DHANAMANJURI UNIVERSITY
JUNE - 2023

Name of Programme	:	B.Sc. Mathematics (Honours)
Semester	:	4th
Paper Type	:	SEC (Theory)
Paper Code	:	SMA-002
Paper Title	:	C Programming

Full Marks : 40
Pass Marks : 16
Duration: 2 Hours

The figures in the margin indicate full marks for the questions.
Answer only 4 (four) from the following questions:

1. Define the following terms: 1x10=10
   a) Application Software
   b) High Level Language
   c) Compiler
   d) ASCII Values
   e) String Constant
   f) Modulo Division
   g) Type Casting
   h) Header File
   i) Preprocessor Directive
   j) Compound Statement

2. Differentiate the following terms: 2x5=10
   a) Keyword and Identifier
   b) Pre-increment and Post-increment
   c) Operator Precedence and Associativity
   d) Implicit and Explicit Conversion
   e) Break and Continue

3. Discuss the various categories of operators available in C and explain their usage. 10

4. Discuss the various decision-making statements available in C by giving their general format. Explain their differences by giving appropriate examples. 10

5. Discuss the various looping structures available in C by giving their general format. Explain their differences by giving appropriate examples. 10

6. a) Write a C program to convert a decimal number to its equivalent binary number. 5
   b) Write a C program to convert a binary number to its equivalent decimal number. 5

7. Write a C program to find multiplication of two matrices. 10

8. Explain what a function is by giving an example. Differentiate between a function declaration and function definition. What are the different ways of passing arguments to a function? Discuss them by giving examples. 2+4+4=10

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Name of Programme	:	B.Sc. Mathematics (Honours)
Semester	:	4^{th}
Paper Type	:	Core-VIII (Theory)
Paper Code	:	CMA-208
Paper Title	:	Riemann Integration & Series of functions

Full Marks : 50

Pass Marks : 20

Duration: 2 Hours

The figures in the margin indicate full marks for the questions.

Answer only 5 (five) from the following questions:

10×5=50

Answer any five questions:

1. Let $|f(x)| \leq k$ $for\ all\ x\ in\ [a,b]$ and P be a partition of [a, b] with norm $\leq \delta$. $If\ P^*$ is a refinement of P containing at most p more points than P, prove that $U(P^*, f) \leq U(P, f) \leq U(P^*, f) + 2pk\delta$.
2. State and prove Darboux's theorem on upper Riemann integral.
3. State one of the condition for integrability and prove the same.
4. If f_1 and f_2 are two bounded and integrable functions on [a, b] , then prove that $f = f_1 + f_2$ is also bounded and integrable on [a, b]
   and $\int_a^b f_1(x)dx + \int_a^b f_2(x)dx = \int_a^b f(x)dx$.
5. Prove that the oscillation of a bounded function f on an interval [a, b] is supremum of the set $\{|f(x_1) - f(x_2)|: x_1, x_2 \in [a,b]\}$.
6. If the set of points of discontinuity of a bounded function f define on [a, b] is finite, then prove that f is Riemann integrable on [a, b].
7. (a) Prove that every continuous function is Riemann integrable.
   (b) If f is monotonic in [a, b], then prove that it is integrable in [a, b].
8. Show that $\int_0^1 x^{m-1}(1-x)^{n-1}dx$ exist if and only if m and n are both positive.
9. Show that $\int_0^\infty x^{n-1}e^{-x}dx$ is convergent if and only if n is positive.
10. State and prove Frullani's improper integral theorem.

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Name of Programme : B.Sc. Mathematics (Honours)
Semester : 4^{th}
Paper Type : Core-IX (Theory)
Paper Code : CMA-209
Paper Title : Ring Theory & Linear Algebra-I
Full Marks : 50 Duration: 2 Hours
Pass Marks : 20

The figures in the margin indicate full marks for the questions.
Answer only 5 (five) from the following questions:

1. Define Rank and Nullity of a linear transformation T. Also state and prove Rank-Nullity theorem. 2+8=10
2. Define ordered basis of a finite dimensional vector space. 1
   Let T be a linear transformation from R^3 to R^2 defined by T(x,y,z)=(x+y,2z-x)
   i) If β and β' are standard ordered basis for R^3 and R^2 respectively, find $[T]_{\beta,\beta'}$ 4
   ii) If β={(1,0,-1), (1,1,1), (1,0,0)} and β'={(0,1),(1,0)} are ordered basis for R^3 and R^2 respectively, find $[T]_{\beta,\beta'}$ 5
3. If M and N are two ideals of a ring R, then prove that $\frac{M+N}{M} \cong \frac{M}{M\cap N}$. Also find all the six ring homomorphisms from $Z_{12} \to Z_{30}$. 6+4=10
4. Prove that a basis of a vector space is the maximal linearly independent set, and conversely. 10
5. i) Let W be a subspace of a finite dimensional vector space V. Then prove that dim $\frac{V}{W}$ = dim V − dim W. 7
   ii) Show that the vectors {(1,1,2), (1,2,5), (5,3,4)} are linearly dependent in $R^3(R)$. 3
6. Define subspace of a vector space. Let V be the vector space of all functions from $R \to R$. Let V_e={f∈V| f is even} and V_o={f∈V| f is odd}. Then prove that V_e and V_o are subspaces of V, and V=$V_e \oplus V_o$. 10
7. Define prime ideal of a ring. Also prove that an ideal P of a commutative ring R is a prime ideal of R iff $\frac{R}{P}$ is an integral domain. 10
8. i) If A and B are two ideals of a ring R, then prove that A+B is an ideal containing both A and B. Also show that A+B=<A∪B>.
   ii) If A is an ideal of a ring R with unity such that 1∈A. Then show that A=R.
9. i) Prove that a finite commutative ring without zero divisors is a field.
   ii) Prove that every ideal is a subring. Is the converse true? Justify.
10. i) Let S be a subset of a vector space V. Prove that the linear span L(S) of S is the smallest subspace of V containing S.
    ii) Is the transformation $T: R \to R^3$ defined by T(x)=(x, x^2, x^3) linear.
    iii) Show that in a vector space V(F),
       a) $\alpha v_1 = \alpha v_2 \Rightarrow v_1 = v_2$ (α≠0)
       b) $\alpha v = 0, \alpha \neq 0 \Rightarrow v = 0$.

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JUNE - 2023

Name of Programme	:	**B.A/B.Sc. Mathematics (Honours)**
Semester	:	**4th**
Paper Type	:	**Core-X (Theory)**
Paper Code	:	**CMA-210**
Paper Title	:	**Numerical Method**

Full Marks : 50
Pass Marks : 20
Duration: 2 Hours

The figures in the margin indicate full marks for the questions.

Answer only 5 (five) from the following questions:

1. If f(x) is a polynomial of degree n in x then prove that $\Delta^n f(x)$ = Constants and $\Delta^{n+1} f(x) = 0$. Also find the relation between operator E of finite differences and differential operator D of Differential Calculus. 10

2. If l_x represent the number of persons living at ages x in a life table, find an accuracy as the data will permit the value of l_{47}. Given that $l_{20}=512$, $l_{30}=439$, $l_{40}=346$, $l_{50}=243$. 10

3. Establish Newton's divided difference formula for unequal interval. 10

4. From the following data find the value of x for which f(x) is minimum and find minimum f(x): 10

x	0.60	0.65	0.70	0.75
f(x)	0.6221	0.6155	0.6138	0.6170

5. Deduce the formulae for Trapezoidal rule and Simpson's $\frac{1}{3}rd$ rule from the general quadrature formula for equal interval. 10

6. Using Euler's method, find y(0.5) for the differential equation $\frac{dy}{dx}=y^2-x^2$ with y=1 when x=0. 10

7. Find a root of equation $x^3-x-1=0$ by using false position method for the root lying between1 and 2. 10

8. Find the cube root of 17 correct to four decimal places by Newton's method. 10

9. Solve the following system of equations by LU Decomposition method. 10

$$2x + 3y + z = 9$$
$$x + 2y + 3z = 6$$
$$3x + y + 2z = 8$$

10. Find the solution of the system of equations by Gauss – Seidel method 10

$$83x + 11y - 4z = 95$$
$$7x + 52y + 13z = 104$$
$$3x + 8y + 29z = 71$$

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