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**R. V. COLLEGE OF ENGINEERING**

Autonomous Institution affiliated to VTU

V Semester B. E. Fast Track Examinations July-17

Computer Science and Engineering

**PROBABILITY, STATISTICS AND QUEUING (ELECTIVE)***Time: 03 Hours**Maximum Marks: 100***Instructions to candidates:**

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.
3. Use of statistical tables permitted.

**PART-A**

1	1.1	If $P(A) = 0.12, P(B) = 0.29$ and $P(A \cap B) = 0.07$ then find $P(\overline{A \cup B})$ .	02
	1.2	State central limit theorem.	02
	1.3	Define Type-I and Type-II error.	02
	1.4	To estimate the average amount of time, visitors take to move from one building to another in an office complex, the mean of the random sample of size $n$ is used. Given $\sigma = 1.4$ minutes, compute how large should be the sample size if it is ascertained with 99% confidence that the error $E$ is at most 0.25.	02
	1.5	In a certain town the duration of a shower is exponentially distributed with mean 5 minutes. What is the probability that a shower will last for less than 10 minutes?	02
	1.6	A car hire firm has 2 cars, which it hires out day by day. The demand for the car on each day is distributed as a Poisson distribution with mean 1.5. Calculate the probability that on a certain day neither car is used.	02
	1.7	A TV repair man finds that the time spent on his jobs has an exponential distribution with mean 30 minutes. If he repairs sets in the order in which they came in, and if the arrival of sets is approximately Poisson with an average rate of 10 per 8-hour day. Estimate the repair man's expected idle time in each day.	02
	1.8	In a railway marshalling yard, goods trains arrive at rate of 30 trains per day. Assuming that the inter arrival time follows an exponential distribution and the service time is also exponential with an average 36 minutes. Find the mean queue size.	02
	1.9	Define any two state of Markov chain.	02
	1.10	A gambler's luck follows a pattern. If he wins a game, the probability of winning the next game is 0.6. However, if he loses a game, the probability of his losing the next game is 0.7. Find the transition matrix of his winning.	02

**PART-B**

2	a	In a bolt factory machines $A, B, C$ manufacture respectively 25, 35 and 40 percent of the total. Of their output 5, 4 and 2 percent are defective bolts, respectively. A bolt is drawn at random from the product and is found to be defective. Find the probabilities that it was manufactured by machines $A, B$ or $C$ .	06
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	b	Prove that the function $f(x,y) = \begin{cases} \frac{2}{5}(3y + 2x); & 0 \leq x,y \leq 1 \\ 0; & otherwise \end{cases}$ is joint probability density function. Find the marginal density functions of $X$ and $Y$ from the joint density function.	06												
	c	If independent random samples of size $n_1 = n_2 = 8$ come from normal population having the same variance. What is the probability that either sample variance will be at least 7 times as large as the other?	04												
	<b>OR</b>														
3	a	The electric light bulbs of a manufacturer $A$ have a mean life of 1300 hours with a standard deviation of 120 hours, while those of a manufacturer $B$ have a mean life of 1200 hours with a standard deviation of 90 hours. If random samples of 150 bulbs of each brand are tested, calculate the probability that brand $A$ bulb will have a mean life which is at least 80 hours more than brand $B$ bulbs.	06												
	b	The joint distribution of two random variables $X$ and $Y$ is given by the following table: <table border="1"><tr><td><math>X \backslash Y</math></td><td>1</td><td>2</td><td>3</td></tr><tr><td>1</td><td>0.06</td><td>0.15</td><td>0.09</td></tr><tr><td>2</td><td>0.14</td><td>0.35</td><td>0.21</td></tr></table>	$X \backslash Y$	1	2	3	1	0.06	0.15	0.09	2	0.14	0.35	0.21	
$X \backslash Y$	1	2	3												
1	0.06	0.15	0.09												
2	0.14	0.35	0.21												
	c	Determine the individual (marginal) distribution of $X$ and $Y$ . also verify that $X$ and $Y$ are stochastically independent. An electric firm manufactures light bulbs that have a length of life that is approximately normally distributed, with mean equal to 800 hours and a standard deviation of 40 hours. Find the probability that a random sample of 16 bulbs will have an average life of less than 775 hours.	06 04												
4	a	A computer scientist, trying to optimize system performance. Collected 50 data on the time in microseconds, between requests for a particular process service which have mean 11,795 and standard deviation 14,054 what can assert with 99% confidence about the maximum error if $\bar{X} = 11,795$ is used to estimate of the true population mean inter request time.	04												
	b	According to the norms established for a mechanical aptitude test, persons who are 18 years old should average 76.4 with a standard deviation of 9.2. If 49 randomly selected persons of the age averaged 8.2. Test the null hypothesis $\mu = 76.4$ against the alternative hypothesis $\mu > 76.4$ at the 0.01 level of significance.	06												
	c	A trucking firm is suspicious of the claim that the average life time of certain tires is at least 28,000 miles. To check the claim, the firm puts 40 of these tires on its trucks and gets a mean lifetime of 27,463 miles with standard deviation of 1.348 miles. What can it conclude if the probability of a Type-I error is to be at most 0.01?	06												
	<b>OR</b>														
5	a	A random sample of 100 teachers in a large metropolitan area revealed a mean weekly salary of Rs 2,000 with standard deviation of Rs 43. With what degree of confidence can we assert that the average weekly salary of all teachers in the metropolitan area is between Rs 1,985 and Rs 2015?	04												

	b	The length of life $X$ of certain electric bulbs is approximately normally distributed with mean 800 hours and standard deviation of 40 hours, if a random sample of 30 bulbs has an average life of 788 hours, test the null hypothesis that $\mu = 800$ against the alternative that $\mu \neq 800$ hours at 10% level of significance.	06
	c	The manufacturer claims that the average tar content of a certain kind of cigarette is $\mu = 14.0$ . In attempt to show that it differs from this value; five measurements are made of the tar content (mg per cigarette) 14.5, 14.2, 14.4, 14.3, 14.6. Show that the difference between the mean of this sample $\bar{X} = 14.4$ and the average tar claimed by the manufacturer, $\mu = 14.0$ , is significant at $\alpha = 0.05$ . Assume normality.	06
6	a	A random variable $X$ has density function given by $(x) = \begin{cases} 1/2 e^{-x/2}, & x > 0 \\ 0, & \text{otherwise} \end{cases}$ , find moment generating function, mean and variance.	06
	b	The average rate of phone calls received is 0.6 call per minute at an office. Determine the probability that i) There will be one or more calls in a minute ii) There will be at least three calls during four minutes.	06
	c	State and prove Markov's inequality.	04
		<b>OR</b>	
7	a	A distributor of bean seeds determines from extensive tests that 5 % of large batch of seeds will not germinate. He sells the seeds in packets of 200 and guarantees 90% germination. Estimate the probability that a particular packet will violate the guarantee.	04
	b	The length of time of one person to be served at a cafeteria is a random variable $X$ having an exponential distribution with a mean of 4 minutes. Determine the probability that a person is served in less than 3 minutes and between 4 and 5 minutes.	06
	c	State and prove Chernoff's bounds.	06
8	a	Patients arrive at the government hospital for emergency service at the rate of one every hour. Currently, only one emergency case can be handled at a time. Patients spend on average of 20 minutes receiving emergency care. The doctor wishes to have enough seats in the waiting room so that no more than of about 1% of arriving patients will have to stand. Find i) The probability that a patient arriving at the hospital have to wait. ii) Average time a patient spends in the system. iii) Average time a patient spends in the queue. iv) Probability that there will be five or more patients waiting for the service.	08
	b	A super market has two girls serving at the counters. The customers arrive in a Poisson fashion at the rate of 12 per hour. The services time for each customer is exponential with mean 6 minutes. Evaluate i) The probability that an arriving customer has to wait for service. ii) The average number of customer in the system. iii) The average time spent by a customer in the supermarket.	08
		<b>OR</b>	

<p>9</p> <p>a</p> <p>b</p>	<p>Suppose people arrive to purchase tickets for a basketball game at the average rate of 4 min. It takes an average of 10 seconds to purchase a ticket. If a sports fan arrives 2 minutes before the game starts and if it take exactly <math>1\frac{1}{2}</math> min to reach the correct seat after the fan purchase a ticket, then</p> <p>i) Can the sports fan expect to be seated for the start of the game?</p> <p>ii) What is the probability that the sorts fan will be seated for the start of the game?</p> <p>iii) How early must the fan arrive in order to be 99% sure of being seated for the start of the game?</p> <p>A telephone exchange has two long distance operators. The telephone company finds that during the peak load, long distance calls arrive in a Poisson distribution at an average of 15 per hour. The length of service on these calls is approximately exponentially distributed with mean length 5 minutes.</p> <p>i) Evaluate the probability that a subscriber will have to wait for his long distance call during the peak hours of the day.</p> <p>ii) If the subscribers will wait and are serviced in turn, estimate the expected waiting time.</p>	<p>08</p> <p>08</p>
<p>10</p> <p>a</p> <p>b</p>	<p>Show that the stochastic matrix</p> $A = \begin{bmatrix} 0 & 1/2 & 1/2 & 0 \\ 1/2 & 1/4 & 0 & 1/4 \\ 0 & 0 & 0 & 1 \\ 0 & 1/2 & 0 & 1/2 \end{bmatrix}$ <p>is regular and find the fixed probability vector of it.</p> <p>Three bags <math>A, B</math> and <math>C</math> are throwing a ball to each other. <math>A</math> always throws the ball to <math>B</math> and <math>B</math> always throw the ball to <math>C</math>. But <math>C</math> is just as likely to throw the ball to <math>B</math> as to <math>A</math>. if <math>C</math> was the first person to throw the ball, find the probabilities that</p> <p>i) <math>A</math> has the ball</p> <p>ii) <math>B</math> has the ball and</p> <p>iii) <math>C</math> has the ball for the fourth throw.</p> <p style="text-align: center;"><b>OR</b></p>	<p>08</p> <p>08</p>
<p>11</p> <p>a</p> <p>b</p>	<p>A student's study habits are as follows: If he studies one night, he is 60% sure not to study the next night, on the other hand if he does not study one night, he is 80% sure to study the next night. Find that in the long run how often does he study?</p> <p>State and prove Monte-Carlo method.</p>	<p>08</p> <p>08</p>

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**R. V. COLLEGE OF ENGINEERING**

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V Semester B. E. Fast Track Examinations July-17

Computer Science and Engineering

**GRAPH THEORY AND APPLICATIONS (ELECTIVE)**


Time: 03 Hours

Maximum Marks: 100

Instructions to candidates:

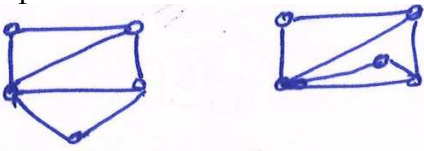
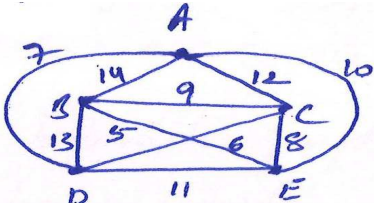
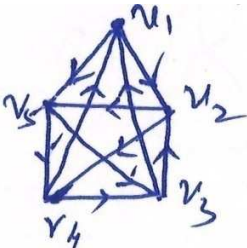
4. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
5. Answer FIVE full questions from Part B.

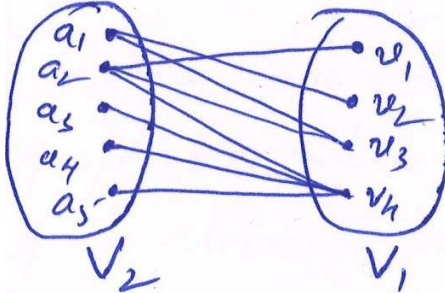
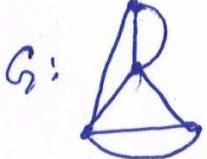
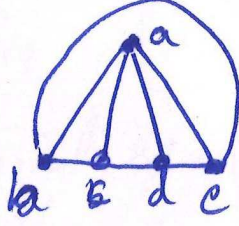
**PART-A**

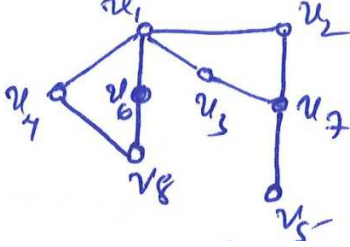
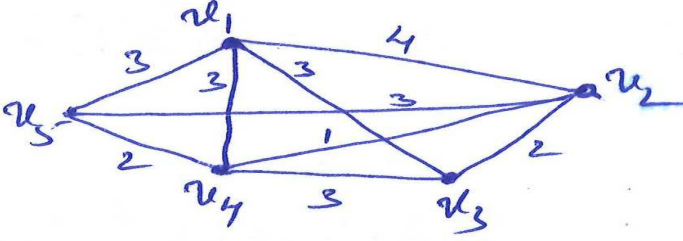
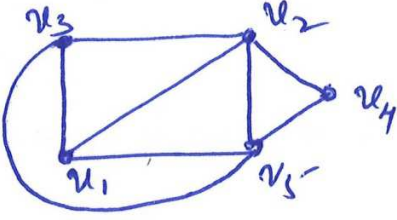
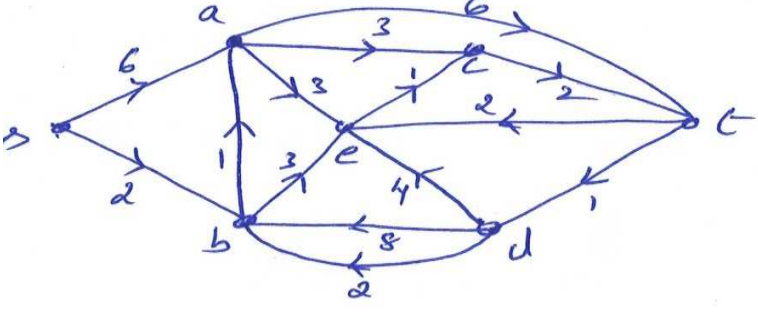
1	1.1	If $G$ is isomorphic to its complement $\bar{G}$ , then $G$ and $\bar{G}$ are called _____ graphs.	01
	1.2	How many cycles of length 6 present in the Peterson graph? Write any two of these cycles.	02
	1.3	Draw the line graph $L(G)$ of the wheel graph on 5-vertices.	02
	1.4	Draw a spanning tree for the graph shown in fig.	
			
	1.5	A digraph $G$ is an Euler digraph if and only if $G$ is connected and _____.	01
	1.6	Show that every tree is a planar graph.	02
	1.7	A circuit formed by adding a chord to a spanning tree is called _____.	01
	1.8	The chromatic number of a bipartite graph $G$ is _____.	01
	1.9	For what value of $n$ is $K_n$ planar?	01
	1.10	A pendent edge in $G$ yields as _____ in the dual graph $G$ .	01
	1.11	A digraph is said to be balanced if for every vertex $V_i$ , _____.	01
	1.12	Maximum flow between any two vertices $A$ and $B$ in a transport network is equal to _____.	01
	1.13	In a binary tree of level 10, the number of leaves are _____.	01
	1.14	Write the Kruskal's algorithm for constructing a minimum cost spanning tree $T$ of a graph.	02
	1.15	State Tait's theorem.	02

**PART-B**

2	a	Prove that a graph with $n$ vertices and $k$ complete components have at the most $\frac{(n-k+1)(n-k)}{2}$ edges.	05
	b	Define: <ol style="list-style-type: none"> <li>i) Sub graph</li> <li>ii) Spanning sub graph</li> <li>iii) Induced sub graph</li> </ol> with an example to each.	05

<p>c</p>	<p>Prove that the two graphs shown below are isomorphic:</p> <div style="text-align: center;">  </div> <p style="text-align: center;"><b>OR</b></p> <p>3 a For a graph <math>G</math> with <math>n</math> vertices and <math>m</math> edges, if <math>\delta</math> is the minimum and <math>\Delta</math> is the maximum of the degree of vertices, then show that <math>\delta \leq \frac{2m}{n} \leq \Delta</math>.</p> <p>b If <math>G: (V, E)</math> is a simple graph, then prove that <math>2 E  \leq  V ^2 -  V </math>.</p> <p>c Let <math>G: (V, E)</math> and <math>G_1: (V^1, E^1)</math> be two graphs and if <math>f: G \rightarrow G'</math> be an isomorphism. Prove the following:</p> <p>i) <math>f^{-1}: G^1 \rightarrow G</math> is also isomorphism</p> <p>ii) For any vertex <math>v \in V</math> in <math>G</math>, <math>\deg(v) = \deg(f(v))</math>.</p>	<p>06</p> <p>05</p> <p>05</p> <p>06</p>
<p>4 a</p> <p>b</p> <p>c</p>	<p>A tree has <math>2n</math> vertices of degree 1, <math>3n</math> vertices of degree 2 and <math>n</math> vertices of degree 3. Determine the number of vertices and edges in the tree.</p> <p>Define:</p> <p>i) Acyclic digraph</p> <p>ii) Eulerian graph</p> <p>iii) Center of tree</p> <p>iv) Binary tree.</p> <p>Find the minimum Hamiltonian circuit starting from node <math>E</math> in the following graph.</p> <div style="text-align: center;">  </div> <p style="text-align: center;"><b>OR</b></p>	<p>05</p> <p>06</p> <p>05</p>
<p>5 a</p> <p>b</p>	<p>Draw the graph for the incidence matrix given below and write any three observations.</p> $A = \begin{bmatrix} 1 & 1 & 0 & 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 1 & 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 1 & 1 & 0 \end{bmatrix}$ <p>Define:</p> <p>i) Euler graph</p> <p>ii) Hamiltonian circuit</p> <p>Find directed Euler cycle and Hamilton circuit for the graph shown in the following figure.</p> <div style="text-align: center;">  </div>	<p>05</p> <p>06</p>

	c	Prove that a connected graph is a tree if and only if it is minimally connected.	05
6	a	State and prove Euler's fundamental theorem on planar graph.	06
	b	For a simple connected planar graph with $f$ regions, $n$ vertices and $e$ edges ( $e > 1$ ), prove that: i) $e \geq 3/2 f$ ii) $e \leq 3n - 6$ .	05
	c	Prove that the bipartite graph shown in the following figure does not have complete matching from $V_1$ to $V_2$ .	
			05
		<b>OR</b>	
7	a	Show that Kuratowski's second graph $K_{3,5}$ is non-planar.	05
	b	Draw the dual of the graph shown in the following figure and write any three observations between the graph and its dual.	
			05
	c	State and prove min-max theorem.	06
8	a	State and prove the multiplication theorem for chromatic polynomials.	06
	b	Find the chromatic polynomial of graph $G$ .	
			05
	c	Define: i) Chordal graph, ii) Powers of graph and iii) Edge coloring of a graph.	05
		<b>OR</b>	
9	a	Define chromatic polynomial and prove that a graph of $n$ vertices is a complete graph if and only if its chromatic polynomial is $P_n(\lambda) = \lambda(\lambda - 1)(\lambda - 2) \dots (\lambda - n + 1)$ .	06

<p>b</p> <p>c</p>	<p>Show that a simple connected planar graph with 8 vertices and 13 edges cannot be bichromatic.</p> <p>Let <math>G</math> be a simple graph with <math>n</math> vertices which is regular of degree <math>r</math>, prove that <math>\psi(G) \geq \frac{n}{n-r}</math></p>	<p>05</p> <p>05</p>
<p>10 a</p> <p>b</p> <p>OR</p> <p>11 a</p> <p>b</p>	<p>Write <i>BFS</i> algorithm and hence find the spanning tree for the graph shown in the following figure.</p>  <p>Find the minimal spanning tree (MST) of the weighted graph shown in figure using Prim's algorithm.</p>  <p>Write <i>DFS</i> algorithm and hence find the spanning tree for the graph shown in the figure.</p>  <p>Obtain a shortest path between vertex <math>s</math> and <math>t</math> in the given weighted digraph using Dijkstra's algorithm.</p> 	<p>08</p> <p>08</p> <p>08</p> <p>08</p>



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**R. V. COLLEGE OF ENGINEERING**  
**Autonomous Institution affiliated to VTU**  
**V Semester B. E. Fast Track Examinations July-17**  
**Computer Science and Engineering**  
**JAVA AND JEE (ELECTIVE)**

*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

6. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
7. Answer FIVE full questions from Part B.

**PART-A**

1	1.1	Write the output for the following statements: a) <code>System.out.println (8 &gt;&gt;&gt; 2);</code> b) <code>System.out.println (-9 &gt;&gt; 1);</code>	02
	1.2	What is the output/error of the following code? <code>int i = 13;</code> <code>while ( i ){ System.out.println(i); }</code>	01
	1.3	Enumeration is an interface defined in _____ package.	01
	1.4	_____ exception is thrown when an object is incompatible with the elements in the deque.	01
	1.5	List out the signature of three different forms of get connection of the DriverManager object.	02
	1.6	All the wrapper classes are defined in _____ package.	01
	1.7	List out the visibility modifiers supported in Java. Also specify its usage.	02
	1.8	What are the three different static variables used to set the priority of the threads? And also specify the values of the static variables.	02
	1.9	Write the Java code for the following: a) Convert the primitive integer to integer object, b) Convert the integer object to primitive type	02
	1.10	Differentiate between Iterator and ListIterator interfaces.	02
	1.11	Find errors, if any or write the output of the following program. Justify your answer. <code>class demo</code> <code>{</code> <code>    static void f1()</code> <code>    {</code> <code>        System . out . println ("Inside f1");</code> <code>        throw new ArithmeticException ("Error");</code> <code>    }</code> <code>    public static void main (string a1 [ ])</code> <code>    {</code> <code>        f1 ();</code> <code>    }</code> <code>}</code>	02
	1.12	What are native methods in Java?	01
	1.13	_____ package provides interfaces and classes for handling <i>HTTP</i> request and <i>HTTP</i> responses.	01

## PART-B

2	a	List out the properties of constructor. Write how it is different from an instance method?	06
	b	Differentiate between abstract class and interface. Explain with an example.	10
<b>OR</b>			
3	a	Explain the following keywords with an example for each: i) this ii) super iii) final.	06
	b	Define inheritance. Explain the concept of single inheritance and multilevel inheritance. Illustrate the same with a program segment for each of the concepts.	10
4	a	Write Java program to discuss the concept of ChainedExceptions.	06
	b	Discuss the different Class and Instance methods of thread class with thread life cycle.	10
<b>OR</b>			
5	a	Create a thread type class by implementing an appropriate interface in Java program. It should print the thread name as "New Thread" 15 times. And also set the maximum priority for a thread. Write the advantages of threads.	08
	b	Create a custom exception class called "NomatchException". Write a program to throw the "NomatchException" when the string is not equal to India.	08
6	a	Define collection framework. Explain the following collection classes with a program for each. i) Array list ii) Array Deque.	10
	b	Write the Java statements for the following: i) Connect to a database using <i>JDBC/ODBC</i> bridge that has <i>url = "JDBC:ODBC:SDB", username = "scott" and password = "tiger"</i> . ii) Run a query "select emp-age from employee" over the connected database. iii) Count the number of employees with condition emp-age > 20.	06
<b>OR</b>			
7	a	Explain the methods for the following collection interfaces. i) Deque ii) NavigableSet.	06
	b	With a program segment explain the following: i) Scrollable ResultSet ii) Callable statement to execute stored procedures.	10
8	a	Write a simple basic Java servlet program to print "Hello" and describe the steps involved in the execution of this servlet.	08
	b	Explain the five types of <i>JSP</i> tags used in any <i>JSP</i> program.	08
<b>OR</b>			

9	a	Write a complete <i>JSP</i> program to declare multiple variables and print them accordingly.	08
	b	Write a complete Java servlet program to read a session attribute.	08
10	a	Write a JSP program to load <i>HTML</i> tables using the different looping statements.	06
	b	Explain the following methods of <i>HTTP</i> servlet and write its signature: i) doGet ii) doPost iii) doPut iv) doDelete.	04
	c	Explain error handling technique in <i>JNI</i> .	06
<b>OR</b>			
11	a	Explain the concept of passing arguments and result between Java and native programs.	06
	b	Write a Java program to invoke a <i>C</i> code to display string or integer data.	10

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**Computer Science and Engineering**  
**ADVANCED ALGORITHMS (ELECTIVE)**

*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

8. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
9. Answer FIVE full questions from Part B.

**PART-A**

1	1.1	Arrange the following function in increasing order of growth rate: $n^{2.5}, n + 10, 10^n, 100^n, n^2 \log n, \log n$ .	02
	1.2	_____ is the time complexity of Knuth Morris Pratt string matching algorithm.	01
	1.3	Define Binomial Queue.	01
	1.4	Construct the string-matching automation for the pattern $P = aabab$ .	02
	1.5	Apply Master theorem to solve the following recurrence relations: i) $T(n) = 3T(n/2) + n^2$ ii) $T(n) = 4T(n/2) + \log n$ .	02
	1.6	Compute the prefix function $\Pi$ for the pattern a) AAACAAAACA b) ababcababaabab.	02
	1.7	Consider the RSA key set with $p = 11, q = 23$ and $e = 3$ . What value of $d$ should be used as a secret key?	02
	1.8	Write the properties of flow network.	02
	1.9	Prove that any sub path of the shortest path is shortest path.	02
	1.10	List the elementary properties of GCD function (Greatest Common Divisor).	02
	1.11	Prove that for any integers $a, b$ and $p$ , if both $\gcd(a, p) = 1$ and $\gcd(b, p) = 1$ , then $\gcd(ab, p) = 1$ .	02

**PART-B**

2	a	Compute the largest value of 'a' such that algorithm B with running time $T(n) = aT(n/2) + n^2$ is asymptotically faster than the algorithm A with running time $T(n) = 4T(n/2) + n^2$ . Prove it using recursion tree method.	10
	b	Prove that the order of growth of function $f(n) = \Theta(g(n))$ , if $f(n) = 3n + 2$ and $g(n) = n$ .	06
<b>OR</b>			

3	<p>a Apply potential method of amortized cost analysis to compute total amortized cost for stack operations (push, pop and multipop).</p> <p>b Solve the recurrence relation <math>T(n) = T(n/3) + T(2n/3) + n</math> using substitution method.</p>	08 08
4	<p>a Trace the Knuth Morris Pratt string matching algorithm for the given text and pattern. <math>T: "ABABABCABABABCABABABC"</math> <math>P: ABABAC</math>.</p> <p>b Use single source shortest path in directed acyclic graph algorithm to compute the shortest paths in the given graph with node 's' as source.</p> <div data-bbox="448 546 1193 763" data-label="Diagram"> </div> <p style="text-align: center;"><b>OR</b></p>	08 08
5	<p>a Prove the correctness of Bellman-Ford algorithm.</p> <p>b Write the Rabin-Karp algorithm and analyze its time complexity. Working with modulo <math>q = 11</math>, how many spurious hits do Rabin Karp matcher encounters in the text <math>T: 6388238496038257</math> for the pattern <math>P: 38</math>.</p>	06 10
6	<p>a Trace the insertion of following values in empty red-black tree 2, 1, 4, 5, 9, 3, 6, 7.</p> <p>b Illustrate with an example the maximum matching in bi-partite graph using Ford-Fulkerson algorithm.</p> <p style="text-align: center;"><b>OR</b></p>	08 08
7	<p>a Apply Ford Fulkerson algorithm, to compute the maximum network flow for the given graph <math>G</math>.</p> <div data-bbox="320 1435 1369 1720" data-label="Diagram"> </div> <p>b Discuss the advantage of using splay trees and its procedure to insert a node into the splay tree.</p>	08 08
8	<p>a Prove that if <math>a</math> and <math>b</math> are any integers, not both zero, then <math>\gcd(a, b)</math> is the smallest positive to the set <math>\{ax + by : x, y \in \mathbb{Z}\}</math> of linear combination of <math>a</math> and <math>b</math>.</p>	08

	b	Determine an integer $n$ that leaves remainder 1, 2 & 3 when divided by 5, 6 & 7 respectively.	08
		<b>OR</b>	
9	a	Discuss the different ways to check whether a given number is prime or not? Explain in detail the Miller-Rabin randomized primality testing algorithm.	08
	b	Solve the given modular equation $15x \equiv 12 \pmod{57}$ .	08
10	a	Discuss the two different ways to represent a polynomial.	08
	b	Explain in detail the procedure of iterative <i>FFT</i> algorithm.	08
		<b>OR</b>	
11	a	Provide graphical representation for multiplying two polynomials efficiently.	08
	b	Write the recursive <i>FFT</i> algorithm and analyze its time complexity.	08

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**R. V. COLLEGE OF ENGINEERING**

Autonomous Institution affiliated to VTU

V Semester B. E. Fast Track Examinations July-17

**Computer Science and Engineering****FUNDAMENTALS OF COMPUTER VISION (ELECTIVE)***Time: 03 Hours**Maximum Marks: 100***Instructions to candidates:**

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.

**PART-A**

1	1.1	First application of Image processing was in _____ field or domain.	01
	1.2	Remote sensing uses _____ and _____ regions of the electromagnetic spectrum.	02
	1.3	List any three uses of spatial domain filters.	02
	1.4	Write the different ways of padding border effects after reforming attenuation on images.	02
	1.5	How is multilevel threshold classified?	02
	1.6	Identify the criteria or condition on which splitting and merging operates on.	02
	1.7	Write the solution to overcome segmentation in watershed method.	02
	1.8	Write any two methods for category recognition model.	01
	1.9	Confer the filter for horizontal and vertical line detection (Sobel operator).	02
	1.10	Recognize why mean shift is non-parametric?	02
	1.11	Write the central issues in part-based segmentation.	02

**PART-B**

2	a	Exemplify the fundamental steps in Digital Image Processing with a neat diagram.	10
	b	Demonstrate how Positron Emission Tomography works ( <i>PET</i> ).	06
<b>OR</b>			
3	a	Explain with a block diagram the components of general purpose Image Processing Systems.	08
	b	Illustrate an example or application which uses microwave band of electromagnetic spectrum.	08
4	a	Filter the following image segment shown in fig 4a using a $3 \times 3$ neighborhood averaging by assuming zero padding. <div style="text-align: center;"> <math display="block">\begin{bmatrix} 1 &amp; 4 &amp; 3 &amp; 3 \\ 4 &amp; 5 &amp; 5 &amp; 1 \\ 1 &amp; 6 &amp; 6 &amp; 4 \\ 2 &amp; 4 &amp; 6 &amp; 8 \end{bmatrix}</math> <p>Fig 4a</p> </div>	06

	b	With necessary diagram explain the Fourier transform of the sampled signal, considering the condition that the sampled signal interacts with each other. <div>OR</div>	10																		
5	a	With appropriate equations demonstrate any five Fourier transform pair (give function of 2D with their Fourier transform).	10																		
	b	Write the three significant properties of shift invariant linear systems.	06																		
6	a	Consider the image segment shown in figure 6a based on the histogram, segment the image into two regions with the threshold value $T$ . (write any assumption made). <div><div><div><div>4</div><div>4</div><div>4</div><div>2</div><div>2</div></div><div><div>3</div><div>2</div><div>5</div><div>4</div><div>3</div></div><div><div>3</div><div>5</div><div>5</div><div>5</div><div>2</div></div><div><div>3</div><div>4</div><div>5</div><div>2</div><div>2</div></div><div><div>4</div><div>4</div><div>4</div><div>4</div><div>4</div></div></div><div>Fig 6a</div></div>	08																		
	b	Write and describe the optimal threshold algorithm. <div>OR</div>	08																		
7	a	Write and explain Otsu's method of global thresholding algorithm with relevant equations.	10																		
	b	Write and explain the role of illumination in thresholding.	06																		
8	a	Investigate or identify a method that is based on the minimal internal difference between neighboring regions are considered, while performing merging and explain the same.	10																		
	b	Deduce mean-shift filter equation and explain. <div>OR</div>	06																		
9	a	Derive Gaussian-Mixture model and explain.	08																		
	b	Apply k-means clustering for the following data where $k = 3$ <div><table><tr><td>Individual</td><td>Variable 1</td><td>Variable 2</td></tr><tr><td>1</td><td>2</td><td>1</td></tr><tr><td>2</td><td>3</td><td>2</td></tr><tr><td>3</td><td>5</td><td>4</td></tr><tr><td>4</td><td>4</td><td>7</td></tr><tr><td>5</td><td>5</td><td>5</td></tr></table></div>	Individual	Variable 1	Variable 2	1	2	1	2	3	2	3	5	4	4	4	7	5	5	5	08
Individual	Variable 1	Variable 2																			
1	2	1																			
2	3	2																			
3	5	4																			
4	4	7																			
5	5	5																			
10	a	Illustrate face recognition using active appearance model with key feature points in an image.	08																		
	b	With a neat diagram explain Distance From Face Space ( $DFFS$ ) and Distance In Face Space ( $DIFS$ ). <div>OR</div>	08																		
11	a	With necessary equations provide detailed explanation of Bag-of-Key points approach.	10																		
	b	Explain interleaved recognition and segmentation approach in image processing.	06																		



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**R. V. COLLEGE OF ENGINEERING**  
**Autonomous Institution affiliated to VTU**  
**V Semester B. E. Fast Track Examinations July-17**  
**Computer Science and Engineering**  
**MULTIMEDIA COMPUTING (ELECTIVE)**

*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

10. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
11. Answer FIVE full questions from Part B.

**PART-A**

1	1.1	Differentiate between Hypertext and Hypermedia.	02
	1.2	What is <i>CYMK</i> color model and where is it used?	01
	1.3	Define Dithering.	01
	1.4	List any two multimedia applications.	02
	1.5	What does <i>AC</i> and <i>DC</i> components of <i>JPEG</i> compression represent?	02
	1.6	Why I-frames are inserted into the compressed output stream relatively frequently?	02
	1.7	What are different types of picture frames in <i>MPEG</i> ?	01
	1.8	Apply run length encoding for the data given below: a) 11112223333331111222. b) Calculate the compression ratio for the above data.	02
	1.9	Why is <i>YUV/YIQ</i> often preferred to work with than <i>RGB</i> ? Where is it used?	02
	1.10	List any one lossless compression algorithm and lossy compression algorithm.	02
	1.11	Differentiate between uniform quantization and non-uniform quantization.	01
	1.12	Differentiate between <i>MPEG4</i> and <i>MPEG7</i> .	02

**PART-B**

2	a	Explain the various image formats available to represent images.	06
	b	Explain the concept of 'out-of-gamut'.	06
	c	Briefly explain why we need to have less than 24-bit color representations (typically down to 8-bit) and why this is sometimes a problem. Give one example, where 8-bit color representation has an advantage?	04
<b>OR</b>			
3	a	What are the key distinctions between multimedia data and more conventional types of media? What key issues or problems does a multimedia system have to deal with when handling multimedia data?	08
	b	Distinguish between graphics image and pixel image.	08

4	a	How is a color lookup table used to represent color? The use of color lookup table can be an advantage and also a disadvantage for multimedia applications. Justify your answer.	06
	b	Audio signals are often sampled at different rates. <i>CD</i> quality audio is sampled at 44.1 <i>kHz</i> rate while telephone quality audio sampled at 8 <i>kHz</i> . What are the maximum frequencies in the input signal that can be fully recovered for these two sampling rates? Briefly describe the theory you use to obtain the results.	
	c	Explain the <i>YIQ</i> , <i>RGB</i> and <i>CMY</i> color model.	04 06
<b>OR</b>			
5	a	What is <i>MIDI</i> ? Explain the different types of <i>MIDI</i> messages in detail.	10
	b	Digital video uses Chroma Subsampling. What is the purpose of this? Why is it feasible?	06
6	a	Distinguish between lossy compression algorithm and lossless compression algorithm with examples.	08
	b	Discuss the working of wavelet transform coding technique.	06
	c	If the <i>DC</i> coefficients for the first five image blocks are 150, 155, 149, 152, 144 find the <i>DPCM</i> values.	02
<b>OR</b>			
7	a	The following example is based on a data source using a set of five different symbols. The symbol's frequencies are:  <i>Symbol Frequency</i> <i>A</i> 24 <i>B</i> 12 <i>C</i> 10 <i>D</i> 8 <i>E</i> 8  Draw the static Huffman coding tree and derive the suitable set of code word for each of the characters.	10
	b	Differentiate between Huffman coding and Arithmetic coding.	06
8	a	Explain how advanced prediction mode in <i>H.263</i> achieves better compression compared to <i>H.261</i> standard.	08
	b	Explain the main steps of <i>JPEG2000</i> Image compression algorithm.	08
<b>OR</b>			
9	a	Explain the significance of all types of video frames in video compression.	06
	b	What type of compression technique is followed by <i>JPEG</i> ? Describe the procedure of <i>JPEG</i> image coding standard.	06
	c	Briefly explain why a bidirectional <i>B</i> -frame improves video compression rates. What are the benefits and drawbacks of using <i>B</i> -frames?	04

10	a	Discuss the QoS parameters required for achieving good quality multimedia data transmission.	08
	b	Explain the working principle of <i>RSVP</i> . List any two applications of usage of <i>RSVP</i> .	08
<b>OR</b>			
11	a	Differentiate between staggered Broadcasting and Pyramid Broadcasting approaches for Video-on Demand application.	08
	b	Discuss the various video bit rates supported by <i>ATM</i> network.	08

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**R. V. COLLEGE OF ENGINEERING**  
**Autonomous Institution affiliated to VTU**  
**V Semester B. E. Fast Track Examinations July-17**  
**Computer Science and Engineering**  
**COMPUTER NETWORKS-I**

*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

1. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
2. Answer FIVE full questions from Part B.

**PART-A**

1	1.1	A television is an example of _____ transmission.	01
	1.2	_____ is the protocol suite for the current internet.	01
	1.3	If the bandwidth of a signal is 5 KHz and the lowest frequency is 52 KHz, what is the highest frequency?	01
	1.4	A signal is measured at two different points. The power is $P_1$ at the first point and $P_2$ at the second point. The dB is 0. This means _____.	01
	1.5	If the frequency spectrum of a signal has a bandwidth of 500 Hz with the highest frequency at 600 Hz, what should be the sampling rate, according to the Nyquist theorem?	02
	1.6	_____ coding is normally referred to as $mB/nB$ coding, it replaces each $m$ – bit group with an $n$ – bit group.	01
	1.7	The _____ mode provides synchronization for the entire stream of bits. In order words, it guarantees that the data arrive at a fixed rate.	01
	1.8	The _____ rate defines the number of data elements sent in 1s, the _____ rate is the number of signal elements sent in 1s.	01
	1.9	Signals with a frequency above 30 MHz use _____ propagation.	01
	1.10	The _____ technique uses $M$ different carrier frequencies that are modulated by the source signal. At one moment, the sign modulates one carrier frequency at the next moment, the signal modulates another carrier frequency.	01
	1.11	_____ can be achieved by using multiplexing, _____ can be achieved by using spreading.	01
	1.12	To deliver a message to the correct application program running on a host, the _____ address must be consulted.	01
	1.13	When data are transmitted from device A to device B, the header from A's layer 4 is read by B's _____ layer.	01
	1.14	In block coding, if $k = 2$ & $n = 3$ , we have _____ invalid code words.	01
	1.15	In the _____ protocol, the sender sends one frame, stops until it receives confirmation from the receiver and then sends the next frame.	01
	1.16	In the _____ method, all data exchanges must be made through the primary device even when the ultimate destination is a secondary device.	01

1.17	In _____ Ethernet, auto-negotiation allows two devices to negotiate the mode or data rate of operation.	01
1.18	In the Ethernet, the _____ field is actually added at the physical layer and is not (formally) part of the frame.	01
1.19	In <i>IEEE 802.11</i> , when a frame is coming from an <i>AP</i> and going to a station, the address flag is _____.	01

### PART-B

2	a	What is data communication? Discuss the four fundamental characteristics of data communication.	04									
	b	Demonstrate the two cases of a baseband communication.	06									
	c	Discuss the two theoretical formulas developed to calculate the data rate for noiseless and noisy channel.	06									
<b>OR</b>												
3	a	Discuss the components of data communication with a neat diagram.	04									
	b	Explain the causes of impairment.	06									
	c	List and explain any three performance measures in the networking.	06									
4	a	Characterize $4B/5B$ and $8B/10B$ coding schemes with supporting diagrams.	08									
	b	Discuss serial transmission mode and also explain the three different serial transmission modes in detail.	08									
<b>OR</b>												
5	a	Examine polar and bipolar line coding schemes in detail with timing diagrams.	08									
	b	With the help of a diagram explain Pulse Code Modulation( $PCM$ ) in detail.	08									
6	a	Identify the four levels of addresses used in an internet and relate each address to the specific layer in the $TCP/IP$ architecture.	06									
	b	Explain the process of error detection and correction in block coding along with the relevant diagrams.	06									
	c	What is hamming distance and minimum hamming distance? Find the minimum hamming distance of the coding scheme given below: <table><tr><td><i>Dataword</i></td><td><i>Codeword</i></td></tr><tr><td>00</td><td>00000</td></tr><tr><td>01</td><td>01011</td></tr><tr><td>10</td><td>10101</td></tr><tr><td>11</td><td>11110</td></tr></table>	<i>Dataword</i>	<i>Codeword</i>	00	00000	01	01011	10	10101	11	11110
<i>Dataword</i>	<i>Codeword</i>											
00	00000											
01	01011											
10	10101											
11	11110											
<b>OR</b>												
7	a	Explain $OSI$ model in detail.	06									
	b	Compute the $CRC$ for the data 1001 using the generator 1011.	06									
	c	Calculate the sender site and receiver site checksum for a text given “ $FOROUZAN$ ”.	04									

8	a	Show the design of stop-and-wait <i>ARQ</i> protocol. Also give the sender-site and receiver-site algorithm.	08
	b	Demonstrate on character – oriented protocol and bit-oriented protocol with examples.	08
<b>OR</b>			
9	a	Design the Go-Back-N <i>ARQ</i> protocol. Also give the sender – site and receiver – site algorithm.	08
	b	With the help of a frame format, discuss the <i>HDLC</i> protocol in detail.	08
10	a	Discuss the three persistence methods in <i>CSMA</i> .	06
	b	Explain <i>IEEE 802.11 MAC</i> sublayer protocol in detail.	06
	c	What is channelization? Explain Frequency Division Multiple Access ( <i>FDMA</i> ) with a neat diagram.	04
<b>OR</b>			
11	a	Explain polling access method.	04
	b	Demonstrate <i>CSMA/CD</i> with flow diagram.	06
	c	Discuss the <i>IEEE 802.3 MAC</i> sublayer protocol with frame format.	06

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**R. V. COLLEGE OF ENGINEERING**  
**Autonomous Institution affiliated to VTU**  
**V Semester B. E. Fast Track Examinations July-17**  
**Computer Science and Engineering**  
**MICROPROCESSOR AND MICROCONTROLLER**

*Time: 03 Hours**Maximum Marks: 100**Instructions to candidates:*

12. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
13. Answer FIVE full questions from Part B.

**PART-A**

1	1.1	What is the advantage of having two units – <i>EU</i> and <i>BIU</i> in 8086 microprocessor architecture?	02
	1.2	What is the content of <i>CS</i> register value when the <i>IP</i> is 0200H and the physical address is 21000H?	02
	1.3	What is the basic operation of <i>CL</i> register other than general purpose 8 bit register?	02
	1.4	What addressing mode is <i>CBW</i> ? Justify your answer.	02
	1.5	What is retrieved from the top of stack when <i>IRET</i> instruction is equated by 8086 microprocessor?	02
	1.6	What is the control word for 8255 to make <i>Port A, PC(V)</i> as input port and <i>Port B, PC(L)</i> as output port in mode – 0?	01
	1.7	Why is pullup resistors used in logic circuits?	01
	1.8	What are the two types of memory areas provided in 8051 microcontroller?	02
	1.9	Which bits of <i>PSW</i> in 8051 microcontroller determine the active register bank?	02
	1.10	In 8051 microcontroller, how many pins are designated as <i>I/O</i> pins.	01
	1.11	In 8051 microcontroller, what instruction is used to transfer data from external <i>ROM</i> space to <i>A</i> register?	01
	1.12	What is the effect of executing the following two instructions in 8051 microcontroller? <i>MOV C P2.3</i> <i>MOV 15H, C.</i>	02

**PART-B**

2	a	Write a block diagram showing the maximum mode configuration with bus controller and clock generator chip. Show the main pins that are connected to bus controller and clock generator with 8086 microprocessor.	10
	b	Mention the control signals generated by bus controller and their importance.	06
<b>OR</b>			

3	a	With a diagram of a system, show how <i>DMA</i> operation can be enabled in 8086 microprocessor. Mention the timings during which the signals are made active to 8086 microprocessor.	08
	b	There are two queue status pins on 8086 microprocessor. Mention how these signals are useful to the external world.	08
4	a	Given that $DS = 0200H, BX = 0300H, SI = 0250H, DI = 0100H, BP = 0400H, LIST = 100$ . Determine the address accessed by the following instructions: i) <i>MOV AL, [1234H]</i> ii) <i>MOV [DI], AL</i> iii) <i>MOV AL, [BP + DI]</i> iv) <i>MOV CL, LIST [BX + SI]</i> v) <i>MOV AL, [SI + 100H]</i>	10
	b	Write an 8086 assembly level program to multiply two 16 bits number and store the result in memory location starting from 3000H. Use register indirect addressing mode. <b>OR</b>	06
5	a	An assembler requires to search for label from a symbol table. Write an 8086 assembly level program that could be used by the designed assembler. Given comments to enable the use to understand the logic used.	12
	b	What do the following instructions do? give example: i) <i>DAA</i> ii) <i>AAA</i> .	04
6	a	What is interrupt vector table in 8086 microprocessor? Briefly explain its importance. Show inferring vector table details.	08
	b	An external device interrupts the 8086 microprocessor through <i>NMI</i> . It is required to give a signal when there is an interrupt by raising an alarm. Design a system and show how this is achieved. [Assume suitable alarm device and write program]. <b>OR</b>	08
7	a	There are eight modes of operation of a device. This information is being obtained to 8086 microprocessor through Port A of 8255. Indicate by designing a simple output, which mode of operation is the device set. [Assume suitably and explicitly mention your assumption].	10
	b	What is a macro? How is it different from subroutine?	06
8	a	What are the different ways of creating a time delay in 8051 microcontroller? Explain any one.	06
	b	With a diagram explain the memory systems of 8051 microcontroller. <b>OR</b>	10
9	a	It is required to send characters to an external seven-segment display from 8051 microcontroller. Design a program to send character bytes serially. The system takes care of converting serial to parallel data to display.	08



	b	Write an 8051 assembly level program to generate 10 <i>kHz</i> square wave through times -1 where <i>XTAL</i> is 20 <i>MHz</i> .	08
10	a	It is required to control a machine by switching <i>ON</i> an switching <i>OFF</i> every 15 minutes. Design a hardware system and a flowchart to achieve the above operation. [ <i>M/C</i> requires 230 <i>V</i> a.c].	08
	b	A water level indicator is to be designed by displaying 10 <i>LEDs</i> . Design and explain briefly how this is achieved? Note: when no <i>LED</i> is glowing, the water in a container is Nil. When all <i>LEDs</i> are glowing the container is full.	08
		<b>OR</b>	
11		A valve is to be controlled using microcontroller. Clockwise rotation of the valve by 90° enables the valve open and anticlockwise rotation by 90° when open will close the valve. Design a complete system showing the microcontroller, device drive and other devices. Write a flow chart to initialize and operate the system.	16

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**R. V. COLLEGE OF ENGINEERING**  
**Autonomous Institution affiliated to VTU**  
**V Semester B. E. Fast Track Examinations July-17**  
**Computer Science and Engineering**  
**DATABASE MANAGEMENT SYSTEMS**

**Time: 03 Hours****Maximum Marks: 100****Instructions to candidates:**

14. Answer all questions from Part A. Part A questions should be answered in first three pages of the answer book only.
15. Answer FIVE full questions from Part B.

**PART-A**

1	1.1	What are the functions of the <i>DBA</i> ?	02
	1.2	Define normalization. List the reason for normalizing the database.	02
	1.3	Mention different types of end users in <i>DBMS</i> .	02
	1.4	Categorize the classification of the <i>DBMS</i> .	02
	1.5	Define strong entity and weak entity.	02
	1.6	List the characteristics of a relation.	02
	1.7	Write a query to retrieve name and address of all employees who work for the research department.	02
	1.8	Why should <i>NUL's</i> in a relation be avoided as far as possible.	02
	1.9	Mention the three tasks performed in the analysis phase during the design of a database.	02
	1.10	List any two main objectives for designing a secure database application.	02

**PART-B**

2	a	Describe the characteristics of database approach.	08
	b	Briefly explain three scheme architecture with a neat diagram.	08
<b>OR</b>			
3	a	Differentiate between structural constraints and cardinality ratios used in entity relationship model.	08
	b	Draw an <i>ER</i> diagram for the movie database with minimum of 4 entity and three relationship types.	04
	c	Explain briefly the <i>DBMS</i> interfaces.	04
4	a	Write a relational algebra query to find the names of employees who work on all the projects controlled by department number five.	08
	b	Write an <i>SQL</i> query to list the names and managers who have at least one dependent.	08
<b>OR</b>			

5	a	Write a query using relational algebra to retrieve the name of employee who have no dependents.	08
	b	Write an <i>SQL</i> query for the following, for each department that has more than five employees, retrieve the department number and the number of its employee who are making more than \$40,000.	08
6	a	Explain briefly the concept of embedded <i>SQL</i> .	04
	b	Briefly explain the informal design guidelines for relational schema.	10
	c	Define dependency preservation and loss less join property with example.	02
<b>OR</b>			
7	a	Discuss the purpose of Boyce – Codd normal form and describe how BCNF is different from and is stronger than 3NF.	08
	b	When does a dangling tuple occur? Explain with an example.	08
8	a	What is locking protocol? Explain strict 2 phase locking protocol.	08
	b	Explain the following: i) Deadlock prevention; ii) Lock conversions.	08
	<b>OR</b>		
9	a	What are <i>ACID</i> properties? Explain with examples.	08
	b	Explain how creating and terminating transactions supports in <i>SQL</i> .	08
10	a	Describe the steps involved in crash recovery in <i>RIES</i> algorithm.	08
	b	Explain briefly the mandatory access control.	08
<b>OR</b>			
11	a	Explain the main principles of <i>RIES</i> recovery algorithm.	08
	b	Write a short note on: i) Discretionary access control	04
		ii) Role based access control.	04