



**AY 2021-22**  
**SCHOOL OF ELECTRONICS**  
**CURRICULUM: IIITUGECE20**

**End Semester Exam**

23-08-2022

Degree	B. Tech.	Branch	ECE
Semester	Second		
Subject Code & Name	CYC222: Engineering Chemistry		
Time: 180 Minutes	Answer All Questions		Maximum: 100 Marks

Sl.No.	Question	Marks
1.a	What are the disadvantages of using hard water in daily life? A standard hard water contains 15 g of $\text{CaCO}_3$ per litre. 20 ml of this solution required 25 ml of EDTA solution, 100 ml of sample water required 18 ml of EDTA solution. The sample after boiling required 12 ml EDTA solution. Calculate the temporary hardness of the given sample of water.	(5)
1.b	What is boiler feed water? What are the consequences of the presence of excess impurities in boiler feed water? Suggest some methods to remove such boiler problems.	(5)
1.c	What are ion-exchange resins? How are they classified? Explain the process of regeneration of these ion exchange resins once they get exhausted.	(5)
1.d	The analysis of raw water and treated water are as follows: <b>Analysis of raw water:</b> $\text{Ca}^{2+} = 300 \text{ ppm}$ ; $\text{Mg}^{2+} = 150 \text{ ppm}$ ; $\text{HCO}_3^- = 24 \text{ ppm}$ ; $\text{CO}_2 = 60 \text{ ppm}$ . <b>Analysis of treated water:</b> $\text{OH}^- = 65 \text{ ppm}$ ; $\text{CO}_3^{2-} = 40 \text{ ppm}$ . Calculate the amount of the Lime (80% pure) and Soda (90% pure) required to soften one million litres of water using $\text{NaAlO}_2$ as coagulant at the rate of 41 mg/litre.	(5)
2.a	Explain the detailed mechanism of free radical addition polymerization of ethylene molecule.	(5)
2.b	What are conducting polymers? Explain the conductivity mechanism of polyaniline.	(5)
2.c	Consider a polystyrene sample with distribution of molecular weights as reported in Table 1. Calculate the number average molecular weight ( $M_n$ ), the weight average molecular weight ( $M_w$ ), the polydispersity index (PDI) and degree of polymerization (DP) of the sample.	(5)

Table.1 Molecular weight distribution of polystyrene sample

M range (g/mol)	Ni
0-10000	5500
10000-20000	4000
20000-30000	6700
30000-40000	1700

Outline the mechanism of acid catalyzed reaction to produce phenol-formaldehyde resin when phenol is in excess (Fig.1).

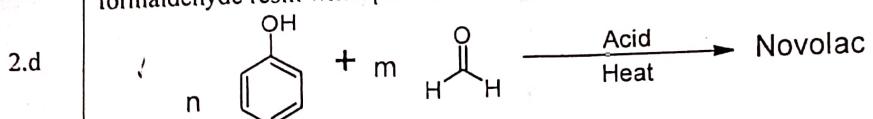


Fig.1 Chemical reaction for 2.d

3.a The coal has the following analysis: C = 54%; H = 6.5%; O = 3%; N = 1.8%, moisture = 17.3 and remaining is ash. This coal sample on combustion with excess air gave 21.5 Kg of dry flue gases per Kg of coal burnt. Calculate the percentage of excess air used for combustion.

3.b What is the ultimate analysis of coal? Explain the various methods to estimate the percentage of carbon, hydrogen and sulphur using ultimate analysis.

3.c The percentage composition of the sample of coal by weight was found to be: C = 76%; H = 5.2%; O = 12.8%; N = 2.7%; S = 1.2%; the remaining is ash. Calculate the minimum weight and volume of air necessary for complete combustion of 1Kg of coal at NTP. Also. Calculate the percentage composition of dry products by weight, if 50 % excess air is supplied.

3.d What is calorific value of the fuel? Explain the theoretical method to determine calorific value of the fuel. Also, Give the various units in which calorific value is expressed.

4.a The value of force constant is the same for  $^1\text{H}^{35}\text{Cl}$  and  $^2\text{D}^{35}\text{Cl}$ . If the fundamental frequency of  $^1\text{H}^{35}\text{Cl}$  is  $2890 \text{ cm}^{-1}$ . Calculate the fundamental frequency of  $^2\text{D}^{35}\text{Cl}$ .

4.b Predict the frequency shift of the carbonyl absorption in the following aldehydes. (Fig. 2i-iii).

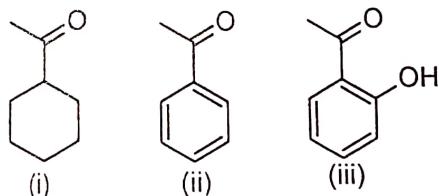
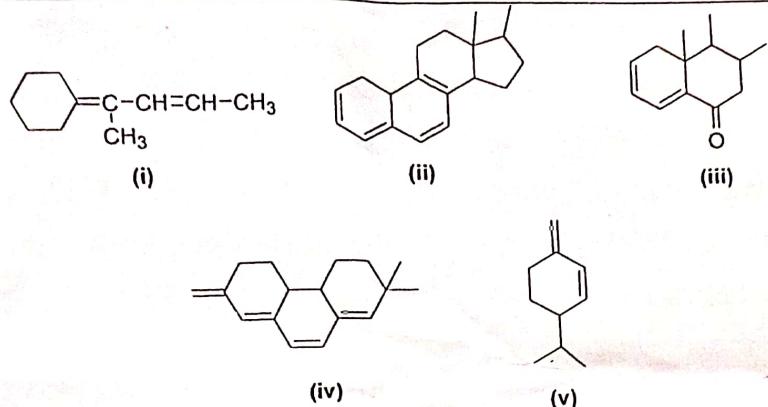


Fig.2 i-iii: Structure of compounds for 4.b

4.c What are the various types of electronic transitions? Explain the effect of polarity of solvent on each type of electronic transition.

4.d Following the Woodward-Fieser rules, calculate the absorption maximum for each of the following compounds (Fig. 3 i-v)

5 Q7



**Fig. 3 i-v: Structure of compounds for 4.d**

Fig. 3 i-v: Structure of compounds for 4.d		
5.a	After treating 10,000 L of water by ion exchanger, the cationic resin required 200 L of 0.1 N HCl and anionic resin required 200 L of 0.1 N NaOH solutions. Find the hardness of the above sample of water.	(5)
5.b	0.72 g of fuel containing 80 % carbon, when burnt in a bomb calorimeter, increased the temperature of water from 27.3°C to 29.1°C. if the calorimeter contains 250 g of water and its water equivalent is 150 g, Calculate the Higher calorific value (HCV) of the fuel.	(5)
5.c	(i) What is the distinguishing peak in IR spectra for aliphatic aldehyde and aliphatic ketone? (ii) What is the effect of ring size on carbonyl absorption for cycloketones?	(5)
5.d	Explain the principle and working of UV spectrophotometer with the help of well labelled diagram.	(5)
	****Good Luck****	

\*\*\*\*Good Luck\*\*\*\*



**INDIAN INSTITUTE OF INFORMATION TECHNOLOGY  
UNA [IIP]**

An Institute of National Importance under MoE

Saloh, Una (IIP) – 177 209

Website: [www.iiituna.ac.in](http://www.iiituna.ac.in)

21205

**AY 2021-22**

**School of Basic Sciences**

**CURRICULUM: IITUGECE20**

**End Semester Examination**

**24, Aug.'22**

<b>Degree</b>	B. Tech.	<b>Branch</b>	ECE
<b>Semester</b>	II		
<b>Subject Code &amp; Name</b>	BIC203: Introduction to Biotechnology		
<b>Time: 180 Minutes</b>	<b>Answer All Questions</b>		<b>Maximum: 100 Marks</b>

- | <b>Sl.<br/>No.</b> | <b>Question</b>   | <b>Marks</b> |
|--------------------|---|--------------|
| 1.a                | Outline a schematic diagram to show that DNA replication is a semiconservative process.   | (5)          |
| 1.b                | List the differences and similarities between the biotechnology industry and pharmaceutical industry with suitable examples. Explain why quality assurance and quality control are important for biotechnology companies?   | (5)          |
| 1.c                | Explain the preliminary observation of Griffith's Transformation Experiment in DNA discovery. How is it verified by Avery, Macleod, and McCarty experiments to conclude DNA as the genetic material?  | (5)          |
| 1.d                | Consider the following sequence of DNA:<br><br>5'-TTTATGGGTTGGCCCGGGTCATGATT- 3'<br>3'-AAATCCCAACCAGGGCCCAGTACTAA- 5'<br><br>(i). Transcribe each of these sequences into mRNA. Which DNA sequence (top or bottom strand) produces a functional mRNA containing a start codon? What is the amino acid sequence of the polypeptide produced from this mRNA?<br><br>(ii). For the DNA strand producing a functional mRNA, number each base from left to right with the first base numbered "1." Insert a "T" between bases 10 and 11, representing a base insertion mutation. Transcribe an mRNA from this new strand and translate it into a protein. Compare the amino acid sequence of this protein to the one translated in (i). Explain. | (5)          |
| 2.a                | Compare the functionality of genomic libraries and cDNA libraries. Which type of library would be the first choice to use if scientists were attempting to clone a gene in adipocyte (fat) cells that encodes a protein thought to be involved in obesity? What type of library would be chosen if scientists were interested in cloning gene regulatory elements such as promoter and enhancer sequences?  | (5)          |
| 2.b                | What features of plasmid cloning vectors make them useful for cloning DNA? Classify different types of cloning vectors and discuss their applications in biotechnology.   | (5)          |
| .c                 | Outline how whole-genome shotgun sequencing and high throughput sequencing techniques enable scientists to rapidly analyze genomes?   | (5)          |

- 2.d Provide examples of how bioinformatics can be used to analyze nucleic acid and protein sequences and structures? (5)
- 3.a Evaluate the role played by microorganisms in the development and production of vaccines; provide examples of different vaccines. (5)
- 3.b Construct the process of insulin production using recombinant DNA technology. (5)
- 3.c Elaborate the transgenic plant production using protoplast fusion, leaf fragment, and gene guns, techniques. (5)
- 3.d How do knockout and knock-in animals provide better predictions of how a drug will work in humans? (5)
- 4.a Define phytoremediation and how it can be used to clean up the environment? (5)
- 4.b Make use of different molecular techniques for detecting chromosomal abnormalities and for genetic testing. (5)
- 4.c Illustrate the process of making stem cells through Nuclear Reprogramming of Somatic Cells. (5)
- 4.d What are the stem cells? Describe how they can be isolated, and provide examples of possible therapies that may be developed from stem cells? (5)
- 5.a List the role of the U.S. Food and Drug Administration in regulating food and food additives produced using biotechnology. (5)
- 5.b Identify outcomes and pitfalls associated with different ethical approaches. (5)
- 5.c What do you mean by Gene doping test? Explain why there are unethical/ethical aspects of doping tests and discuss the consequences associated with the defaulter in the sports industry. (5)
- 5.d When drug companies find out that a drug target is not responding to their new drug, is it a legal obligation to inform other drug companies? Justify the above cited with purview of two leading approaches of ethical thought. (5)

\*\*\*\*\*GOOD LUCK\*\*\*\*\*



# INDIAN INSTITUTE OF INFORMATION TECHNOLOGY

## UNA IIIP

An Institute of National Importance under MoE  
 Saloh, Una (H.P.) – 177 209  
 Website: [www.iiipu.ac.in](http://www.iiipu.ac.in)

AY 2021-22

### School of Electronics

CURRICULUM: IITRUGCE20

END SEMESTER EXAMINATION

26, August'22

Degree	B. Tech.	Branch	ECE
Semester	II		
Subject Code & Name	EEC205: Signals and Systems		
Time: 180 Minutes	Answer All Questions	Maximum: 100 Marks	

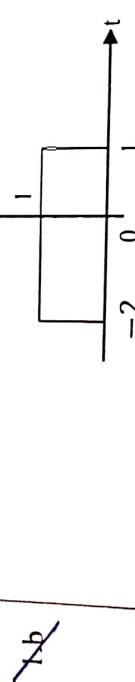
Sl. No.	Question	Marks
1.a	<p>Evaluate the value of following integral:</p> $\int_{-\infty}^{\infty} \frac{\cos(\pi(t-1))}{t^2+1} g(t) dt$ <p>where <math>g(t)</math> is impulse function placed at <math>t = -3</math> with area <math>1/7</math>.</p>	5
1.b	<p>Find the even and odd part of <math>f(t)</math> given in Figure 1 and draw it.</p>  <p><math>f(t)</math></p>	5

Figure 1: Signal for Problem 1.b

A signal  $f(t)$  is given in Figure 2. A signal  $g(t)$  is realized by multiplying  $f(t)$  with  $\delta(t+2) - \delta(t-2)$ . Is integral of  $g(t)$  energy or power signal? Find the energy or power of the signal.

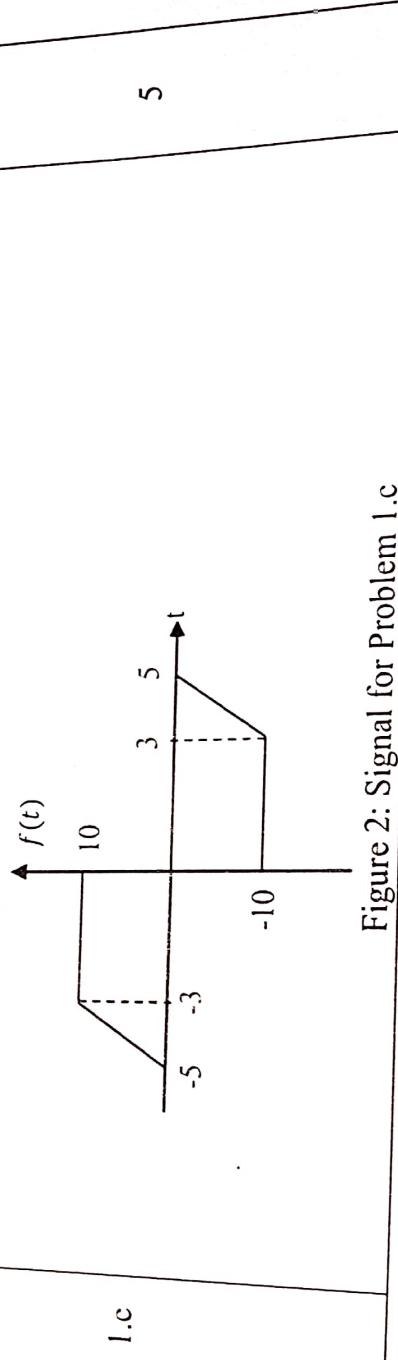


Figure 2: Signal for Problem 1.c



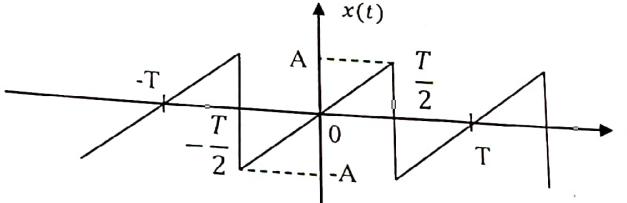
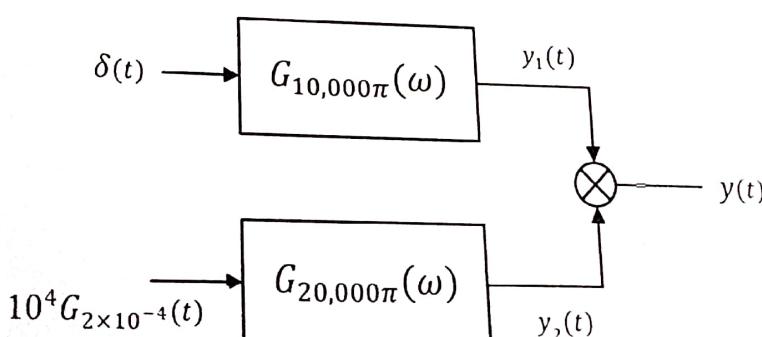
1.d	A signal $\cos(24\pi \times 10^3 t)$ is sampled using $T_s = 50\mu s$ . The sampled signal is passed through LPF having cut off frequency 15kHz. What are the frequencies present at the output of LPF?	5
2.a	A discrete time LTI system generates a response $\{2, 4\}$ for impulse input. Find the response of system for input $f[n] = \{1, 3\}$ .	5
2.b	Discuss the properties of LTI system with proper justification and diagrams.	5
2.c	A discrete time LTI system is having the following impulse response: $h[n] = \begin{cases} 2; & n = -2, 2 \\ 1; & n = -1, 1 \\ 0 & \text{otherwise} \end{cases}$ Find the output response for the input $e^{jn\pi/2}$ .	5
2.d	Find the power for the output response of RC low pass filter response with input power spectral density of $K$ .	5
3.a	A signal $f(t)$ is defined as: $f(t) = 20 + \sin\left(\frac{\pi}{7}t + \frac{\pi}{3}\right) + 5\sin\left(\frac{5\pi}{6}t - \frac{\pi}{4}\right) - \cos\left(\frac{6\pi}{5}t - \frac{\pi}{6}\right)$ i) Is this a valid Fourier series expansion? ii) If valid, find the values of Harmonics in it.	5
3.b	Discuss the Dirichlet's conditions for the existence Fourier series with proper justification.	5
3.c	The fundamental period of saw-tooth wave shown in Figure 3 is $T$ . What are minimum number of Harmonics to be considered in Fourier series of saw-tooth waveform such that the considered Harmonic will contribute atleast 90% of total power of signal?	5
		
3.d	Derive the Interpolation formula for the reconstruction of original signal from its sampled version.	5
4.a	Find the Fourier Transform of Gaussian pulse of $f(t) = e^{-\pi t^2}$ .	5
4.b	Derive the expression of Energy Spectral Density (ESD). Write the relationship between input and output ESD of LTI system.	5
4.c	Discuss the properties of auto-correlation for energy signals with their proofs.	5
4.d	For the system shown in Figure 4, find the Bandwidth of signal $y_1(t)$ , $y_2(t)$ , and $y(t)$ .	5
		

Figure 4: System setup for Problem 4.d

5.a	Calculate the inverse Laplace transform of the following expression: $F(s) = \frac{1}{5} \cdot \frac{1}{s-3} - \frac{1}{5} \cdot \frac{1}{s+2}$ for different values of ROC.	5
5.b	Find the final value of a continuous-time signal: $x(t) = [2 + e^{-3t}]u(t)$	5
5.c	Discuss the concept of Pole-zero diagram for checking the stability of a system with suitable example.	5
5.d	A system is defined by following differential equation: $\frac{d^2y}{dt^2} + 9\frac{dy}{dt} + 20y(t) = \frac{d^2x}{dt^2} + 3\frac{dx}{dt} + 2x(t)$ i) Is the system stable? ii) Is the inverse of system stable?	5



AY 2021-22  
School of Electronics  
Curriculum: IIITUGECE20  
End Semester Exam  
22-08-2022

Degree	B.Tech.
Branch	ECE
Semester	II
Subject code/name	MAC221 / Mathematics-II
Time	180 minutes
Maximum Marks	100

Answer all the questions.

Q. No.	Questions	Marks
1(a)	Define order and degree of a differential equation. Hence, find the order and degree of the following differential equation: $y' = \sin y$ . State also, whether the given differential equation is linear or non-linear.	5
1(b)	Obtain the differential equation satisfied by the following family of curves: $y = \left(\frac{a}{x^2}\right) + bx$	5
1(c)	Find the general solution of the following differential equation: $x^2y'' - 3xy' + 3y = 2 + 3\log x, x > 0$	5
1(d)	Find the equation of the family of all orthogonal trajectories of the family of circles which pass through $(0, 0)$ and have centers on the $y$ -axis.	5
2(a)	Find the solution of the following initial value problem: $y' + y = f(t), y(0) = 2$ where $f(t) = \begin{cases} 0, & 0 \leq t \leq \frac{\pi}{2}, \\ \cos t, & t \geq \frac{\pi}{2}. \end{cases}$	5
2(b)	Solve the following initial value problem: $y'' + y = t, y(0) = 1, y'(0) = 0$	5

2(c)	Find the inverse Laplace transform of the following function: $F(s) = \frac{1}{s^2 - 4s + 5}$	5
2(d)	Using convolution of Laplace transform, solve the following initial value problem: $y' + y = t \cos t, y(0) = 0$	5
3(a)	Find the Fourier series expansion of $2\pi$ periodic function given as:	5
	$f(x) = \frac{x}{2}, -\pi < x < \pi.$	
3(b)	Using the result of 3(a), evaluate the series below:	5
	$1 + \frac{1}{2^2} + \frac{1}{3^2} + \dots$	
3(c)	Construct the Fourier cosine and sine series representation of the $2\pi$ periodic function given below:	5
	$f(x) = 1, 0 < x < \pi$	
3(d)	(a) State Parseval's identity for Fourier series. (b) Write the values of the Fourier coefficients $a_0, a_n, b_n, n = 1, 2, \dots$ used in harmonic analysis.	5
4(a)	Find the Fourier transform of the following function:	5
	$f(x) = \begin{cases} 1, &  x  < a, \\ 0, &  x  > a. \end{cases}$	
4(b)	Solve for the Fourier sine transform of the function given below:	5
	$f(x) = \frac{e^{-ax}}{x}, x > 0.$	
4(c)	Find the finite Fourier sine and cosine transform of the following function:	5
	$f(x) = \begin{cases} kx, 0 \leq x \leq \pi/2, \\ k(\pi - x), \pi/2 \leq x \leq \pi \end{cases}$	
4(d)	Apply Fourier transform to find the solution of the differential equation: $\frac{dy}{dx} - 4y = H(x)e^{-4x}, -\infty < x < \infty$ Given that $H(x)$ is the unit step function and $\mathcal{F}(H(x)e^{-4x}) = \frac{1}{a - 4}$ , $\operatorname{Re}(a) > 0$ .	5

5(a)	From a pack of well shuffled cards, one card is drawn. Find the probability that this card is either a king or an ace.	5														
5(b)	Two cards are drawn one after the other from a well-shuffled deck of 52 cards. Find the probability that both are spades, if the first card is (i) replaced and (ii) not replaced.	5														
5(c)	A random variable $X$ has the following probability distribution:	5														
5(d)	<table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td><math>X=x</math></td> <td>-2</td> <td>-1</td> <td>0</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td><math>P(X=x)</math></td> <td>0.1</td> <td><math>k</math></td> <td>0.2</td> <td><math>2k</math></td> <td>0.2</td> <td><math>3k</math></td> </tr> </table> <p><del>Find <math>k</math>. Evaluate <math>P(X &lt; 2)</math> and <math>P(-2 &lt; X &lt; 2)</math>.</del> Find cdf of <math>X</math>.</p> <p>Find the mean, median and mode of the random variable <math>X</math> with pdf <math>f(x) = kx(1-x)</math>, <math>0 \leq x \leq 1</math>.</p>	$X=x$	-2	-1	0	1	2	3	$P(X=x)$	0.1	$k$	0.2	$2k$	0.2	$3k$	5
$X=x$	-2	-1	0	1	2	3										
$P(X=x)$	0.1	$k$	0.2	$2k$	0.2	$3k$										

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

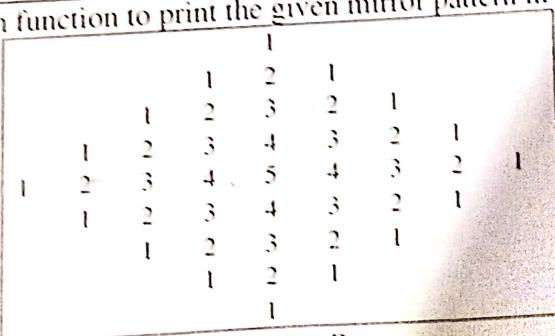
$$\begin{array}{r}
 \textcircled{1} \cdot 2 \\
 \textcircled{2} \cdot \lambda \\
 \textcircled{3} \cdot 1 \\
 \hline
 \textcircled{4} \cdot 5
 \end{array}$$



## End Semester Examination

August 25, 2022

Degree	B. Tech.	Branch	ECE
Semester	II		
Subject Code & Name	CSC204-Basics of Programming in C		
Time: 180 Minutes	Answer All Questions		Maximum: 100 Marks

Sl. No.	Question	Marks
1.a	What is a Variable? Discuss the rules for constructing variable names in C programming.	5(2+3)
1.b	Make use of the Associativity and Precedence rules of operators to determine the output and discuss the sequence of expression evaluation in the following code:  #include <stdio.h> void main() { int a = 1, ans; ans = a++ + ++a; printf("%d", ans); }	5 (2+3)
1.c	Discuss relational and logical operators. Build a scenario that utilizes them together for complex decision making in programming.	5 (2+2+1)
1.d	Demonstrate any five formatted input and output function calls.	5
2.a	How can a pointer be used to access individual elements of an array? Explain with an example.	5
2.b	Utilize the concept of selection control statements to demonstrate how 'switch' statement can be used in the programs instead of 'if-else' statements with a suitable example.	5
2.c	Build a C-program function to print the given mirror pattern in Fig. 1.    Fig. 1: Mirror Pattern	5

2.d	<p>Discuss the following keywords:</p> <ul style="list-style-type: none"> <li>'<u>b</u>' break</li> <li>'<u>c</u>' continue</li> <li>'<u>g</u>' goto</li> </ul> <p>Construct a C program function to use the above three keywords.</p>	5 (3+2)
3.a	Compare Structure and Union with the help of example.	5
3.b	Construct a C function to read name and marks of $n$ number of students from user and store them in a file. If the file previously exists, add the information of $n$ students. Also calculate the length of file and no. of lines in that file.	5
3.c	<p>Apply the concepts of structures and functions to determine the output of the following code:</p> <pre>#include&lt;stdio.h&gt; #include&lt;string.h&gt; struct vehFuel {     char fname[20]; }vl; char* newTrend(struct vehFuel *temp_vl) {     strcpy(temp_vl-&gt;fname, "Electricity");     return temp_vl-&gt;fname; } int main() {     strcpy(vl.fname, "Fossil");     printf("%s %s", vl.fname, newTrend(&amp;vl));     return 0; }</pre>	5
3.d	Develop a C function that prints the source code of itself as an output.	5
4.a	Draw and explain flowchart for finding largest number out of ten given numbers.	5
4.b	What is a software? Explain its significance from the perspective of the system software and application software.	5(1+2+2)
4.c	Discuss the steps involved in problem solving in computer programming.	5
4.d	Define an algorithm. Explain its characteristics.	5 (2+3)
5.a	Define a string. Illustrate with a C function that reads a sentence and prints the frequency of each of the vowels and total count of consonants?	5 (2+3)
5.b	Explain the types of argument passing techniques to functions with examples. Identify the appropriate one out of these techniques to use with arrays and structures.	5 (2+2+1)
5.c	Identify a situation that illustrates the use of function prototype.	5
5.d	Construct a function that removes extra spaces from a sentence.	5

\*\*\*\*\*GOOD LUCK\*\*\*\*\*

a+a    +    + + a  
 1       +      3