Q. Code:266618

Reg. No. | | | | | | | | | | | | | |

B.E./ B.TECH. DEGREE EXAMINATIONS, MAY 2024

Third Semester

MA18354 – MATHEMATICS FOR DATA ANALYSIS

(Regulation 2018 & 2018A)

TIME: 3 HOURS **MAX. MARKS: 100**

CO 1 The students will be able to apply the concepts of basic principles of Combinatorics and its Applications.

CO 2 The students will be able to understand the basic concepts in Number Theory and its Applications in Data Science.

CO 3 The students will be able to provide the required support to develop regression models which can be used in data analytics.

CO 4 The students will be able to understand the fundamental concepts of graph theory.

CO 5 The students will be able to understand the advanced concepts of graph theory and its applications to Computer science.

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

		CO	RBT LEVEL
1	State the principle of Mathematical induction.	**1**	**1**
2	Solve the recurrence relation $a_n = a_{n-1} + 2a_{n-2}$ with $a_0 = 2,\ a_1 = 7$.	**1**	**2**
3	Express (28, 12) as a linear combination of 28 and 12.	**2**	**2**
4	Determine whether 1601 is a prime number.	**2**	**2**
5	What is the residual sum of squares?	**3**	**1**
6	Write the normal equations to fit a second-degree polynomial by the method of least squares.	**3**	**1**
7	Define a complete graph and give an example.	**4**	**2**
8	Draw a graph which is Hamiltonian but not Eulerian.	**4**	**2**
9	What is a residual network graph?	**5**	**1**
10	What are the conditions to be assumed while using the Ford Fulkerson algorithm in finding the maximum flow of a flow network?	**5**	**1**

PART- B (5 x 14 = 70 Marks)

(Restrict to a maximum of TWO subdivisions)

			Marks	CO	RBT LEVEL
11(a)	**(i)**	There are 2504 computer science students at a school. Of these, 1876 have taken a course in Java, 999 have taken a course in Linux, and 345 have taken a course in C. Further, 876 have taken courses in both Java and Linux, 231 have taken courses in both Linux and C, and 290 have taken courses in both Java and C. If 189 of these students have taken courses in Linux, Java,	**(7)**	**1**	**3**

and C, how many of these 2504 students have not taken a course in any of these three programming languages?

	(ii)	Prove that for every positive integer n, $1.2+2.3+\cdots n(n+1)=\frac{n(n+1)(n+2)}{3}$.	**(7)**	**1**	**3**

(OR)

11(b)	**(i)**	How many permutations of the letters *ABCDEFG* contain? **a)** the string *BCD*? **b)** the strings *BA* and *GF*?	**(4)**	**1**	**3**
	(ii)	Use Generating functions to solve the recurrence relation $a_n = 5a_{n-1} - 6a_{n-2}$ with initial conditions $a_0 = 6,\ a_1 = 30$.	**(10)**	**1**	**3**
12(a)	**(i)**	Using the euclidean algorithm, express (4076, 1024) as a linear combination of 4076 and 1024.	**(7)**	**2**	**3**
	(ii)	Show that the gcd of the positive integers a and b is a linear combination of a and b.	**(7)**	**2**	**3**

(OR)

12(b)	**(i)**	Using canonical decompositions of 1050 and 2574, find [1050, 2574].	**(7)**	**2**	**3**
	(ii)	Show that there are infinitely many primes.	**(7)**	**2**	**3**
13(a)		The following are measurements of the air velocity and evaporation coefficient of burning fuel droplets in an impulse engine.	**(14)**	**3**	**3**

Air velocity(cm/sec) x	20	60	100	140	180	220	260	300	340	380
Evaporation coefficient (mm^2/sec) y	0.18	0.37	0.35	0.78	0.56	0.75	1.18	1.36	1.17	1.65

Fit a straight line to these data by the method of least squares, and use it to estimate the evaporation coefficient of a droplet when the air velocity is 190 cm/s. Also find the residual sum of squares and construct a 95% confidence interval for

the regression coefficient. ($t_{0.025,8} = 2.306$)

(OR)

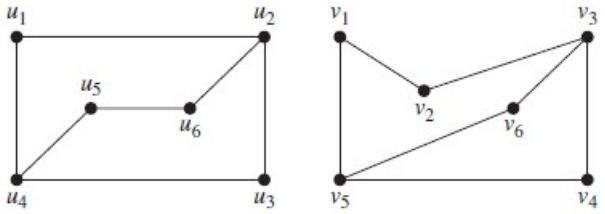
13(b) The following are data on the ages and incomes of 5 executives working for the same company and the number of years they went to college: **(14) 3 3**

Age x_1	37	45	38	42	31
Years college x_2	4	0	5	2	4
Income(dollars) y	71,200	66,800	75,000	70,300	65,400

Fit an equation of the form $y = \beta_0 + \beta_1 x_1 + \beta_2 x_2$ to the given data.

14(a) **(i)** Show that in a tree any two vertices are connected by a unique path. **(7) 4 3**

(ii) Determine whether the graphs *G* and *H* are isomorphic. **(7) 4 3**

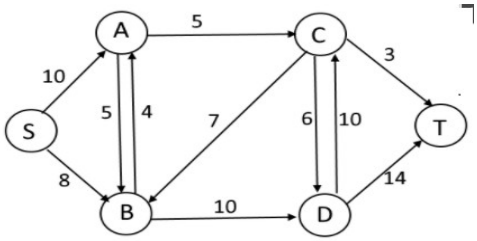


G H

(OR)

14(b) Show that a Graph is Eulerian if and only if it has no vertices of odd degree. **(14) 4 3**

15(a) Using Ford-Fulkerson algorithm, find the maximum flow possible from source S to sink T. **(14) 5 3**



(OR)

15(b) **(i)** Show that if a matching M in G is a maximum matching then G contains no M-augmenting path. **(7) 5 3**

	(ii)	Show that a simple graph G with n vertices is connected if it has more than $\frac{(n-1)(n-2)}{2}$ edges.	**(7)**	**5**	**3**

PART- C (1 x 10 = 10 Marks)

(Q.No.16 is compulsory)

			Marks	CO	RBT LEVEL
16	**(i)**	How many positive integers not exceeding 1000 are divisible by 7 or 11?	**(6)**	**1**	**3**
	(ii)	There are 18 mathematics majors and 325 computer science majors at a college. **a)** In how many ways can two representatives be picked so that one is a mathematics major and the other is a computer science major? **b)** In how many ways can one representative be picked who is either a mathematics major or a computer science major?	**(4)**	**1**	**3**

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