KARNATAKA STATE OPEN UNIVERSITY

Mukthagangotri, Mysore – 570 006

Department of Studies in Mathematics

Date: 10-05-2022

M.Sc. MATHEMATICS (CBCS) ASSIGNMENT QUESTIONS

For First Semester Students of July 2021-22 and January 2021-22 Cycle

Instructions:

- Answer All the Questions. Each question carry equal 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, Batch, Course title, Course code and Date of submission. The facing sheet should be enclosed for all the five courses separately.
- Using plastic sheets / spiral binding of assignment is strictly prohibited.
- Assignments shall be submitted on or before 30th June 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 - PGM 1.1: Algebra

Max. Marks 20

1. Let H and K be finite subgroup of 'G' then prove that $|HK| = \frac{o(H)\,.\,o(K)}{o(H \cap K)}$.
2. State and prove the Sylow first theorem and prove that a group of order $5^2 \,.7^2$ is abelian.
3. Define an integral domain and show that every integral domain can be embedded in a field.
4. State and prove Einstein's criterion for the irreducibility of a polynomial.

Course - PGM 1.2: Real Analysis-I

Max. Marks 20

1. Define a countable Set. Let $\{E_n\}_{n=1}^{\infty}$ be a countable collection of countable sets. Then prove that $\bigcup_{n=1}^{\infty} E_n$ is countable. Further, show that the set of all rational numbers is countable.
2. Prove that the subsequential limits of a sequence $\{x_n\}$ form a closed subset of $\mathbb{R}$.
3. Define continuous function. State and prove Sequential criterion of continuity of a function.
4. If $x_0 \in [a,b]$ and $f:[a,b] \longrightarrow \mathbb{R}$ and $g:[a,b] \longrightarrow \mathbb{R}$ be differentiable at x_0. Then prove that, $f+g$, fg and $\frac{f}{g}$ are differentiable at x_0 and for some $\alpha \in \mathbb{R}$, αf is differentiable at x_0 and also prove the following:

   $i)$ $(\alpha f)'(x_0) = \alpha f'(x_0)$

   ii) $(f+g)'(x_0) = f'(x_0) + g'(x_0)$

   $iii)$ $(fg)'(x_0) = f'(x_0)g(x_0) + f(x_0)g'(x_0)$ (Product rule)

   iv) If $g(x_0) \neq 0$ then $\left(\frac{f}{g}\right)'(x_0) = \frac{f'(x_0)g(x_0) - f(x_0)g'(x_0)}{(g(x_0))^2}$ (Quotient rule).

Course - PGM 1.3: Complex Analysis-I

Max. Marks 20

1. Define limit of a function. If $\lim_{z \to z_0} f(z) = A$ and $\lim_{z \to z_0} g(z) = B$ then prove the following:

$$i) \lim_{z \to z_0} [f(z) + g(z)] = \lim_{z \to z_0} f(z) + \lim_{z \to z_0} g(z) = A + B$$

$$ii) \lim_{z \to z_0} [f(z).g(z)] = \lim_{z \to z_0} f(z) . \lim_{z \to z_0} g(z) = A . B$$

2. State and prove Abel's limit theorem.
3. State and prove Cauchy's theorem of a disk.
4. State and prove Laurent's theorem and obtain the Taylor's series expansion of $f(z) = \frac{z}{(z+1)(z+2)}$ in the region $|z| < 1$ and $|z| < \frac{3}{4}$.

Course - PGM 1.4: Ordinary Differential Equations

Max. Marks 20

1. Solve $\frac{d^2y}{dx^2} + y = \frac{1}{1+sinx}$ by using method of variation of parameter.
2. Express $2x^2 - 4x + 5$ in terms of Legendre's polynomial.
3. State and prove Picard's theorem.
4. State and prove Sturm's separation theorem.

Course - PGM 1.5: Numerical Analysis

Max. Marks 20

1. Perform three iteration of the Muller method to find the smallest positive root of the equation $x^3 - 5x + 1 = 0$.
2. Use Gauss-Siedel iteration method to solve the system of linear equation.

$$10x + y + z = 12$$
$$x + 10y + z = 12$$
$$x + y + 10z = 12$$

3. Derive Hermite Interpolating polynomial.
4. Apply Gauss- Jordon method to solve the system of linear equation.

$$2x + 5y + 7z = 52$$
$$2x + y - z = 0$$
$$x + y + z = 9$$

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Facing sheet

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FIRST SEMESTER M.Sc. MATHEMATICS (CBCS)

ASSIGNMENT

COURSE CODE:
COURSE TITLE:

Name of the candidate	
Roll Number	
Date of Submission	

For Office Use only

Marks Obtained	

Signature of The Evaluator	