MATHEMATICS HSSC–I

Time allowed: 2:35 Hours **Total Marks Sections B and C: 80**

NOTE: Attempt any twelve parts from Section 'B' and any four questions from Section 'C' on the separately provided answer book. Use supplementary answer sheet i.e. Sheet–B if required. Write your answers neatly and legibly. Graph paper will be provided on request.

SECTION – B (Marks 48)

Q. 2 Attempt any TWELVE parts. All parts carry equal marks. **(12 x 4 = 48)**

(i) Simplify $\frac{9}{\sqrt{5}+\sqrt{-4}}$ in the form of $a+bi$

(ii) If U = the set of the English alphabets, A and B are subsets of U, where $A=\{x \mid x \text{ is a vowel}\}$, $B=\{y \mid y \text{ is a consonant}\}$, then verify the de Morgan's Laws (i) $(A\cup B)'=A'\cap B'$ (ii) $(A\cap B)'=A'\cup B'$

(iii) Construct the truth table for the biconditional $p\leftrightarrow q$

(iv) If $A=\begin{bmatrix}1 & 1+i & i\end{bmatrix}$, then find $\left(\overline{A}\right)^t A$

(v) Without expansion, show that $\begin{vmatrix}2 & 3 & -1\\ 1 & 1 & 0\\ 2 & -3 & 5\end{vmatrix}=0$

(vi) Find the numerical value of k if polynomial x^3+kx^2-7x+6 has remainder 4 when divided by $x-2$

(vii) Find the two consecutive numbers whose product is 72

(viii) If 5,8 are two arithmetic means between a and b, then find a and b

(ix) Find $9th$ term of the hormonic sequence $-\frac{1}{5},-\frac{1}{3},-1,\ldots$

(x) Find values of n and r, when ${}^nC_r=56$ and ${}^nP_r=336$

(xi) If x is so small that its square and higher powers can be neglected, then show that $\frac{\sqrt{4+x}}{(1+x)^3}\cong 2-\frac{23}{4}x$

(xii) Show that the area of a sector of a circular region of radius r is $\frac{1}{2}r^2\theta$, where θ is the circular measure of the central angle of the sector.

(xiii) If $\cot\theta=-\frac{4}{3}$ and the terminal arm of the angle is not in the quadrant-I, find the values of $\cos\theta$ and $\operatorname{cosec}\theta$

(xiv) Show that $\frac{\cos(\pi+\theta)\sec(\pi-\theta)}{\sin^2(\pi+\theta)\cdot\tan(\pi-\theta)}=-\cot\theta\cdot\operatorname{cosec}^2\theta$

(xv) Prove that $\cot 2x=\frac{\sin x-\sin 3x}{\cos 3x-\cos x}$

(xvi) Show that $\tan^{-1}\left(\frac{27}{11}\right)-\tan^{-1}\frac{8}{19}=\frac{\pi}{4}$

SECTION – C (Marks 32)

Note: Attempt any FOUR questions. All questions carry equal marks. **(4 x 8 = 32)**

Q. 3 Solve the following system by reducing their augmented matrix to the echelon form

$$x_1+4x_2+2x_3=2$$
$$2x_1+x_2-2x_3=9$$
$$2x_1+2x_2-2x_3=12$$

Q. 4 Solve the system of simultaneous equations:

$$3x+2y=7$$
$$3x^2=25+2y^2$$

Q. 5 (a) Resolve $\frac{2x^4}{(x+3)(x-2)^2}$ into partial fractions

(b) Find the sum S_n of the Arithmetic Series $a+(a+d)+(a+2d)+\ldots+(a+(n-1)d)$

Q. 6 Find the sum of the following series to n-terms: $1+(1+2)+(1+2+3)+\ldots$

Q. 7 If $2y=\frac{1}{2^2}+\frac{1\cdot 3}{2!}\frac{1}{2^4}+\frac{1\cdot 3\cdot 5}{3!}\frac{1}{2^6}+\ldots$ then prove that $4y^2+4y-1=0$

Q. 8 Without using calculator/table prove that $\sin 10^\circ\sin 30^\circ\sin 50^\circ\sin 70^\circ=\frac{1}{16}$