| Reg. No. | | | | | | | | | | |
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Manipal
INSPIRED BY LIFE

**FIRST SEMESTER MCA**

**END SEMESTER EXAMINATIONS, NOV/DEC 2015**

SUBJECT: COMPUTATIONAL MATHEMATICS [MAT- 4150]

**REVISED CREDIT SYSTEM**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

1A. If A and B are any two events, which are not mutually exclusive then prove the following

*i)* $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

*ii)* $P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$

1B. On the set of rational numbers $Q_1$ the operation * is defined by $a * b = a + b - ab$ Show that $\{Q_1 ; *\}$ is an abelian group and hence solve for x given $2*x = 3^{-1}$ in $Q_1$

1C. State Baye's theorem. 2% of the population has a certain blood disease in serious form, 10% have it in a mild form and 88% do not have it at all. A new blood test is developed. The prob. that test is positive is 0.9 if the subject has the serious form; 0.6 if the subject has the mild form and 0.1 if the subject does not have the disease. A subject has tested positive. What is the probability that the subject has the serious form of the disease?

**(3 + 3+ 4)**

2A. From 8 positive and 6 negative integers, 4 are chosen at random and are multiplied. i) What is the probability that the product is positive? ii) What is the probability that the product is negative?

2B. In a test on electric bulbs, it was found that the life time of a particular brand was distributed normally with an average life of 2000 hrs and Standard deviation of 60 hours, if a firm purchases 2500 bulbs. Find the number of bulbs that are likely to last for i) more than 2000 hrs ii) less than1950 hrs iii) between 1900 to 2100 hrs.

2 C. Derive the expression for mean and standard deviation of Binomial distribution.

**(3 + 3 + 4)**

3A. If G is a simple graph with n vertices and k components then prove that G can have at most $\frac{(n-k)(n-k+1)}{2}$ edges

3B. The probability density function of a discrete random variable X is given by

$$f(x)=\begin{cases} Cx^2, & 0<x<3 \\ 0, & \text{otherwise} \end{cases}$$

i) Find the constant C ii) Compute P(1< x < 2)

iii) Find the distribution function F(x)

3C. Diagonalize the matrix $A=\begin{bmatrix} 8 & -8 & -2 \\ 4 & -3 & -2 \\ 3 & -4 & 1 \end{bmatrix}$

**(3 + 3 + 4)**

4A Find the rank of a matrix $A=\begin{bmatrix} 1 & 2 & -2 & 3 \\ 2 & 5 & -4 & 6 \\ -1 & -3 & 2 & -2 \\ 2 & 4 & 1 & 6 \end{bmatrix}$

4B. Show that the set B = {2, 4, 6, 8 ; x mod 10} is an abelian group.

4C. Test for consistency and solve: $x + 2y + 2z = 2$, $3x - 2y - z = 5$, $2x - 5y + 3z = -4$ and $x + 4y + 6z = 0$.

**(3+ 3 + 4)**

5A. Define the following

i) Linearly independent and Linearly dependent vectors

ii) Commutative Ring

iii) Complete bipartite graph with example iv) Cut sets with example

5B. The joint density function of two random variables X and Y is given by

$$f(x,y)=\begin{cases} \frac{1}{8}(6-x-y), & 0<x<2, \quad 2<y<4 \\ 0, & \text{otherwise} \end{cases}$$

Find: i) E(X), ii) P(X <1, Y<3), iii) P(X+Y < 3), v) P(X+Y ≥ 3)

**(4 + 6)**

6A. Define Eulerian circuit and Hamiltonian cycle give an example of i) Hamiltonian graph but not an Eulerian graph ii) Eulerian graph but not an Hamiltonian graph.

iii) Neither Hamiltonian graph nor Eulerian graph

iii) Graph which is both Hamiltonian and Eulerian graph

6B. Reduce the quadratic form $3x^2 + 5y^2 + 3z^2 - 2yz + 2zx - 2xy$ to the canonical form by an orthogonal reduction and indicate the nature, rank, index and signature of the canonical form.

**(4 + 6)**

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