



Course: Mathematics Paper-II

Course Code: U'SMT102

Maximum marks: 75

Duration: 2 ½ Hrs

Instructions:

All questions are compulsory and carry equal marks

Figures to the right indicate full marks

**Q.1 Attempt any four of the following**

20

- State Well ordering principle and prove that 1 is the least element of set of natural number
- Prove that  $2C_2 + 3C_2 + 4C_2 = 5C_3$
- With the help of Binomial theorem expand terms  $(a + b)^5$  and  $(a - b)^3$
- Verify the Wilson's theorem for  $p=13$
- Show that -180 and 252 are coprime

**Q.2 Attempt any four of the following**

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- Show that  $f: R \rightarrow R$ , given by  $f(x) = 2x + 5$ , is bijection and hence find its inverse
- State properties of binary operation and check whether the binary operation  $a*b = a+2b$  is commutative and associative
- $f: X \rightarrow Y$  and  $g: Y \rightarrow Z$  are two functions if  $g \circ f$  is bijective and  $g$  is injective then  $f$  is surjective
- Define the following 1) Partition of non-empty set  $X$  2) Equivalence class of  $a$
- If  $\sim$  is equivalence relation on non-empty set  $X$  then any two equivalence classes are either disjoint or identical

**Q.3 Attempt any four of the following**

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- Explain algebraic structure of  $R[x]$
- Find the GCD of polynomials  $f(x) = x^2 - 4$ ,  $g(x) = x^3 + 2x^2 - x - 2$
- Show that  $x^2 + 4$  is irreducible in  $R[x]$
- State and prove Unique Factorization theorem in  $R[x]$
- Prove that the only unit polynomials in  $R[x]$  are the non-zero constant polynomial

**Q.4 Attempt any four of the following**

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- Show that  $\sqrt{13}$  is not rational
- Prove that if  $p$  is prime such that  $p|ab$  then  $p|a$  or  $p|b$
- Find the value of 1)  $\phi(30)$  2)  $\phi(100)$
- Define the following 1) Associates in  $R[x]$  2) Reducible and irreducible polynomials