

Date: 2081/09/01	Level BE	Full Marks 50
Programme BCE		Time
Semester III		1.5 hrs

Subject: - Database Management System

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- 1) What is DBMS. State advantages of DBMS over file processing system. [8]
- 2.a) Define the role of relational algebra and its associated basic operators with necessary notations. [8]
- b) Draw an E-R diagram for hospital management system. (Use DOCTOR, PATIENT, HOSPITAL and MEDICAL_RECORD Entity) [6]
- 3) Define Normalization and state the advantages of normalization. Normalize database
Employee(emp_id,emp_name,phone,skill,salary,deptno,dept_name,jobno,job_title)
upto 3NF. [8]
- 4) Consider the following relations:
EMP(empno , deptno, ename ,salary,city) [10]

Write SQL query for the following cases:

- I. Display employee number and name in an increasing order of salary.
- II. Display employee name starting with "S" and working in deptno 105
- III. Delete all employee of department 100.
- IV. Display number of employees department wise
- V. Insert the new employee as 500, 102, rohit, 50000, kathmandu.

5. Write short notes on: (any two)
- a) Keys .
b) Integrity Constraints
c) Aggregate Functions

2x5

Date:	2081/10/25	Full Marks	100
Level	BE	Time	
Programme	BCE		

Subject: - Database Management Systems

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. What are the three levels of DBMS architecture? Explain each. [7]
2. Draw an ERD (Entity-Relationship Diagram) for a library management system that keeps the information about user, admin, login, book and book record. Assume suitable relationships and attributes. [8]
- a) Derive the relational schema from E-R diagram that you designed in question no 2.a) [7]
- b) [8]
3. Consider the following relations:
employee (employee-name, street, city)
works (employee-name, company-name, salary)
company (company-name, city)
manages (employee-name, manager-name)
- Write the SQL commands for the following
- I. Find the names and cities of residence of all employees who work for "ABC Bank".
- II. Find all employees in the database who live in the same cities as the companies for which they work.
- III. Modify the database so that Janardan now lives in Butwal.
- IV. Delete all tuples in the works relation for employees of "XYZ Bank".
4. What are triggers? Explain the concept of referential integrity constraint in relational databases with a suitable example. [7]
- a) Define BCNF. Given the following relation R and the set of functional dependencies F that hold on R, find all candidate keys for R. [8]
- R (A, B, C, D, E, F)
 $F = \{AB \rightarrow C, AC \rightarrow B, AD \rightarrow E, BC \rightarrow A, E \rightarrow F\}$
5. How do views help in maintaining database security? Explain the granting and revoking of privileges to database users. [7]

6. For the following banking database schema:

branch(branch-name, branch-city, assets)

account (account number, branch-name, balance)

depositor (customer name, account number)

[8]

Write down an expression in the relational algebra for query:

- Find the names of all depositors who have an account in "Satdobato" branch with a balance greater than 60,000

Construct an initial operator tree and final efficient operator tree after applying transformation rules.

7. Define B+ tree structure used for indexing. Briefly explain how variable length records are stored in the databases.

[7]

8. a) What are the properties that must be hold by transaction. Explain the usefulness of each.

[8]

b) Explain briefly two-phase locking protocol for concurrency control. Write the different types of failure that may occur in a system. Define the role of checkpoint in system recovery.

[7]

9. Compare between a traditional RDBMS and a distributed NoSQL database. How does Blockchain technology ensure secure and tamper-proof databases?

[8]

10. a) Write short notes on:

Strong and Weak Entity Sets

Stored Procedures

Query Processing

[2*5=10]

Term Test I

Date:	2081/09/02	Full Marks	50
Level	BE	Time	
Programme	BCE		

Semester III

Subject: - Operating Systems

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Define process. Explain the different structures of os along with its evolution. [8]
2. Explain producer consumer problems. Provide a solution using busy wait. Is it a proper solution? Give your opinions. [8]
3. Define threads. Differentiate between user level threads and kernel level threads. [7]
4. Draw a Gantt Chart and find average turnaround time and waiting time of the following process applying SJF(Preemptive), FCFS and Round Robin (quantum=3) scheduling algorithm. [8]

Process	A	B	C	D	E
Arrival Time	0	2	4	7	9
Burst Time	7	6	8	5	4

5. Consider the following page reference strings: a, b, c, d, b, a, e, f, b, a, b, c, g, f, c, b, a, b, c, f. How many page faults would occur for each of the following page replacement algorithms assuming 3 pages a frame? In each case calculate the fault ratio. [7]
 - FIFO Page Replacement
 - LRU Page Replacement
 - Second Chance Page Replacement
6. Given five memory partitions of 200KB, 500KB, 200KB, 300KB and 600KB (in order), how would each of the first fit, best fit and worst fit algorithms place process of 212KB, 417KB, 112KB and 426KB (in order)? Which algorithm makes the most efficient use of memory? [7]

$$[2.5*2=5]$$
7. Write short notes on: (**Any two**)
 - Translation Lookaside Buffer
 - PCB
 - Multithreading Models Kernel, CPU

Term Test II

Date:	2081/10/27		
Level	BE	Full Marks	100
Programme	BCE	Time	
Semester	III	3 hrs	

Subject: - Operating Systems

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. Define Operating System (OS). Explain the concept of OS as a Resource Manager. [8]
2. Explain the Process Control Block (PCB) and the different process states in detail. [7]
3. Define Race Condition. What causes race conditions? Explain the Test-and-Set Lock (TSL) solution for race conditions. [8]
4. Explain the Producer-Consumer Problem in process synchronization and provide solutions using semaphores. [7]
5. Define threads. Explain multithreading models with appropriate figures. [7]
6. Define the Critical Section. Consider the following state snapshot:

Process	Allocation (A, B, C, D)	Max (A, B, C, D)	Available (A, B, C, D)
P0	3, 0, 1, 4	5, 1, 1, 7	1, 0, 0, 2
P1	2, 2, 1, 0	3, 2, 1, 1	
P2	3, 1, 2, 1	3, 3, 2, 1	
P3	0, 5, 1, 0	4, 6, 1, 2	
P4	4, 2, 1, 2	6, 3, 2, 5	

Determine whether the system is in a safe state. If yes, find the safe sequence. [8]

7. Compute average waiting time and turnaround time for the given processes using:
 - (i) Round Robin (Quantum = 5),
 - (ii) SJF,
 - (iii) Priority Scheduling (High = 1).

Process	P1	P2	P3	P4	P5	P6
Burst Time	30	7	5	18	5	8
Priority	2	6	1	3	5	4

8. Given five memory partitions of 200KB, 500KB, 200KB, 300KB, and 600KB, analyze how the First Fit, Best Fit, and Worst Fit algorithms would allocate memory to processes of 212KB, 417KB, 112KB, and 426KB (in order). Which algorithm makes the most efficient use of memory? [7]
9. Given the page reference string:
~~1, 3, 5, 3, 7, 1, 5, 3~~ (1, 2, 3, 7, 6, 3), 4, 1, 8,
calculate the number of page faults for the following page replacement algorithms (assuming 4-page frames) and compute the fault ratio:
(i) FIFO Page Replacement
(ii) LRU Page Replacement
(iii) Second Chance Page Replacement [7]
10. Define file descriptor. Explain the various file system implementations with appropriate figures. [7]
11. Define directory. Explain the working of the access control matrix contrasting with the access control list. [7]
12. Consider the disk track requests: 123, 250, 298, 120, 13, 300, 224. Assume the last request was at track 150, and the head is moving towards track 0. Calculate the total seek time for the following disk scheduling algorithms:
(i) SSF, (ii) C-SCAN, (iii) FIFO. [6]
13. Define the term memory wall. Explain the cloud operating system. [8]
14. Write short notes on: (any two)
a. Thrashing
b. Convoy Effect
c. Starvation [7]
[2.5*2 = 5]

Term Test I

Date:	20/1/09/05	Full Marks:	50
Level:	BE	Time:	
Programme:	BCE		

Semester: III

1.5 hrs

Subject: - Data Communication

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Why do we need data communication system? Draw and explain the model of data communication system. 6
- b) Define bit rate and baud rate. Explain the RS-232 standards with <sup>asyn
randomising</sup> 8
- handshake signals.
2. a) State Shannon channel capacity theorem. Consider that a 100-kbps data stream is to be transmitted on a voice-grade telephone circuit (with a bandwidth of 3kHz). Is it possible to approach error-free transmission with a SNR of 10 dB? Justify your answer. 7
- b) Comment on the linearity, stability, time invariance and causality for the following system:
 $y(t) = t^2 x(t)$. 10
3. a) Differentiate between energy and power signal. 5
- b) Compare and contrast between OSI reference model and TCP/IP model. 9
4. Write short note: (Any one) 5
 - a) Modes of data transmission
 - b. ALOHA

user to host
 - non
 - relay
 - dup
 - connect
 - disconnect
 - timer
 - queue
 - idle
 - wait
 - wire & user
 - netw. the
 - autonomous

1. OSI
 2. model is
 than proto

Term Test II

Date:	2081/11/04		
Level	BE	Full Marks	100
Programme	BCE	Time	
Semester	III		3 hrs

Subject: - Data Communication

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) How did people communicate in the past and how does it differ from today? Which method do you think is more reliable and why? 7
- b) Define bit rate and baud rate. A TV channel has a signal with bandwidth of 18MHZ and it is transmitted with average power of 6W. This signal has to travel through a channel which introduces an average noise of 0.1mW. If this TV signal is digitized and sent, find the maximum data rate of the channel. 8
2. a) Find whether the given signal is energy or power signal. 8
 $x(t)=e^{-2t}u(t)$.
OR
 a) Check for linearity, causality, stability and time variance for the following signal.
 $y(t)=t * x(t)$
 b) How do you classify a signal? Explain any four classification of signals. 7
3. a) Name the layers of TCP/IP model. Compare and contrast CSMA/CD and CSMA/CA in terms of their working mechanisms and applications. 1+6
 b) Among all the guided transmission media, which do you think is the best? Explain. *wire*. 8
4. a) Given the message, BCCABBDDAECCBBAED, find
 - i. Huffman code for each character
 - ii. Compression ratio if original character is represented by 8 bits.
 - iii. Encode the message.**OR**
 a) A bit stream 1100110 is transmitted using CRC method. The generator polynomial is x^3+1 . Calculate error free message at receiver. If the third bit from the left is inverted then show that error is detected at receiver's end. 8

 b) What is Hamming code? A 7-bit hamming code is received as 1110101. 7
 What will be the correct code?
5. a) What are the data link layer design issues? How does Go-Back-N ARQ improve stop-and-wait protocol? 8

 b) Is multiplexing and switching same? Explain the different types of switching. 7
6. a) How is QPSK better than PSK? Explain in detail. 7

 b) Define line coding. Represent the given sequence of bits 11001000011001 using:
 - i. AMI
 - ii. HDB3
 - iii. Unipolar NRZ
 - iv. NRZ-I

7. a) Write short note: (Any two)
- a. Amplitude modulation
 - b. Cellular telephony
 - c. Analog Hierarchy

Term Test I

Date: 2081/09/03			
Level	BE	Full Marks	50
Programme	BCE	Time	
Semester	III	1.5 hrs	

Subject: - Microprocessor & Assembly Language Programming

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a. Draw a well labeled timing diagram of instruction MVI C, 24H. Describe about the bus and signals used in the diagram. [7]
- b. Design an interfacing circuit to interface 2 RAM chips of 8 KB each with starting address C000H [8]
2. a. Draw the pin configuration of 8085 microprocessor and explain about the pins related with Interrupts. [7]
- b. Show the READ and WRITE operation of Static RAM with its advantages and disadvantages. [8]
3. a. Write an assembly language program in 8085 multiply two numbers. First number is 09H and second number is located in memory location [D055]- 08H. Store the result in memory location E056H. [7]
- b. Explain briefly about Von-Newmann and Harvard Architecture along with diagram. [8]
4. Write short notes on: (**any one**) [1*5=5]
 - a. Microprocessor vs microcontroller
 - b. Synchronous and Asynchronous Bus

Term Test II

Date:	2081/10/29	Full Marks	100
Level	BE	Time	
Programme	BCE		

Semester III

3 hrs

Subject: - Microprocessor & Assembly Language Programming

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- CPU MUL INT JNTR DAA ADD SUB
1. a) Define Microprocessor. Explain the types of Architecture according to storage and memory. 7
 - b) What are the interrupt pins of 8085 microprocessor? Explain the different methods of handling multiple interrupts 8
 2. a) Write an assembly language program in 8085 to count the number of 1's in the number F3H and store the count value in the memory location EFEF. Comments in program indicate full marks. 7
 - b) Draw and explain a well-labelled timing diagram of the instruction IN 05H and calculate the time required to execute this instruction if the crystal frequency is 6MHz. 8
 3. a) What is the importance of DAA instruction? Explain it with an appropriate example along with the necessary calculations. 7
 - b) Design an Addressing Decoding circuit to interface 2¹⁶ RAM chips each of size 256 bytes with starting address 5300H. 8
 4. a) Explain the architecture of 8255A controller and explain the selection of ports available in it. 7
 - b) What do you mean by addressing modes? Explain the types of addressing modes on 8086 microprocessors. 8
 5. a) Discuss the advantage of 8086 over 8085 and explain the concept of pipelining and segmentation. 7
 - b) Write an assembly language program in 8086 to find the largest number among 10 blocks of data and store the largest value in location "largest" 8
 6. a) What is Macro assembler? Differentiate between Macros and Procedures. 7
 - b) Explain simplex, Half-duplex and Full duplex mode in serial communication. 8
 7. Write short notes on: (Any Two) 2x5
 - a) Memory hierarchy
 - b) Interrupt Vector Table
 - c) Static and Dynamic RAM

Term Test I

Date: 2081/09/04			
Level	BE	Full Marks	50
Programme	BCE	Time	
Semester	III	1.5 hrs	

Subject: - Computer Graphics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. **a)** What is Computer Graphics? Differentiate between raster and random display with its architecture [8]
 - b) Define Frame buffer? Suppose an RGB raster system is to be designed using an 8 inch x 10 inch screen with a resolution of 100 pixels per inch in each direction. If we want to store 6 bits per pixel in the frame buffer, how much storage in bytes do we need for the frame buffer? Also find out the aspect ratio of the raster system. [7]
 2. a) Derive an equation for line drawing using Bresenham's algorithm for slope less than one? [7]
- OR**
- Digitize a circle using mid point circle algorithm for $(X-2)^2/25 + (Y-3)^2/36 = 1$
- b)** Explain the boundary fill algorithm in detail and how this approach differs from flood fill. [8]
 3. a) What is composite transformation. Explain why do we need homogeneous coordinate system for transformation of computation in computer graphics. [7]
- OR**
- What is transformation? Magnify the triangle with vertices A (0,0) B(1,1) and C(5,2) to thrice its size while keeping C(5,2) fixed. [8]
- b) Explain the shadow mask method with neat figure.
 4. Write short notes on **(Any one)** 5 marks
 - a) Video controller
 - b)** DDA vs Bresenham's

Date:	2081/11/01		
Level	BE	Full Marks	100
Programme	BCE	Time	

Semester III

3 hrs

Subject: - Computer Graphics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

- 1 a) What is Computer Graphics? Differentiate between raster and random display with its architecture. [8]
- b) Define Frame buffer? Suppose an RGB raster system is to be designed using an 8 inch x 10 inch screen with a resolution of 100 pixels per inch in each direction. If we want to store 6 bits per pixel in the frame buffer, how much storage in bytes do we need for the frame buffer? Also find out the aspect ratio of the raster system. [7]
- 2 a) Derive an equation for line drawing using Bresenham's algorithm for slope less than one? [7]

OR

- Digitize a circle using mid point circle algorithm for $(X-2)^2/25 + (Y-3)^2/36 = 1$
- b) Explain the boundary fill algorithm in detail and how this approach differs from flood fill. [8]

- 3 a) What is composite transformation. Explain why do we need homogeneous coordinate system for transformation of computation in computer graphics. [7]

OR

- What is window and viewport? Magnify the triangle with vertices A(0,0) B(1,1) and C(5,2) to thrice its size while keeping C(5,2) fixed.
- b) Explain the Sutherland Hodgeman polygon clipping algorithm considering the four different cases with example. [8]

OR

- Let R be the rectangular window whose lower left hand corner is at L (-3, 1) and upper right-hand corner is at R (2, 6). Use Cohen -Sutherland algorithm to clip the line segments A (-4, 2) and B (-1, 7).

- 4 a) What do you mean by Interpolated and Approximated spline. Derive an expression to specify a cubic Bezier curve segment controlled by the point P_0, P_1, P_2, P_3 [8]
- b) Derive the transformation matrix formed by Oblique and Orthographic projection. [7]

- 5 a) Explain the Painter's algorithm with necessary figure for removing hidden surface problem. [7]
- b) Explain Gouraud shading with its disadvantage and which method would be applicable to remove the drawback of Gouraud shading and how? [8]

Date:	2081/08/30	Full Marks	50
Level	BE	Time	
Programme	BEIT, BCE, BCV		
Semester	III		1.5 hrs

Subject: - Calculus II

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) Prove that the necessary and sufficient condition for the vector function \vec{a} of scalar variable t to have a constant direction is $\vec{a} \times \frac{d\vec{a}}{dt} = \vec{0}$. [8]

OR

State Stoke's Theorem. Using Stokes theorem evaluate $\int_C \vec{F} \cdot d\vec{r}$ where

$\vec{F} = (y, \frac{z}{2}, \frac{3y}{2})$ and C is the ellipse $x^2 + y^2 + z^2 = 6z, z = x + 3$.

- b) State Green's Theorem. Using it evaluate $\oint_C [(x^3 - 3y)dx + (x + \sin y)dy]$, C : the boundary of the triangle with vertices $(0,0), (1,0), (0,2)$. [7]

2. a) Find the Fourier cosine series of the function

$$f(x) = \begin{cases} kx & \text{for } 0 \leq x \leq \frac{l}{2} \\ k(l-x) & \text{for } \frac{l}{2} \leq x \leq l \end{cases} \text{ and show that } \frac{1}{1^2} + \frac{1}{3^2} + \frac{1}{5^2} + \dots = \frac{\pi^2}{8}. \quad [8]$$

- b) Find the Fourier series expansion of $f(x) = x + |x|$ for $-\pi < x < \pi$. [7]

3. a) Evaluate the integral $\int_0^2 \int_0^{4-x^2} \frac{xe^{xy}}{4-y} dy dx$ by changing the order of integration if necessary. [8]

- b) Find the volume in the first octant bounded by the co-ordinate planes, the

- cylinder $x^2 + y^2 = 4$ and the plane $z = x + 4$. [7]

4. Short Questions:

- (b) Evaluate $\int_0^1 \int_0^y \int_0^{x+y} dz dx dy$.

- (c) Define directional derivative of ϕ in the direction of \vec{a} . Find the directional

- derivative of $\phi = x^2 + y^2 - z^2$ at the point $A(1,3,-2)$ in the direction of \overrightarrow{AB} where B is the point $(4,7,3)$. [2 × 2.5 = 5]

Term Test II

Date: 2081/10/23

Level BE

Programme BEIT, BCE, BCV

Semester III

Full Marks 100

Time

3 hrs

Subject: - Calculus II

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a. Evaluate the integral

$$\int_0^z \int_x^2 y^2 \sin(xy) dy dx$$

by changing the order of integration. [5]

- b. Evaluate

$$\iiint_V (xy + yz + zx) dx dy dz$$

where V is the region bounded by

$x = 0, x = 1, y = 0, y = 2, z = 0$ and $z = 3$. [5]

- c. Find the volume in the first octant bounded by the co-ordinate planes, the cylinder $x^2 + y^2 = 4$ and the plane $z + y = 3$. [5]

2. a. Solve $(1 - x^2)y'' - 2xy' + 2y = 0$ by using power series method. [7]

- b. State Legendre polynomial. Express $10x^3 + 2x^2 - 5x - 3$ in terms of Legendre polynomials by using Rodrigues formula. [8]

OR

Define Bessel's differential equation of order n . Show that

$$J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \left(\frac{3-x^2}{x^2} \sin x - \frac{3}{x} \cos x \right)$$

3. a. Solve the following differential equation by using Laplace transform
 $y'' + 4y' + 4y = \sin t, y(0) = 1, y'(0) = 3$. [7]

- b. Define inverse Laplace transform. Find the inverse Laplace Transform of

i) $\frac{1}{(s-3)^3}$

ii) $\frac{s^2 - \pi^2}{(s^2 + \pi^2)^2}$

[8]

4. a. If $\phi = \ln(x^2 + y^2 + z^2)$, find $\text{div}(\text{grad } \phi)$ and $\text{curl}(\text{grad } \phi)$. [7]

OR

Let S be the part of the graph of $z = 9 - x^2 - y^2$ with $z \geq 0$. If

$\vec{F} = 3x\vec{i} + 3y\vec{j} + z\vec{k}$, find the flux of \vec{F} through S .

- b. State Gauss divergence theorem. Evaluate $\iiint_V \text{div } \vec{F} dv$ where

$\vec{F} = (x^3, y^3, z^3)$, S is the sphere $x^2 + y^2 + z^2 = 9$. [8]

5. a. State Green's theorem. Using Green's theorem, calculate
 $\int \{(x^2 + y^2)i - 2xyj\} \cdot d\vec{r}$
 along the rectangle bounded by
 $y = 0, y = b, x = 0, x = a.$ [7]
- b. Evaluate $\iint_S \vec{F} \cdot \hat{n} dA$ where $\vec{F} = (y^2, x^2, z^2), S: x^2 + 4y^2 = 1, x \geq 0, y \geq 0, 0 \leq z \leq h.$ [8]
6. a. Find the Fourier series for the function
 $f(x) = x$ in the interval $0 < x < 2\pi.$ [7]
- b. Find the Fourier sine as well as cosine series representation of the half range
 function $f(x) = x^2$ for $0 < x < 1.$ [8]
7. Attempt all the questions: [4*2.5=10]
- a. Find the general solution of $2u_{xx} + 2u_{yy} - u = 0.$
- b. Define unit step function and find its Laplace transform.
- c. If $P_n(x)$ is the Legendre polynomial, prove that $P_n(1) = 1.$
- d. Find the acceleration of the curve $\vec{r} = (t, t^2, t^3)$ at $t = 1.$