S.E. Com / Sem III

Applied Mathematics III

Con. 4013-10. **AN–2509**

(3 Hours) **[Total Marks : 100**

N.B. 1) Question No. 1 is compulsory
2) Attempt any FOUR from remaining six questions.
3) Figures to the right indicate the full marks.

1. a) Prove that $L\{t^n\ f(t)\} = (-1)^n \frac{d^n}{ds^n}\overline{f(s)}$ where $L\{f(t)\} = \overline{f(s)}$ 05

b) Obtain the complex form of the Fourier series for 05

$f(x) = e^{ax}$ *for* $x \in [0, 2\pi]$

c) If $A = [a_{ij}]$ is a square matrix of order 3 where $\mathbf{a_{ij} = i + j}$ 05

find the rank of A.

d) Find the Z-transform of $f(k) = a^k, k \geq 0$ 05

2. a) If $J_0(t) = \sum_0^\infty \frac{(-1)^r}{(r!)^2}\left(\frac{t}{2}\right)^{2r}$ find $L\{J_0(t)\}$ 06

b) Find the 'Fourier series' of 06

$$f(x) = \quad 1 \qquad 0 \leq x \leq \pi$$

$$= 2 - \frac{x}{\pi} \qquad \pi \leq x \leq 2\pi$$

c) Find the values of λ **and** μ such that the following equations , 08

$$\mathbf{2x + 3y + 5z = 9}$$
$$\mathbf{7x + 3y - 2z = 8}$$
$$\mathbf{2x + 3y + \lambda z = \mu}$$

such that the above system (i) no solution (ii) a unique solution

(iii) an infinite number of solutions.

3. a) Find the Z-transform of $\cos\left(\frac{k\pi}{3} + a\right), k \geq 0.$ 06

b) Using adjoint, find B such that $AB = \begin{bmatrix} 3 & 4 & 2 \\ 1 & 6 & 1 \\ 5 & 6 & 4 \end{bmatrix}$ if $A = \begin{bmatrix} 3 & 2 & 2 \\ 1 & 3 & 1 \\ 5 & 6 & 4 \end{bmatrix}$ 06

c) Find the Laplace of: 08

(i) $\frac{1}{t}(\cos at - \cos bt)$ (ii) $e^{-3u}\int_0^t u \sin 3u du$

[TURN OVER

4. a) Prove the following matrix A is unitary and hence find A^{-1} 06

for $A = \begin{bmatrix} \frac{1+i}{2} & \frac{-1+i}{2} \\ \frac{1+i}{2} & \frac{1-i}{2} \end{bmatrix}$

b) Show that the set of functions $\phi_n(x) = \sin\frac{n\pi x}{L}, n = 1,2,3,4,...$ 06

is orthogonal over [0,L] and find the corresponding orthogonal set.

c) Find, 08

(i) $L^{-1}\left\{\frac{s}{s^4+4}\right\}$ (ii) $L^{-1}\left\{\frac{s+1}{s^2+s+1}.e^{-s}\right\}$

5. a) Find the Z-transform of $\cos\left(\frac{k\pi}{3}+a\right), k \geq 0$. 06

b) Find a cosine series for **sin x on** $0 \leq x \leq \pi$.

c) Find the Fourier Sine Integral representation for $f(x) = \frac{e^{-ax}}{x}$. 08

6. a) Find the inverse Z-transform of $f(z) = \frac{1}{(z-3)(z-2)}$ 06

If the region of convergence is (i) $|z| < 2$ (ii) $2 < |z| < 3$ (iii) $|z| > 3$

b) Prove that every skew-hermitian matrix A can be expressed as B + i C where B is real skew-symmetric and C is real symmetric matrix. 06

c) Find the Fourier series of, 08

$f(x) = -\pi \quad -\pi < x < 0$

$= x \quad 0 < x < \pi$

state the value of $f(x)$ *at* $x = 0$;

hence deduce that $\frac{\pi^2}{8} = \sum_{n=1}^{\infty}\frac{1}{(2n-1)^2}$

7. a) Prove: $\int_0^{\infty} t e^{-3t} J_0(4t)dt = \frac{3}{125}$ where $L\{J_0(t)\} = \frac{1}{\sqrt{1+s^2}}$ 06

b) Examine whether the following vectors are linearly dependent or independent [1,0,2,1], [3,1,2,1], [4,6,2,–4], [–6,0,–3,–4] 06

c) Find the Fourier series of f(x) = x sinx for $x \in (0,2\pi)$. 08

S.E. Com / SEM III

31 May 2010

VT-April-10- 156

Data Structure & files.

Con. 3670–10. AN–2497

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions from Q.Nos. **2** to **7**.
(3) Use **diagrams** wherever **necessary**.
(4) Assume **suitable** data wherever **required** bust justify the **same**.

1. (a) Write a program in java to implement Binary search. **10**
   (b) What is Recursion & write a program in java to implement "Tower of Hanoi." **10**

2. (a) Write a java program to implement circular queue using linked list. **10**
   (b) Construct the binary tree for the inorder and post order traversal sequences given below. **10**
   Inorder : "INFORMATION"
   Post Order : "INOFMAINOTR"

3. (a) Discuss Threaded binary tree in detail. **10**
   (b) Write the program in java to perform quick sort. Show the steps with example. **10**

4. (a) Explain Huffman Coding with example. Write a java program to create the binary tree using Huffman Coding for the given characters and their frequencies. Print the Huffman Code for each character. **14**
   (b) Compare Interation and Recursion. **6**

5. (a) Write a program in java to sort given n integer number using heap sort. **10**
   (b) Explain BFS algorithm, explain it by example. **10**

6. (a) Write short note on B-Trees and B^+-Trees. **10**
   (b) Hash the following in a table of size 11. Use any two collision resolution techniques :– **10**
   23, 0, 52, 61, 78, 33, 100, 8, 90, 10, 14.

7. (a) Show with example how graphs are represented in Computer Memory. **6**
   (b) Discuss practical application of tress. **4**
   (c) Write short notes on :– **10**
   (i) AVL Tree
   (ii) Array Representation of Linked List.

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S.E. Com / Sem III Exam

Digital Logic Design & Application.

Con. 3016–10. AN–2500

(3 Hours) [Total Marks : 100

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assume **suitable** data and it **clearly**.

1. (a) Convert $(1473.45)_{10}$ to Octal, Binary and Hexadecimal. (6)
(b) Perform directly without converting to any other base. (8)
(i) $(BC5)_H - (A2BD)_H$ (ii) $(12.3)_4 + (212.3)_4$
(iii) $(77)_8 * (17)_8$ (iv) $(11110)_2 \div (110)_2$

(b) Write the hamming code for 1010. (3)
(c) State and prove De Morgan's Theorem. (3)

2. (a) Using the K-map Method minimization technique simplify and draw the circuit for the following function. (10)
$F(A,B,C,D,E) = \sum m(0,1,2,3,5,7,8,9,11,14,16,17,18,19) + d(24,25)$
(b) Design 3 bit Binary to gray code converter. (5)
(c) What is essential prime implicant in Quine McClusky Method. (2)
(d) Prove OR-AND configuration is equivalent to a NOR-NOR configuration. (3)

3. (a) What is Canonical SOP and POS form? Explain with an example. (5)
(b) Implement the following using only one 8:1 MUX and few gate. (5)
$F(A,B,C,D) = \sum m(0,3,5,7,9,13,15)$
(c) Design and draw a combinational circuit that multiplies two 2-bit numbers A1A2 and B1B2 to produce 4-bit product C3C2C1C0. (10)

4. (a) Design a sequence generator using T flip-flop for the given sequence. Check for lock-out conditions. (10)
$0 \rightarrow 2 \rightarrow 4 \rightarrow 5 \rightarrow 0$
(b) Implements the following Boolean function using 4:1 MUX (10)
$F(A,B,C,D) = \sum m(0,1,2,4,6,9,12,14)$.

5. (a) Convert SR flip-flop to D and T flip-flop and draw the circuit. (10)
(b)Calculate the characteristics equation using characteristic table of SR, JK, D and T Flip-Flop. (10)

6. (a) Design a synchronous counter for the following sequence using JK FF.Draw the timing diagram. (10)
$1 \rightarrow 0 \rightarrow 3 \rightarrow 2 \rightarrow 5 \rightarrow 4$
(b) Using the Quine McClusky method simplify (10)
$F = \sum m(1,3,7,9,11,13,15) + D(2,4)$

7. (a) Air India Complex has four elevators for visitors.To save on power only two elevators cars are available.If the traffic is heavy or if car1 is shutdown due to technical problem, the third elevators car is switched ON. The fourth elevators car is a standby car which is powered ON if both car1 and car2 fail.Design a logic circuit for starting power to car3 an car4. (10)

(b) Compare TTL, CMOS and ECL families with respect to gate, voltage level, fan-in, fan-out, propagation delay, power dissipation and noise margin. (10)

S.E. com / sem III

Con. 3022–10. Computer Organization & Architecture. AN–2506

(3 Hours) [Total Marks : 100

N.B. : 1) Q. 1 Is compulsory.
2) Solve any four questions out of remaining.
3) Draw neat labeled diagram wherever necessary.
4) Assume suitable data if required.

1. **(a)** Explain in detail characteristics of RISC and CISC. 10

(b) Explain with suitable example booth s Algorithm for signed multiplication. 10

2. **(a)** Explain Flynns classification in detail 10

(b) Define the term "soft wired and "hardwired". Explain with example the soft wired. 10

3. **(a)** Explain with suitable example the difference between computer architecture and computer Organization. 10

(b) Explain IEEE format for floating point number representation. 10

4. **(a)** State the function of following CPU registers.

MAR, MDR, IR, PC, SP. 10

(b) What is memory interleaving? Discuss various memory leaving techniques. 10

5. **(a)** What is pipelining ? Explain with suitable example the difference between serial executions And pipelined instruction execution. 10

(b) Explain SPARC processor. 10

6. **(a)** Explain with state diagram MESI (Mutual Exclusive Shaved Invalid) protocol . 10

(b) Explain and solve the following problem using by non-restoring division algorithm. Hence Divide 10/3. 10

7. **(a)** Explain the different RAID levels. 10

(b) Write short notes on : –

1) DMA

2) Vonneuman model in detail. 10

S.E./Comp/Sem III/Exam 2010

Con. 3018–10. (REVISED COURSE) AN–2503

Sub. D.S.D.T.

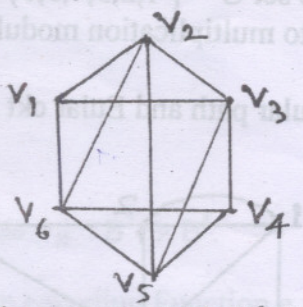
(3 Hours) [Total Marks : 100

Discrete Structure and Draft Theory

N.B. : (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of remaining **six** questions.
(3) Assumption made should be **clearly stated**.
(4) **Figures** to the **right** indicate **full** marks.

1. (a) Use mathematical induction to prove the following inequality 4
$n < 2^n$ for all positive integers n .
(b) Define a pigeonhole principle. 4
Show that if seven colours are used to paint 50 bicycles, at least 8 bicycles will be of same colour.
(c) What is an Universal and existential quantifier? 4
(d) Define the following terms with the example 4
(i) Disjoint set (iii) Partial order relation
(ii) Symmetric difference (iv) Antisymmetric relation.
(e) How many numbers must be selected from the set {1,2,3,4,5,6} to Guarantee that at least one pair of these numbers add up to 7? 4

2. (a) Prove that if x is a rational number and y is an irrational number, then x + y is an irrational number. 5
(b) Define following – Power Set, Surjective and Injective function 5
(c) Is a graph a planar graph? 5



(d) How many friends must you have to guarantee that at least five of them will have birthdays in same month ? 5

3. (a) Let A={ a, b, c, d} and x be a relation on A whose matrix is 10

$$M_R = \begin{bmatrix} 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

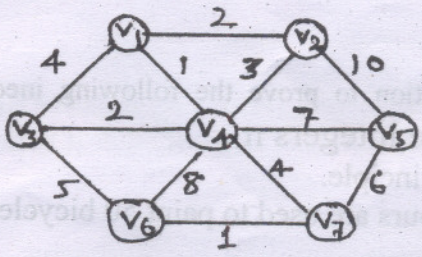
Prove that R is partial order. Draw Hasse diagram of R.

[TURN OVER

(b) (i) Define group, monoid, semigroup. 5

(ii) Converse of statement is given . 5
Write inverse and contra positive of statement
" If I come early then I can get a car "

4. (a) Write Prims Algorithm. Apply it to following graph. 10



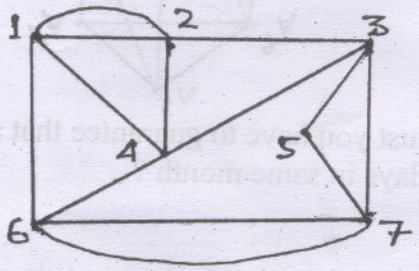
(b) (i) Let A= { 1,2,3,4,5}, P={{1,2} {3}, {4,5}} find equivalence relation Determined by P and draw its diagraph. 5

(ii)Check whether relation is reflexive , irreflexive, symmetric, anti symmetric , transitive. 5

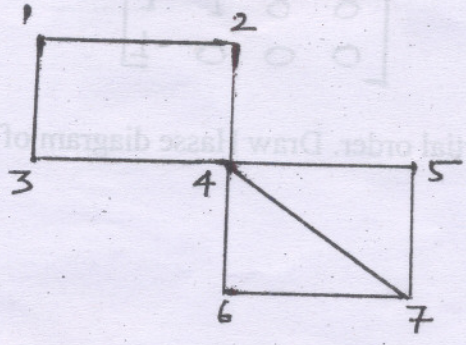
R_1 = {(1,1),(1,2),(2,1),(2,2),(3,3),(4,3),(3,4),(4,4)}
R_2 = {(1,3),(1,1),(3,1),(1,2),(3,3),(4,4)}

5. (a) Prove that the set G = { 1,2,3,4,5,6} is a Finite Abelian group of order 6 with respect to multiplication modulo 7 . 10

(b) (i) Find out Eular path and Eular ckt for the graph 5



(ii) Find out Hamiltonian path and Hamiltonian cycle. 5



6. (a). (i) Show that (2,5) encoding function e: $B^2 \rightarrow B^5$ defined by 5

e (00) = 00000
e (01) = 01110
e (10) = 10101
e(11) = 11011

is a group code.

(ii) R = {O,2,4,6,8}.Show that R is a commutative ring under addition and multiplication modulo 10. Verify whether it is field or not. 5

(b) (i) Let L be the bounded distributive lattice. 5
Prove that if complement exist then it is unique.

(ii) Give the exponential generating functions for the sequences given bellow 5
(i) {1,1,1,.....}
(ii) {0,1,0,-1,0,1,0,-1,.....}

7. (a) In any Ring (R + .) prove that 10
i) The zero element z is unique.
ii) The additive inverse of each ring element is unique.

(b) (i) Let m = 2, n = 5 and 5

$$H=\begin{bmatrix} 1 & 1 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Determine the group code $e_H : B^2 \rightarrow B^5$.

(ii) Consider the (3, 5) group encoding Function e : $B^3 \rightarrow B^5$ defined by 5

e(000) = 00000 e(100) = 10011
e(001) = 00110 e(101) = 10101
e(010) = 01001 e(110) = 11010
e(011) = 01111 e(111) = 11100

Decode the following words relative to a maximum likelihood decoding functi
(i) 11001 . (ij) 01010 (iii) 00111

S. E. Com (SEM) III Exam

Electronic Devices & linear Circuits

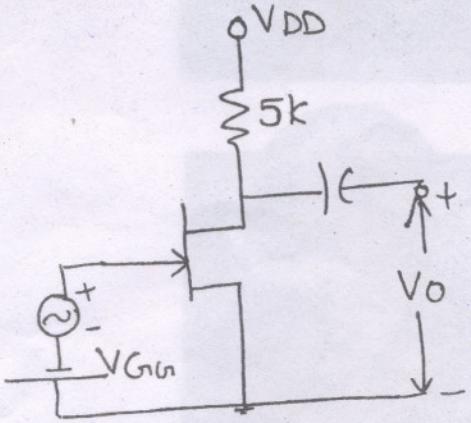
Con. 3003-10. **AN-2494**

30 : 1st half-10-DD (F)

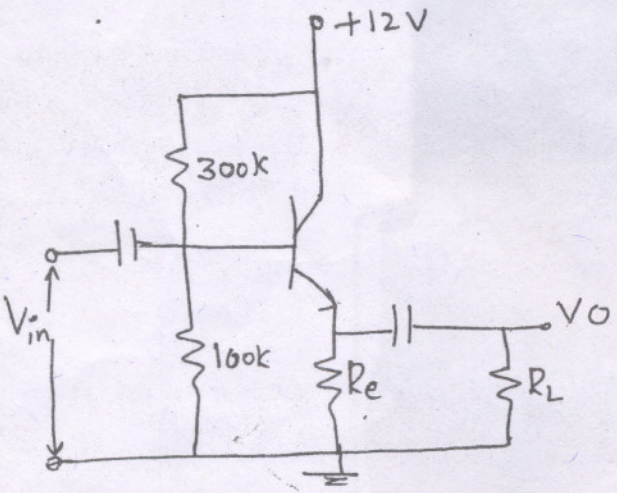
(3 Hours) **[Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory**.
(2) Attempt any **four** questions out of the remaining **six** questions.
(3) Answer to questions should be **grouped** and written **together**.
(4) Assume any **suitable** data wherever **required** but justify the **same**.

1. (a) Derive the expressions for A_v, Z_i, Z_o, A_i for CE Amplifier. **10**
(b) Compare JFET and BJT. **5**
(c) Consider the following circuit. Determine I_D, V_{GS} for $(I_{DSS}) = 4$ mA **5**



2. (a) Explain the Graphical determination of the h-parameters using characteristic curves of CE Amplifier. **10**
(b) For the amplifier shown in below **figure**. Determine the following parameters :— **10**
(i) DC bias Q-point (V_{CEQ} and I_{CQ})
(ii) Current gain (i_o/i_n)



Assume :
$r_e = 100\ \Omega$
$V_{BE} = 0{\cdot}6$ V
$\beta = 100$
$R_e = 3k\ \Omega$
$R_L = 5k\ \Omega$

3. (a) Draw the block diagram of typical Op-Amp. Explain function of each block. **6**
(b) Explain the following terms for an Op-Amp :— **4**
(i) Input offset voltage
(ii) CMRR.
(c) Explain three Op-Amp Instrumentation Amplifier and also derive the overall gain A_V. **10**

4. (a) Explain how an Op-Amp can be used as : **15**
   (i) Integrator (ii) Differentiator (iii) Summing amplifier.
   (b) Using practical Op-Amp realize the following relation :— **5**
   $V_O = 5V_1 - 5V_2 + 3V_3$.

5. (a) Explain the operation of Monostable multivibrator using IC 555. **10**
   (b) Explain any two applications of Astable multivibrator. **10**

6. (a) Explain a high voltage Low Current Regulator and Low Voltage High Current Regulator. **10**
   (b) Design a regulator using LM 723 for $V_O = 9V$, $I_O = 3Amp$. **10**

7. Write short notes on any **three** of the following :— **20**
   (a) pLL
   (b) Non-Inverting Schmitt Trigger
   (c) Digital to Analog Converter using R-2R Resistors.
   (d) Properties of Ideal Op-Amp.

S.E / sem III / comp / Exam - May - 2010
Rev / K.T.
Dt:. 04-06-2010

Sub:. DLDSA

Con. 3016–10. AN–2500

(3 Hours) [Total Marks : 100

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   (i) $(BC5)_H - (A2BD)_H$ (ii) $(12.3)_4 + (212.3)_4$
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   (b) Design 3 bit Binary to gray code converter. (5)
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   $F = \sum m(1,3,7,9,11,13,15) + D(2,4)$

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   (b) Compare TTL, CMOS and ECL families with respect to gate, voltage level, fan-in, fan-out, propagation delay, power dissipation and noise margin. (10)