><td>7</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>The joint probability distribution table for two random variable x and y is as follows :<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 the marginal probability distributions of x and y. Also find
(i) Expectation of x, y and xy.
(ii) Covariance of x and y.</td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Define : (i) Null hypothesis (ii) Significance level
(iii) Type-I and Type-II error.</td><td>7</td><td>L1</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>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.</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>A group of 10 boys fed on a diet A and another group of 8 boys fed on a different diet B for a period of 6 months recovered the following increase in weights (lbs).<table><tr><td>Diet A</td><td>5</td><td>6</td><td>8</td><td>1</td><td>12</td><td>4</td><td>3</td><td>9</td><td>6</td><td>10</td></tr><tr><td>Diet B</td><td>2</td><td>3</td><td>6</td><td>8</td><td>10</td><td>1</td><td>2</td><td>8</td><td></td><td></td></tr></table>Test whether diet A and B differ significantly regarding their effect on increase in weight ($t_{0.05}=2.12$)</td><td>6</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>4 coins are tossed 100 times and the following results are obtained. Fit a binomial distribution for the data and test the goodness of fit
($\chi^2_{0.05}=9.49$ for 4 dif)<table><tr><td>No. of heads</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr><tr><td>Frequency</td><td>5</td><td>29</td><td>36</td><td>25</td><td>5</td></tr></table></td><td>7</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>In 324 throws of a six faced ‘die’ an odd number turned up 181 times. Is it reasonable to think that the ‘die’ is an un biased one.</td><td>7</td><td>L3</td><td>CO5</td></tr>
</table>

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐

BCS301

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.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.
4. Mathematics hand book is permitted.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	A Random variable X has the following probability function for variable values of x. $\begin{array}{\|c\|c\|c\|c\|c\|c\|c\|c\|c\|}\hline x & 0 & 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ \hline P(x) & 0 & k & 2k & 2k & 3k & k^2 & 2k^2 & 7k^2+k \\ \hline\end{array}$ (i) Find the value of k. (ii) Evaluate $P(x \geq 6)$ and $P(3 < x \leq 6)$.	6	L2	CO1
	b.	Find the mean and variance of Binomial distribution.	7	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) 10 minutes or more. (ii) Less than 10 minutes. (iii) Between 10 and 12 minutes.	7	L3	CO2
		OR			
Q.2	**a.**	A random variable x has the following density function $P(x)=\begin{cases} Kx^2 & -3 \leq x \leq 3 \\ 0 & \text{elsewhere} \end{cases}$. Find the value of K. Evaluate (i) $P(1 \leq x \leq 2)$ (ii) $P(x \leq 2)$	6	L2	CO1
	b.	In a factory producing blades, the probability of any blade being defective is 0.002. If blades are supplied in packets of 10, using Poisson distribution determine the number of packets containing, (i) No defective. (ii) One defective (iii) Two defective blades respectively in a consignment of 10,000 packets.	7	L2	CO2
	c.	In a test on electric bulbs, it was found that the life time of a particular brand was distributed normally with an average life of 2000 hours and standard deviation of 60 hours. If a firm purchases 2500 bulbs find the number of bulbs that are likely to last for, (i) More than 2100 hours. (ii) Between 1900 to 2100 hours. (iii) Less than 1950 hours. (Given $\phi(1.67) = 0.4525$, $\phi(0.83) = 0.2967$)	7	L3	CO2

Module – 2

Q.3 **a.** The joint probability distribution table for two random variable x and y is as follows : — 6 | L2 | CO2

Y X	-2	-1	4	5
1	0.1	0.2	0	0.3
2	0.2	0.1	0.1	0

Determine the marginal probability distribution of x and y. Obtain the correlation coefficient between x and y.

b. Find the unique fixed probability vector for the regular stochastic matrix — 7 | L2 | CO3

$$A = \begin{bmatrix} 0 & 1 & 0 \\ \frac{1}{6} & \frac{1}{2} & \frac{1}{3} \\ 0 & \frac{2}{3} & \frac{1}{3} \end{bmatrix}$$

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 : — 7 | L3 | CO3

(i) A has the ball.
(ii) B has the ball.
(iii) C has the ball.

OR

Q.4 **a.** 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 $0 \le x \le 2$, $0 \le y \le 3$. — 6 | L2 | CO2

(i) Find the value of the constant K.
(ii) Find the marginal probability distribution of X and Y.
(iii) Show that the random variables X and Y are dependent.

b. Find the unique fixed probability vector for the matrix, $P = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$. — 7 | L2 | CO3

c. Each year a man trades his car for a new car in 3 brands of the popular company. If he has a 'swift' he trades it for 'Dzire'. If he has a 'Dzire' he trades it for a 'Wagnor'. If he has a 'Wagnor' he is just as likely to trade it for a new 'Wagnor' or for a 'Dzire' or a 'Swift' one. In 2020 he bought his first car which was 'Wagnor'. Find the probability that he has — 7 | L3 | CO3

(i) 2022 Wagnor.
(ii) 2022 Swift.
(iii) 2023 Dzire.
(iv) 2023 Wagnor.

Module – 3

Q.5 **a.** Explain the following terms: — 6 | L1 | CO5

(i) Statistical Hypothesis.
(ii) Critical region of statistical test.
(iii) Test for significance.

<table>
<tr><td></td><td>b.</td><td>In 324 throws of a six faced die an odd number turned up 181 times. Is it reasonable to think that the die is an unbiased one at 5% level of significance?</td><td>7</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 200 flights. Is there a significant difference in the two types of aircrafts so far as engine defects are concerned? Test at 5% significance level.</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>Define :
(i) Null Hypothesis.
(ii) Significance level.
(iii) Type I and II error.</td><td>6</td><td>L1</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>A coin was tossed 1000 times and head turns up 540 times. Test the hypothesis that the coin is unbiased at 1% level of significance.</td><td>7</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 an other 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 1% level of significance.</td><td>7</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>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</td><td>6</td><td>L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>The following data shows the runs scored by two batsman: Can it be said that the performance of batsman A is more consistent than the performance of batsman B? Use 1% level of significance ($F_{0.01,4,7} = 7.85$)
<table>
<tr><td>Batsman A</td><td>40</td><td>50</td><td>35</td><td>25</td><td>60</td><td>70</td><td>65</td><td>55</td></tr>
<tr><td>Batsman B</td><td>60</td><td>70</td><td>40</td><td>30</td><td>50</td><td>-</td><td>-</td><td>-</td></tr>
</table></td><td>7</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>A coins are tossed 100 times and the following results were obtained. Fit a binomial distribution for the data and calculate the theoretical frequencies.
<table>
<tr><td>Number of heads</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td></tr>
<tr><td>Frequency</td><td>5</td><td>29</td><td>36</td><td>25</td><td>5</td></tr>
</table>
(Given $\chi^2_{0.05} = 9.49$ for 4 degree of freedom)</td><td>7</td><td>L3</td><td>CO4</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>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.</td><td>6</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>The 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. (Given $t_{0.05} = 2.262$ for 9 degree of freedom).</td><td>7</td><td>L3</td><td>CO5</td></tr>
<tr><td></td><td>c.</td><td>A sample analysis of examination results of 500 students war made. It was found that 220 students had failed, 170 had secured third class, 90 had secured second class and 20 had secured first class. Do these figures support the general examination result which is in the ratio 4 : 3 : 2 : 1 for the respective categories
(Given $\chi^2_{0.05} = 7.81$ for 3 degree of freedom).</td><td>7</td><td>L3</td><td>CO4</td></tr>
</table>

Module – 5

Q.9 **a.** Three different kinds of food are tested on three groups of rats for 5 weeks. The objective is to check the difference in mean weight (in grams) of the rats per week. Apply one-way ANOVA using a 0.05 significance level to the following data :

Food 1	8	12	19	8	6	11
Food 2	4	5	4	6	9	7
Food 3	11	8	7	13	7	9

10 | L3 | CO6

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, D under a Latin-square design.

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

10 | L4 | CO6

OR

Q.10 **a.** Set up an analysis of variance table for the following per acre production data for three varieties of wheat, each grown on four plots and state it the variety differences are significant at 5% significant level (Two way ANOVA).

Plot of land	Per acre production data		
	Variety of wheat		
	A	B	C
1	6	5	5
2	7	5	4
3	3	3	3
4	8	7	4

10 | L3 | CO6

b. 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.

Group of people	Drug		
	X	Y	Z
A	14 15	10 9	11 11
B	12 11	7 8	10 11
C	10 11	11 11	8 7

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%?

10 | L4 | CO6

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CBCS SCHEME

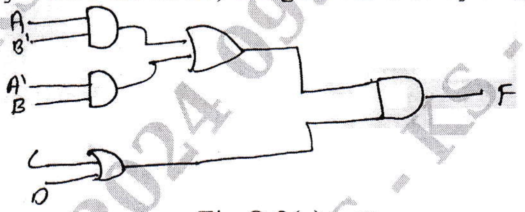
USN ☐☐☐☐☐☐☐☐☐☐ **BCS302**

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024

Digital Design and Computer Organization

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.**	Obtain a minimum product of sums with a Karnaugh map. $F(w, x, y, z) = x'z' + wyz + w'y'z' + x'y$.	10	L3	CO1
	b.	Find the minimum sum of products for each function using a Karnaugh map i) $F_1(a, b, c) = M_0 + M_2 + M_5 + M_6$ ii) $F_2(d, e, f) = \Sigma m(0, 1, 2, 4)$ iii) $F_3(r, s, t) = rt' + r's' + r's$	10	L3	CO1
		OR			
Q.2	**a.**	Identify the prime implicants and essential prime implicants of the following functions: i) $f(A, B, C, D) = \Sigma(1, 3, 4, 5, 10, 11, 12, 13, 14, 15)$ ii) $f(W, X, Y, Z) = \Sigma(0, 1, 2, 5, 7, 8, 10, 15)$.	10	L3	CO1
	b.	Write the verilog code for the given expression using dataflow and behavioral model where $Y = (AB' + A'B)(CB + AD)(AB'C + AC)$.	5	L2	CO1
	c.	Write the verilog code and time diagram for the given circuit with propagation delay where the AND, OR gate has a delay of 30ns and 10ns.  Fig.Q.2(c)	5	L2	CO1
		Module – 2			
Q.3	**a.**	What is Latch? With neat diagram, explain S-R latch using NOR gate. Derive characteristics equation.	10	L3	CO2
	b.	What is priority encoder? Design 4:2 priority encoder with necessary diagrams.	10	L3	CO2
		OR			
Q.4	**a.**	Design and explain four bit adder with carry look ahead.	10	L3	CO2
	b.	What is multiplexer? Design 9:1 mux using 2:1 mux.	10	L3	CO2

		Module – 3			
Q.5	**a.**	Explain four types of operation performed by computer with an example.	**10**	**L2**	**CO3**
	b.	Show how below expression will be executed in one address, two address zero address and three address processor in an accumulator organization X = (A ∗ B) + (C ∗ D).	**10**	**L1**	**CO3**
		OR			
Q.6	**a.**	What is addressing mode? Explain different types of addressing mode with an examples.	**10**	**L2**	**CO3**
	b.	With a neat diagram, explain basic operational concepts of a computer.	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Explain the following with respect to interrupts with diagram. i) Vector interrupt ii) Interrupt nesting iii) Simultaneous request.	**10**	**L2**	**CO3**
	b.	Explain Direct Memory Access with a neat diagram.	**10**	**L2**	**CO3**
		OR			
Q.8	**a.**	What is Bus arbitration? Explain different types of bus arbitration.	**10**	**L2**	**CO3**
	b.	Discuss different types of mapping functions of coaches.	**10**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Draw and explain the single-bus organization of the data path inside a processor.	**10**	**L2**	**CO4**
	b.	List out the actions needed to execute the instruction ADD (R3), R1 write and explain the sequence of control steps for the execution of the same.	**10**	**L2**	**CO4**
		OR			
Q.10	**a.**	Analyze how does execution of a complete instruction carry out.	**10**	**L4**	**CO4**
	b.	What is pipeline? Explain the performance of pipeline with an example.	**10**	**L4**	**CO4**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐ **BCS303**

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024

Operating Systems

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 Operating System. Explain dual mode of OS with a neat diagram.	**5**	**L1, L2**	**CO1**
	b.	Distinguish between the following terms: i) Multiprogramming and Multitasking ii) Multiprocessor system and clustered system.	**10**	**L2**	**CO1**
	c.	With a neat diagram, explain the concept the concept of VM-WARE architecture.	**5**	**L1, L2**	**CO1**
		OR			
Q.2	**a.**	Explain the operating system services with respect to programs and users.	**5**	**L2**	**CO1**
	b.	List and explain the different computing environments.	**5**	**L1, L2**	**CO1**
	c.	What are system calls? List and explain the different types of system calls.	**10**	**L1, L2**	**CO1**
		Module – 2			
Q.3	**a.**	Define process. Explain different states of a process with state diagram.	**8**	**L1, L2**	**CO1**
	b.	What is IPC? Explain direct and indirect communication with respect to message passing.	**8**	**L1, L2**	**CO2**
	c.	Explain context-switching.	**4**	**L2**	**CO2**
		OR			
Q.4	**a.**	What is multi-threaded process? Explain the four benefits of multithreaded programming.	**6**	**L2**	**CO2**
	b.	Calculate the average waiting time and average turn around time by drawing the Gantt-chart using FCFS, SJF-non preemptive, SRTF, RR(q = 2ms) and porosity algorithms.	**14**	**L3**	**CO2**

Process	Arrival time	Burst time	Porosity
P1	0	9	3
P2	1	4	2
P3	2	9	1
P4	3	5	4

		Module – 3			
Q.5	**a.**	What is critical section? What are the requirements for the solution to critical section problem? Explain Peaterson's solution.	**8**	**L1, L2**	**CO3**
	b.	Explain Reader's-Writer's problem using semaphores.	**12**	**L2**	**CO3**

<table>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.6</td><td>a.</td><td>What is deadlock? What are the necessary conditions for the deadlock to occur?</td><td>6</td><td>L1, L2</td><td>CO3</td></tr>
<tr><td></td><td>b.</td><td>Consider the following snap-shot of a system:
<table>
<tr><td rowspan="2">Process</td><td colspan="4">Allocation</td><td colspan="4">Max</td><td colspan="4">Available</td></tr>
<tr><td>A</td><td>B</td><td>C</td><td>D</td><td>A</td><td>B</td><td>C</td><td>D</td><td>A</td><td>B</td><td>C</td><td>D</td></tr>
<tr><td>P0</td><td>2</td><td>0</td><td>0</td><td>1</td><td>4</td><td>2</td><td>1</td><td>2</td><td>3</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>P1</td><td>3</td><td>1</td><td>2</td><td>1</td><td>5</td><td>2</td><td>5</td><td>2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P2</td><td>2</td><td>1</td><td>0</td><td>3</td><td>2</td><td>3</td><td>1</td><td>6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P3</td><td>1</td><td>3</td><td>1</td><td>2</td><td>1</td><td>4</td><td>2</td><td>4</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P4</td><td>1</td><td>4</td><td>3</td><td>2</td><td>3</td><td>6</td><td>6</td><td>5</td><td></td><td></td><td></td><td></td></tr>
</table>
Answer the following using Banker's algorithm:
i) Is the system in safe state? If so give the safe sequence.
ii) If process P2 requests (0, 1, 1, 3) resource can it be granted immediately.</td><td>14</td><td>L3</td><td>CO3</td></tr>
<tr><td colspan="6">Module – 4</td></tr>
<tr><td>Q.7</td><td>a.</td><td>What is paging? Explain with neat diagram paging hardware with TLB?</td><td>10</td><td>L1, L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>What are the commonly used strategies to select a free hole from the available holes?</td><td>6</td><td>L1</td><td>CO4</td></tr>
<tr><td></td><td>c.</td><td>Explain fragmentation in detail.</td><td>4</td><td>L2</td><td>CO4</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.8</td><td>a.</td><td>With a neat diagram? Describe the steps in handling the page fault.</td><td>8</td><td>L2</td><td>CO4</td></tr>
<tr><td></td><td>b.</td><td>Consider the page reference string: 1, 0, 7, 1, 0, 2, 1, 2, 3, 0, 3, 2, 4, 0, 3, 6, 2, 1 for a memory with 3 frames. Determine the number of page faults using F1, F0, optimal and LRU replacement algorithms which algorithm is more efficient.</td><td>12</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>Define file. List and explain the different file attributes and operations.</td><td>10</td><td>L1</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>Explain the different allocation methods.</td><td>10</td><td>L2</td><td>CO5</td></tr>
<tr><td colspan="6">OR</td></tr>
<tr><td>Q.10</td><td>a.</td><td>What is Access Matrix? Explain Access Matrix method of system protection with domain as objects and its implementation.</td><td>10</td><td>L1, L2</td><td>CO5</td></tr>
<tr><td></td><td>b.</td><td>A drive has 5000 cylinders numbered 0 to 4999. The drive is currently serving a request 143 and previously serviced a request at 125. The queue of pending requests in FIFO order is:
86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130 starting from current head position. What is the total distance travelled (in cylinders) by disk arm to satisfy the requests using FCFS, SSTF, SCAN, LOOK and C-LOOK algorithm.</td><td>10</td><td>L3</td><td>CO5</td></tr>
</table>

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CBCS SCHEME

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BCS304

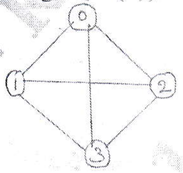
Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024

Data Structures and Applications

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 Data Structures. Explain with neat block schematic different type of data structures with examples. What are the primitive operations that can be performed?	**10**	**L2**	**CO1**
	b.	Differentiate between structures and unions shown examples for both.	**5**	**L1**	**CO1**
	c.	What do you mean by pattern matching? Outline knuth, Morris, Pratt pattern matching algorithm.	**5**	**L2**	**CO1**
		OR			
Q.2	**a.**	Define stack. Give the implementation of Push ( ), POP ( ) and display ( ) functions by considering its empty and full conditions.	**7**	**L2**	**CO1**
	b.	Write an algorithm to evaluate a postfix expression and apply the same for the given postfix expression 6, 2, /, 3, -, 4, 2, *, +	**7**	**L3**	**CO1**
	c.	Write the Postfix form of the following using stack : (i) A*(B*C+D*E) + F (ii) (a + (b*c) / (d-e))	**6**	**L3**	**CO1**
		Module – 2			
Q.3	**a.**	What are the disadvantages of ordinary queue? Discuss the implementation of circular queue.	**8**	**L2**	**CO2**
	b.	Write a note on multiple stacks and priority queue.	**6**	**L2**	**CO2**
	c.	Define Queue. Discuss how to represent queue using dynamic arrays.	**6**	**L2**	**CO2**
		OR			
Q.4	**a.**	What is a linked list? Explain the different types of linked lists with neat diagram.	**4**	**L2**	**CO2**
	b.	Give the structure definition for singly linked list (SLL). Write a C function to, (i) Insert on element at the end of SLL. (ii) Delete a node at the beginning of SLL.	**8**	**L3**	**CO2**
	c.	Write a C-function to add two polynomials show the linked list representation of below two polynomials $p(x) = 3x^{14} + 2x^{8} + 1$ $q(x) = 8x^{14} - 3x^{10} + 10x^{6}$	**8**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Write a C-function for the following operations on Doubly Linked List (DLL): (i) addition of a node. (ii) concatenation of two DLL.	**8**	**L3**	**CO3**
	b.	Write C functions for the following operations on circular linked list : (i) Inserting at the front of a list. (ii) Finding the length of a circular list.	**8**	**L3**	**CO3**

	c.	For the given sparse matrix, give the diagrammatic linked representation. $A = \begin{bmatrix} 2 & 0 & 0 & 0 \\ 4 & 0 & 0 & 3 \\ 0 & 0 & 0 & 0 \\ 8 & 0 & 0 & 1 \\ 0 & 0 & 6 & 0 \end{bmatrix}.$	4	L3	CO3
OR					
Q.6	**a.**	Discuss how binary tree are represented using, (i) Array (ii) Linked list	6	L2	CO3
	b.	Discuss inorder, preorder, postorder and level order traversal with suitable recursive function for each.	8	L2	CO3
	c.	Define Threaded Binary Tree. Discuss In-Threaded binary Tree.	6	L2	CO3
Module – 4					
Q.7	**a.**	Write a function to perform the following operations on Binary Search Tree (BST) : (i) Inserting an element into BST. (ii) Recursive search of a BST.	8	L3	CO4
	b.	Discuss selection Trees with an example.	8	L2	CO4
	c.	Explain Transforming a first into a binary tree with an example.	4	L2	CO4
OR					
Q.8	**a.**	Define graph. Show the adjacency matrix and adjacency list representation of the graph given below (Refer Fig. Q8 (a)).  Fig. Q8 (a)	6	L3	CO4
	b.	Define the following Terminologies with examples, (i) Digraph (ii) Weighted graph (iii) Self loop (iv) Parallel edges	8	L1	CO4
	c.	Explain in detail elementary graph operations.	6	L2	CO4
Module – 5					
Q.9	**a.**	What is collision? What are the methods to resolve collision? Explain linear probing with an example.	7	L2	CO5
	b.	Explain in detail, about static and dynamic hashing.	6	L2	CO5
	c.	Discuss Leftist Trees with an example.	7	L2	CO5
OR					
Q.10	**a.**	Explain different types of HASH function with example.	6	L2	CO5
	b.	Discuss AVL tree with an example. Write a function for insertion into an AVL Tree.	6	L3	CO5
	c.	Define Red-black Tree, Splay tree. Discuss the method to insert an element into Red-Black tree.	8	L2	CO5

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CBCS SCHEME

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BCS306A

Third Semester B.E./B.Tech. Degree Examination, Dec.2023/Jan.2024

Object Oriented Programming with Java

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.	Discuss the different data types supported by Java along with the default values and literals.	8	L2	CO1
	b.	Develop a Java program to convert Celsius temperature to Fahrenheit.	6	L3	CO2
	c.	Justify the statement "Compile once and run anywhere" in Java.	6	L2	CO1
		OR			
Q.2	a.	List the various operators supported by Java. Illustrate the working of >> and >>> operators with an example.	8	L2	CO1
	b.	Develop a Java program to add two matrices using command line argument.	10	L3	CO2
	c.	Explain the syntax of declaration of 2D arrays in Java.	2	L2	CO1
		Module – 2			
Q.3	a.	Examine Java Garbage collection mechanism by classifying the 3 generations of Java heap.	6	L2	CO1
	b.	Develop a Java program to find area of rectangle, area of circle and area of triangle using method overloading concept. Call these methods from main method with suitable inputs.	10	L3	CO2
	c.	Interpret the general form of a class with example.	4	L2	CO2
		OR			
Q.4	a.	Outline the following keywords with an example : (i) this (ii) static	6	L2	CO2
	b.	Develop a Java program to create a class called 'Employee' which contains 'name', 'designation', 'empid' and 'basic salary' as instance variables and read ( ) and write ( ) as methods. Using this class, read and write five employee information from main ( ) method.	10	L3	CO2
	c.	Interpret with an example, types of constructions.	4	L2	CO2
		Module – 3			
Q.5	a.	Illustrate the usage of super keyword in Java with suitable example. Also explain the dynamic method dispatch.	10	L2	CO3
	b.	Build a Java program to create an interface Resizable with method resize (int radius) that allow an object to be resized. Create a class circle that implements resizable interface and implements the resize method.	10	L3	CO3
		OR			
Q.6	a.	Compare and contrast method overloading and method overriding with suitable example.	8	L2	CO2

	b.	Define inheritance and list the different types of inheritance in Java.	4	L2	CO3
	c.	Build a Java program to create a class named 'Shape'. Create 3 sub classes namely circle, triangle and square ; each class has 2 methods named draw ( ) and erase ( ). Demonstrate polymorphism concepts by developing suitable methods and main program.	8	L3	CO3
Module – 4					
Q.7	**a.**	Examine the various levels of access protections available for packages and their implications with suitable examples.	10	L2	CO4
	b.	Build a Java program for a banking application to throw an exception, where a person tries to withdraw the amount even though he/she has lesser than minimum balance (Create a custom exception)	10	L3	CO4
OR					
Q.8	**a.**	Define Exception. Explain Exception handling mechanism provided in Java along with syntax and example.	10	L2	CO4
	b.	Build a Java program to create a package "balance" containing Account Class with displayBalance ( ) method and import this package in another program to access method of Account Class.	10	L3	CO4
Module – 5					
Q.9	**a.**	Define a thread. Also discuss the different ways of creating a thread.	6	L2	CO5
	b.	How synchronization can be achieved between threads in Java? Explain with an example.	6	L2	CO5
	c.	Develop a Java program for automatic conversion of wrapper class type into corresponding primitive type that demonstrates unboxing.	8	L3	CO5
OR					
Q.10	**a.**	Summarize the type wrappers supported in Java.	6	L2	CO5
	b.	Explain Autoboxing/Unboxing that occurs in expressions and operators.	6	L2	CO5
	c.	Develop a Java program to create a class myThread. Call the base class constructor in this class's constructor using super and start the thread. The run method of the class starts after this. It can be observed that both main thread and created child thread are executed concurrently.	8	L3	CO5

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