DAR ES SALAAM INSTITUTE OF TECHNOLOGY (DIT)

DEPARTMENT OF GENERAL STUDIES

STUDY GUIDE

SEMESTER I: 2025/26

Module Code: GSU 07314
Module Name: Calculus

November, 2025

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1 INTRODUCTION

This module Calculus with code GSU 07314 taught in semester III of NTA level 7 builds upon the content covered in the module Algebra and Application of Integrals with code GSU 07212 from Semester II. To excel in this module, students should possess a foundational understanding of basics of calculus, which are vital for calculating definite and indefinite integrals, determining derivative of various functions, and use them to solve computational problems.

1.1 Learning Activities

1.1.1 Consultations

Two hours per week will be designated for consultation sessions during the semester. The schedule for consultations can be accessed on the door of the Office - 3 located on the 2nd floor of the Teaching Tower building.

1.1.2 Assessments

Assessment shall have two components that are assessed separately namely Continuous Assessment (CA) and end of Semester Examinations (SE). The candidates shall be required to pass both of them. Weighting of assessment components unless specified otherwise at the beginning of the semester shall be 60% for CA and 40% for SE. The CA consists of several components as shown in the Table 1.1.

Table 1.1: CA Components and Weight Distribution

S/N	Category	Details	Weight (Mark)
1	Classroom tests (at least two tests)	Two timed tests (each for 1 hour) will be administered to the student.	15
2	Individual Assignments	At least one individual assignment will be given to the students.	15
3	Group Assignments	At least one group assignment will be given to the students.	15
4	Presentation of the group assignment	The group assignment will be presented by students.	15
	TOTAL CA		**60**

The passing score for each assessment component (CA and SE) shall be 40%. The assessment is conducted as per DIT Examination regulations.

1.2 Teaching Methods

1.2.1 Prerequisite Module

GSU 07212: Algebra and Application of Integrals.

1.2.2 Learning Context

This module will be conducted through Lectures, Laboratory work and Tutorials.

1.2.3 Learning Materials

Mathematical software e.g. Matlab, or R

1.2.4 Learning Reference Materials

Required References

1. Dyke, P. P. G. (2011): An Introduction to Laplace Transforms and Fourier Series, Springer
2. Bird, J. (2014): Higher Engineering Mathematics, Routledge Taylors & Francis Group, 7th Edition
3. Kaplan, W. (2013): Advanced Calculus, Addison – Wesley Higher Mathematics, 5th Edition
4. Kreyszig, E. (2010): Advanced Engineering Mathematics, Wiley, 9th Edition.

Recommended References

5. Burns, J.A., 2013. Introduction to the calculus of variations and control with modern applications. CRC Press.
6. Ramana, B. V. (2007): Higher Engineering Mathematics, Tata McGraw-Hill.
7. Rogawski, J. (2012): Calculus, W. H. Freeman and Company, 2nd Edition
8. Smith, R. T and R. B. Minton (2002): Multivariable Calculus, McGraw-Hill
9. Stroud, K.A. (2003): Advanced Engineering Mathematics, Palgrave Macmillan, 4th Edition.

2 STUDY COMPONENTS

2.1 General

Module code: GSU 07314.

Module Name: Calculus.

2.2 Sub enabling outcomes

The following are the sub-enabling outcomes to be acquired by the trainee by the end of this module.

- Utilize calculus techniques to determine limits, continuities and differentiations of functions of single and several variables
- Engage derivatives of transcendental functions in solving engineering problems
- Employ Fourier integrals of various functions to solve engineering related problems
- Employ method of separation of variables to solve partial differential equations arising from engineering related problems
- Engage power series to solve ordinary differential
- Employ polynomial in to solve finite series of Legendre and Bessel equations
- Engage calculus of complex functions to solve engineering related problems

Table 2.1: Sub-enabling outcomes, topics, related tasks and teaching weeks

Sub-Enabling Outcome	Topic(s)	Related tasks	Learning Time
Orienting trainees to the module	Orientation to GSU 07314	(a) Discussion of study guide	Week 1
		(b) Discussion of assessment plan	
		(c) Discussion on groups formulation and ethics on doing assignment	
1. Utilize calculus techniques to determine limits, continuities and differentiations of functions of single and several variables 2. Engage derivatives of transcendental functions in solving engineering problems	i. Limits and continuities	(a) Discuss the limit of a function and finite limits	Week 1 & 2
		(b) State the properties of limits and techniques for evaluating limits	
		(c) Calculate continuity and continuity on an interval	
		(d) Determine Rates of Change and The Limit Definition of the derivative	
	Class exercise		Week 2
	ii. Derivative of function	(a) Determine Derivatives of Algebraic Functions	Week 3 & 4
		(b) Calculate The Product and Quotient Rules	
		(c) Demonstrate derivatives Trigonometric functions	
		(d) Demonstrate derivatives of hyperbolic and inverse hyperbolic functions	
		(e) Demonstrate derivatives of Inverse trigonometric functions	
		(f) Demonstrate derivatives Logarithmic functions	
		(g) Demonstrate derivatives Exponential functions	
Class exercise			Week 4
Individual Assignment			Week 4

3. Employ Fourier integrals of various functions to solve engineering related problems	iii. Fourier integrals	(a) Solve problems using complex Fourier integrals	Week 5 & 6
		(b) Solve arithmetic problem using Fourier series	
		(c) Solve problems using periodicity, time and spacing	
Class exercise			Week 6
Test 1			Week 7
4. Engage power series to solve ordinary differential 5. Employ method of separation of variables to solve partial differential equations arising from engineering related problems	iv. Differential equations	(a) Solve ODEs using series solutions near an ordinary point	Week 8 &9
		(b) Solve ODEs using series solutions near a regular singular point	
		(c) Employ ODEs in solving engineering problems	
		(d) solve systems of partial differential equations (PDEs) of the first order	
		(e) solve Nonlinear PDEs of first order and its applications	
		(f) Solve Partial differential equations of second order	
		(g) Solve Mathematical modeling of heat, Laplace and wave equations	
		(h) Discuss Classification of 2nd order PDEs	
Class exercise			Week 9
Group Assignment			Week 9
6. Employ polynomial in ^{X} to solve finite series of Legendre and Bessel equations	v. Legendre and Bessel equations	(a) Describe polynomial in ^{X} as a finite series of Legendre and Bessel equations	Week 10 & 11
		(b) Develop cylindrical form of Bessel equation using power series	
		(c) Classify different cases of generating functions of Bessel equations	
		(d) Identify different Recurrence relations for Bessel equations	

Class exercise			Week 11
Test 2			Week 12
7. Engage calculus of complex functions to solve engineering related problems	vi. Calculus of complex functions	(a) Describe calculus of complex functions	Week 13 & 14
		(b) Determine derivative of different functions involving complex variables	
		(c) Determine integrals of different functions involving complex variables	
		(d) Employ derivatives and integrals of different functions involving complex variables to solve engineering problems	
Class exercise			Week 14
Corrections of Test 1 and Test 2			Week 15