B.C.A. UG (CBCS) RUSA IIIrd Semester Examination

3841

MATHEMATICS-III

BCA–301

Time : 3 Hours] [Maximum Marks : 70

Note :– There are *nine* questions in all. Section–A is compulsory for all and the students have to attempt *one* question each from Section B, C, D and E.

Section–A

1\. (A) (i) Product of the cube roots of unity is ....

(ii) Write the modulus of $3 + i$.

(iii) Write the additive inverse of the complex number $3 - 2i$.

(iv) What is order of the differential equation $y'' + 3y = 0$.

(v) What is degree of the differential equation $y'' + 5y = 0$.

(vi) 2 is the smallest prime. (True/False)

(vii) What are prime factors of 231 ?

(viii) Every positive integer $a \geq 1$ can be expressed uniquely as a product of positive primes. (True/False)

(ix) Write the value of $4 \times_7 3$.

(x) Subtraction is a binary operation on the set of integers. (True/False)

$1 \times 10 = 10$ 8

(B) (i) What is linear differential equation. Give *two* examples.

3
5
2 7 3

(ii) State Chinese Remainder Theorem.

(iii) State De-Moivre's theorem.

(iv) Find the prime factorization of 864. Write your answer using exponential notation.

(v) Add the two polynomials $f(x) = 1$ and $g(x) = x^2 + x + 1$ over the field of real numbers.

$4 \times 5 = 20$ 14

Section–B

2. (a) Find the order and degree of the following differential equations :

(i) $y = x\left[\frac{dy}{dx} + \sqrt{1 + \frac{dy}{dx}}\right]$. 1, 2 — 2

(ii) $\left[1 + \left(\frac{dy}{dx}\right)^2\right]^{3/2} = \frac{d^2y}{dx^2}$. 2, 2. — 3

5

(b) Form the differential equation from the following :

$$y = A \sin (nt + \alpha).$$ 5

3. (a) Solve :

$$\frac{d^4y}{dx^4} + 8\frac{d^2y}{dx^2} + 16y = 0.$$ 5

(b) Solve :

$$\frac{d^2y}{dx^2} - 4\frac{dy}{dx} + 4y = 8\sin 2x.$$ 5

Section–C

4. (a) Find modulus and argument of the following :

(i) $-1 + i$, $\sqrt{2}$ $\frac{3\pi}{4}$ — 2.5

(ii) $1 - i$. $\sqrt{2}$ — 2.5

10

(b) Find the value of $\sqrt{7 + 24i}$. 5

5. (a) Simplify :

$$\frac{(\cos\theta + i\sin\theta)^3}{(\cos\theta - i\sin\theta)^2}.$$ 5

(b) Show that the sum of the three cube roots of unity is zero. 5

Section–D

6. Explain the following :

(i) Primes Factorization.

(ii) Quadratic Congruences 5×2=10

7. Use the Chinese Remainder Theorem to find all solutions such that : 10

$x \equiv 2 \pmod{3}$

$x \equiv 3 \pmod{4}$

$x \equiv 4 \pmod{5}$

10

Section–E

8. (i) Add the two polynomials $f(x) = 1$ and $g(x) = x^2 + x + 1$ over GF(2). 5

(ii) Show that the set F = {0, 1, 2}, with compositions addition and multiplication modulo 3 forms a field. 5

9. Explain the following :

(i) Finite fields

(ii) Multiplication of Polynomials over GF(2). 5×2=10