

Name :
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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
07 THRISSUR CLUSTER

FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2017

Computer Science and Engineering

Computer Science and Engineering

07MA 6011 MATHEMATICAL FOUNDATION OF COMPUTER SCIENCE

Time : 3 hours

Max.Marks: 60

Answer all six questions. Part 'a' of each question is compulsory.

Answer either part 'b' or part 'c' of each question

Q.no.	Module 1	Marks
1a	Find the Range and Kernel for the linear transformation $T(v_1, v_2, v_3) = (v_1, v_2)$	4
	Answer b or c	
b	Let $D : P_3(x) \rightarrow P_2(x)$ where D denotes derivative transform and $I : P_2(x) \rightarrow P_3(x)$ where I denotes integration transform .write the corresponding matrix representations.	5
c	Diagonalize the matrix $\begin{pmatrix} 4 & 1 \\ 2 & 3 \end{pmatrix}$	5
Q.no.	Module 2	Marks
2a	Define Haar scaling function and Haar wavelet functions and prove that they are orthogonal	4
	Answer b or c	
b	Let $x = [9 \ 5 \ 0 \ 1 \ -6 \ -5 \ 1 \ 4 \ 0 \ -5 \ 7 \ 9 \ 0 \ -1 \ 5 \ 3]$.Perform the Haar decomposition using $(\frac{1}{2}, \frac{1}{2})$ and $(\frac{1}{2}, -\frac{1}{2})$ as decomposition filters.	5
c	Discuss about the space spanned by scaling function bases are nested.	5
Q.no.	Module 3	Marks
3a	Write $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 4 & 1 & 6 & 2 & 3 & 5 \end{pmatrix}$ as a product of disjoint cycles.	4
	Answer b or c	
b	Define i) Ring , ii) Ideal , iii) Integral domain and iv) Field	5
c	Show that the Ring Z of integers is a Euclidean domain with the function $\delta(n) = n $	5

Q.no.	Module 4	Marks
4a	i) Define Conditional probability of two events ii) What is meant by weak Law of Large Numbers	4

Answer b or c

- b** Let X_1, X_2, \dots, X_n be identically and independently distributed random variable with mean 3 and variance $\frac{1}{2}$. If $n=120$ use C.L.T to estimate $P(340 \leq S_n \leq 370)$ where $S_n = X_1 + X_2 + \dots + X_n$. **5**
- c** A problem in statistics is given to three students A, B and C and the chances for them to solve the problem are $\frac{1}{2}, \frac{3}{4}, \frac{1}{4}$ respectively. What is the probability that the problem will be solved if all of them try independently. **5**

Q.no.	Module 5	Marks
5a	Define Poisson process. What is its mean and variance.	5

Answer b or c

- b** Babies are born in the state at the rate of one birth in every 20 minutes. The inter arrival time follows exponential distribution. Find
 i) Expected number of births in a year.
 ii) The Probability that no birth will occur in any one day.
 iii) The Probability for 20 births in 4 hours given that 15 births have taken place in the first three hours of the four hours period. **7**
- c** The transition Probability matrix of a Markov chain $\{X_n\}$ where $n = 1, 2, 3$ having three states 1, 2, 3 is given below **7**

$$P = \begin{bmatrix} 0.1 & 0.5 & 0.4 \\ 0.6 & 0.2 & 0.2 \\ 0.3 & 0.4 & 0.3 \end{bmatrix} \text{ with initial distribution } P^{(0)} = (0.7, 0.2, 0.1) \text{ find}$$

- i) $P(X_2 = 3)$
 ii) $P(X_3 = 2, X_2 = 3, X_1 = 3, X_0 = 2)$

Q.no.	Module 6	Marks
6a	Explain the Queuing model $(M/M/1 : \infty / FCFS)$.	5

Answer b or c

- b** In a railway marshalling yard, goods trains arrive at the rate of 30 trains / day. Assuming that inter arrival times follow exponential distribution and the service time is also exponential with an average of 36 minutes, calculate
 i) average length of non empty Queue **7**

- ii) probability that queue size exceeds 10 .
- c** A city has a one – person barber shop which can accommodate a maximum of 5 customers at a time (4 waiting and 1 getting haircut). On average , customers arrive at the rate of 8 / hours and the barber takes 6 minutes for serving each customer. It is estimated that arrival process in poisson and service time is an exponential random variable . Find **7**
- i) Percentage of time the barber in idle.
- ii) Expected number of customers in the barber shop.
- iii) Expected number of customers waiting for a hair cut.