THIRD SEMESTER B.TECH DEGREE EXAMINATION

(2013 Scheme)

13.301 ENGINEERING MATHEMATICS-II (ABCEFHMNPRSTU)

MODEL QUESTION PAPER

Time: 3 hours　　　　　　　　　　　　　　　　　　　　Maximum marks: 100

PART-A

*Answer **all** questions. **Each** question carries 4 marks*

1. A particle moves so that its position vector is given by

$\vec{r} = coswt\ \hat{\imath} + sinwt\ \hat{\jmath}$, show that the velocity $\overrightarrow{V}$ of the particle is perpendicular to $\vec{r}$.

2. If $f(x) = x\ ,\ o < x < \frac{\pi}{2}$

$= \pi - x\ ,\ \frac{\pi}{2} < x < \pi$. Show that $f(x) = \frac{4}{\pi}\ (sinx - \frac{sin3x}{3^2} + \frac{sin5x}{5^2} - \cdots)$

3. Find the cosine transform of $f(x) = sinx$ in $0 < x < \pi$.

4. Solve the partial differential equation if $\frac{\partial z}{\partial x} = 6x + 3y\ ; \frac{\partial z}{\partial y} = 3x - 4y$.

5. State the assumptions involved in the derivation of one dimensional Heat equation.

PART-B

*Answer **one full** question from **each** module. **Each** question carries **20** marks.*

MODULE-I

6. a) Find the constants a and b so that the surfaces $5x^2 - 2yz - 9x = 0$ and $ax^2y + bz^3 = 4$, may cut orthogonally at the point $(1, -1, 2)$.

b) If φ is a scalar point function, use Stoke's theorem to prove that $Curl(grad\ \varphi) = 0$.

c) Evaluate by Green's theorem in the plane for $\int_C (y - sinx)dx + cosx\ dy$ where C is the boundary of the triangle whose vertices are (0,0), $(\frac{\pi}{2}$,0) and $(\frac{\pi}{2}, 1)$.

7. a) If $\vec{r} = x\ \hat{\imath} + y\ \hat{\jmath} + z\ \hat{k}$ prove that $\nabla r^n = nr^{n-2}\ \vec{r}$ where $r = |\vec{r}|$.

b) Show that $\vec{F} = e^x\left[(2y + 3z)\hat{\imath} + 2\hat{\jmath} + 3\hat{k}\right]$ is irrotational and find its scalar potential.

c) Using divergence theorem, evaluate $\iint_S F.n\hat{}\ ds$ where $\overrightarrow{F} = 4x\hat{\imath} - 2y^2\hat{\jmath} + z^2\hat{k}$ and S is the surface bounding $x^2 + y^2 = 4, z = 0$ and $z = 3$

MODULE-II

8. a) Obtain the Fourier series of the function $f(x) = \left(\frac{\pi-x}{2}\right)^2$ in $(0,2\pi)$

b) Find the Fourier transform of $f(x) = 1 \ , |x| < a$

$= 0 \ , |x| \geq a$

Hence evaluate $\int_0^\infty \frac{sinx}{x} dx$

9. a) Find the Fourier series of $f(x) = -x + 1 \ , -\pi \leq x \leq 0$

$= x + 1 \quad , \quad 0 \leq x \leq \pi$

b) Find the Fourier cosine transform of $f(x) = e^{-4x}$ and

hence show that $\int_0^\infty \frac{cos2x}{x^2+16} dx = \frac{\pi}{8} e^{-8}$

MODULE-III

10. a) Solve the pde $pxy + pq + qy = yz$.

b) Solve the pde $(D^2 - DD' + 2D'^2)z = e^{3x+4y} + \sin(x - y)$

11. a) Solve the partial differential equation $x(y^2 - z^2)p - y(z^2 + x^2)q = z(x^2 + y^2)$

b) Solve the pde $(D^2 + DD' - 6D'^2)z = \ ycosx$

MODULE-IV

12. a) Using the method of separation of variables, solve $\frac{\partial u}{\partial x} - 2\frac{\partial u}{\partial t} = u$ given that

$u = 3e^{-5x} + 2e^{-3x}$ when $t = 0$.

b) A string of length l is fixed at both the ends. The midpoint of the string is taken to a height b and then released from rest in that position. Find the displacement of the string.

13. a) Solve $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$ subject to the condition, $u(0,t) = 0 = u(\pi,t)$ and

$u(x,0) = \pi x - x^2$ in $(0,\pi)$

b) A rod of length l has its ends A and B kept at $0^0 C$ and $100^0 C$ respectively until steady conditions prevail. The temperature at A is suddenly raised to $25^0 C$ and at the same time that B is lowered to $75^0 C$ and the end temperatures are thereafter maintained. Find the temperature function $U(x,t)$.

THIRD SEMESTER B.TECH DEGREE EXAMINATION

(2013Scheme)

13.302 HUMANITIES (BEFMRSU)

MODEL QUESTION PAPER

Time: 3Hours Max. Marks: 100

***Instructions**: Answer Part-I and Part-II in separate Answer Books.*

PART-I (Economics)

Time: 2 hrs Max. Marks: 70

PART-A

*Answer **all** questions. Each question carries 2 marks.*

1. Distinguish between Producer good and consumer good.
2. Define production function.
3. Give an example of diminishing returns to scale.
4. Who is an entrepreneur?
5. Define the concept of Marginal Product.
6. What is meant by 'reserve requirement' by banks?
7. Name the methods of measuring National Income.
8. What is stagflation?
9. List out two reasons for Privatisation.
10. Define the concept of Poverty. (2 x10= 20 marks)

PART-B

*Answer any **one** full question from each Module. Each full question carries 25 Marks*

MODULE - I

11. What are the Central problems of an economy? Why do they arise? Do all economies have identical Central Problems?

OR

12. Explain the Law of variable proportion and Law of Returns to Scale.

MODULE - II

13. Explain the different concepts related to National Income calculation. Explain the sectoral distribution of National Income in India and what are the issues associated to it.

OR

14. a) Discuss the impact of multinational companies in Indian Economy.

b) Discuss the impact of globalization on Telecom and Financial sector.

PART-II (Accountancy)

Time: 1 hr Max. Marks: 30

*Answer any **two** questions. Each question carries 15 marks.*

1. Explain the concepts and conventions of accountancy.

2. (a) What are journal accounts? Explain the rules for journalizing.
(b) Briefly explain the accounting package.

3. Based on the following trial balance prepare a profit and loss account and a balance sheet.

The following is the trial balance of Mr. Alex as on 31st December, 2013.

	Dr (Rs)	Cr (Rs)
Plant and machinery	45,000	
Freehold premises	55,000	
Stock 1st January 2006	36,500	
Salaries	7,600	
Purchases	65,000	
Sales		1,21,000
Furniture and fitting	6,000	
Carriage inwards	1,675	
Carriage outwards	1,315	
Sales returns	2,400	
Purchases returns		1,365
Discount received		635
Discount allowed	430	
Wages	16,100	
Sundry debtors	41,000	
Sundry creditors		28,800
Alex's capital		1,10,000
Rent, rates and taxes	1,430	
Advertisement	2,400	
Cash in hand	450	
Cash at bank	2,500	
Drawings	3,000	
Loan from Rajesh		26,000
Total	2,87,800	2,87,800

THIRD SEMESTER BTECH DEGREE EXAMINATION 2014

(SCHEME: 2013)

13.303 DISCRETE STRUCTURES (FR)

MODEL QUESTION PAPER

Time: 3 hours Maximum marks: 100

PART-A

*Answer **all** questions. **Each** question carries 2 marks*

1. Write the given formula to an equivalent form and which contains the connectives $\neg$ and $\wedge$ only.

$$\neg\, (P \leftrightarrows (Q \rightarrow (R \vee P)))$$

2. Show that the following implication is a tautology without constructing the truth table

$$((P \vee \neg\, P) \rightarrow Q) \rightarrow ((P \vee \neg\, P) \rightarrow R) \Rightarrow (Q \rightarrow R)$$

3. Show that $(\neg\, P \wedge (\neg\, Q \wedge R)) \vee (Q \wedge R) \vee (P \wedge R) \Leftrightarrow R$ without constructing the truth table.

4. Differentiate between a partition and Covering of a Set with an example.

5. Give an example of an equivalence relation.

6. Let $(A,.)$ be a Group. Show that $(ab)^{-1} = b^{-1}a^{-1}$.

7. List out the properties of a ring.

8. Prove that the Zero element and Unit element of a Boolean algebra B are unique.

9. Define path in a Graph.

10. 51 numbers are chosen from the integers between 1 and 100 inclusively .Prove that 2 of the chosen integers are consecutive.

(10 x 2 Marks = 20 Marks)

PART-B

*Answer **one full** question from **each** module. **Each** question carries **20** marks.*

MODULE - I

11. (a) Show that $(x)\,(P(x) \vee Q(x)) \Rightarrow (x)P(x) \vee (\exists x)Q(x)$ using Indirect method of Proof.

(10 Marks)

(b) Discuss Indirect method of Proof. Show that the following premises are inconsistent.

(i) If Jack misses many classes through illness, then he fails high school.

(ii) If Jack fails high School, then he is uneducated.

(iii) If Jack reads a lot of books, then he is not uneducated.

(iv) Jack misses many classes through illness and reads a lot of books. (10 marks)

12. (a) Show that

(i) $(\exists x)\,(F(x) \wedge S(x)) \rightarrow (y)\,(M(y) \rightarrow W(y))$

(ii) $(\exists y)\,(M(y) \wedge \neg W(y))$ the conclusion $(x)(F(x) \rightarrow \neg S(x))$ follows. (10 marks)

(b) Show that $S \vee R$ is tautologically implied by $(P \vee Q) \wedge (P \rightarrow R) \wedge (Q \rightarrow S)$ (5 marks)

(c) Show the following implication using rules of inferences

$$P \rightarrow (Q \rightarrow R), Q \rightarrow (R \rightarrow S) \Rightarrow P \rightarrow (Q \rightarrow S)$$ (5 marks)

MODULE - II

13. (a) For any two sets A and B Show that $A - (A \cap B) = A - B$. (5 marks)

(b)) Let R and S be two relations on a set of positive integers I.

$R = \{ \langle x, 2x \rangle / x \in I \}$ $S = \{ \langle x, 7x \rangle / x \in I \}$

Find RoS, RoR, RoRoR, RoSoR. (5 marks)

(c) Let $a_0 = 1$, $a_1 = 2$, $a_2 = 3$. $a_n = a_{n-1} + a_{n-2} + a_{n-3}$ for $n \geq 3$ Prove that $a_n \leq 3^n$

(5 marks)

14. (a) Construct a formula for the sum of first n positive odd numbers. Prove the same using mathematical Induction. (5 marks)

(b) Draw the Hasse Diagram of $(P(A), \leq)$ where $\leq$ represents $A \subseteq B$ and $A = \{a, b, c\}$ (5 marks)

(c) Five friends run a race everyday for 4 months (excluding Feb). If no race ends in a tie, show that there are at least 2 races with identical outcomes. (5 marks)

(d) What are Piano Axioms? Explain. (5 marks)

MODULE - III

15. (a) If $(a+b)^2 = a^2 + 2ab + b^2$, $\forall\ a, b \in R$, prove that R is a commutative ring and conversely. (5 marks)

(b) Show that any subgroup of a cyclic group is cyclic. (5 marks)

(c) State and prove Lagrange's Theorem. (10 marks)

16. (a) Let (A,∗) be a Group. Show **that** (A,∗) is an abelian Group if and only if

$a^2 * b^2 = (a*b)^2$ for all a and b in A. (5 marks)

(b) Let (H, .) be a subgroup of a Group (G, .) . Let $N = \{x / x \in G, xHx^{-1} = H\}$. Show that (N, .) is a subgroup of (G, .). (10 marks)

(c) Prove that Every Field is an Integral Domain. (5 marks)

MODULE - IV

17. (a) Prove that in a distributive Lattice, if $b \wedge c = 0$, then $b \leq c$. (5 marks)

(b) Show that $a \vee b$ is the least upper bound of a and b in $(A, \leq)$. Show that $a \wedge b$ is the greatest lower bound of a and b in $(A, \leq)$. (5 marks)

(c) Differentiate between Connected ,Disconnected and Strongly Connected Graphs using examples (10 marks)

18. (a) State and prove any four basic properties of algebraic systems defined by Lattices.

(10 marks)

(b) Differentiate between a Boolean function & Boolean expression. (5 marks)

(c) Simplify the following Boolean expression

$(a \wedge b) \vee c) \wedge (a \vee b) \wedge c)$ (5 marks)

THIRD SEMESTER BTECH DEGREE EXAMINATION 2014

(SCHEME: 2013)

13.304 ELECTRONIC DEVICES AND CIRCUITS (FR)

MODEL QUESTION PAPER

Time: 3 hours Maximum marks: 100

PART-A

*Answer **all** questions. **Each** question carries 2 marks*

1. Why is the bias stabilization required in transistor amplifiers?
2. How Q point is fixed?
3. Discuss the Barkhausen criterion for feedback oscillators.
4. What do you mean by liner wave shaping circuit?
5. Compare the performance of shunt and series regulators.
6. Discuss the important design criterion of a power amplifier.
7. Draw the block diagram of operational amplifier.
8. Explain the virtual ground concept.
9. List the uses of LDR.
10. Explain the term body effect. (10 x 2 Marks = 20 Marks)

PART-B

*Answer **one full** question from **each** module. **Each** question carries **20** marks.*

MODULE - I

11. (a) Derive an expression for stability factor for voltage divider bias of a BJT.

(b) Draw the circuit of a RC coupled amplifier and explain the working.

12. (a) Discuss the effect of negative feedback on the performance of an amplifier.

(b) Explain the working of a Wien oscillator. Derive an expression for the frequency of oscillations.

MODULE - II

13. (a) Draw the circuit of an integrator and derive an expression for its output.

(b) What is a clamping circuit? With the help of a circuit diagram explain its working.

14. (a) List the important features of 7805 voltage regulator IC. Draw a typical circuit to get 5V regulated voltage.

(b) Draw the functional block diagram of 555 timer. What would be the duration of pulse for monostable operation of IC 555 timer with R = 1MΩ and C = 470µF?

MODULE - III

15. (a) A transistor dissipates 10W of power in the following configurations:

(i) Class A transformer coupled amplifier (ii) Class B push pullamplifier.

Find the maximum signal power the amplifier can produce under ideal conditions.

(b) Design an op-amp with a closed loop gain of -20 and an output resistance of 10KΩ.

16. (a) Draw the circuit of a notch filter using simulated inductance approach.

(b) Four parallel8Ω speakers are connected to a transformer. Calculate the turns ratio so that they appear as 3.2K effective load.

MODULE - IV

17. (a) Explain the working of a TFT display with figure.

(b) Draw the structure of typical optocoupler module and explain the working.

18. (a) Explain operation of a MOSFET and its uses as an amplifier.

(b) Calculate the minimum value of Vds required for a nMOSFET to operate in the pinchoff when V_{gs}=1V with V_p=-2V and I_{dss}=10mA. What would be the corresponding value of I_d ?

THIRD SEMESTER BTECH DEGREE EXAMINATION 2014

(SCHEME: 2013)

13.305 DIGITAL SYSTEM DESIGN (FR)

MODEL QUESTION PAPER

Time: 3 hours | Maximum marks: 100

PART-A

*Answer **all** questions**. Each** question carries 2 marks*

1. Simplify the Boolean Expression as much as possible:
   a. $F(A,B,C,D) = BC + ABC\bar{D} + \bar{A}BCD + ABCD$ using postulates and theorems
   b. $F(W,X,Y,Z)=\Sigma m(1,3,5,7,9,11,13,15)$ using K-map.
2. Each of three coins has two sides, head and tail. Represent the head or tail status of each coin by a logical variable (A for the first coin,B for the second coin and C for the third) where the logical variable is 1 for head and 0 for tail. Write a logic function F(A,B,C) which is exactly one of the coins is head after a toss of the coin. Express F as a Minterm expansion.
3. Explain Binary Subtractor.
4. Show the logic diagram of a clocked RS flip-flop with four NAND gates.
5. Identify the main characteristics of a synchronous sequential circuit and an asynchronous sequential circuit.
6. What are the basic differences of flip-flop and latch.
7. Discuss the applications of Jhonson counter.
8. Design a 2x4 decoder in HDL.
9. Draw the logic diagram of a 4 bit-by-3 bit array multiplier.
10. How the didvide-overflow problem can be avoided?

(10 x 2 Marks = 20 Marks)

PART-B

*Answer **one full** question from **each** module. **Each** question carries **20** marks.*

MODULE - I

1. (a) Design a 3-bit comparator. (10)

b. Minimize the function $F=\Sigma(4,5,10,11,15,18,20,24,26,30,31) + \Sigma_{\phi}(9,12,14,16,19,21,25)$ where Σ_{ϕ} are the minterms corresponding to don't care condition using Quine-McCluskey method.(10)

OR

12. a. Design a combinational circuit that will convert the BCD codes for the decimal digits (0 through 9) to their Gray codes.

b. Minimize the following fn. $F(A,B,C,D)= \Sigma m(6,7,8,9)$ assuming that the condition having both A=1 and B=1 (don't care condition = $\Sigma m(12,13,14,15)$) can never occur. Realize the digital circuit using:

i) NAND gates

ii) NOR gates

MODULE – II

13. a. Design a BCD-to-excess3 decoder with a BCD-to-decimal decoder and four OR gates. (6)

b. Reduce the no. Of states in the following state table and tabulate the reduced state table.

Present State	Next State		Output	
	x=0	**x=1**	**X=0**	**x=1**
a	f	b	0	0
b	d	c	0	0
c	f	e	0	0
d	g	a	1	0
e	d	c	0	0
f	f	b	1	1
g	g	h	0	1
h	g	a	1	0

Starting from state 'a' of the above state table, find the output sequence generated with an input sequence 01110010011. (10)

c. What is race condition. With a neat diagram explain how the race condition is removed in JK flip-flop.(4)

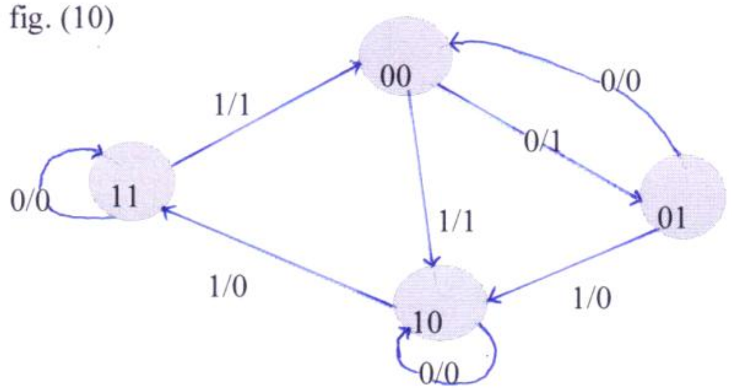
OR

14. a. Design a 4-bit binary ripple down counter using flip-flops that trigger on the

i) Positive edge tyransition

ii) Negative edge transition. (10)

b. Draw a synchronous sequential circuit using D flip-flop for the state diagram in fig. (10)



MODULE - III

15. .a Design a circuit using ROM which accepts a 3-bit binary no. And outputs the square of the number.(4)

b. What size ROM would it take to implement: (6)

i) A BCD adder/ subtractor with a control input to select between the addition and subtraction

ii) A binry multiplier that multiplies two 4-bit numbers

iii)Dual 4-line to 1-line multiplexer with common selection inputs.

c. Design a 4-bit up-down binary counter.(10)

OR

16. a. Design BCD-to-grayncode converter using PLA(10)

b. Design a 3-bit counter that will count in the sequence 000,010,011,101,110,111 and repeat the sequence. Use T flip-flops.(10)

MODULE – IV

17. a. Explain the algorithm for addition and subtraction of floating-point numbers.(10)

b. Prove that the multiplication of two n-digit numbers in base-r gives a product no more than 2n digits in length.Show that this statement implies that no overflow can occur in the multiplication operation. (10)

OR

18. a. Explain Booth's multiplication algorithm with an example. (10)

b. Derive an algorithm for adding and subtracting two fixed point binary numbers when negative numbers are in signed 1's complement representation.(10)

THIRD SEMESTER BTECH DEGREE EXAMINATION 2014

(SCHEME: 2013)

13.306 DATA STRUCTURES AND ALGORITHMS (FR)

MODEL QUESTION PAPER

Time: 3 hours   Maximum marks: 100

PART-A

*Answer **all** questions. **Each** question carries 2 marks*

1. List out four factors that affect running time of an algorithm.

2. Define O-notation.

3. What is step-wise refinement?

4. Write C language statements to check if a circular, double linked list is empty.

5. Give examples for complete binary tree and full binary tree.

6. What is the use of stacks in recursion?

7. How is internal fragmentation different from external fragmentation?

8. Illustrate how mid-square method is used for hashing.

9. For the following list of integers how many comparisons are done by insertion sort and selection sort?

2, 4, 6, 8, 7, 5, 3

10. Show the (final) heap formed the following values are added in the order given?

3, 3, 4, 4, 5, 2, 2, 1, 1   (10 x 2 Marks = 20 Marks)

PART-B

*Answer **one full** question from **each** module. **Each** question carries **20** marks.*

MODULE - I

11. (a) Briefly distinguish between top-down and bottom-up styles of program development.
(4 Marks)

(b) What is the effect of the following code snippets on matrix A of size _ × _?

(i)

```
for(i=0; i<n; i++)
    for (j=i+1; j<n; j++){
            temp=A[i][j];
            A[i][j]=A[j][i];
            A[j][i]=temp;
    }
```

(ii)

```
for(i=0;
i<n; i++)
            for (j=0; j<n; j++){
                    if (i<j)
                            A[i][j]=0;
}
```

(3 Marks)

(c) For each of the snippets above, deduce the expression representing the running time by counting the loops. (6 Marks)

(d) Arrange the following functions in the in the *increasing* order of growth rate:

n^3, $n \log_2 n$, 2^n , $n!$, $\log_2 \log_2 n$, n^n (2 Marks)

(e) Concatenate two circular double linked lists A and B so that B appears *after* A.

(5 Marks)

12. (a) Show, by identifying suitable constants, that,

(i) $(n+1)^3$ is $O(n^3)$ (ii) $\sum_{i=1}^{n} \frac{n-i}{2}$ is $O(n^2)$ (7 Marks)

(b) Distinguish between *worst-case*, *best-case* and *average-case* running times of an algorithm. Give example for an algorithm which has the same worst, best and average running times. ` (4 Marks)

(c) Write an algorithm/C function to find the *rank* of each value in an array of *distinct* integers. Rank of a value *v* is one *more* than the number of values less than *v*. The algorithm/function accepts an array, say *A*, of length *n* as input and return a rank array, Say *R*, of the same length such that *R*[*i*]= rank of *A*[*i*], $0 \le i < n$. For example, if *A* is [4, 1, 7, 0, 5] then *R* is [3, 2, 5, 1, 4]. What is the running time of your algorithm?

(5 Marks)

(d) Write a function that deletes the last element of a singly linked list. (4 Marks)

MODULE - II

13. (a) Draw the following:

(i) A binary tree of height 4 with minimum nodes.

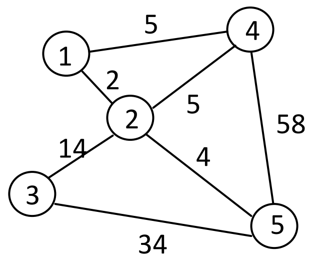
(ii) Two *distinct* binary trees, each of ten nodes, which generate the *same* sequence by in-order traversal.

(iii) A binary tree of 7 nodes with which generate the same sequence in-order as well as pre-order traversal. (5 Marks)

(b) Show the contents of the stack and output after each token when the following infix expression is processed to generate the equivalent postfix expression:

A + B – C *(D/F)/G. (6 Marks)

(c) For the following undirected graph, show the adjacency list and adjacency matrix representations.



(6 Marks)

(d) Represent the following infix expression as a binary tree and show its pre-fix equivalent. P + (Q*R)/W – (A – B)/E (3 Marks)

14. (a) Show pictorially the contents an initially empty circular queue of size 6 *after* each of the following operations: *insert (2), insert(3), insert(5), delete, insert (4), insert(9), delete, insert(10), insert(1), delete, insert(7), insert(8).* (5 Marks)

(b) Show the structure of the binary search tree after adding each of the following values in that order: 1, 12, 5, 7, 1, 0. (6Marks)

(c) Prove, by induction on number of internal nodes that a full binary tree with I internal nodes have I+1 leaf nodes. (4 Marks)

(d) Write a C function that squeezes a string by removing all white spaces. (5 Marks)

MODULE - III

15. (a) Give the algorithm for best-fit allocation. (5 Marks)

(b) Compare first-fit, best-fit and worst-fit strategies. (6 Marks)

(c) Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the First-fit, Best-fit, and Worst-fit strategies processes request for 212K, 417K, 112K, and 426K (in that order)? Which strategy makes the most efficient use of memory? (9 Marks)

16. (a) Discuss and illustrate the buddy system of memory management. (8 Marks)

(b) Consider a memory of size 1024K that uses buddy system for memory management. Suppose that there are four jobs A, B, C and D with memory requirements 70K, 35K, 80K and 60K, respectively. Assume that when a job starts memory is allocated and when it ends, memory is de-allocated. Show the memory structure (allocated and free areas) maintained by the buddy system when each job starts and ends if the jobs are executed in the following order:

A starts, Bstarts, C starts, A ends, D starts, B ends, D ends, C ends

(12 Marks)

MODULE - IV

17. (a) Show (pictorially or otherwise) how split an merge take place when merge sort is applied on the following list of numbers: 2, 5, 2, 0, 10, 9, 8, 23, 7. (9 Marks)

(b) When does binary search give the best and worst performances? Give examples of for each of these situations. (4 Marks)

(c) Give the algorithm/C function for inserting an element in to a heap. (7 Marks)

18. (a) Deduce the expression for best and worst case running times of insertion sort. (8 Marks)

(b) Show (pictorially or otherwise) how the following list is partitioned into smaller sub-lists when quick sort is applied: 3, 4, 6, 20, 10, 9, 7, 5, 1. (8 Marks)

(c) Explain how overflow is handled in hashing. (4 Marks)