2020

MATHEMATICS (General)

Paper : MTMG - SEC-1

[CBCS]

Full Marks : 32 Time : Two Hours

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.

Notations and symbols have their usual meanings.

Group - A

1. Answer any **four** questions. $1 \times 4 = 4$

(a) Define prime number.

(b) State the fundamental theorem of Arithmetic.

(c) Prove that if $a \equiv b \pmod{m}$ and $c \equiv d \pmod{m}$, then $a + c \equiv b + d \pmod{m}$.

(d) Prove that in a Boolean algebra B, $a + (a' \cdot b) = a + b$.

(e) Give an example of a partially ordered set.

(f) What is the full form of ISBN?

(g) Convert 77 into binary number system.

Group - B

Answer any *two* questions. 5×2=10

2. If p is a prime > 2, then prove that $1^p + 2^p + \cdots + (p-1)^p \equiv 0 \pmod{p}$. [5]

3. Use the principle of mathematical induction to prove that $9^n - 8n - 1$ is divisible by 64, for all integers $n \geq 0$. [5]

4. Find a switching circuit which realizes the Boolean expression $x \cdot y + y \cdot z + z \cdot x$. [5]

5. In a Boolean algebra B, prove that $(a+b)' = a' \cdot b'$ and $(a \cdot b)' = a' + b'$. [5]

Group - C

Answer any *two* questions. 9×2=18

6. (a) Use the principle of mathematical induction to prove that $n! > 2^n$, for all natural numbers $n \geq 4$. [4]

   (b) Find the unit digit in 7^{99}. [5]

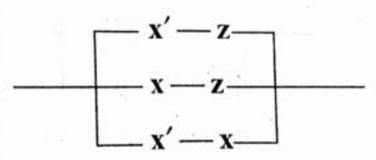
7. Solve the system of linear congruences by Chinese remainder theorem:

$$x \equiv 1 \pmod 3$$
$$x \equiv 2 \pmod 5$$
$$x \equiv 3 \pmod 7.$$

[9]

8. (a) Find the correct check digit (★) for the incomplete ISBN: 81 - 203 - 0871 - ★ . [4]

   (b) Write a Boolean function for the following circuit and simplify it (if possible). Also draw the simplified circuit.



[2+1+2]