Seat No. : _______________

MQ-122

March-2019

B.Sc., Sem.-VI

SE-311 : Mathematics
(Operation Research)

Time : 2:30 Hours] **[Max. Marks : 70**

Instructions : (1) **All** questions are compulsory.
(2) Figures to the right indicate marks of the question.

1. (A) (1) Explain Economic Order Quantity (EOQ) model with finite replenishment rate. **9**

(2) Data relevant to component A used by Eng. India Private Limited in 20 different assemblies includes : purchase price ₹ 15 per 100, annual usage 1,00,000 units, cost of buying office (fixed) ₹ 15,575 per annum, set up cost ₹ 12 per order, rent of component ₹ 3,000 per annum, interest 25 % per annum, insurance 0.05 % per annum based on total purchases, depreciation as 1% per annum of all items purchase. Calculate : **9**

(i) EOQ for component A.

(ii) The percentage changes in total annual costs relating to component A if the annual usage was 1,25,000 units.

OR

(1) Explain the order level lot size (OLLS) system. **9**

(2) The demand for a certain item is 16 units per period. Unsatisfied demand causes a shortage cost of ₹ 0.75 per unit per short period. The cost of initiating purchasing action is ₹ 15 per purchase and the holding cost is 15% of average inventory valuation per period. Item cost is ₹ 8 per unit. Find the minimum cost and purchase quantity. **9**

(B) Attempt any **three** in short : **6**

(1) Define : Inventory. List the types of inventory.

(2) Explain any two types of cost, related to the inventory system.

(3) Define : Lead time, Cycle time.

(4) Write down the EOQ formula for EOQ model with constant rate of demand.

(5) In the EOQ model with constant demand rate, if the order quantity increased by 25% then how much total cost increase ?

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2. (A) (1) Explain the basic difference between PERT and CPM. **9**

(2) Consider the following project activities and their duration : **9**

Activity	A	B	C	D	E	F	G	H	I	J	K	L	M
Immediate Predecessor	–	A	B	A	D	E	–	G	J, H	–	A	C, K	I, L
Duration	6	4	7	2	4	10	2	10	6	13	9	3	5

Construct the project network. Determine the critical path.

OR

(1) Explain the terms in brief : (1) Events (2) Activities. **9**

(2) Consider the following information on the activities required for project. **9**

Activity	A	B	C	D	E	F	G	H	I	J	K	L
Immediate Predecessor	–	–	–	A	A	E	B	B	D, F	C	H, J	G, I, K
Duration	2	2	2	3	4	0	7	6	4	10	3	4

Construct the project network. Compute the total float and free float for each non-critical activities.

(B) Attempt any **three** in short. **6**

(1) Draw the network for the following information :

Activity	A	B	C	D	E
Immediate Predecessor	–	–	A	A, B	C, D

(2) Give the full form of PERT and CPM.

(3) Define : Critical activities. How to find them ?

(4) Define : Merge event, Burst event.

(5) What is float ? List the types of float.

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3. (A) (1) Explain : (i) Pay-off matrix (ii) Assumption of the game. **8**

(2) Find the optimum strategy and value of the game of the following pay-off matrix using matrix method. **8**

Player - B

		B_1	B_2	B_3	B_4
Player - A	A_1	3	2	4	0
	A_2	3	3	2	4
	A_3	4	2	4	0
	A_4	0	4	0	8

OR

(1) Explain the principle of dominance in Game theory. **8**

(2) Solve the game whose pay-off matrix is given below by Simplex method. **8**

Player - B

		B_1	B_2	B_3
Player - A	A_1	1	–1	–1
	A_2	–1	–1	3
	A_3	–1	2	–1

(B) Attempt any **three** in short. **6**

(1) Define : Pure strategy, Mixed strategy.

(2) Give an example of pay-off matrix for game without saddle point.

(3) Define : A fair game with illustration.

(4) Determine the value of the game with the pay-off matrix.

Player - B

		B_1	B_2	B_3
Player - A	A_1	2	0	2
	A_2	1	–3	2

(5) Define : Two person zero sum game.

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Seat No. : _______________

MQ-122

March-2019

B.Sc., Sem.-VI

SE-311 : Mathematics
(Cryptography)

Time : 2:30 Hours] **[Max. Marks : 70**

Instruction : There are **3** questions. **All** questions are compulsory.

1. (A) (i) Define Ring. Explain Euclidean algorithm. **9**

(ii) Obtain the value of x that satisfies the following four congruence $x \equiv 1 (\text{mod} 2)$, $x \equiv 2 (\text{mod} 3)$, $x \equiv 3 (\text{mod} 5)$, $x \equiv 4 (\text{mod} 7)$. **9**

OR

(i) If n is a fixed positive integer and a, b, c, d are integer, then prove that the following : **9**

(a) $a \equiv b \ (\text{mod } n) \Leftrightarrow b \equiv a \ (\text{mod } n) \Leftrightarrow a - b \equiv 0 \ (\text{mod } n)$.

(b) $a \equiv a \ (\text{mod } n)$

(c) $a \equiv b \ (\text{mod } n)$ and $b \equiv c \ (\text{mod } n) \Leftrightarrow a \equiv c \ (\text{mod } n)$.

(ii) Obtain all the primite element of of $\mathbb{Z}_{37}$. **9**

(B) Attempt any **Three**. Do as directed. **6**

(a) a is not primitive element of $\mathbb{Z}_p$ if ______.

(b) $\phi(n_1,n_2) = \phi(n_1)\phi(n_2)$ if _______.

(c) If c expressed as $c \equiv a^{-1}$ (mod b) is valid inverse of a if ______.

(d) What is the fundamental theorem of arithmetic ? Give an illustrative example.

(e) State generalization of Fermat's little Theorem.

2. (A) (i) Define Cryptosystem. Encrypt the following message using a shift cipher with a shift of +20. "Comfort is the enemy of achievement"

Encrypt the following message using a shift cipher with a shift of –20. "The person that you will spend the most time within your life is yourself, so you better try to make yourself as interesting as possible." **9**

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(ii) Using Affine cipher encrypt "People are not against you; they are for themselves" with $(4x + 5)(\text{mod}26)$. **9**

OR

(i) A ciphertext obtained using the shift cipher is given below. Do the cryptanalysis and obtain the plaintext.: HAAHJRHAKHDU.

(ii) Suppose that affine cipher $E(x) = (ax + b)(\text{mod } 26)$ enciphers s as U and o as A. Find a and b.

(B) Attempt any **Three**. Do as directed. **6**

(a) Explain the terms in the context of cryptography: Encryption, Diagram, Trigram.

(b) ______ and ______ are specific case of Polycryptosystem.

(c) Hill cipher is a generalized version of ______ and ______ combined.

(d) ______ cipher is simplified version of ______ cipher.

(e) Define Permutation Cipher.

3. (A) (i) Define Trapdoor function. Discuss Birthday Paradox. **8**

(ii) Alice and Bob select the prime number p = 17 with g = 6 as a primitive elements. Alice select a random number a = 5 as private key, computes her public key and sends it to Bob; Bob uses b = 9 as the ephemeral key to mail a message m = 13 to Alice. Show the full transaction including the recovery of message key using ElGamal Public-Key cryptosystem. **8**

OR

(i) Alice selects p = 23 and c = 5 and convey the same to Bob. Alice selects a = 6 and Bob selects b = 15. What is private key exchange between them using the DH algorithm ? Show how Eve mounts an attack using Shank's algorithm and wrenches the private key shared between Alice and Bob.

(ii) With p = 17, q = 19, e = 29 and m = 25. Show that the complete transaction conforming to the RSA cryptosystem.

(B) Attempt any **Three**. Do as directed. **6**

(a) What is probability that at least two share a birthday form group of n people ?

(b) Which function suggested by Pollard to find discrete logarithm.

(c) The ______ is the original message before transformation.

(d) A combination of an encryption algorithm and a decryption algorithm is called a ______.

(e) Full form of RSA.

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MQ-122

March-2019

B.Sc., Sem.-VI

SE-311 : Mathematics
(Convex Analysis and Probability Theory)

Time : 2:30 Hours] **[Max. Marks : 70**

Instructions : (i) Notations are usual everywhere.
(ii) Figures to the right indicate full marks of the question/sub-question.

1. (a) (i) Show that the function f : R $\rightarrow$ R defined as $f(x) = x^3$ is increasing on $(-\infty,\infty)$, convex function on $[0, \infty)$ and concave on $(-\infty, 0]$. **9**

(ii) If I is an interval containing more than one point and f:I $\rightarrow$R is a differential function then prove that if f is non-negative throughout I then f is monotonically increasing on I. **9**

OR

(i) State and prove the Intermediate Value Theorem.

(ii) If the polynomial function f:R$\rightarrow$R is defined as

$f(x) = x^4 - 8x^3 + 22x^2 - 24x + 7$ then check the differentiability and monotonicity of f.

(b) Answer any **Three** questions in Short : **6**

(i) Define convex linear combination and Convex Set.

(ii) By figure give examples of convex and non-convex sets.

(iii) Define monotonically increasing and decreasing functions on an interval I.

(iv) If $A = \{ x = (x_1 , x_2) \in R^2 / (x_1)^2 + (x_2)^2 = 16 \}$ then find the convex hull of A.

(v) Define Convex and concave functions on an interval I.

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2. (a) (i) Define following terms :

(1) Sample space, (2) Event, (3) Elementary event, (4) Mutually Exhaustive events. **9**

(ii) State addition rule of probability for two events.

If two events A and B defined on a finite sample space such that P[A]=0.25, P[B] = 0.50 and P[A∩B] = 0.25, then find the probability of following events :

(1) $\bar{A}$ (2) $A \cap \bar{B}$ (3) $A \cup B$ (4) $\overline{A \cap B}$. **9**

OR

(i) State Classical, axiomatic and conditional probability and Bayes' Rule. There are two bags, one contains 5 red and 8 black balls and other bag contains 7 red and 10 black balls. A ball is drawn from one or the other bag. Find the chance of drawing a red ball.

(ii) Two balanced dice are thrown once, simultaneously. Find the probability of the following events :

(1) 2 on a first die and odd number on a second die

(2) Even number on first die and a multiple of 3 on second die.

(3) Sum of numbers on two dice is 7.

(b) Answer any **Three** questions in Short : **6**

(i) State parameters of binomial distribution. If a random variable X follows binomial distribution and its mean and n are 2 and 6 respectively, what is the value of p ?

(ii) State the bayes' rule of probability.

(iii) State the independence of two events, A and B. If A and B are independent, are events $\bar{A}$ and $\bar{B}$ independent ?

(iv) State addition rule of probability for three events.

(v) For two mutually exclusive events A, B on a finite sample space S,

$P(\bar{A} \mid B) = 1$. Do you agree ? If yes, justify.

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3 (a) (i) State the probability function of binomial distribution. Also, state the conditions to derive the binomial distribution. **9**

(ii) If a random variable X follows a binomial distribution with parameters $n=8$ and $p = 0.5$, state the probability function of X.

Find mean and variance of a random variable X. Also, obtain probability that (1) $X = 1$, (2) $X < 2$. **9**

OR

(i) For a normal distribution, state its probability distribution function. Also, state mean, variance, mode and median of normal distribution.

(ii) During a typical football game, injuries are expected and are treated as a random variable, following a Poisson distribution. A coach can expect 3.2 injuries. Find the probability that the team will have at most 1 injury in this game.

(b) Answer any **Two** questions in Short : **4**

(i) Define conditional probability.

(ii) If $P(A) = 0.35$, $P(B) = 0.45$, and $P(A \cup B) = 0.50$, then find $P(A \mid B)$.

(iii) State the theorem on total probability.

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