KARNATAKA STATE OPEN UNIVERSITY

Mukthagangotri, Mysore – 570 006

Department of Studies in Mathematics

Date: 11-07-2022

THIRD SEMESTER M.Sc. MATHEMATICS ASSIGNMENT QUESTIONS

(For 2020 – 2021 July and January Cycles)

Instructions:

- Answer **All the Questions** and each question carries **04 marks**.
- Assignment on each course shall be submitted separately.
- Assignment shall be in one's own handwriting and be written in A4 size sheet.
- On the covering sheet of the assignment write your Name, Register Number, Course and Date of submission.
- Using plastic sheets / spiral wires to bind assignment is strictly prohibited.
- Assignments shall be submitted on or before **20th August 2022.**
- The assignments submitted after the last date will not be considered for internal assessment marks.
- All the assignments shall be put in a single cover and to be submitted to the address given below by post or in person on or before the last date.

The Faculty
DOS in Mathematics, Vijnan Bhavan
Karnataka State Open University
Mukthagangothri, Mysore -570 006.

Course - Math 3.1: Topology

Max. Marks: 20

1. The following holds in $(X, \Im)$
   i. $d(\phi) = \phi$
   ii. $A \subseteq B \Rightarrow d(A) \subseteq d(B)$
   iii. $d(A \cup B) = d(A) \cup d(B)$.
2. Given a mapping $f : (X, \Im) \to (Y,U)$ the following are equivalent.
   i. f is continuous.
   ii. B is closed in Y $\Rightarrow f^{-1}(B)$ is closed in X.
   iii. $f\left(\overline{A}\right) \subseteq \overline{f(A)} \quad \forall, A \subseteq X$.
3. Prove that $(X, \Im)$ is compact iff every family of closed sets having finite intersection property has a non-empty intersection.
4. State and prove Urysohn's lemma.
5. State and prove Tychonoff Theorem.

Course - Math 3.2: Measure and Integration

Max. Marks: 20

1. Let A be an algebra of X and $\{A_i\}$ a sequence of sets in A. Then for a sequence $\{B_i\}$ of sets in A such that $B_n \cap B_m = \phi$ for n ≠ m, Show that $\bigcup_{i=1}^{\infty} B_i = \bigcup_{i=1}^{\infty} A_i$.
2. Prove that the Lebesgue outer measure of an interval is its length.
3. Let $\{A_n\}$ be a countable collection of sets of real numbers. Then prove that, $m^*\left(\bigcup_{n=1}^{\infty} A_n\right) \leq \sum_{n=1}^{\infty} m^* A_n$.
4. Prove that $m^*\left(A \cap \left[\bigcup_{i=1}^{n} E_i\right]\right) = \sum_{i=1}^{n} m^*\left(A \cap E_i\right)$.
5. State and prove Littlewood's three principles.

Course –Math 3.3: Functional Analysis

Max. Marks: 20

1. Define complete metric space and show that (C^n, d) is a complete metric space.
2. Prove that every closed subspace of a complete metric space is also complete.
3. State and prove Metric Completion Theorem.
4. State and prove Banach Contraction Mapping Theorem.
5. Prove that every non-empty complete metric space is of second category. [Baire's category Theorem].

Course – Math 3.4: Mathematical Modeling

Max. Marks: 20

1. Explain the procedure for solving problems through Mathematical Modeling.
2. Write the characteristics of Mathematical Modeling.
3. Using qualitative technique, explain general properties of the solutions of differential equation $\frac{dx}{dt} = bx - x^3$. Also find the equilibrium points and their stability.
4. Set up a differential equation to describe the spring dashpot model. Discuss the solutions in all possible cases.
5. Find the orthogonal trajectories of the family of confocal conics.

Course – Math 3.5: Computer programming

Max. Marks: 20

1. Explain the following RAM, ROM, PROM, EPROM & EEPROM.
2. Explain software and its types.
3. Write an algorithm and flow chart to compute the area of a circle.
4. Explain the types of networks along with examples.
5. Explain the following;
    a. World Wide Web
    b. Uniform Resource Locator
    c. Hyper text markup language
    d. Hyper text transfer protocol

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Facing sheet

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THIRD SEMESTER M.Sc. MATHEMATICS

ASSIGNMENT

COURSE CODE:
COURSE TITLE:

Name of the candidate	
Roll Number	
Date of Submission	

For Office Use only

Marks Obtained		**Signature of The Evaluator**	