

Con. 3567-12.

(3 Hours)

- N.B. :** 1) Question No. 1 is compulsory.
 2) Solve any four questions out of remaining six questions.
 3) Figures to the right indicate full marks

Q.1 a) Find the Laplace transform of $f(t) = e^{-4t} \sin ht \cos t$. (5)

b) Express the matrix $A = \begin{bmatrix} 3 & -2 & 6 \\ 2 & 7 & -1 \\ 5 & 4 & 0 \end{bmatrix}$ as the sum of a symmetric and skew symmetric matrix. (5)

c) If the functions $f_1(x) = 1, f_2(x) = x$ and $f_3(x) = -1 + ax + bx^2$ are orthogonal in $[-1, 1]$ then determine the constants a and b . (5)

d) Find the Fourier transform of $f(x) = e^{-|x|}$ (5)

Q.2 a) Find the Laplace transform of $f(t) = \sin^5 t$ (6)

b) For the matrix $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 2 & 3 \\ 0 & -1 & -1 \end{bmatrix}$ Find the nonsingular matrices P and Q such that PAQ is in normal form. (6)

c) Find the Fourier series for $f(x) = x$ in $(0, 2\pi)$ (8)

Q.3 a) Find the Laplace transform of $f(t) = \sin 2t, 0 < t < \pi/2$ (6)

$$= 0, \pi/2 < t < \pi \text{ and } f(t) = f(t + \pi).$$

b) Reduce the following the matrix to normal form and find its rank (6)

$$\begin{bmatrix} 3 & 2 & 5 & 7 & 12 \\ 1 & 1 & 2 & 3 & 5 \\ 3 & 3 & 6 & 9 & 15 \end{bmatrix}$$

c) Find Fourier series expansion of $f(x) = \left(\frac{\pi-x}{2}\right)^2$ in $(0, 2\pi)$ and hence prove that (8)

$$\frac{\pi^4}{90} = \frac{1}{1^4} + \frac{1}{2^4} + \frac{1}{3^4} + \frac{1}{4^4} + \dots$$

Q.4 a) Find Inverse Laplace transform of $\phi(s) = \frac{s^2+1}{s^3+3s^2+2s}$ (6)

b) Is the matrix $A = \begin{bmatrix} 1+i & -1+i \\ 2 & 2 \\ 1+i & 1-i \\ 2 & 2 \end{bmatrix}$ Unitary? If yes find A^{-1} (6)

c) Obtain the half range sine series in $(0, \pi)$ for $f(x) = x(\pi - x)$ and hence find the value of (8)

$$\sum \frac{(-1)^n}{(2n-1)^3}$$

[TURN OVER

Q.5 a) Find Inverse Laplace transform of $\phi(s) = \frac{(s+1)e^{-s}}{s^2+s+1}$ (6)

b) Find the complex form of Fourier series for $f(x) = e^x$ in $(-\pi, \pi)$. (6)

c) Express the function $f(x) = \begin{cases} 1 & \text{for } |x| < 1 \\ 0 & \text{for } |x| > 1 \end{cases}$ as Fourier integral .Hence evaluate (8)

$$\int_0^{\infty} \frac{\sin \omega \sin \omega x}{\cos \omega} d\omega.$$

Q.6 a) Using Convolution theorem find Laplace Inverse of $\phi(s) = \frac{1}{(s^2+4s+13)^2}$ (6)

b) Find Fourier series for $f(x) = 1 - x^2$ in $(-1,1)$ (6)

c) Solve the following system of equations (8)

$$x + 2y + 3z = 14$$

$$3x + y + 2z = 11$$

$$2x + 3y + z = 11$$

Q.7 a) Evaluate $\int_0^{\infty} \frac{\sin 2t + \sin 3t}{te^t} dt$ (6)

b) Find Z-Transform of (6)

i) $f(k) = 1, k \geq 0, |z| > 1$

ii) $f(k) = a^k, k \geq 0, |z| > a$

iii) $f(k) = \frac{1}{2^k}, k \geq 0, |2z| > 1$

c) Solve $\frac{dx}{dt} + y = \sin t, \frac{dy}{dt} + x = \cos t$ where $x = 0, y = 2$ at $t = 0$. (8)

Con. 3763-12.

GN-5312

(3 Hours)

[Total Marks : 100

- N.B. :** (1) Question No. 1 is compulsory.
 (2) Attempt any four from remaining six questions.
 (3) Make suitable assumptions wherever necessary.

- Each question carries equal marks. 20marks
 - Draw re model and h model for CE amplifier configuration.
 - Investigate the effect of I_B on the performance of the inverting amplifier, if $I_B = 10\text{nA}$ and all resistances are $100\text{k}\Omega$. What dummy resistance R_p must be installed in series with the non inverting input to minimize E_O ?
 - List features of IC 723 regulator.
 - Explain two static and two dynamic parameters of OP_AMP.
 - Why voltage divider biasing is widely used? Give reason.
- Draw the circuit diagram of 3 OP_AMP Instrumentation amplifier using IC741. Explain its requirements, applications and its advantages over difference amplifier. 12marks
 - Derive equations for Z_i , Z_o and A_v for CE amplifier using voltage divider network (with unbypassed RE). 08marks
- Why in an emitter coupled differential amplifier RE resistor is replaced by a constant current source? Draw such circuit. Explain how this network acts as a constant current source (I_o). 10marks
 - For n-channel FET (unbypassed R_S) with $R_1=910\text{k}\Omega$, $R_2=110\text{k}\Omega$, $R_D=2.2\text{k}\Omega$, $R_S=510\Omega$, $I_{DSS}=5.8\text{mA}$, $V_P=-3\text{V}$ and $V_{GSS}=-2\text{V}$. Find I_D , V_{GS} , V_G , V_D , V_S and V_{DS} . 10marks
 Note: [for common source circuit]
- Design a monostable multivibrator to generate a pulse of 1.1ms . Draw circuit diagram with trigger circuit and waveforms obtained at pin.3 and across capacitor. 10marks
 - Draw and explain the working of R_2R ladder network and the following terms: 10marks
 - Resolution
 - Offset voltage
 - Full scale voltage
- Draw and explain the block diagram of IC 723 regulator and also explain the need of short circuit protection circuitry. 10marks
 - Draw neat functional diagram of PLL IC 565 and explain the following terms along with the working of this PLL: - 10marks
 - Free running frequency
 - Capture range
 - Lock range

6. a) Explain OP_AMP as summer and Comparator. 10marks
b) Compare ideal and practical Integrator circuit 10marks
7. Write short notes on any four of the following: 20marks
- i. Schmitt trigger circuit.
 - ii. Successive approximation resistor Analog to Digital Converter.
 - iii. FET characteristics.
 - iv. Wein bridge oscillator.
 - v. Stability factor of biasing circuit.
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SE(CMPN) III CREW 24/5/2012
Data Structure & Files

70-p3-d-upq-FH KL12 B

Con. 3889-12.

GN-5300

(3 Hours)

[Total Marks : 100

N.B. : (1) Question No. 1 is **compulsory**.

(2) Attempt any **four** questions from Q. No. 2 to 7.

(3) Assume **suitable** data wherever required but justify the **same**.

1. (a) What is Recursion ? Write a program to calculate factorial of a number using recursion. 10
- (b) Explain linear and non-linear data structure with example. 5
- (c) Write ADT for stack. Give application of Stack. 5
2. (a) Write a program to implement Insertion sort using Java. Show passes of Insertion sort for following input data : 5, 3, 2, 1, 4. 10
- (b) Give different searching techniques. Write a program to implement Binary Search. 10
3. (a) Write a program in Java to copy content of a file to another file. 10
- (b) Write a program in Java to sort n integer numbers using Quicksort. Show the steps to sort the given numbers : 10
25, 10, 7, 30, 15, 2, 96, 14.
4. (a) Explain different representation of graph. State advantages and disadvantages of each representation. 10
- (b) What is the use of Huffman Encoding ? Apply and give Huffman code for each symbol in sentence "DATA STRUCTURE". 10
5. (a) Write a Java program to implement circular queue using array. 10
- (b) Write a Java program to create a binary search tree. Show BST for following input : 10, 5, 4, 12, 15, 11, 3. 10
6. (a) What is the use of hashing ? Show hash table entries for the given dataset using Linear probing and quadratic probing : 12, 45, 67, 88, 27, 78, 20, 62, 36, 55. 10
- (b) What are the advantages of Linked List over array ? Write a program in Java to implement stack using linked list. 10
7. Write short note on (any two) :— 20
 - (a) Tree traversal algorithm
 - (b) Graph traversal algorithm
 - (c) Priority queue.

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(3 Hours)

[Total Marks : 100]

N.B. : (1) Question No. 1 is **compulsory**.(2) Attempt any **four** questions from remaining **six** questions.(3) Assume **suitable** data whenever **necessary**.

1. (a) Consider a cache (M 1) and memory (M 2) hierarchy with the following characteristics : **10**
 M 1 : 16 K words, 50 ns access time
 M 2 : 1 M words, 400 ns access time
 Assume 8 words cache blocks and set size of 256 words with set associative mapping.
 (i) Show the mapping between M 1 and M 2.
 (ii) Calculate the effective access time with a cache hit ratio of $h = 0.95$
 (b) What do you mean by Fetch cycle, instruction cycle, machine cycle and interrupt acknowledgement cycle ? Explain in brief. **10**
2. (a) Multiply (-7) with (3) by using Booth's multiplication. Give the flow table of multiplication. **10**
 (b) What is microoperation ? Give suitable examples of some four types of microoperations. **10**
3. (a) What do you mean by initialization of DMA controller ? How DMA controller works ? Explain with suitable block diagram. **10**
 (b) What is virtual memory ? Explain how virtual address is mapped to actual physical address. **10**
4. (a) Explain with an example, how effective address is calculated in different types of addressing modes. **10**
 (b) Formulate a four segment instruction pipeline for a computer. Specify the operation to be performed in each segment. **10**
5. (a) Explain any two methods of hardwired control unit. **10**
 (b) Explain the von newmann architecture with the help of diagram. **10**
6. (a) With neat flow chart, explain the procedure for division of floating point numbers carried out in a computer. **10**
 (b) Explain the Flynn's classification of parallel processing. **10**
7. Write short notes on (any four) :- **20**
 - (a) PCI bus architecture
 - (b) Systolic arrays
 - (c) Comparison of RISC and CISC
 - (d) IEEE 754 format
 - (e) Programmed I/O.