

**ASSIGNMENT BOOKLET  
Bachelor's Degree Programme  
(B.Sc./B.A./B.Com.)**

**Bachelor's Degree Programme  
Discrete Mathematics  
(1<sup>st</sup> January, 2021 to 31<sup>st</sup> December, 2021)**

- **It is compulsory to submit the Assignment before filling in the Term-End Examination form.**
- **It is mandatory to register for a course before appearing in the Term-End Examination of the course. Otherwise, your result will not be declared.**

**For B.Sc. Students Only**

- **You can take electives(56 or 64 credits) from a minimum of TWO and a maximum of FOUR science disciplines, viz. Physics, Chemistry, Life Sciences and Mathematics.**
- **You can opt for elective courses worth a MINIMUM OF 8 CREDITS and a MAXIMUM OF 48 CREDITS from any of these four disciplines.**
- **At least 25% of the total credits that you register for in the elective courses from elective courses from Life Sciences, Chemistry and Physics discipline must be from the laboratory courses. For example, if you opt for a total of 24 credits of electives in these 3 disciplines, at least 6 credits should be from lab courses.**



**School of Sciences  
Indira Gandhi National Open University  
Maidan Garhi, New Delhi-110068  
( 2021)**

Dear Student,

Please read the section on assignments in the Programme Guide for elective Courses that we sent you after your enrolment. A weightage of 30%, as you are aware, has been earmarked for continuous evaluation, **which would consist of one tutor-marked assignment** for this course. The assignment is in this booklet.

### Instructions for Formatting Your Assignments

Before attempting the assignment please read the following instructions carefully.

1. On top of the first page of your answer sheet, please write the details exactly in the following format:

---

**ROLL NO. :**.....

**NAME :**.....

**ADDRESS :**.....

.....

.....

**COURSE CODE :** .....

**COURSE TITLE :** .....

**STUDY CENTRE :** .....

**DATE**.....

---

**PLEASE FOLLOW THE ABOVE FORMAT STRICTLY TO FACILITATE EVALUATION AND TO AVOID DELAY.**

2. Use only foolscap size writing paper (but not of very thin variety) for writing your answers.
3. Leave a 4 cm margin on the left, top and bottom of your answer sheet.
4. Your answers should be precise.
5. While solving problems, clearly indicate which part of which question is being solved.
6. This assignment is to be submitted to the Study Centre as per the schedule made by the study centre. **Answer sheets received after the due date shall not be accepted.**
7. This assignment is valid only up to 31<sup>st</sup> December, 2021. If you fail in this assignment or fail to submit it by 31<sup>st</sup> December, 2021, then you need to get the assignment for the year 2022 and submit it as per the instructions given in the Programme Guide.
8. **You cannot fill the Exam form for this course till you have submitted this assignment. So solve it and submit it to your study centre at the earliest.**
9. **We strongly suggest that you retain a copy of your answer sheets.**

We wish you good luck.

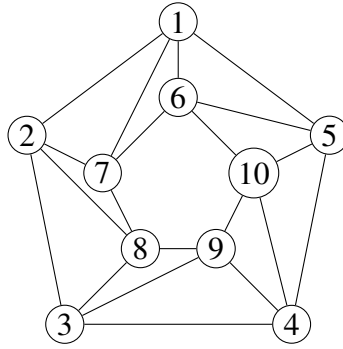
## Assignment

Course Code: MTE-13  
Assignment Code: MTE-13/TMA/2021  
Maximum Marks: 100

1. Which of the following statements are true and which are false? Give reasons for your answer. (20)
    - i) ' $x^2 + y^2 - 3$  is not dividible by 4.' is mathematical statement.
    - ii) The number of onto functions from  $\{1, 2, 3, 4, 5, 6\}$  to  $\{a, b, c, d\}$  is  $4!S_6^4$ .
    - iii) The generating function associated with a sequence can never be a polynomial.
    - iv)  $K_{4,4}$  is non-planar.
    - v) Every bipartite graph with odd number of vertices is non-hamiltonian.
    - vi)  $a_n = a_{\frac{n}{2}} + n, a_1 = 0$ , where  $n$  is a power of 2, is a linear recurrence relation.
    - vii) The generating function of the sequence  $\{1, 2, 3, 4, \dots, n, \dots\}$  is  $(1 - z)^{-2}$ .
    - viii) If  $g(x)$  is the generating function for  $\{a_n\}_{n \geq 1}$ , then  $(1 - x)g(x)$  is the generating function for the sequence  $\{b_n\}_{n \geq 1}$  where  $b_n = a_n - 1, \forall n$ .
    - ix) If a graph is isomorphic to its complement, then it has odd number of vertices.
    - x) Every 3-colourable graph is 4-colourable.
  2. a) Consider the propositions ' $2 + 3 = 5$ ' and 'The Sun rises in the West'.
    - i) Write the disjunction of the statements and give its truth value.
    - ii) Write the conjunction of the statements and give its truth value.
    - iii) Write the exclusive disjunction of the statements and give its truth value. (3)b) Prove or disprove the following statement. (2)

"If  $m$  divides  $a^n - b^n$ , then  $m$  divides  $ab^n - ba^n$  also."

c) Show that any tree with exactly two vertices of degree 1 is a path. (3)
  - d) Write down the converse of each of the following statements: (2)
    - i) If  $p$  is a prime number and  $a$  and  $b$  are any two natural numbers and if  $p$  divides  $a$  or  $b$ , then  $p$  divides  $ab$ .
    - ii) In a triangle  $\triangle ABC$ , if  $AB^2 + AC^2 = BC^2$ , then  $\angle BAC = 90^\circ$ .
3. a) If the solution of the recurrence relation  $\alpha u_{n-1} + \beta u_{n-2} = f(n), (n \geq 2)$  is  $u_n = 1 - 2n + 3 \cdot 2^n$ , then determine the values of  $\alpha, \beta$  and  $f(n)$ . (6)
- b) A bank pays you 4.5% interest per year. In addition, you receive ₹100 as bonus at the end of the year (after the interest is paid). Find a recurrence for the amount of money after  $n$  years if you invest ₹2000. (4)
- c) If 5 points are chosen in a square of side 2cm, show that there will always be two points at a distance of at most  $\sqrt{2}$ cm. (5)
4. a) A die is rolled twice and the sum of the numbers that appear is observed. What is the probability that the sum is either a perfect square or a perfect cube? (3)
  - b) Consider the graph given below:



- i) Write the degree sequence of the graph.  
 ii) Exhibit a cycle of length 9 in this graph.  
 iii) Does this have any complete graph as its subgraph? If yes, exhibit one. (7)
5. a) Write the expression  $x_1 \vee x_2 \wedge x_3 \vee x_4$  in conjunction normal form and disjunctive normal form. (5)  
 b) Find the general form of the solution to a linear homogeneous recurrence relation with constant coefficients for which the characteristic roots are 1,  $-2$  and 3 with multiplicities 2, 1 and 2, respectively. The relation also has a non-homogeneous part which is a linear combination of  $3^n$  and  $(-2)^n$ . (5)
6. a) Use generating function to prove the identity
- $$\sum_{k=0}^n \binom{r}{k} \binom{s}{n-k} = \binom{r+s}{n}. \quad (5)$$
- b) If a planar graph has the degree sequence  $(2, 2, 2, 3, 4, 4, 5)$ , how many faces will it have? Draw a planar graph with this degree sequence and the number of faces obtained to check your answer. (5)
7. a) How many numbers form 0 to 999 (0 and 999 inclusive) are indivisible by 7 or 11? (4)  
 b) From a survey of 120 people, the following data was obtained:  
 90 owned a car, 35 owned a computer, 40 owned a house, 32 owned a car and a house, 21 owned a house and a computer, 26 owned a car and a computer, 17 owned all the three facilities.  
 i) How many people owned neither of the three.  
 ii) How many people owned only a car?  
 iii) How many people owned only a computer? (6)
8. a) Find the generating function of the recurrence  $a_n = 6a_{n-1} - 5a_{n-2} + 1$  with initial conditions  $a_0 = 2, a_1 = 5$ . (4)  
 b) Express  $3x^4 + 4x^3 + 2x^2 + x$  in terms of  $[x]_4, [x]_3, [x]_2$  and  $[x]$ . (3)  
 c) Draw the Ferrar graph of the following partitions:  
 i)  $20 = 9 + 6 + 3 + 2$   
 ii)  $28 = 10 + 9 + 8 + 1$   
 Also, write down the conjugate partitions of each of these partitions. (5)

d) Check whether the following graph is critical or not.

(3)

