2023-24

B. TECH. (ODD SEMESTER) EXAMINATION
COMPUTER ENGINEERING & ARTIFICIAL INTELLIGENCE
HIGHER MATHEMATICS
AMS2610

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No	Question	CO	M.M.
1(a)	Show that the function $f(z) = \frac{x^3(1+i)-y^3(1-i)}{x^2+y^2}, z \neq 0$ and $f(0) = 0$ satisfies the Cauchy-Riemann equations at $z = 0$ but $f'(0)$ does not exist.	(CO1)	[05]
	OR		
1(a')	If ϕ and ψ are functions of x and y satisfying Laplace's equation, show that $s + it$ is analytic, where $s = \frac{\partial \phi}{\partial y} - \frac{\partial \psi}{\partial x}$ and $t = \frac{\partial \phi}{\partial x} + \frac{\partial \psi}{\partial y}$		
1(b)	Evaluate the integral $I = \oint_C \frac{e^z}{z^2(z+1)^3} dz$, where C is the circle $\|z\| = 2$.	(CO1)	[05]
1(c)	If $f(z) = u + iv$ is an analytic function of z and $u - v = \frac{\cos x + \sin x - e^{-y}}{2\cos x - 2\cosh y}$, prove that $f(z) = \frac{1}{2}\left[1 - \cot\frac{z}{2}\right]$, when $f\left(\frac{\pi}{2}\right) = 0$.	(CO1)	[05]
2(a)	If C is a closed contour around origin, prove that $\left(\frac{a^n}{n!}\right)^2 = \frac{1}{2\pi i}\int_C \frac{a^n e^{az}}{n!\, z^{n+1}} dz$. Hence evaluate $\sum_{n=0}^{\infty}\left(\frac{a^n}{n!}\right)^2 = \frac{1}{2\pi}\int_0^{2\pi} e^{2a\cos\theta}\, d\theta$.	(CO2)	[05]
2(b)	Using Residue theorem, evaluate $I = \oint_C \frac{e^z - 1}{z(z-1)(z-i)^2} dz$, where C is the circle $\|z\|=2$.	(CO2)	[05]
2(c)	Using contour integration, evaluate $\int_0^{\pi} \frac{\cos 2\theta}{1 - 2a\cos\theta + a^2} d\theta$, $\|a\| < 1$.	(CO2)	[05]

contd...2.

OR

2(c') Using contour integration, evaluate $\int_0^{\infty} \frac{cos3x}{(x^2+1)(x^2+4)} dx$ (CO2) [05]

3(a)

(i) Prove that $div(gradr^n) = \nabla^2(r^n)=n(n+1)r^{n-2}$, where $\vec{r}=x\hat{\imath}+ y\hat{\jmath}+z\hat{k}$. Hence show that $\nabla^2(\frac{1}{r})=0$. (CO3) [07]

(ii) Find the value of n for which the vector $r^n\vec{r}$ is solenoidal, where $\vec{r}=x\hat{\imath}+y\hat{\jmath}+z\hat{k}$

OR

3(a')

(i) If r is the distance of a point from the origin, prove that

$$curl\left(\hat{k} \times grad\ \frac{1}{r}\right) + grad\left(\hat{k} \cdot grad\ \frac{1}{r}\right) = \vec{0}$$

where $\hat{k}$ is the unit vector in the direction of OZ.

(ii) If f and g are two scalar point functions prove that

$$div(f\nabla g) = f\nabla^2 g + \nabla f.\nabla g$$

3(b) Prove that $\vec{F}=(y^2\cos x + z^3)\hat{\imath}+(2ysinx - 4)\hat{\jmath} +(3xz^2+2)\hat{k}$ is a conservative field. Find (i) scalar potential for $\vec{F}$ (ii) work done in moving an object in this field from $(0,1,-1)$ to $(\frac{\pi}{2},-1,2)$. (CO3) [08]

4(a) Using Gauss Divergence theorem to evaluate $\iint_S (\vec{V}.\hat{n})dS$, where $\vec{V} = x^2z\hat{\imath}\ y\hat{\jmath} - xz^2\hat{k}$ and S is the boundary of the region bounded by the paraboloid $z = x^2+y^2$ and the plane $z = 4y$. (CO4) [07]

4(b) Apply Stoke's theorem to evaluate $\int_C [(x+2y)dx + (x-z)dy + (y-z)dz]$, where C is the boundary of the triangle with vertices (2,0,0), (0,3,0) and (0,0,6) oriented in the anti-clockwise direction. (CO4) [08]

2023-2024
B. TECH. (AUTUMN SEMESTER) EXAMINATION
(COMPUTER ENGINEERING)
OBJECT ORIENTED PROGRAMING
COC-2030

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all questions.
Assume suitable data if missing.
Notations and symbols used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	Describe the key differences between object-oriented programming and procedural programming. Provide at least three points highlighting their distinctions.	(CO1)	[05]

1(b)	int main () {
	char c[ ] ="AMUCSIT2023";
	char *p=c;
	printf("%s", c + 2[p] - 5[p] - 5);
	return 0;
	}
	What is the output of the code snippet and explain the same?
		(CO2)	[04]

1(c)	Explain the difference between passing parameters by value and passing parameters by reference in C++. Provide examples to illustrate each method.	(CO2)	[06]
	OR		
1(c')	Write a function called zeroSmaller() which accepts two int arguments passed by reference and then sets the smaller of the two numbers to 0. Write a main() program to exercise this function.	(CO3) & (CO2)	[06]
2(a)	Explain the concept of operator overloading in C++. Provide a detailed example by creating a class of your own choice. In this class, overload both pre-decrement (--) and post-increment (++) operators. Include the class definition, the overloaded operators, and demonstrate the usage of these operators in a C++ program.	(CO4)	[04]

contd...2.

2(b)	Explain the concept of a friend function in C++. How can a friend function access private members of a class?	(CO3)	[05]
2(c)	Define what is constructor and destructor in C++ and explain its role in a class. Provide an example class with a default constructor and a parameterized constructor.	(CO3)	[06]
	OR		

2(c')	class Base{
	public:
	Base() { cout << "Constructor of Base\n"; }
	virtual ~Base(){cout << "Destructor of Base" << endl;}
	};
	class Derived : public Base{
	public:
	Derived() { cout << "Constructor of Derived\n"; }
	~Derived(){cout << "Destructor of Derived" << endl;}
	};
	void fun(){
	Base *p = new Derived();
	delete p;
	}
	int main(){
	fun();
	}
	Explain the code with output?
		(CO4)
		&
		(CO3)
			[06]

3(a)	Create a C++ program that defines a function called calculateRectangleArea to calculate the area of a rectangle. The function should take the length and width as parameters, with the width as a constant parameter. In the main function, take user input, call the calculateRectangleArea function, and display the result.	(CO4)	[07]
3(b)	Create a C++ program that demonstrates the use of multiple inheritance. Define three classes: A, B, and C. Class A and B both have a method named display(). Class C is derived from both A and B. Show how the diamond problem is resolved in this scenario.	(CO4)	[08]
	OR		
3(b')	Define the term "generic programming" in C++. How does it differ from traditional programming paradigms, and what advantages does it offer? Provide a simple example to illustrate the concept of generic programming.	(CO2)	[08]
4(a)	Explain final, finally and finalize in java.	(CO2)	[04]
4(b)	Explain the concept of "Write Once, Run Anywhere" in the context of Java and the JVM. How does the JVM contribute to platform independence?	(CO2)	[07]
	OR		
4(b')	Describe the architecture of the Java Virtual Machine. Highlight the main components and their roles in the execution of Java programs.	(CO2)	[07]
4(c)	Explain the concept of the event delegation model in Java.	(CO3)	[04]

2023-24

B.TECH. (AUTUMN SEMESTER) EXAMINATION

COMPUTER ENGINEERING/ARTIFICIAL INTELLIGENCE

DATA STRUCTURE AND ALGORITHM

COC2060/AIC2060

Maximum Marks: 60 **Duration: Two Hours**

Answer all the questions.
Make suitable assumptions wherever required. Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	Differentiate between 'little' and 'Big' notations used for asymptotic complexity with a suitable example. Explain why the following is true or false? (i) $n\log n = o(n\log n + n^2)$ (ii) $\log n = \Omega(\log\log n)$ (iii) $n^2 = O(n^2 + n^2\log n)$	CO5	[7]
1(b)	What are the advantages and disadvantages of Doubly Linked List? Write algorithms for insertion and deletion operations in doubly linked list.	CO1	[8]
	OR		
1(b')	What are the advantages of Linked list over the arrays? Write an algorithm to multiply two integers, which are stored in linked lists. Each digit of integer is stored in a separate linked list node from right to left.	CO1	[8]
2(a)	Differentiate between primary and secondary clustering in Hashing. What are the solutions to these clustering problems? What is the expected number of probes required for successful and unsuccessful search in Chaining and Linear Probing.	CO3	[7]
2(b)	Sort the following list using Merge sort algorithm: 12,11,10,15,20,30,25,27,35,9,34,17 Show all the intermediate steps. Design an algorithm that finds the surpasser count for each element of an array in O(nlogn) complexity. Surpasser count of an element is the total number of elements to its right, which are greater than it.	CO4	[8]
	OR		
2(b')	Sort the following list using Quick sort and Radix sort. 245, 163, 207, 309, 243, 341, 273 Show all the intermediate steps in both algorithms. Also compare both algorithms with respect to number of comparisons and interchange operations.	CO4	[8]
3(a)	What is a double ended queue? Write the algorithms for the insertion and deletion operations for double ended queue.	CO2	[7]
3(b)	Explain how a heap is used for the implementation for the Queue. Build a maxheap for the following numbers:	CO3	[8]

Contd.....2.

23, 47, 21, 12, 89, 56, 33, 67, 43, 88, 65, 27, 55

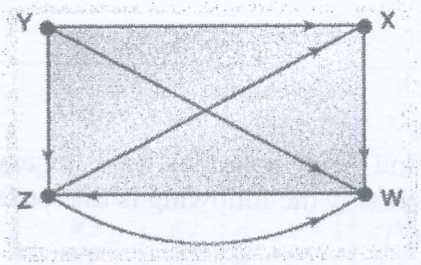
OR

3(b') Consider the following algebraic expression in prefix notations: CO3 [8]

* + a – b c / - d e + f – g h

Convert the above expression into equivalent postfix expression. Show the content of stack used for this conversion.

4(a) Find the number of paths of length 3 from node y to node w using Warshall's algorithm in the following graph. Also traverse the following graph using DFS and BFS starting with node z. CO5 [7]



4(b) Insert the following numbers in an empty balanced binary search tree. CO4 [8]

20, 25, 33, 15, 10, 7, 3

Show the tree after each insertion. Identify the type of rotations at each step if required.

OR

4(b') Consider the following list of 07 numbers: CO4 [8]

15, 10, 13, 19, 17, 23, 20

i. Build an in-threaded binary search tree T using the above numbers. Show the tree after every insertion.

ii. What will be the modified tree after 17 is deleted from the tree.

(PAPER CODE:6543/6536)

2023-24

B.TECH. (AUTUMN SEMESTER) EXAMINATION

COMPUTER ENGINEERING/ARTIFICAL INTELLIGENCE

DIGITAL LOGIC AND SYSTEM DESIGN

COC2070/AIC2070

Maximum Marks: 60 **Credits: 04** **Duration: Two Hours**

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.	Question	CO	M.M.
1(a)	State and Explain with the help of suitable examples the Duality Principle.	CO1	[5]
1(b)	Realize in NAND-AND form the function $F(w,x,y,z) = \Sigma(1,2,4,7,8,9,11,14)$	CO1	[10]
	OR		
1'(a)	Discuss the differences between the Boolean Algebra and the Ordinary Algebra.	CO1	[5]
1'(b)	Subtract $(63405.502)_7$ from $(9207.43)_A$ using r's complement method, where $r = 9$.	CO1	[10]
2(a)	Explain how a decoder may be converted to a demultiplexer.	CO2	[5]
2(b)	Realize the function $F(w,x,y,z) = \pi(0,3,5,6,9,10,12,14,15)$ using a Multiplexer.	CO2	[10]
	OR		
2'(a)	Design a 4 × 16 decoder using 3 × 8 decoders.	CO2	[5]
2'(b)	Design a BCD to Excess-3 Code Converter using PLA.	CO2	[10]
3(a)	Design and explain the Clocked Master-Slave J-K Flip Flop using NAND gates.	CO3	[5]
3(b)	Design and explain the sequential circuit with the following functionality:	CO3	[10]

contd ....2.

Clear	CP	Load	Count	Function
0	X	X	X	Clear to Zero
1	X	0	0	No change
1	↑	1	X	Load inputs
1	↑	0	1	Count Next Binary State

4(a) In the following table, how one of the transfers does C←0 and the other one does C←1: CO4 [7]

Binary code	Function of selection variables					
	A	*B*	*D*	*F* with $C_{in} = 0$	*F* with $C_{in} = 1$	*H*
0 0 0	Input data	Input data	None	$A, C \leftarrow 0$	$A + 1$	No shift
0 0 1	*R1*	*R1*	*R1*	$A + B$	$A + B + 1$	Shift-right, $I_R = 0$
0 1 0	*R2*	*R2*	*R2*	$A - B - 1$	$A - B$	Shift-left, $I_L = 0$
0 1 1	*R3*	*R3*	*R3*	$A - 1$	$A, C \leftarrow 1$	0's to output bus
1 0 0	*R4*	*R4*	*R4*	$A \vee B$	—	—
1 0 1	*R5*	*R5*	*R5*	$A \oplus B$	—	Circulate-right with *C*
1 1 0	*R6*	*R6*	*R6*	$A \wedge B$	—	Circulate-left with *C*
1 1 1	*R7*	*R7*	*R7*	$\overline{A}$	—	—

4(b) For the table given in Question 4(a) above, find out the control words for the following Operations. Also, specify the functions being carried out by each of these Operations. CO4 [8]

(i) R4←clc(R5+R4+1)

(ii) R2-Input

(iii) Output← shr(R1-(R5+1))

(iv) R3←Input

(v) R6← $\overline{R4}+1$

(vi) R3←R3+ $\overline{R4}+1$

(vii) R7←0

(viii) R5←R5, C←0
