RAN-1803000201030131

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B.Sc. Sem-I Examination

March / April - 2019

Mathematics Paper : MCS – 101
Discrete Mathematics - I

Time: 2 Hours] **[Total Marks: 50**

સૂચના : / Instructions

નીચે દર્શાવેલ ☛ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.
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Name of the Examination:
☛ **B.Sc. Sem-I**

Name of the Subject :
☛ **Mathematics Paper : MCS – 101 Discrete Mathematics - I**

Subject Code No.: **1803000201030131**

Seat No.:

Student's Signature

(1) All questions are compulsory.
(2) Figures to the right indicate marks of corresponding question.
(3) Follow usual notations.

Q-1] Answer the following questions: **[10]**

1] Define biconditional proposition with an illustration.

2] Write the inverse and contrapositive of the following:
"If it rains then the crops will grow."

3] Write an equivalent expression for $(p \Rightarrow q) \Rightarrow r$ which does not contain implication.

4] Write negation of each of the following statements:
   (a) *If Shubham wins, then Mehul loses.*
   (b) *Rahul swims if and only if the water is warm.*

5] Construct the truth table for $p \vee \sim q$

Q-2] Answer any two of the following: [10]

1] (i) Prove that the product of two odd integers is an odd integer,

(ii) Prove that for every positive integer n, $n^3 + n$ is even.

2] Prove De' Morgan's laws using truth table.

3] Show that $p \Rightarrow (s \vee t)$ is a valid conclusion from the premises

$p \Rightarrow (q \vee r)$, $q \Rightarrow s$, $r \Rightarrow t$

4] Prove that the following propositions are tautology,

(i) $\sim (p \wedge q) \vee q$ (ii) $p \Rightarrow (p \vee q)$

Q-3] Answer any two of the following: [10]

1] Use truth table to prove the distributive law.

$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$

2] Prove that propositions $p \vee \sim q$ and $(p \vee q) \wedge (\sim p) \wedge (\sim q)$ are contradiction.

(i) Prove that if x and y are rational numbers then $x + y$ is rational.

(ii) Prove that $\sqrt{2}$ is irrational by giving a proof through contradiction.

3] Define fallacy and state its types. Show that the following inference is a fallacy:

If today is Ira's birthday, then today is July 27. Today is July 27. Hence today is Ira's birthday.

4] Rewrite the following arguments using quantifiers, variables and predicate symbols.

(i) There is a student who can speak German and who knows the language C++

(ii) There is a student who can speak German but does not know C++

(iii) Every student either can speak German or knows C++

(iv) No student can speak German or knows C++

Q-4] Answer any two of the following: [10]

1] Show that the following pair of propositions is logically equivalent.

(i) $p \vee (p \wedge q)$ and p

(ii) $p \wedge (\sim q \vee q)$ and p

2] Consider the following:

Let p: *It is cold day.*

and q: *The temperature is 5 degrees Celsius.*

then write in simple sentences the meaning of following:

(i) $p \wedge q$

(ii) $\sim (p \vee q)$

(iii) $\sim (p \wedge q)$

(iv) $\sim p \wedge \sim q$

(v) $\sim (\sim p \vee \sim q)$

3] Prove that the propositions $p \wedge \sim q$ and $(p \vee q) \wedge (\sim p) \wedge (\sim q)$ are contradiction.

4] Find pdnf of the following using truth table:

(i) $(\sim p \vee \sim q) \Rightarrow (\sim p \wedge r)$

(ii) $(p \wedge q) \vee (\sim p \wedge r) \vee (q \wedge r)$

Q-5] Answer any two of the following: [10]

1] Obtain principal conjunctive normal form of

$(\sim p \Rightarrow q) \wedge (q \Leftrightarrow p)$ without using truth table

2] Rewrite the following argument symbolically and determine its validity:
If Reecha wears the green hat she leads the band.
Reecha does not wear the green hat.
Therefore Reecha does not lead the band.

3] Use rules of inference to determine w is the conclusion or not, for following premises

$\sim t \Rightarrow \sim r, \sim s, t \Rightarrow w, r \vee s$

4] Obtain conjunctive normal form of $[q \vee (p \wedge r)] \wedge \sim [(p \vee r) \wedge q]$
