Course: 1.1 ABSTRACT ALGEBRA

Answer **ALL** questions   Max.Marks: 25

$(5 \times 5 = 25)$

1. If G is the abelian group of integers in the mapping $T: G \rightarrow G$ given by $T(x) = x$ then prove that as an automorphism.
2. Let G be a group of order $11^2 : 13^2$. How many 11-sylow subgroups and 13 sylow subgroups are there in G?
3. Find aba^{-1} where (i) $a = (5, 7, 9)$, $b = (1, 2, 3)$ (ii) $a = (1, 2, 5)(3, 4)$, $b = (1, 4, 5)$.
4. Prove that all real of the form $a + b\sqrt{2}$, $a; b \in Z$ forms a ring.
5. Find all the units in $J[i]$.

Course – 1.2 – Real Analysis

Answer **all** questions   Max. Mark: 25

$(5 \times 5 = 25)$

1. Show that if f is differentiable at c then, f is continuous at c.

2. State and prove the Rolle's theorem.

3. State and prove Taylor's formula.

4. Define the functions of bounded variation. Show that if f is continuous on [a,b], and if f' exists and is bounded in the interior, say $|f'(x)| \leq A$ for all x in (a, b), then f is of bounded variation on [a,b].

5. If f is monotonic on [a,b], then show that f is of bounded variation on [a,b].

Course – 1.3 – Differential Equations and Applications

Answer **all** questions   Max. Mark: 25

$(5 \times 5 = 25)$

1. Show that $y = c_1 e^x + c_2 e^{2x}$ is the general solution of $y'' - 3y' + 2y = 0$ on any interval, and find the particular solution for which $y(0) = -1$ and $y'(0) = 1$.

2. Solve by the method of variation of parameter $y'' + y = secx$.

3. Find the particular solution of $y'' + y = sinx$ using method of undetermined coefficients.

4. Find a power series solution of $xy' = y$.

5. For the following differential equation locate and classify its singular points on the x-axis $x^2 y'' + (2 - x)y' = 0$.

Course – 1.4 – **ANALYTICAL MECHANICS**

Answer **all** questions   Max. Mark: 25

$(5 \times 5 = 25)$

1. Explain the general motion of a Simple Pendulum.
2. Explain the motion of rigid body with a fixed point under no forces.
3. Discuss the steady precision of the top.
4. Derive Lagrange's equation for a particle in a plane.
5. Define the Hamiltonism and derive Canonical Equations of Motion.