BENNETT UNIVERSITY
TIMES OF INDIA GROUP

POSSESSION OF MOBILE IN EXAMINATION IS A UFM PRACTICE

Name of Student ---------- Enrolment No. ----------

Department ----------

BENNETT UNIVERSITY, GREATER NOIDA

Mid Term Examination, FALL SEMESTER 2018-19

COURSE CODE: **ECSE209L** MAX. DURATION: **ONE HOUR**

COURSE NAME: **Discrete Mathematical Structures**

COURSE CREDIT: **04** MAX. MARKS: **20**

Note

- All the questions are compulsory.
- Please write precisely and neatly. Please make clear diagram wherever required.

Q1. (a) Determine whether these system specifications are consistent: **(1 mark)**
"The diagnostic message is stored in the buffer or it is retransmitted."
"The diagnostic message is not stored in the buffer."
"If the diagnostic message is stored in the buffer, then it is retransmitted."

(b) Determine which of the following propositions are true and which are false? **(1 mark)**
(i) If Alexander Graham Bell invented telephone, then tigers have wings.
(ii) If tigers have wings then RDX is dangerous.

Q2. Show that $P \leftrightarrow Q \equiv (P \vee Q) \rightarrow (P \wedge Q)$ using **(1+1 marks)**
(a) Truth Table **(b)** Algebra of propositions

Q3. Use mathematical induction to prove that **(2 marks)**

$$1^2 + 2^2 + 3^2 + \cdots + n^2 = n(n+1)\,(2n+1)/6\,, n \geq 1$$

Q4. (a) Determine the negation of the following statement:
"For all real numbers x, if $x > 3$ then $x^2 > 9$." **(1 mark)**
(b) Show that the function $f(x) = x^3$ *and* $g(x) = x^{1/3}$ for all $x \in R$ are inverses of one another. **(1 mark)**

Q5. (a) State the converse, inverse and contrapositive of the following: **(2 marks)**
"If today is Easter then tomorrow is Monday"

(b) The proposition $P \wedge (Q \wedge \sim Q)$ is a _____ .
(i) Contradiction
(ii) Tautology

(iii) Both (i) and (ii)
(iv) None of these

Q6. (a) Let $A_n = \{i \in Z: i \; is \; divisible \; by \; n\}$ be a set where $n \in N$. Compute the following: **(1 mark)**

(i) $A_3 \cap A_7$
(ii) $A_3 \cup A_7$

(b) Determine which of the following sets are null sets: **(1 mark)**
(i) $A = \{x|3x - 2 = 0, x \in Q\}$
(ii) $B = \{x|x^3 - 1 = 0, x \in R\}$
(iii) $C = \{x|30x - 59 = 0, x \in N\}$
(iv) $D = \{x|x = 1, x \in Z\}$

Q7. Let $A \cup B = A \cup C$ and $A \cap B = A \cap C$. Prove that $B = C$ where A, B and C are three sets. **(2 marks)**

Q8. In a group of 70 cars tested by a garage in Delhi, 15 had faulty tyres, 20 had faulty brakes and 18 exceed the allowable emission limits. Also, 5 cars had faulty tyres and brakes, 6 failed on tyres and emission, 10 failed on brakes and emissions, and 4 cars were unsatisfactory in all three respects. Calculate the number of cars that had no faults in these three checks? Draw an appropriate Venn Diagram. **(2 marks)**

Q9. Shanu is looking for a plot to construct his office whose cost is low around 30 lakhs and which is within a distance of 5 Kms from his house. Represent the given conditions using membership functions. Also, determine which of the following plot is more suitable for being bought by Shanu: **(2 marks)**
(i) Plot A: Cost - 50 lakhs and Distance from house – 2 Kms
(ii) Plot B: Cost – 28 lakhs and Distance from house – 6.8 Kms

Q10. Let m be a positive integer with $m > 1$. Show that the relation

$$R = \{(a, b)| \; a \equiv b \; (mod \; m)\}$$

is an equivalence relation on the set of integers. **(2 marks)**
(Note: Here, $a \equiv b \; (mod \; m)$ is read as a is congruent to b modulo m and its equivalent form is $a - b$ is divisible by m).