AY 2022-23
School of Electronics
Curriculum: IIITUGECE22
Cycle Test - II
July 17, 2023

Degree	B.Tech
Branch	ECE
Semester	II
Subject code/name	MAC221/ Mathematics-II
Time	60 minutes
Maximum Marks	20

Answer all the questions.

Q. No	Questions	Marks
1(a)	State the convolution theorem of the Laplace transform.	1
1(b)	Construct the Laplace transform of the solution of the following boundary value problem: $$y'' + y = \int_0^t \sin \tau \; y(t - \tau)d\tau \text{ with } y(0) = 1, y'(0) = 0.$$	2
1(c)	Compute the inverse Laplace transform of the function given below: $$H(s) = \log\left(\frac{s + 6}{s + 5}\right).$$	2
2(a)	State the Parseval's Identity.	1
2(b)	Find the Fourier series of the function given below: $$f(x) = \begin{cases} -\pi, & -\pi < x < 0, \\ x, & 0 < x < \pi \end{cases}.$$	2
2(c)	Using the Fourier series obtained in Q.No. 2(b) deduce that: $$\frac{\pi^2}{8} = \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots.$$ (Give reasoning for the answer.)	2

3(a)	Consider the function $f(x) = \dfrac{\pi^2}{12} - \dfrac{x^2}{4}$ in the interval $[-\pi, \pi]$. Is $f(x)$ an even function?	1
3(b)	Find the Fourier series for the function $f(x)$ stated in Q.No. 3(a).	2
3(c)	Find the half range cosine series for $f(x) = \sin x$ in the interval $(0, \pi)$.	2
4(a)	Define the Fourier cosine transform for the derivative of the function $f(x)$.	1
4(b)	Find the Fourier transform of the function given below: $$f(x) = \begin{cases} a - |x|, & |x| \le a \\ 0, & |x| > a. \end{cases}$$	2
4(c)	Using the Fourier transform obtained in Q.No. 4(b) deduce that: $$\int_0^\infty \frac{\sin^2 x}{x^2} dx = \frac{\pi}{2}.$$	2

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AY 2022-23
SCHOOL OF ELECTRONICS
CURRICULUM: IIITUGECE22
Cycle Test – II
17, July '23

Degree	B. Tech.	Branch	ECE
Semester	Second		
Subject Code & Name	CYC222: Engineering Chemistry		
Time: 60 Minutes	Answer All Questions		Maximum: 20 Marks

Marks

Sl. No.	Questions	

1.a What are the functions of fillers and plasticizers in the plastic industry? Briefly outline the applications of plastics in engineering and industry. **(1)**

1.b A carbon sample of 2.65 g in the form of graphite was tested in the laboratory for its calorific value in the bomb calorimeter. The following data were obtained: weight of water taken = 500 g, water equivalent of bomb and calorimeter = 2300 g, rise in temperature = 0.15 °C, cooling correction = 0.02 °C, fuse wire correction = 100 cal, and acid correction = 50 cal. Calculate the net calorific value of the coal in cal/g. (Assume the latent heat of condensation of steam as 580 cal/g). **(2)**

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1.c A coal sample was found to contain: C = 66.2%, H = 4.2%, O = 6.1%, N = 1.4%, S = 2.9%, moisture = 9.7%, and ash = 9.5% by weight. Calculate the volume of air required for combustion, if 2 kg of coal is burnt with 25% excess air. **(2)**

2.a How to analytically determine the masses of CO_2 and H_2O produced during combustion of a fuel sample? **(1)**

2.b Explain the role of bottom-up and top-down approaches in nanotechnology. **(2)**

2.c 2.3 g of air-dried coal sample was taken in a silica crucible. After heating it in an electric oven at 105-110 °C for 1 hour, the residue weighed 2.2 g. The residue was then ignited at 700-750 °C to a constant weight of 0.245 g. Calculate the percentage of moisture and ash in the given coal sample. **(2)**

3.a Define octane number and cetane number? What are the structural features of hydrocarbons that promote its high value? **(1)**

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3.b   Calculate the gross and net calorific value (Kcal/Kg) of the bitumen fuel having   (2)
       the following composition: C = 85%, H = 5%, S = 2%, N = 4%, Si = 1%, ash =
       3%, and latent heat of steam = 587 cal/g.

3.c   In a Bomb calorimeter, 0.25 g of peat sample was taken for the determination of   (2)
       the calorific value. The residue formed in the calorimeter was extracted with acid.
       The acidic extract was treated with $BaCl_2$ solution and the precipitate of barium
       sulphate was obtained. The precipitate was filtered, dried and weighed. The
       weight of the precipitate was 0.10 mg. Calculate the percentage of Sulphur in the
       sample.

4.a   Illustrate the differences between single walled and multi walled carbon   (1)
       nanotubes.

4.b   The percentage analysis by volume of producer gas is: (2)
       H_2 = 19.4, CO = 20.5, N_2 = 50.1 CH_4 = 4.2 and CO_2 = 6.0
       Calculate percentage of dry product obtained, if 30% excess air is supplied for
       complete combustion.

4.c   Describe, with a diagram, the process of injection moulding. How does it differ   (2)
       from extrusion moulding?

Good Luck

AY 2022-23
School of Computing
CURRICULUM: IIITUGECE22
Cycle Test – II
18, July'23
(09:00 AM – 10:00 AM)

Degree	B. Tech.	Branch	ECE
Semester	II		
Subject Code & Name	CSC 204: Basics of Programming in C		
Time: 60 Minutes	Answer All Questions	Maximum: 20 Marks	

Sl. No.	Question	Marks
1.a	What is a NULL pointer?	(1)
1.b	What is the meaning of the following declarations? 　i.　int const a; 　ii.　const int *a; 　iii.　int * const a; 　iv.　int const * a const;	(2)
1.c	Write a C program to copy one array to another using pointers.	(2)

2.a	Fill the question mark to get "10" as an output.
	　#include<stdio.h>
	　int main()
	　{
	　int i = 10,*ptr;
	　ptr= &i;
	　void *vptr;
	　vptr = &ptr;
	　printf("\nValue of iptr = %d ", ?);
	　return 0;
	　}
		(1)

2.b	What is the difference between arrays and pointers? Is the memory access in pointer faster than the array? Explain the answer.	(2)
2.c	Write a C program to find the maximum element of an array.	(2)
3.a	Can the array be accessed using a pointer in C language?	(1)
3.b	Write a function to reverse the elements of an array using recursion.	(2)
3.c	What is function? Explain different classification of user defined functions based on parameter passing and return type with examples.	(2)

4.a	Does C language support object-oriented approach?	(1)
4.b	Explain different categories of pre-processor directives used in C.	(2)
4.c	Describe any four string manipulation library functions with syntax.	(2)

rite a program in C to displ
1/3 + 1/4 + 1/5 ... 1/n
rite a short note on
i. getch( )
ii. getche
iii. putc
iv. p
v.
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AY 2022-23
School of Basic Sciences
CURRICULUM: IIITUGECE22
Cycle Test – II
18, Jul.'23

Degree	B. Tech.	Branch	ECE
Semester	II		
Subject Code & Name	BIC203: Introduction to Biotechnology		
Time: 60 Minutes	Answer All Questions		Maximum: 20 Marks

Sl. No.	Question	Marks

1.a How much energy can be produced from a lactic acid fermentation? (1)

1.b Calculate the Isoelectric point (pI) of an amino acid namely histidine if the values of pK_1, pK_2 and pK_R are 1.82, 6.00, and 9.17 respectively. What information can be deducted from the calculated pI value of histidine? (2)

1.c Calculate the specific activity, fold purification, and yield% of the following protein purification process: (2)

Purification Step	Total Protein (mg)	Enzyme Activity (units)	Specific activity	Yield %	Fold Purification
A	5000	175000			
B	1000	125000			

2.a Which chromatography technique can be used to separate out the specific hydrophobic amino acid, phenylalanine, from the mixture of three polar (hydrophilic) amino acids namely serine, threonine, cysteine? (1)

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

2.c Demonstrate the working of protoplast fusion technique with an example of a commercial product. (2)

3.a Calculate the number of peptide bonds present in a tissue plasminogen activator protein that is composed of 527 amino acids. (1)

3.b Construct a flow chart elucidating the steps in identification of 16S ribosomal RNA of a newly discovered microorganism. (2)

3 c. Briefly explain the working mechanism of bioluminescent marine bacteria. How is it being exploited in other biotechnological applications?

4 a   Draw the separation pattern of three different protein molecules of sizes 7 kDa, 15 kDa, and 30 kDa in the size exclusion chromatography.   (1)

4 b   Illustrate the production and separation process of insulin protein at the industry setting.   (2)

c   Demonstrate the working principle of four types of vaccines production with suitable examples.   (2)
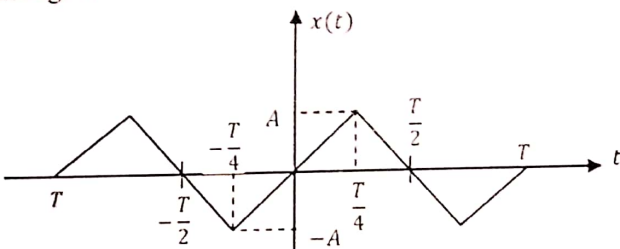
****GOOD LUCK*****

AY 2022-23

School of Electronics

CURRICULUM: IIITUECE22

Cycle Test – II

19, July'23

Degree	B. Tech.	Branch	ECE
Semester	II		
Subject Code & Name	ECC205: Signals and Systems		
Time: 60 Minutes	Answer All Questions		Maximum: 20 Marks

Sl. No.	Question	Marks
1.a	The Fourier Series expansion of a real periodic signal with fundamental frequency f_0 is given by: $$x(t) = \sum_{n=-\infty}^{\infty} c_n e^{j2\pi n f_0 t}$$ If the value of $c_5 = 8 + j7$, then find the value of c_{-5}.	(1)
1.b	Find the value of exponential Fourier Series Coefficient for the signal $x(t)$ shown in Fig. 1. Fig. 1: Signal for Problem 1.b	(2)
1.c	A periodic signal $x(t)$ of period T_0 is given by: $$x(t) = \begin{cases} 1, & |t| < T_1 \\ 0, & T_1 < |t| < \dfrac{T_0}{2} \end{cases}$$ Calculate the DC component of $x(t)$.	(2)
2.a	Let $x(t)$ be the input to a Linear time-invariant system. The required output is $4x(t-2)$. Find the value of transfer function.	(1)
2.b	Find the Fourier Transform for a signal $g(t) = e^{-10|t|} \sin 100t$.	(2)
2.c	Derive the formula for power spectral density with proper example.	(2)

3.a	The Fourier Transform of $f(t)$ is $F(\omega)$. Find the inverse Fourier transform of $F(8\omega + 3)$.	(1)
3.b	Discuss the properties of cross-correlation for power signals mathematically with their significance.	(2)
3.c	Verify the Parseval's theorem for $x(t) = 2\ rect\ (t/4)$.	(2)
4.a	Let $x(t) = \cos(10\pi t) + \cos(30\pi t)$ be sampled at 20Hz and reconstructed using an ideal low-pass filter with cut-off frequency 20Hz. Find the value of frequencies present in the reconstructed signal.	(1)
4.b	Find the Nyquist rate for the continuous-time signal given below: $$x(t) = \frac{\sin(4 \times 10^3 \pi t)}{\pi t}$$	(2)
4.c	State and prove the sampling theorem in time and Frequency domain.	(2)