QP – 452

I Semester B.C.A. Examination, April/May 2021
(CBCS) (F+R) (Y2K14 Scheme)
COMPUTER SCIENCE
BCA105T : Discrete Mathematics

Time : 3 Hours Max. Marks : 100

***Instruction :** Answer **all** questions.*

SECTION – A

I. Answer **any ten** of the following. **(10×2=20)**

1) Find x and y if (x + 3, 7) = (4, 2x – y).
2) If A = {0, –2, 4} and B = {x/x³ – 1 = 0 and x is real}, then find A × B.
3) Define an equivalence relation on a set.
4) Write the negation of $p \to q$.
5) Find the adjoint of $\begin{bmatrix} 2 & -1 \\ 3 & 2 \end{bmatrix}$.
6) If $A = \begin{bmatrix} 2 & -1 \\ 4 & 0 \end{bmatrix}$ and $B = \begin{bmatrix} 5 & 2 \\ -3 & 2 \end{bmatrix}$, find 3A – 2B.
7) Find 'x' if $\log_{32} 256 = x$.
8) Find 'n' if ${}^nC_8 = {}^nC_2$.
9) Show that $*$ is not a binary operation on the set z of integers defined by $a * b = a^b, \forall a, b \in z$.
10) If $\vec{a} = 2\hat{i} + \hat{j} - \hat{k}$ and $\vec{b} = \hat{i} - 3\hat{j} + \hat{k}$, find $|\vec{a} + \vec{b}|$.
11) Find the mid point of the line joining (3, 1) and (–2, 5).
12) Find x intercept and y intercept of the line x – 3y + 9 = 0.

P.T.O.

SECTION – B

II. Answer **any six** of the following. **(6×5=30)**

13) Find the number of ways 5 English, 4 Kannada and 6 Commerce books be arranged in a shelf such that (i) books of the same subjects are always together (ii) no two books of the same subject are together.

14) If $f : R \to R$ is defined by $f(x) = 2x + 3$, prove that 'f' is bijective and hence find f^{-1}.

15) Show that $\sim(p \to q) \leftrightarrow p \wedge \sim q$ is a tautology.

16) Show that $(p \to q) \equiv (\sim p \vee q) \wedge (\sim q \vee p)$.

17) If the truth value of $(p \to q) \wedge (p \vee r)$ is given to be false, find the truth values of p, q, r.

18) Find the inverse of $\begin{bmatrix} 3 & -1 & 2 \\ 2 & 1 & -1 \\ 1 & 3 & -5 \end{bmatrix}$.

19) Verify Cayley-Hemilton theorem for the matrix $\begin{bmatrix} 3 & 1 \\ -1 & 2 \end{bmatrix}$.

20) Solve by Cramer's rule $3x - y = 13$, $x + 3y + 8 = 0$.

SECTION – C

III. Answer **any six** of the following. **(6×5=30)**

21) If $a^2 + b^2 = 23ab$, prove that $\log\left(\frac{a+b}{5}\right) = \frac{1}{2}(\log a + \log b)$.

22) If $(2n + 1)\, P_{n-1} : (2n - 1) P_n = 3 : 5$, find 'n'.

23) Prove that the set of all positive rationals Q^+ is a non-abelian group w.r.t. $*$ defined by $a * b = \frac{2a}{b}$, $\forall\, a, b \in Q^+$.

24) Prove that the set {0, 2, 4} is a subgroup of integer modulo6 w.r.t. addition.

25) Find the area of parallelogram whose diagonals are given by the vectors $3\hat{i} + \hat{j} - 2\hat{k}$ and $\hat{i} - 2\hat{j} + \hat{k}$.

26) Find μ, if the vectors are $\vec{a} = (\mu, 1, -2), \vec{b} = (2, 1, 1)$ and $\vec{c} = (1, -1, 3)$ are coplanar.

27) Find the equation of perpendicular bisector of the line joining (3, –2) and (4, 1).

28) In how many ways can the letters of the word "PENCIL" be arranged so that (i) N is always next to E (ii) N and E are always together.

SECTION – D

IV. Answer **any four** of the following. **(4×5=20)**

29) Show that the points (5, 1), (1, –7), (9, – 3) and (13, 5) form a rhombus.

30) Find the value of 'k' such that the area of triangle formed by (k – 1, 2), (–1, 3), (2, – 4) is 32 sq. units.

31) Find the equation of straight line passing through (1, –2) and parallel to the line $2x + 3y + 4 = 0$.

32) Find foot of the perpendicular drawn from (–3, 5) on the line $x – y – 5 = 0$.

33) Show that the lines $x – y + 3 = 0$, $2x – 7y + 1 = 0$, $x – 6y – 2 = 0$ are concurrent.

34) Find the equation of the line passing through intersection of the lines $3x – 4y + 21 = 0$ and $15x + 8y + 45 = 0$ and through (1, –1).
