IT3305: Mathematics for Computing II

(Compulsory)

INTRODUCTION

This course covers mathematical concepts required to understand and successfully complete the other courses in the degree program and strengthen the mathematical foundation required in solving problem.

CREDITS: 03

LEARNING OUTCOMES

After successfully completing this module the student will be able to;

- Apply mathematical concepts and solve problems in the areas of matrices, sequences & series, vectors, and differentiation & integration.
- Solve statistical problems involving discrete & continuous probability distributions.

ONLINE LEARNING MATERIALS AND ACTIVITIES

You can access all learning materials and this syllabus in the VLE: http://vle.bit.lk/, if you are a registered student of BIT degree program. It is very important to participate in learning activities given in the VLE to learn this subject.

ONLINE ASSIGNMENTS

The assignments consist of two quizzes, assignment quiz 1 (It covers the first half of the syllabus) and assignment quiz 2 (It covers the second half of the syllabus). Maximum mark for a question is 10, minimum mark for a question is 0 (irrespective of negative scores). Final assignment mark is calculated considering 40% of assignment quiz 1 and 60% of assignment quiz 2. Pass mark for the online assignments in a course is 50. You are advised to do online assignments before the final exam of the course. It is compulsory to pass all online assignments to partially qualify to obtain Year 2 Certificate.

FINAL EXAMINATION

Final examination of the course will be held at the end of the semester. The course is evaluated using a two hour question paper which consists of 20-25 MCQ and 2-3 structured questions.

OUTLINE OF SYLLABUS

Topic	Hours
1. Matrices	09
2. Sequences and Series	09
3. Vectors	09
4. Differentiation and Integration	09
5. Basic Statistics	09
Total for the Subject	**45**

REQUIRED MATERIALS

Main Reading

Ref 1: Business Mathematics by Qazi Zameeruddin,V.K Khanna and S.K Bhambri (vikas publishing house)

Ref 2: Schaum's Outline Probability and Statistics, by Murray R. Spiegel, J. Schiller, R. A. Srinivasan, 2rd edition, 2000, Mc Graw Hill

Ref 3: Vector Algebra by Shanti Narayan, S.Chand and Company Ltd, New Delhi

Ref 4: Schuam's Outline Series, Theory and Problems of Matrices by Frank Ayres, JR, McGraw-Hill

Ref 5: Schaum's Outlines, Calculus by Frank Ayres, JR and Elliot Mendelson, 4th Edition 2000, Mc Graw-Hill

DETAILED SYLLABUS

Section 1: Matrices (09 hrs.) [Ref 1, Ref 4]

Learning Objectives

- Identify different types of matrices and their basic properties
- Perform basic operations on matrices
- Find the determinants of square matrices of orders 2 and 3 and use the properties of determinants
- Identify singular and non-singular matrices and determine the inverses of non-singular matrices (order 2 and 3)
- Solve systems of linear equations

Material /Sub Topics

1.1. Definition of a matrix [Ref.1: pg.699, Ref. 4: pg.1]
1.2. Column and row matrices (vectors) [Ref.1: pg.700]
1.3. Square, diagonal, identity, null, symmetric, skew-symmetric, and triangular (upper and lower) matrices, equality of matrices [Ref.1: pg.700-702, Ref.4: pg.2, 10-12, 103 (13.9 and 13.9' only)]
1.4. Matrix addition [Ref.1: pg.702-703, Ref.4: pg.2]
1.5. Scalar multiplication of a matrix [Ref.1: pg.703]
1.6. Matrix multiplication and its properties [Ref.1: pg.712-713, Ref.4: pg. 3]]
1.7. Orthogonal matrix, invertible matrix and transpose of a matrix [Ref.1:pg. 739-742, Ref.4: pg.2, 10-12, 55, 103]
1.8. Determinants of matrices (In particular of orders 2 and 3) and properties of determinants [Ref.1: pg.745-749, Ref.4: pg.20-22]
1.9. Singular and non-singular matrices [Ref.4: pg.39]
1.10. The adjoint of a square matrix and its properties [Ref.1: pg.719-720, Ref.4: pg.11-12, 22-23, 49]
1.11. Finding inverse of a matrix [Ref.1: pg.739-742, Ref.4: pg.55]
1.12. Systems of linear equations (Through examples, where all types and cases are done) [Ref.1: pg.724-739. Ref.4: pg.75-79]

Section 2: Sequences and Series (09hrs) [Ref 1, Ref 5]

Learning Objectives

- Define a sequence
- Identify different types of sequences
- Define the different types of limits of sequences
- Identify properties of sequences and use them to evaluate limits of sequences
- Define a series
- Identify convergent series and divergent series
- Identify tests for convergence and apply them to determine whether a series is convergent or not
- Define a power series
- Identify properties of power series

Material /Sub Topics

2.1 Sequences [Ref.1: pg.266 - 269, Ref.5: pg.385-393]

2.1.1 Definition of a sequence [Ref.1: pg.266, Ref.5: pg.385]

2.1.2 Convergent and divergent sequences [Ref.1: pg.267-268, Ref.5: pg.385]

2.1.3 Limits of a sequence [Ref.1: pg.267-268, Ref.5: pg.385-386]

2.1.4 Elementary properties of limits [Ref.5: pg. 386-387]

2.1.5 Monotonic sequences [Ref.1: pg.268-269, Ref.5: pg.387]

2.1.6 Bounded sequences [Ref.1: pg.268, Ref.5: pg. 386]

2.1.7 Relationship between monotonicity, boundedness [Ref. 5: pg. 388]

2.2 Infinite Series [Ref.1: pg.269-285, Ref.5: pg.394-441]

2.2.1 Definition [Ref.1: pg.269, Ref.5: pg. 394]

2.2.2 Convergence and Divergence [Ref.1: pg.269, Ref.5: pg.394]

2.2.3 Fundamental facts about infinite series [Ref.1: pg. 270-285, Ref.5: pg.395-418]

2.3 Power Series [Ref.5: pg.419-441]

2.3.1 Fundamental facts about power series [Ref.5: pg. 419-431]

2.3.2 Taylor and Maclaurin Series [Ref.5: pg.432-441]

Section 3: Vectors (09hrs.) [Ref 1, Ref 3]

Learning Objectives

- Distinguish between vectors and scalars
- Use vector concepts
- Apply vector theory in geometry

Material /Sub Topics

3.1 Definition of a vector and a scalar [Ref.1: pg.762, Ref. 3: pg.2-3]

3.2 Equality of vectors [Ref.1: pg. 763, Ref.3: pg.3]

3.3 Geometric representation of a vector [Ref.1: pg.762, Ref.3: pg.2]

3.4 Magnitude of a vector [Ref.1: pg.763, Ref.3: pg.4]

3.5 Unit vector and null vector [Ref.1: pg.763, Ref.3: pg.5]

3.6 Multiplication of a vector by a scalar [Ref.1: pg.766, Ref.3: pg.5-7]

3.7 Vector addition and subtraction [Ref.1: pg.764-766, Ref.3: pg.7-11]

3.8 Position vectors [Ref.1: pg.770-771, Ref. 3: pg.25-26]

3.9 Vectors in a plane and in 3-dimensional space [Ref.1:pg. 771-772]

3.10 The angle between two vectors [Ref.1: pg.164, 772-773]

3.11 The Ratio Theorem [Ref.1: pg.774-775, Ref.3: pg.26-27]

3.12 Scalar product, vector product, and their properties [Ref.1: pg.779-795, Ref.3: pg.70-75, 116-120]

Section 4: Differentiation and Integration (09hrs.) [Ref 1]

Learning Objectives

- Evaluate limits
- Differentiate elementary functions
- Solve real world problems using differentiation
- Integrate standard functions
- Find the area under a curve using integration

Material /Sub Topics

4.1 Differentiation [Ref.1: pg.545-548, 551-561, 563-565, 567-568, 577-579, 596-597, 606-612, Ref.5: pg.61-63, 71-73, 79-80, 86-87, 89, 102, 108, 110, 115-117, 129-130, 153, 155-156, 166-169, 175-176, 225, 234-235, 237, 243-245],

4.1.1 Definition

4.1.2 Properties and examples

4.1.3 Higher order derivatives

4.1.4 Finding limits using L'Hospital's Rule

4.2 Integration [Ref.1: pg.630-641, 649-651, 657-661, 672-675, Ref.2: pg.196-198, 206-211, 216—218, 225, 234-238, 257-259, 281-309]

4.2.1 Integration as the inverse of differentiation (the indefinite integral)

4.2.2 Integration of standard functions (e^x, log x, sin x, cos x, tan x, sec x, cosec x, cot x)

4.2.3 Properties of integration

4.2.4 Techniques of integration

4.2.5 Area under a curve (the definite integral)

Section 5: Basic Statistics (09hrs.) [Ref 2]

Learning Objectives

- Define what random variables are and how they are used.
- Define what is meant by a discrete probability distribution
- Compute the mean and variance of a discrete and a continuous random variable
- Use and interpret some discrete probability distributions such as the Binomial probability distribution, the Poisson probability distribution
- Use and interpret some continuous probability distributions such as the Uniform probability distribution, the Normal probability distribution, the Exponential probability distribution
- Identify properties of the Normal probability distribution
- Compute normal probabilities using standard normal tables
- Convert a random variable to a standard normal random variable
- Use the normal probability distribution to approximate binomial probabilities

Material /Sub Topics

5.1 Random variables [Ref.2: pg.36-40, 47-49, 68-69]

5.1.1 Discrete random variables

5.1.2 Continuous random variables

5.2 Probability distribution of a discrete random variable (Ref.2: pg.47)

5.2.1 Definition

5.2.2 Mean and Variance

5.3 The Binomial probability distribution [Ref.2: pg.113-115]

5.4 The Poisson probability distribution [Ref.2: pg.116-117]

5.5 Probability distribution of a continuous random variable [Ref.2: pg.49,113-119]

5.5.1 Definition

5.5.2 Mean and Variance

5.5.3 The Uniform probability distribution

5.5.4 The Normal probability distribution

5.5.5 Normal approximation of the Binomial distribution

5.5.6 The Exponential distribution