

HSEI - MODEL EXAMINATION 2011-2012

MATHEMATICS [SCIENCE]

MARK : 80
Time : 2.45 hrs
[INCLUDING
COOL OFF TIME]

1 Let $U = \{x \mid x \text{ is an integer } 0 \leq x \leq 10\}$
be the universal set.

$A =$ The set of prime numbers less than 10

$B = \{x : x^2 - 5x + 6 = 0, x \in \mathbb{N}\}$

(a) Write $A \cap B$ in Roster form [1]

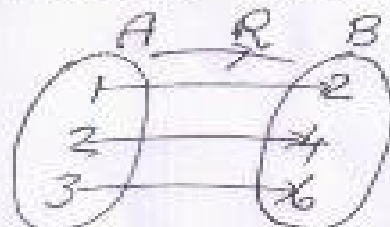
(b) Find $(A \cup B) - B$ [2]

(c) Prove that $(A \cap B)' = A' \cup B'$ [2]

2 (a) Let $A = \{a, b, c\}$ $B = \{2, 3\}$
write $A \times B$ [1]

(b) How many relations are there from
A to B [1]

(c)



write R in set builder form [1]

(d) Draw the graph of the modulus
function. Also write domain & Range
of the above function. [2+1]

3 a) If $\cos x = -\frac{3}{5}$, x lies in the 3rd quadrant find the values of the other five trigonometric functions [2]

b) Prove that $\frac{\sin x - \sin 3x}{\sin^2 x - \cos^2 x} = 2 \sin x$ [2]

c) Find the principal and general solution of $\sin x = -\frac{\sqrt{3}}{2}$ [2]

4 Consider the statement: $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$ [1]

(1) Find $P(1)$

(2) Assuming that $P(k)$ is true prove that $P(k+1)$ is true [3]

5 (a) $Z = \frac{1+i}{1-i}$, write Z in aib form [2]

(b) Express Z in the polar form [2]

(c) Solve the equation $2x^2 + x + 1 = 0$ [2]

6 a) Solve $\frac{2x+3}{5} \leq \frac{x+3}{2}$ [2]

b) Solve graphically $2x+3y \leq 6$,
 $3x+4y \leq 12$, $x \geq 0$ and $y \geq 0$ [3]

7 a) Find the value of r , if
 $5 \cdot 4P_r = 6 \cdot 5P_{r-1}$ [2]

⑥ A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has.

(i) no girl (ii) at least 3 girls [3]

8 OR
⑧ Find the value of n if

$$2 {}^n C_3 : {}^n C_3 = 12 : 1 \quad [2]$$

⑥ How many words with or without meaning can be made from the letters of the word MONDAY, assuming that no letter is repeated if

(i) 4 letters are used at a time

(2) All letters are used but 1st letter is a vowel. [3]

9. (i) Expand $\left(\frac{2}{x} - \frac{x}{2}\right)^5$ [2]

(ii) Find the coefficient of $x^6 y^3$ in the expansion of $(x+2y)^9$ [2]

10 (i) Insert 6 numbers between 3 and 24 such that resulting sequence is an A.P. [2]

(ii) Find the sum of the sequence 6, 66, 666, - - - to n terms [2]

(iii) If AM & GM of 2 +ve numbers a & b are 10 & 8 respectively. Find the numbers. [2]

- 11 Consider the equation of the line $x - 3y + 4 = 0$.
- Reduce the above equation into slope intercept form [1]
 - Find its slope [2]
 - Find the foot of the perpendicular from $(1, 2)$ to the given line [2]
 - Find the image of $(1, 2)$ w.r. to the given line [2]
- 12
- Consider the equation of an ellipse $4x^2 + 9y^2 = 36$. Find Foci, vertices, directrices & length of the Latusrectum [3]
 - Find the equation of the parabola with focus $(2, 0)$ and directrix $y = 2$ [1]
- 13
- Find the octant in which the point $(5, -4, -2)$ lie [1]
 - Show that the points $P(-2, 3, 5)$, $Q(1, 2, 3)$ & $R(-1, 0, -1)$ are collinear [3]
- 14 Find the derivative of the function $\sin x$ using first principles. [3]
- OR
- 15 Find the derivative of $x^5(3 - 6x^4)$ [3]

- 16 a) Evaluate $\lim_{x \rightarrow -1} \frac{x^5 + 1}{x + 1}$ [1]
 (b) Find the derivative of $\sin \cos x$ [2]
- 17 a) Write the component statements of
 "If a number is divisible by 9,
 then it is divisible by 3" [1]
 (b) Write the contrapositive of the
 above statement [1]
 (c) Verify by the method of contradiction
 " $\sqrt{7}$ is irrational " [2]
- 18 Find the mean, mean deviation about
 mean for the following data. [3]

marks	0-10	10-20	20-30	30-40	40-50	50-60
No. of student	6	8	14	16	4	2

- 19 (i) Suppose two coins are tossed, [5]
 write its sample space [1]
 (ii) One card is drawn from a well
 shuffled deck of 52 cards. If each
 outcome is equally likely, calculate
 the probability of selecting
 a) A diamond (b) a black card
 (c) not an ace [3]

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