



UNIVERSITY EXAMINATIONS

**EXAMINATION FOR SEPTEMBER/DECEMBER 2015 /2016 FOR BACHELOR OF
SCIENCE IN COMPUTER SCIENCE**

RCCS: 105

DISCRETE STRUCTURES

DATE: 3RD DECEMBER 2015

TIME: 2 HOURS

GENERAL INSTRUCTIONS:

Students are NOT permitted to write on the examination paper during reading time.

This is a closed book examination. Text book/Reference books/notes are not permitted.

SPECIAL INSTRUCTIONS:

This examination paper consists Questions in Section A followed by section B.

Answer **Question 1 and any Other Two** questions.

QUESTIONS in ALL Sections should be answered in answer booklet(s).

1. **PLEASE** start the answer to EACH question on a **NEW PAGE**.
2. **Keep your phone(s) switched off at the front of the examination room and NOT on your person.**
3. **Keep ALL bags and caps at the front of the examination room and DO NOT refer to ANY unauthorized material before or during the course of the examination.**
4. **ALWAYS** show your working.
5. **Marks indicated in parenthesis i.e. () will be awarded for clear and logical answers.**
6. **Write your REGISTRATION No. clearly on the answer booklet(s).**
7. **For the Questions, write the number of the question on the answer booklet(s) in the order you answered them.**
8. **DO NOT** use your **PHONE** as a **CALCULATOR**.
9. **YOU** are **ONLY ALLOWED** to leave the exam room **30minutes** to the end of the **Exam**.

SECTION A(Compulsory)

Question One (30marks)

- a. Define the following terms as used in discrete structures **(5marks)**
- Propositional function
 - Predicate
 - Contrapositive
 - Tautology
 - Contingency
- b. With the aid of a diagram, define the truth table of the following propositional variables (P, Q). Use the following connectives (Exclusive or, implies, and &OR). **(8marks)**
- c. A proposition becomes valid only when values to the argument are assigned and when we quantify them. Define two types of quantifiers used. **(4marks)**
- d. Proof that: $\overline{(A \cap B)} = A \cup B$ **(4marks)**
- e. Study the following expression and answer the questions that follow.
- $\forall x, y, z \exists r, q P(x, y, z, r, q, c)$
- What is the scope of existential quantifier? **(2marks)**
 - What is the scope of universal quantifier **(2marks)**
 - What are the free variables? **(2marks)**
 - What are the bound variables? **(2marks)**
 - Is the expression a well formed formula? Support your answer. **(1mark)**

SECTION B (ANSWER ANY TWO QUESTIONS)

Question Two (20marks)

- a. Proof that: $(p \rightarrow r) \vee (q \rightarrow r) \equiv (p \wedge q) \rightarrow r$ **(8marks)**
- b. List six types of relations and their properties. **(6marks)**
- c. Is a relation a function? Discuss with an illustration to show your understanding. **(6marks)**

Question Three (20marks)

- a. Elaborate your understanding on the following terms as used.
- Rule of sum **(2marks)**
 - Principle of inclusion and Exclusion **(2marks)**
 - Binomial coefficient **(2marks)**
- b. Explain the importance of pascal triangle in real life situations. **(4marks)**
- c. A restaurant offers 5 choices of appetizer, 10 choices of main meal and 4 choices of dessert. A customer can choose to eat just one course, or two different courses, or all three courses. Assuming all choices are available, how many different possible meals does the restaurant offer? **(5marks)**

- d. A special type of password consists of four **different** letters of the alphabet, where each letter is used only once. How many different possible passwords are there? **(3marks)**
- e. In how many ways can you wear two shirts, three pairs of trousers and two pairs of shoes? **(2marks)**

Question Four (20marks)

- a. Differentiate between the following terms.
- i. combinations and permutations **(4marks)**
 - ii. Sample space and sample points **(4marks)**
- b. Jones is the Chairman of a committee. In how many ways can a committee of 5 be chosen from 10 people given that Jones must be one of them? **(3marks)**
- c. A special type of password consists of four **different** letters of the alphabet, where each letter is used only once. How many different possible passwords are there? **(3marks)**
- d. Study the following series and state next three values that follow in the series.
0, 1, 1, 2, 3, 5, 8, 13, 21, 34..... **(3marks)**
- e. An encyclopedia has eight volumes. In how many ways can the eight volumes be replaced on the shelf? **(3marks)**

Question Five (20marks)

- a. ~~Define~~ Explain the following words as used. **(6marks)**
- i. Set
 - ii. Relation
 - iii. Function
- b. Using a Venn diagram, proof that: $(A-B) \cup (B - C) = A-C$?
Where: $A = \{1,2,4,5\}$, $B = \{2,3,5,6\}$, $C = \{4,5,6,7\}$. **(4marks)**
- c. U is a set of Universal Numbers i.e. R, Z, Q e.t.c. **(10marks)**

Let $U = \{x \in \mathbb{Z} \mid 1 \leq x \leq 50\}$.
 $A = \{x \in U \mid x \text{ is divisible by } 3\}$, $B = \{x \in U \mid x \text{ is divisible by } 5\}$
 $A \cap B = \{x \in U \mid x \text{ is divisible by } 15\}$
 $A \cup B = \{x \in U \mid x \text{ is divisible by } 3 \text{ or is divisible by } 5 \text{ (or both)}\}$
 $A - B = \{x \in U \mid x \text{ is divisible by } 3 \text{ but is not divisible by } 5\}$

Exercise: compute $|A|$, $|B|$, $|A \cap B|$, $|A \cup B|$, $|A - B|$.