(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 154204   Roll No.

B.Tech.

(SEM. II) THEORY EXAMINATION 2013-14

ELEMENTARY MATHEMATICS–II

Time : 3 Hours   *Total Marks : 100*

Note :– (1)   Section–A consists of 10 objective questions (**20 Marks**).

(2)   Section–B consists of 5 theory questions, of which student can attempt any **three**. This section is of **30 marks**.

(3)   Section–C consists of 5 theory questions. Each question is of **10 marks**.

SECTION–A

1.   All parts of this question are compulsory :   (2×10=20)

(a)   Obtain the direction ratios and the direction cosines of the vector $\vec{r} = 2\,\hat{i} + 3\hat{j} + \hat{k}$.

(b)   The direction ratios of a vector are $2, -3, 4$. Find its direction cosines.

(c)   There are 14 boys and 12 girls in a class. Obtain the number of ways of selecting one student as class representative.

(d) Classify the following measures as scalars and vectors :

(i) 30 seconds

(ii) 50 km/hrs

(iii) 20 newtons

(iv) 26 m/s towards South.

(e) Show that the planes $2x - 4y + 3z = 7$ and $x + 2y + 2z = 18$ are perpendicular to each other.

(f) Obtain the equation of the plane passing through the points $(0, -1, 0)$, $(1, 1, 1)$ and $(3, 3, 0)$.

(g) Prove that vector addition is commutative.

(h) Define Coplaner lines and Skew lines.

(i) Find the angle between the planes $2x - 3y + 4z = 1$ and $-x + y = 4$.

(j) Represent graphically a displacement of 50 km, 60 degree west of North.

SECTION–B

2. Attempt any **three** out of **five** questions. Each question is of **10** marks : $(10 \times 3 = 30)$

(a) If $A(0, 1, 1)$, $B(3, 1, 5)$ and $C(0, 3, 3)$ be the vertices of a $\triangle ABC$, show using vectors, that $\triangle ABC$ is right angled at C.

(b) Find the angle between the planes $2x - 3y + 4z = 1$ and $-x + y = 4$.

(c) If α and β are the roots of the equation $x^2 + x + 1 = 0$ then prove that the equation whose roots are $m\alpha + n\beta$ and $m\beta + n\alpha$ is $x^2 + (m + n)x + (m^2 - mn + n^2) = 0$.

(d) Prove that $C(n + 1, r) = C(n, r) + C(n, r - 1)$, where symbols have their usual meanings.

(e) Find the equation of circle which passes through $(3, -2)$ and $(-2, 0)$ and whose centre lies on the line $2x = y = 3$.

SECTION–C

Note :– Attempt **all (five)** questions. Each question is of **10** marks. $(10 \times 5 = 50)$

3. Attempt any **two** parts from the following :

(a) Find the angle between the lines $\dfrac{x + 4}{3} = \dfrac{y - 1}{5} = \dfrac{z + 3}{4}$

and $\dfrac{x + 1}{1} = \dfrac{y - 4}{1} = \dfrac{z - 5}{2}$.

(b) Find the equation of hyperbola having directrix $x + 2y = 1$, focus $(2, 1)$ and eccentricity 2.

(c) State and prove fundamental theorem of algebra.

4. Attempt any **two** parts from the following :

(a) Find the equation of the straight line which passes through the point $(3, 4)$ and the intercept made by this line on y-axis is two times the intercept on x-axis.

(b) Find the equation of the circle which passes through the points $(0, 1)$ $(1, 0)$ and $(2, 1)$. Also find its radius and coordinate of the centre.

(c) Find the five geometric mean terms between 2/3 and 486.

5. Attempt any **two** parts from the following :

(a) A shopkeeper has 9 different goods. How many different parcels containing four goods each can he make ?

(b) If one root of the equation $x^4 + 2x^3 = 16x^2 - 22x + 7 = 0$ is $2 + \sqrt{3}$, find the other roots of the equation.

(c) Prove that the position vector of the join of two points with position vectors $\hat{a}$ and $\hat{b}$ is $\frac{1}{2}\left(\hat{a} + \hat{b}\right)$.

6. Attempt any **two** parts from the following :

(a) Write two different vectors having same direction and magnitude.

(b) If A(6, –6, 0), B(–1, –7, 6), C(3, –4, 4) and D(2, –9, 2) be four points in space show that A $\perp$ B.

(c) Find the direction cosines of the line which is perpendicular to the lines whose direction ratios are 1, –1, 2 and 2, 1, –1.

7. Attempt any **two** parts from the following :

(a) Prove that two planes always intersect in a line.

(b) Two numbers are selected at random from the integers 1 through 9. If the sum is even, find the probability that both the numbers are odd.

(c) The roots of the equation $x^3 - 9x^2 + 23x - 15 = 0$ are in arithmetic progression. Find the roots of the equation.