KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 1st Term Examination, 2024
Department of Computer Science and Engineering
CSE 2103
Microprocessors and Microcontrollers

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates the course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) "At any given time 8086 works with only four 64Kbyte segments with its 1Mbyte range" – justify this statement. (09) [CO1]
   b) Fill the values of the following 8086 flags after execution of each instruction. What will be the program flow? (e.g., 1→2→…) (08) [CO1]

	CF	ZF	SF
(1) A: XOR CX, CX			
(2) ADD CX, 1			
(3) LOOP B			
(4) JZ A			
(5) B: SUB CX, 1			

   c) What are the addressing modes of 8086? Determine and explain the addressing modes of the following instructions: (12) [CO1]
   (i) MOV AX, BX (ii) MOV DX, 1234H (iii) MOV AX, [SI] (iv) MOV BX, 50H[DI]
   d) What are the advantages of using assembly language instead of writing a program directly in machine language? Explain. (06) [CO1]

2. a) If a code segment starts at address 3123H, then what will be the value of IP if it is pointed at the end of the code segment? What is the physical address of the middle of CS? Consider the memory space as 16MB, CS and IP have the same width. (12) [CO1]
   b) Suppose you want to generate 1 second time delay using the following code on a 5MHz 8086 microprocessor. What would be the value of N? (10) [CO4]

	Clock Cycles
MOV DX, N	4
B: MOV CX, 10	4
A: NOP	3
LOOP A	17 or 5
SUB DX, 2	8
JA B	16 or 4

   c) What is pipelining in 8086 microprocessor? (07) [CO1]
   d) Show and explain two examples when divide-by-zero interrupt occur. (06) [CO2]

3. a) Write the 8086 instructions to add two numbers, where parameters are passed to the procedure using stack. (12) [CO4]
   b) Write the machine codes for 8086 of the following instructions with detailed rationale (template and others). (15) [CO1]
   (i) MOV 03H[BX], CL (ii) MOV AL, DL (iii) ADD AL, BL
   (iv) MOV 73H[SI][BP], AL (v) MOV 1203H[BX], CX
   c) Write the instructions to set or reset trap flag. Explain in brief how these instructions perform the desired functions. (08) [CO4]

4. a) What is the role of Instruction Set Architecture (ISA) in computers? (07) [CO1]
   b) Illustrate reentrant procedure with necessary figure. Write down the conditions that are crucial for a procedure to be reentrant. (10) [CO1]
   c) How does priority resolver handle the situation when 8086 microprocessor is executing the IR_3 service procedure meanwhile an interrupt signal arrives at IR_2 input of 8259A? (10) [CO2]

d) Show the stack mapping for the following 8086 instructions. Also, write the values of the corresponding register after execution of each instruction. (08) [CO4]

```
HOW PROC FAR
        PUSHF
        PUSH AX
        PUSH BX
        PUSH CX
        .
        .
        .
        POP BX
        POP CX
        POP AX
        POPF
        RET
HOW ENDP
```

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) How do 8086 and 8087 execute their respective instructions? (08) [CO3]
   b) Suppose the status register of 8087 holds '1000H' and the tag register contains '000FH'. Now show the conditions of it's stack after performing the following operations sequentially. (12) [CO2]
      (i) After 3 PUSH operations (ii) After 2 POP operations.
   c) Suppose you want to build a system using a microcontroller. Depict how the proper microcontroller can be chosen. (07) [CO3]
   d) Express -2507.75 in double precision floating point based on 8087 math co-processor. (08) [CO3]

6. a) If a microcomputer has a 24bit address bus, then measure the maximum physical memory size of it without any virtualization. (06) [CO1]
   b) What should be the value of signals A_0, $\overline{BHE}$, memory banks, location addresses, $D_0 - D_7$, $D_8 - D_{15}$ for the following transfer operations? [Bank is either even or odd] (12) [CO1]
      (i) Microprocessor writes a Byte 22H into odd address location 2000:0003H
      (ii) Microprocessor writes a Byte 11H into even address location 2500:0002H
      (iii) Microprocessor writes a Word 1526H into odd address location 1000:0005H
      (iv) Microprocessor writes a Word 1625H into even address location 2000:0004H
   c) Given the arrival times and types of interrupts, analyze the sequence in which the 8051 microcontroller will service them, considering IE = '90H' and IP = '19H'. (10) [CO3]

Arrival Time	Interrupt Type
1	INT0
2	RI+TI
3	TFO
3	INT1
3	TF1

   d) How is page fault handled by OS? Explain graphically with necessary steps. (07) [CO1]

7. a) Draw and explain the architecture of 8051 microcontroller. (09) [CO3]
   b) Design a Line Follower Robot using 8051 microcontroller to follow a square path continuously once the system is boot-up. (Assume there are 3 IR sensors and 2 DC motors.) (14) [CO3]
      (i) Provide necessary pin diagram with brief explanation.
      (ii) Write the program using C language.
   c) Is it possible for the 8051 microcontroller, which has only 128 bytes of RAM built-in, to have more RAM? If so, how can 8051 interface with the external RAM? (12) [CO3]

8. a) Briefly explain Overlays and Bank Switching techniques with appropriate figures. (10) [CO1]
   b) Draw and explain the virtual memory technique for 80386 and show how you can access 64TB of virtual memory. (10) [CO1]
   c) Describe how the protected mode of operation of an 80286 is different from real mode of operation. (07) [CO1]
   d) How can we use 8051 microcontroller for serial communication? (08) [CO3]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 1st Term Examination, 2024
Department of Computer Science and Engineering
CSE 2105
Data Structures and Algorithms

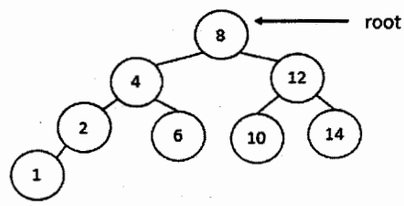
TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Differentiate between linear and non-linear data structures with suitable examples. (6) [CO1]
   b) Given a two-dimensional array A[20][40] where each element takes 4 bytes of storage and the baseline address is 1000: (14) [CO2]
      i. Compute the address of A[10][15] using row-major order.
      ii. Compute the address of A[15][20] using column-major order.
   c) Explain the skewness problem in the binary search trees. For the given binary search tree, perform the following operations and show the updated tree after each operation. (15) [CO4]
      i. Delete the element 8
      ii. Delete the element 2
      Write pseudocode for deleting a node with two children node

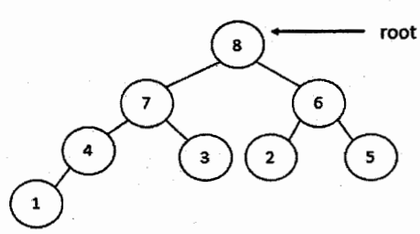


2. a) Prove that the height of a balanced binary tree with n nodes is $O(log_2 n)$. (6) [CO1]
   b) Implement a queue using stacks and explain how the operations simulate queue behaviour. (7) [CO2]
   c) Construct a B-tree of degree 3 for the sequence 1, 2, 3, 4, 5, 7, 6 and show the tree after each insertion. (10) [CO3]
   d) Design and implement a circular queue that supports the following operations: (12) [CO4]
      i. **bool push (int** value) – Insert an element. Return true if successful.
      ii. **bool pop ()** – Delete an element. Return true if successful.
      iii. **bool isEmpty ()** – Check whether the circular queue is empty.
      iv. **bool isFull ()** – Check whether the circular queue is full.

3. a) Differentiate between full, complete, and balanced binary trees with examples. (6) [CO1]
   b) Draw the recursion tree for $fn(3)$ showing all recursive calls for the function below: (14) [CO3]

```
coins = [1, 5, 4, 2];
Function fn(v) {
     if (v==0) return 0;
     if (v==1) return Infinity;
     let ans = Infinity;
     for (const coin in coins) {
          ans = Math.min(ans, 1 + fn(v-coin));
     }
     return ans;
}
```

   c) For the given max heap, perform the following operations and show the update heap after each operation. (15) [CO4]
      i. Delete the root element (Extract Max)
      ii. Insert the element 10.
      Write pseudocode for the Extract Max operation.



4. a) Explain the key properties of a B-tree. (5) [CO1]
   b) Explain whether a binary heap of n elements can be built in $O(n)$ time. (8) [CO2]
   c) Given the postfix expression: (10) [CO3]

   10 12 9 3 + 1 * / * 20 + 5 +

   Evaluate the expression using a stack.
   d) Construct an AVL tree for the sequence 22, 26, 30, 10, 4, 14, 28 and show the tree after each insertion. (12) [CO3]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Given a singly linked list where the elements are sorted in ascending order, write an algorithm to remove all duplicate nodes so that each element appears exactly once. Explain your approach and analyze its time and space complexity. (13) [CO1]
   b) You have a list of students in your campus with their heights (in cm). Sort the list using Quick sort in such a way that the number of redundant recursive call is minimized. Explain how you would modify the standard quick sort to efficiently handle multiple students with same height. (12) [CO4]
   c) A hash table of size 11 uses the hash function $h(k) = k \ mod \ 11$. Insert the following keys in order: (10) [CO4]

   10, 21, 32, 4, 40, 7, 29, 18, 26, 15

   Show that the final arrangement of the hash table when collisions are resolved using linear probing and quadratic probing.

6. a) A music player stored its collection of songs in a doubly linked list, where each node contains the song title, the singer's name, and a pointer to the next node. (23) [CO1]
      i) Design an algorithm to sort the linked list of songs lexicographically by the singer's names using merge sort.
      ii) Write an algorithm to insert a new song at a specified valid position in the linked list. Assume that the linked list is not empty and the given position is valid.
   b) Given an undirected graph, write an algorithm to determine whether it is two-colorable (i.e., whether it is possible to color all vertices using two colors such that no two adjacent vertices have the same color). Explain how your algorithm can be used to check if the graph is bipartite. (12) [CO3]

7. a) Radix sort can be implemented using different bases such as binary (base 2), decimal (base 10), and hexadecimal (base 16). For the case of sorting 32-bit integers, determine the number of passed and the number of buckets required for each base. Compare their relative performance and state which base is the most efficient. Assume that the number of elements $n \geq 10{,}000$. (11) [CO4]
   b) Explain how you would check if two vertices are connected using an adjacency matrix and an adjacency list, and compare the complexities of both methods. Based on your analysis discuss which representation is more suitable for sparse graphs and dense graphs, justifying your answer in terms of both time and space efficiency. (12) [CO3]
   c) You are designing a hash table for a university database with a large number of student records. Collisions are expected to be frequent. Decide whether you would use chaining or open addressing to handle collisions. Justify your choice in terms of memory usage, search/insert/delete efficiency and handling of high load factors. (12) [CO4]

8. a) Your friend in the Urban and Regional Planning (URP) department is designing a plan to connect several islands with m bridges. The current design is not optimal, meaning some islands may be disconnected and some bridges may be redundant. Help your friend by writing an algorithm that identifies redundant bridges and computes the minimum number of additional bridges needed to make all islands connected. (15) [CO3]
   b) In the Floyd's cycle detection algorithm, the slow pointer moves 1 step and the fast pointer moves 2 steps. If both pointer speeds are double (slow moves 2 steps, fast moves 4 steps), will this reduce the time complexity of cycle detection by half? Explain your answer. (10) [CO1]
   c) How can binary search be modified to return the first and last occurrence of a key in a sorted array with duplicates. (10) [CO4]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 1st Term Examination, 2024
Department of Computer Science and Engineering
MATH 2107
Fourier Analysis and Linear Algebra

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define integral transform kernel of Fourier sine transform. (10) [CO2]
   b) Define causal and noncausal system with example. Check whether the following systems are causal or not. (13) [CO3]
   i) $y(t) = tx(t)$ ii) $y(n) = x(n) - x(n-1)$ iii) $y(t) = x(t^2)$.
   c) Write down the important properties of Region of Convergence (ROC) for Z-transform. (12) [CO2]

2. a) Define Z-transform. Find the Z-transform of the signal $x(n) = cosw_0nu(n)$ and hence using scaling property find the Z-transform of the signal $x(n) = 2^n cosw_0nu(n)$. (12) [CO2]
   b) Find $x(n)$ by using convolution for $X(Z) = \frac{1}{(1-\frac{1}{2}z^{-1})(1+\frac{1}{4}z^{-1})}$. (10) [CO2]
   c) Find the inverse z-transform of $X(Z) = \frac{z+0.5}{(z+0.6)(z+0.8)}$, $|z| > 0.8$ using residue method. (13) [CO2]

3. a) Solve the difference equation $y(k+2) - 18y(k+1) + 32y(k) = 0$ subject to $y(0) = 0, y(1) = 2$ using z-transform method. (13) [CO2]
   b) Write down the assumption for the validity of Fourier series expansion. Find a series of sine and cosine multiple of x which represent $x + x^2$ in the interval $-\pi < x < \pi$ and deduce that $\frac{\pi^2}{6} = \sum_{n=1}^{\alpha} \frac{1}{n^2}$. (22) [CO1]

4. a) Write down the parsevals identity for Fourier series expansion. Use parsevals identity to the function $f(x) = sinx,\ 0 < x < \pi$ and show that $\frac{1}{1^2-3^2} + \frac{1}{3^2-5^2} + \frac{1}{5^2-7^2} + \cdots = \frac{\pi^2-8}{16}$. (20) [CO1]
   b) Find the Fourier transform of $F(x) = \begin{cases} 1-x^2, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ and hence evaluate $\int_0^{\alpha} \frac{xcosx-sinx}{x^2} cos\frac{x}{2} dx$. (15) [CO1]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Define with example (i) skew symmetric matrix (ii) diagonal matrix (iii) principal submatrix (iv) elementary matrix. (12) [CO3]
   b) If $A = \begin{bmatrix} 1 & 0 & 3 \\ 0 & 1 & 2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 0 \\ 0 & 1 \\ 1 & 2 \end{bmatrix}$ then find AB by partitioning. (08) [CO3]
   c) Reduce the matrix A to echelon from then to its canonical form then to its normal form. Also find its rank, where $A = \begin{bmatrix} 2 & 7 & 3 & 5 \\ 1 & 2 & 3 & 4 \\ 3 & 8 & 1 & -2 \\ 4 & 13 & 1 & -1 \end{bmatrix}$. (15) [CO3]

6. a) Examine the following set of vectors over a real field for linear dependence or independence. If the set of vectors are linearly dependent, determine the maximum subset of linearly independent vectors and express the others as linear combination of these $X_1 = [2, -1, 3, 2], X_2 = [1, 3, 4, 2], X_3 = [3, -5, 2, 2]$. (18) [CO3]
   b) Given $cx - y + 2z = 0,\ 2x + 2y + 3z = 0,\ x - 3y + 2z = 0$, then determine the value of 'c' for which the given system of linear equations has i) a trivial solution and ii) non-trivial solutions. If non trivial solutions exist, find the corresponding solution by selecting an appropriate numerical value for 'c'. Find nullity and basis of the null space. Express this solution space in vector parametric form and illustrate the solution space through drawing. (17) [CO4]

7. a) If possible, using elementary transformation, find A^{-1}, where $A = \begin{bmatrix} 1 & -1 & -1 \\ 2 & 1 & -1 \\ -1 & 2 & 1 \end{bmatrix}$. (17) [CO3]

Now given $AX=H$, where $H = \begin{bmatrix} 1 \\ -1 \\ 1 \end{bmatrix}$, then, if possible, find the value of X. Are the columns of matrix A linearly dependent, why?

b) Given $u_1 = [2 \quad 5 \quad -1]^t$, $u_2 = [-2 \quad 1 \quad 1]^t$, and $y = [-3 \quad 2 \quad 1]^t$. Are u_1 and u_2 Orthogonal basis of the vector space W in R^2, why? Find the orthogonal projection of y on W space and express y as sum of a vector in W and a vector orthogonal to W. (10) [CO4]

c) Let $p(t) = 12t^2 + 2t - 1$ and $q(t) = t - 1$, be in P_2, then find the inner product of p and q where $t = 0, 1$ and 2. Also, find the vector norm of q. (08) [CO4]

8. a) Find the eigen value and corresponding eigen space for the operator A, where $A = \begin{bmatrix} 2 & 1 \\ 0 & 0 \end{bmatrix}$. Also sketch the eigen space. (13) [CO4]

b) Let $W_1 = [1 \ 2]^1$ and $W_2 = [2 \ 1]^1$ are basis of W space and $Z_1 = [1 \ -1]^1$ and $Z_2 = [0 \ 1]^1$ are basis of Z space. If a vector X whose coordinates are [1, 1] in Z basis, find the coordinates of X in W basis. (09) [CO4]

c) Define four types of matrix norms with a numerical example. Also, discuss the estimation of eigenvalues of a matrix operator, along with a numerical illustration, considering any three rules. (13) [CO3]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 1st Term Examination, 2024
Department of Computer Science and Engineering
CSE 2113
Computer Architecture

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates course outcomes.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Differentiate between computer architecture and computer organization. Draw and explain functional view of a computer. (12) [CO1]
   b) State and explain Von Neumann architecture. (10) [CO1]
   c) What are the factors that are related to speed up computer systems? Explain them. (13) [CO1]

2. a) What is meant by register? Describe: (13) [CO2]
      i) user visible register,
      ii) control and status register.
   b) Differentiate between direct and indirect cycle. Draw instruction cycle state diagram. (10) [CO2]
   c) Describe dataflow techniques in fetch and interrupt cycle with proper diagram. (12) [CO2]

3. a) If the last operation performed on an 8-bit computer is: (15) [CO3]
      i) addition of 2 and 3,
      ii) addition of −1 (2's complement) and +1.

      What would be the value of the Carry, Overflow, Zero, Sign, and Even Parity flags?
   b) Compute $Z = \frac{(A+B-C)}{E\times(C-D)}$ using one, two, and three address instructions. (13) [CO3]
   c) Define overflow in a computer system. Explain a scenario where Overflow flag is useful. (07) [CO3]

4. a) What is instruction pipeline? What difficulties arise in instruction pipelining? Draw a diagram to illustrate instruction pipelining. (07) [CO4]
   b) Differentiate between CISC and RISC with example(s). (08) [CO4]
   c) What is instruction level parallelism and machine parallelism? Make a comparison among simple 4-stage pipeline, superpipelined, and superscalar concepts. (08) [CO4]
   d) What is addressing mode? Describe various types of addressing modes with proper diagram. (12) [CO3]

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Describe the memory hierarchy of a computer system. Explain why do we need more than one type of memory. (10) [CO2]
   b) "Virtual memory bridges the gap between HDD and RAM" – justify the statement if true. (10) [CO2]
   c) Say, main memory to cache memory ratio is 64:16 and 20 bits are used for addressing. Calculate: (15) [CO2]
      i) TAG, BLOCK, and WORD bits in direct mapping when block size is 32 words.
      ii) TAG, and WORD bits in associate mapping when block size is 32 words.
      iii) TAG, SET, and WORD bits for set-associative mapping where 1 set contains 4 block and 1 block contains 32 words.

6. a) How does RAID 3 reconstruct data in the event of drive failure? Explain with example. (10) [CO2]
   b) Define paging in a computer system. "Page should not be too small or too big" – justify the statement. (10) [CO2]
   c) Organize a memory of 64k words of 8 bits each, with 16k×1 static memory chips. (15) [CO2]

7. a) Define interrupts in a computer system. Describe the ways of handling multiple interrupts. (10) [CO1]
   b) Describe the merits and demerits of write through and copy back protocol in cache memory. (10) [CO2]
   c) Consider three interrupt handlers X, Y, and Z (having priority $X > Y > Z$) with ISR 10, 20, and 30 respectively. Show the transfer of control for interrupt sequence Z, X, Y at time t =10, 35, 45 respectively. (15) [CO1]

8. a) What is DMA? Explain error correction code function with figure. (12) [CO2]
   b) Describe different types of ROM. Explain the timing of disk I/O transfer with suitable diagram. (12) [CO2]
   c) A 7-bit data 1001010 is passed and written. After that when reading, we use Hamming corrector and before correcting, we get 1101010. How do you detect and correct this 1-bit error? (11) [CO2]

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 2nd Year 1st Term Examination, 2024
Department of Computer Science and Engineering
EEE 2117
Analog Electronics

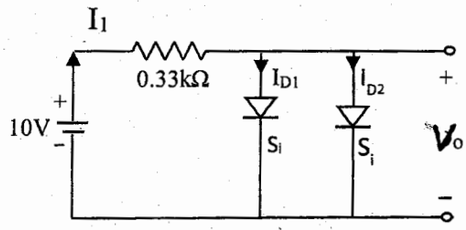
TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the immediate right column of the questions indicate full marks.
iii) The rightmost column indicates course outcomes.

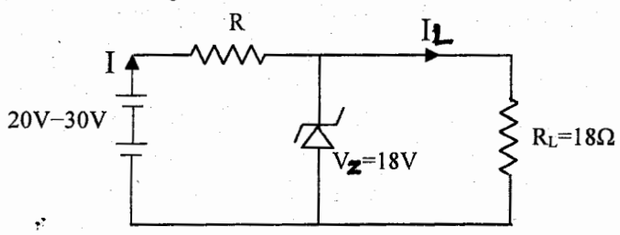
SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Define electronics. Write some applications of electronics. (06) [CO1]
   b) Why is silicon preferred over germanium in making semiconductor devices? Explain the transition capacitance of a diode. (10) [CO1]
   c) "Full-wave rectification is invariably used for conversion of A.C. into D.C.", – justify the statement. (12) [CO1]
   d) Find V_0, I_1, I_{D_1} & I_{D_2} for the following circuit. (07) [CO2]

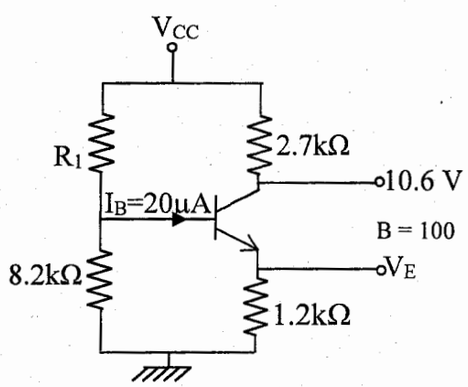


2. a) What are the differences between Zener breakdown and an Avalanche break down? (05) [CO1]
   b) The Zener diode shown in the following figure has $V_Z = 18V$ the voltage across the load stays at 18V as long as I_Z is maintained between 100ma and 1.5A. Find the value of series resistance R so that E_0 remains at 18V. (10) [CO2]



   c) Draw the frequency response of CE amplifier and explain why gain falls at very high frequencies and very low frequencies. (10) [CO3]
   d) Draw and briefly explain common emitter characteristics. Also, show that $\beta = \frac{\alpha}{1-\alpha}$, Where the symbols have their usual meanings. (10) [CO1]

3. a) Why the stabilization of the operating point is necessary? Describe the working principle of a π – fiter. (10) [CO2]
   b) Determine (i) I_c (ii) V_E (iii) V_{CC} (iv) V_{CE} (v) V_B (vi) R_1 for the amplifier circuit in the following figure (10) [CO3]



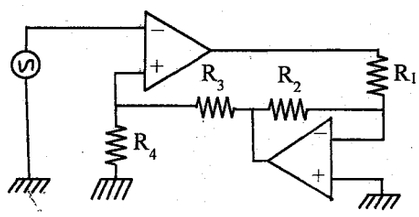
   c) What is meant by the term "hybrid parameter"? Given that $I_E = 2.5mA$, $h_{fe} = 150\ \mu S$, $h_{oe} = 20\ \mu S$ and $h_{ob} = 0.5\mu S$. Determine (i) The common-emitter hybrid equivalent circuit and (ii) The common base r_e model. (10) [CO3]
   d) Why is JFET always depletion-mode only, while MOSFET can be both enhancement and depletion? (05) [CO1]

4. a) Briefly explain the operation of E-MOSFET. Prove that C-MOS works as an inverter. (15) [CO1]
   b) Show that the maximum conversion efficiency of class A power amplifier can be increased using transformer coupling. (10) [CO3]
   c) Design and draw a DC power supply that provided -8V. Also, show the wave Forms at every stage. (10) [CO2]

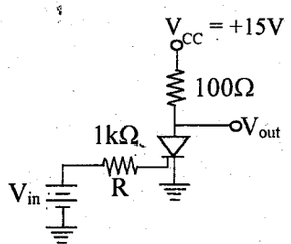
SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) List any of six ideal characteristics of op-amp. Derive the equations of output voltage of an op-amp inverting amplifier and integrator from their respective AC equivalent circuit. (12) [CO3]
   b) Design op-amp circuit that provide the following output voltage. (10) [CO4]
   (i) $V_0 = 4V_1 - \int V_1 dt + 10\frac{dV_2}{dt}$ (ii) $V_0 = 3\iint V_1 dt + 12V_2$.
   c) Power of a 100w, 110V lamp is to varied by controlling firing angle of SCR full wave circuit. The r.m.s value of a.c. voltage appearing across each SCR begin 110V. Find the r.m.s voltage and current in the lamp at firing angle of 45°. (08) [CO1]
   d) Determine the voltage gain of the circuit in the following figure when $R_1 = R_2 = 15k\Omega$ and $R_3 = R_4 = 5\ k\Omega$. (05) [CO4]



6. a) Explain the operation of SCR using two-transistor model then derive expression for anode current, I_A. (12) [CO1]
   b) The SCR of the following figure has gate trigger voltage $V_T = 0.7V$, gate trigger current $I_T = 7mA$ holding current $I_H = 6mA$. (12) [CO1]
   (i) What in the output voltage when the SCR is off? (ii) What is the input voltage that triggers the SCR? (iii) If V_{cc} is decreased until the SCR opens, what is the value of V_{cc}?



   c) How are the chips manufactured from a wafer? Describe the whole process by describing silicon wafer manufacturing. (11) [CO2]

7. a) Explain the operation of UJT as relaxation Oscillator and derive the expression for the Frequency of the generated wave. (13) [CO1]
   b) Explain the role of DIAC in reducing harmonic distortion in light dimmers. Draw the V-I characteristics of TRIAC and explain the four modes of conduction. (13) [CO1]
   c) Design and explain an active band pass filter, also show frequency response of it. (09) [CO1]

8. a) What do you mean by UPS? Explain three different types of UPS with appropriate block diagrams. (11) [CO4]
   b) Explain Barkhausen criteria. Explain the operation of Tank circuit. (10) [CO3]
   c) Explain the operation of RC phase shift oscillator. Derive the expression of frequency of oscillation for the mentioned oscillator. (14) [CO3]