UPES
Supplementary Examination, December 2023

Course: Remedial Mathematics
Semester   : I
Program: Int. BMSC Microbiology/N &D/Clinical Research,
           BT Biomedical/Biotechnical,
           B.Sc. FND/Microbiology/Clinical Research

Duration   : 3 Hours
Course Code: BP106RMT   **Max. Marks: 100**

Instructions: All questions are compulsory.

S. No.	Section A **Short answer questions/ MCQ/T&F** **(20Qx1.5M= 30 Marks)**	Marks	COs

Q 1	The order of Matrix A is 4×4 and B is 4×3 the order of AB is:
	  a. 1×3
	  b. 4×3
	  c. 3×3
	  d. 3×4
		1.5	CO1

Q2.	The cofactor of 4 in $\begin{bmatrix} 1 & 2 & 3 \\ 5 & 4 & 2 \\ 3 & 2 & 1 \end{bmatrix}$ is:
	  a. 0
	  b. -8
	  c. 8
	  d. -4
		1.5	CO1

Q3.	Find the order of A^T if the matrix $A = \begin{pmatrix} 2 & -3 & 5 \\ 1 & 6 & 9 \end{pmatrix}$	1.5	CO1
Q4.	Check whether the following matrix is invertible: $\begin{bmatrix} 2 & 4 & -6 \\ 7 & 3 & 5 \\ 1 & -2 & 4 \end{bmatrix}$	1.5	CO1

Q5.	If $A^2 - A + I = O$ then inverse of then the inverse of A is:
	  a. $I - A$
	  b. $A - I$
	  c. A
	  d. $A + I$
		1.5	CO1

Q6.	The slope of a line $ax + by + c = 0$ is:
	
	  a. $\frac{a}{b}$
	
	  b. $-\frac{a}{b}$
	
	  c. $\frac{c}{b}$
	
	  d. $-\frac{c}{b}$
		1.5	CO2

Q7.	The lines $3x + 4y = 9$ and $6x + 8y = 15$ are parallel:
	
	  a. True
	
	  b. False
		1.5	CO2

Q8.	Find the distance of $(5, 12)$ from the origin.	1.5	CO2
Q9.	Write the condition for two lines to be perpendicular.	1.5	CO2

Q10.	$\int_0^2 (x^2 + 2)\, dx$ is equal to:
	
	  a. $\frac{24}{3}$
	
	  b. $\frac{25}{3}$
	
	  c. $\frac{26}{3}$
	
	  d. $\frac{27}{3}$
		1.5	CO2

Q11.	$\int_0^\pi \sin^2 x\, dx =$
	
	  a. $\frac{\pi}{2}$
	
	  b. $\frac{\pi}{4}$
	
	  c. 2π
	
	  d. 4π
		1.5	CO2

Q12.	If $f(x) = x^4 + 5x^3 - 11x^2 - 45x + 60$ then find $f''(x)$.	1.5	CO3
Q13.	Write the formula of $\frac{d}{dx}(uv)$ where u & v are the functions of x.	1.5	CO3

Q14.	$\frac{d}{dx}(sinx\ cosx)$ is equal to:
	
	  a. $cos^2x + sin^2x$
	
	  b. $sin^2x - cos^2x$
	
	  c. $cos^2x - sin^2x$
	
	  d. $-2cos^2x$
		1.5	CO3

Q15.	If $f(x) = \frac{e^x}{x^2}$ then, $f'(1)$ is:
	
	  a. e
	
	  b. $-e$
	
	  c. $2e$
	
	  d. $-2e$
		1.5	CO3

Q16.	If u & v are two functions of x then write the formula for integration of uv.	1.5	CO2

Q17.	Integration of xe^x is given by:
	
	  a. $e^x(x + 1)$
	
	  b. $-e^x(x + 1)$
		1.5	CO2

	c. $e^x(x-1)$ d. xe^x		
Q18.	Define upper triangular matrix.	**1.5**	**CO1**
Q19.	Find the value of $\lim\limits_{x\to 8}\frac{x^2-64}{x-8}$	**1.5**	**CO1**
Q20.	The function $f(x)=x^3-4x^2+4x+3$ defined on $[-1,3]$ has: a. Minimum value -6 at $x=-1$ b. Minimum value 6 at $x=3$ c. Minimum value 3 at $x=2$ d. None of these	**1.5**	**CO3**

Section B
(4Qx5M=20 Marks)

Attempt any 4 questions out of 5.

Q 1	Find the equation of a line passing through the point $(3,-2)$ and perpendicular to the line $x-3y+5=0$.	5	CO2
Q 2	Show that the points $A(-3,-3), B(3,3)\,\&\,C(-3\sqrt{3},3\sqrt{3})$ are the vertices of equilateral triangle.	5	CO2
Q 3	Evaluate $\frac{dy}{dx}$ when $y=(3x^4e^x+5)$	5	CO3
Q 4	Evaluate the Laplace transform of $(t^2+4t+2)e^{3t}$	5	CO3
Q 5	Evaluate $I=\int\frac{x}{x^2-1}\,dx$	5	CO3

Section C
(2Qx15M=30 Marks)

All questions are compulsory Q1 has internal choice.

Q 1	A pharmaceutical company produces three medicines using ingredients A, B and C. One unit of P requires $1, 2$ and 3 units of A, B and C respectively. One unit of Q requires $2, 3$ and 2 units of A, B and C respectively. One unit of R requires $1, 2$ and 2 units of A, B and C respectively. The number of units available for ingredients A, B and C are $8, 14$ and 13 units respectively. Using the matrix method, determine the number of units of each medicine to produce to utilize completely the available resources. **OR** Bacteria increases at the rate proportional to the number of bacteria present. If the original number N doubles in 4 hours, find how many hours the number of bacteria will be $16N$.	15	CO4
Q 2	Evaluate the integral I using the method of partial fractions $$I=\int\frac{x+4}{(3+2x-x^2)}\,dx$$	15	CO3

	Section D **(2Qx10M=20 Marks)** **All questions are compulsory Q2 has internal choice.**		
Q 1	Find the equation of the line which passes through the point $(3, 4)$ and the sum of its intercept on the axes is 14.	**10**	**CO2**
Q 2	Apply Cramer's rule to solve the following system of equations: $$x + y + z = 6$$ $$y + 3z = 11$$ $$x - 2y + z = 0$$ **OR** Determine whether the matrix A is invertible or not. If it is invertible then apply adjoint method to find the inverse of matrix A: $$A = \begin{bmatrix} 2 & 6 & 3 \\ 4 & -1 & 3 \\ 1 & 3 & 2 \end{bmatrix}$$	**10**	**CO1**