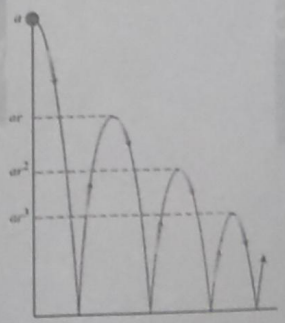
INDIAN INSTITUTE OF INFORMATION TECHNOLOGY UNA
HIMACHAL PRADESH
An institute of National Importance under MoE
Saloh, Una - 177 209

Website: www.iiitu.ac.in

AY 2023-24
School of Computing
Curriculum: IIITUGIT22
Cycle Test - II
November 20, 2023

Degree	B.Tech.
Branch	IT
Semester	I
Subject code/name	MAC131/Engineering Mathematics
Time	60 minutes
Maximum Marks	20

Answer all the questions.

Q.No.	Questions	Marks
1(a)	State if the following statement is true/false with reasoning: $Q = x_1x_2x_3$ is a positive definite quadratic form.	1
1(b)	Find the value of k so that the quadratic form given below is positive definite: $$k(x_1^2 + x_2^2 + x_3^2) + 2x_1x_2 - 2x_2x_3 + 2x_3x_1.$$	2
1(c)	Determine the nature, rank, index and signature of the quadratic form $Q = 6x_1^2 + 3x_2^2 + 3x_3^2 - 4x_1x_2 - 2x_2x_3 + 4x_3x_1$.	2
2(a)	Consider the Figure 1 below. Use the knowledge of infinite series to calculate the total vertical distance traveled by the bouncing ball.  Figure 1: A ball initially at a and height of each rebound reduces by a factor 'r'.	1

2(b)	Determine if the series: $$x+\frac{2^2x^2}{2!}+\frac{3^3x^3}{3!}+\frac{4^4x^4}{4!}+\cdots$$ is convergent/divergent at $x=\frac{1}{e}$.	2
2(c)	Investigate the convergence or divergence of the series $\sum_{n=1}^{\infty}\left(\frac{\sqrt[n]{n}}{n^2}\right)$.	2
3(a)	Show that, if the series $\sum_{n=1}^{\infty}u_n$ is absolutely convergent, then it is convergent.	1
3(b)	Determine if the series below is convergent or divergent: $$4-1+\frac{1}{4}-\frac{1}{16}+\cdots$$	2
3(c)	Examine if the series $\sum_{n=1}^{\infty}(-1)^{n+1}\frac{1}{(n+3\sqrt{n})^3}$ is absolutely or conditionally convergent.	2
4(a)	Is the series $\sum_{n=1}^{\infty}n!x^n$, a power series? If yes, then what is the centre?	1
4(b)	Calculate the interval and radius of convergence of the power series $\sum_{n=1}^{\infty}\frac{(x-2)^n}{n}$.	2
4(c)	Examine the convergence or divergence of the series $\frac{1}{3}+\frac{1}{10}+\frac{1}{29}+\cdots$	2

******* All the best*******

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AY 2023-24

School of Basic Sciences

CURRICULUM: IIITUGIT22

Cycle Test – II

20, Nov.' 2023

Degree	B. Tech.	**Branch**	Information Technology
Semester	First		
Subject Code & Name	PHC132: Engineering Physics		
Time: 60 Minutes	**Answer All Questions**	**Maximum: 20 Marks**	

Sl. No.	Question	Marks
1.a	What is the relation between the probability density and the probability current density?	1
1.b	Make use of properties of the wave function to find the good wave function from the functions given below: i) $\tan(\pi/4)\, e^{ikx}$, ii) $\tan(x)\, e^{ikx}$.	2
1.c	Make use of an infinitely deep potential well, and show that the total energy of a particle confined in it, is the ground state energy times 'sum of square of natural numbers'.	2
2.a	What is the degeneracy of quantum state?	1
2.b	Consider a system whose state is given in terms of an orthonormal set of three vectors: $\|\phi_1\rangle, \|\phi_2\rangle, \|\phi_3\rangle$ as $$\|\psi\rangle = \frac{\sqrt{5}}{6}\|\phi_1\rangle + \frac{\sqrt{6}}{6}\|\phi_2\rangle + \frac{5}{6}\|\phi_3\rangle.$$ Calculate the probability of finding the system in any one of the states $\|\phi_1\rangle, \|\phi_2\rangle, and\ \|\phi_3\rangle$.	2
2.c	Make use of Fermi-Dirac distribution, and show that the energy states above the Fermi level are empty at absolute zero.	2

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School of Basic Sciences
CURRICULUM: IIITUGIT22
Cycle Test – II
21, Nov.'23

Degree	B. Tech.	**Branch**	IT
Semester	I		
Subject Code & Name	BIC103: Introduction to Biotechnology		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

S. No.	Question	Marks
1.a	Calculate the number of peptide bonds present in a hemoglobin molecule made up of four polypeptide chains, two alpha chains of 141 amino acid residues each and two beta chains of 146 amino acid residues each.	(1)
1.b	Draw the separation pattern of three proteins of size 50 kDa, 100 kDa, 200 kDa using the size exclusion chromatography.	(2)
1.c	Calculate the specific activity, and yield (%) of a target protein for each step from the given purification data as follows:	(1+1=2)

Purification step	Total Protein (mg)	Total Activity (U)	Specific Activity	Yield %
A	2500	150000		
B	500	75000		

2.a	Contrast the process of lactic acid, and ethanol fermentations.	(1)
2.b	Demonstrate the working of Gram staining technique employed for the separation of bacteria.	(2)
2.c	Illustrate the process of protein separation of three positively charged proteins A^{+7}, A^{+5}, A^{+2} using ion exchange chromatography.	(2)
3.a	Interpret the structure of normal human cells when exposed to the isotonic, and hypertonic solutions.	(1)
3.b	Demonstrate the working principle of four types of vaccines production with suitable examples.	(1+1=2)
3.c	Calculate the isoelectric point (pI) of an amino acid lysine if the data of pK_1, pK_2, and pK_R are 2.18, 8.95, and 10.53, respectively. Interpret the significance of the obtained pI data pertaining to protein structure.	(1+1=2)

4.a Which separation technique can be employed to separate out the tryptophan, a hydrophobic amino acid, from the mixture of three polar amino acids namely serine, threonine, cysteine? (1)

4.b Determine the cleavage pattern of amino acid residues after the treatments of cyanogen bromide and chymotrypsin to the purified target protein as follows: Gly-Ala-Met-Val-Val-Ala-Try-Pro-Gly-Lys-Phe-Val-Met-Val-Arg-Val-Phe-Met-Ala-Gly-Lys-Phe-Gly-Tyr-Ser-Lys-Pro. (1+1=2)

4.c Demonstrate the working mechanism of the lux gene present in the bioluminescent marine bacteria. How is it being exploited in biotechnological applications? (1+1=2)

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Degree	B. Tech.	**Branch**	IT
Semester	I		
Subject Code & Name	ITC104 / Basics of Programming in C		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

S. N.	Question	Marks
1.a	Define multi-dimensional array.	(1)
1.b	Write a C program to find transpose of a matrix.	(2)
1.c	What is the difference between call by value and call by reference, and which one should be used? Explain with a suitable example.	(2)
2.a	Write down two uses of break statement?	(1)
2.b	What are the advantages and disadvantages of using a switch statement over an if-else statement, and vice versa?	(2)
2.c	Define nested loop. Write a C program to print all prime numbers between 1 and 100 using nesting of loops.	(2)
3.a	How user defined functions are different from library functions?	(1)
3.b	Write a function called reverse_number() that takes an integer as input and returns the reverse of that integer.	(2)
3.c	Explain the following: i) Format specifier ii) Types of Comments in C iii) Pointer to a pointer iv) Reusability	(2)
4.a	What is the difference between actual arguments and formal arguments?	(1)
4.b	Define Recursion. Write a C program to print n^{th} term of Fibonacci series using recursion.	(2)
4.c	What are advantages and disadvantages of recursion over iteration.	(2)

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22, Nov. '23

Degree	B. Tech.	**Branch**	IT
Semester	I		
Subject Code & Name	ENC135: Communication Skills		
Time: 60 Minutes	**Answer All Questions**		**Maximum: 20 Marks**

S. No.	Question	Marks
1.a	Explain the difference between 'Semantics' and 'Pragmatics' with suitable examples. (Word limit: 50-80)	1
1.b	Explain 'Nativist Theory' by Noam Chomsky with at least one example? (Word limit: 100-120)	2
1.c	Explain at least two advantages and two disadvantages of diagonal communication. (Word limit: 100-120)	2
2.a	Interaction makes you a better communicator. Explain. (Word limit: 50-80)	1
2.b	What is the difference between visual and non-verbal communication? (Word Limit: 100-120)	2
2.c	What are the different types of listening? Define each type with at least one example. (Word Limit: 100-120)	2
3.a	What is the importance of 'decoding' in communication?	1

3.b	Paralinguistics plays an important role in speaking. Explain this statement considering pitch, volume, tone and accent as significant vocal qualifiers.	2
3.c	Write down one-word substitution for the following words: 1. The study of languages 2. One who has delusion of one's grandeur 3. A speech or writing praising someone 4. An embarrassing mistake	2
4.a	How does 'fear from superiors' become a barrier in organizational communication? (Word Limit: 50-80)	1
4.b	Explain with an example the difference between drafting, editing, and proofreading. (Word limit: 100-120)	2
4.c	Write down at least two synonyms for the following words: 1. Repugnant 3. Aspersion 2. Conspicuous 4. Obdurate	2