UC-5709

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M. A. / M. Sc. (Sem. II) Examination,
June - 2023

MATHEMATICS

Paper - MATH 2C4

Methods of Applied Maths - II

Time Allowed : **Three Hours**

Maximum Marks : **100**

Note : *This question paper contains* ***three*** *sections as under :*

Section-A ***Max. Marks-10***

This section contains ***one compulsory*** *question comprising* ***10*** *parts, having* ***2*** *parts from each unit, short answer in* ***20*** *words for each part. All questions carry* ***equal*** *marks.*

Section-B ***Max. Marks-50***

This section contains ***10*** *questions having* ***2*** *questions from each unit. Answer* ***5*** *questions (****250*** *words each) selecting* ***one*** *question from each unit. All questions carry* ***equal*** *marks.*

Section-C ***Max. Marks-40***

This section contains ***04*** *descriptive type questions (questions may have sub division) covering all units but not more than* ***one*** *question from each unit. Answer any* ***two*** *questions. (****500*** *words each). All questions carry* ***equal*** *marks.*

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SECTION - A

1 (i) State principle of inclusion and exclusion.

(ii) Define Boolean Algebra.

(iii) Define bridge circuit.

(iv) Define Planner graph.

(v) Show that a graph is tree if it is minimally connected.

(vi) Prove that every complete lattice is bounded.

(vii) What do you mean by fractional derivative?

(viii) Write physical interpretation of fractional integration.

(ix) Define sequential fractional derivative.

(x) Define left and right fractional derivation.

SECTION - B

UNIT - I

2 Prove that following statement is a tautology.

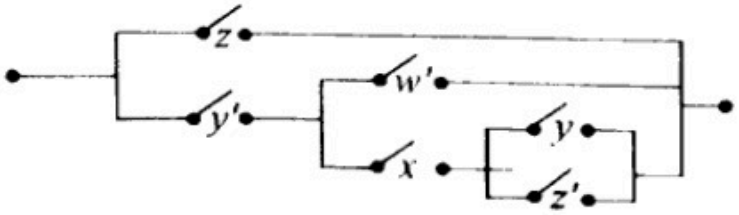
$$\left[(p \to q) \wedge (q \to r)\right] \to (p \to r)$$

3 Express the following boolean function in disjunctive normal form.

$$\left(x'y + xyz' + xy'z + x'y'z't + t'\right)'$$

UNIT - II

4 Find the function which represent the circuit given below :



5 If G is a simple graph with n vertices and e edges with $n \geq 3$ and $e \geq \frac{1}{2}\left(n^2 - 3n + 6\right)$. then prove that G is Hamiltonian graph.

UNIT - III

6 Prove that every tree has either one or two centres.

7 Prove that in a distributive lattice, if an element has a complement then this complement is unique.

UNIT - IV

8 Explain Grunwald-Letnikov construction of fractional derivative.

9 Prove that :

$${}_{\alpha}D_t^{-p}\left({}_{\alpha}D_t^{-q}f(t)\right) = {}_{\alpha}D_t^{-q}\left({}_{\alpha}D_t^{-p}f(t)\right) = {}_{\alpha}D_t^{-p-q}f(t)$$

UNIT - V

10 Using Laplace transform solve fractional derivative

$${}_0D_t^{1/3}f(t) = C_1 f(t)$$

11 Prove that :

$${}_{\alpha}D_t^{p}\left(\lambda f(t) + \mu g(t)\right) = \lambda\,{}_{\alpha}D_t^{p}f(t) + \mu\,{}_{\alpha}D_t^{p}g(t)$$

SECTION - C

12 (a) State and prove Pigeon-hole principle.

(b) Prove that no boolean algebra can have 3 distinct elements.

13 (a) Design a 4-terminal circuit to realize the following three functions using common switches wherever possible.

$$f = xy'z + (xy' + x'y)zw$$

$$g = xy'zw' + x'yzw'$$

$$h = x'y + (xy' + x'y)(z' + w')$$

(b) Prove that a connected graph G is an Euler graph if and only if the degree of every vertex in G is even.

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14 (a) Show that every connected graph with n vertices and $(n-1)$ edges is a tree.

(b) Establish the equivalence of the two definition of a lattice.

15 Explain Riemann-Liouvelle fractional integral and Riemann-Liouvelle fractional derivative. Also find Laplace transform of Riemann-Liovelle fractional integral and Riemann-Liouvelle fractional derivative.

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