National University of Technology (NUTECH)

Course Plan

COURSE CODE:	MATH1102
COURSE NAME:	Calculus II
CREDIT HOURS:	4 (Theory) + 0 (Practical)
CONTACT HOURS:	64 (Theory)
PREREQUISITES:	MATH1101 Calculus I
MODE OF TEACHING:	Lectures and Problems – Solving Activities
DISCIPLINE:	BET (Civil)

SUBJECT DESCRIPTION:

This course covers vector and multi-variable calculus. It is the second semester course in the freshman calculus sequence. Topics include vectors and matrices, partial derivatives, double and triple integrals, and vector calculus in 2 and 3-space. It is used extensively in physics and engineering, especially in the description of electromagnetic fields, gravitational fields and fluid flow specially in Civil Engineering Technology for understanding the basic concept of engineering.

SUBJECT OBJECTIVES:

1. To provide students a deeper understanding of the basic concepts of vectors, matrices and functions of several variables.

2. To provide students sufficient knowledge in solving multi-variable differential problems in engineering and technology.

3. To strengthen and broaden students' knowledge in integration which they may encounter in solving different types of differentiation problems.

SUBJECT LEARNING OUTCOMES:

At the end of the course, students would be able to:

SLO		Learning Domain	Taxonomy Level	PLO
1.	***Explain*** the concept of vectors, matrices, parametric equations and functions of several variables	Cognitive	2	1
2.	***Apply*** basic matrices operations to solve system of equations		3	
3.	***Calculate*** the rate of change of functions of several variables using partial derivatives			
4.	***Solve*** Double and Triple integrals to find volume and flux problems			

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TEXT AND MATERIAL:

Textbook (s)

1. Thomas' Calculus, 11th Edition, Addison-Wesley, 2005.

References Material:

2. Thomas, G. B. and Finney, R. L. Calculus and Analytic Geometry, 9th Edition, Pearson, 1996.
3. Swokowski, E. W. Calculus with Analytic Geometry, Alternate Edition, PWS Publishers 1983.
4. Anton, H. Calculus. John Wiley and Sons, 2012.
5. Stewart, J. Calculus, 5th Edition, Brooks/Cole, 2002.
6. Simmons, G. F. Calculus with Analytic Geometry. 2nd Edition, McGraw-Hill, 1996.

RELEVANT PROGRAM LEARNING OUTCOMES (PLOs):

The course is designed so that students will achieve the following PLOs:

1	Engineering Knowledge:	☑	7	Environment and Sustainability:	☐
2	Problem Analysis:	☐	8	Ethics:	☐
3	Design/Development of Solutions:	☐	9	Individual and Team Work:	☐
4	Investigation:	☐	10	Communication:	☐
5	Modern Tool Usage:	☐	11	Project Management:	☐
6	The Engineer and Society:	☐	12	Lifelong Learning:	☐

RELEVANCE OF COURSE TO REAL LIFE (PRACTICAL APPLICATIONS):

In all aspects of engineering, when confronted with a problem, one usually defines the problem with a model using mathematical equations describing the relationships of different aspects of the problem, usually through calculus. Basic things that occur all the time in engineering are rates of change with respect to time, or space of such variables as heat, wave, gas, electromagnetic fields, conductivity, vibrations in solids like bridges and buildings, and many others.

Calculus, at least the concepts developed from Calculus, are used all the time in civil engineering. Any time there is a rate of change of something then the derivative is an efficient way to characterize it. Any time there is an area under some function describing behavior then the integral is an efficient way to quantify it. The basic problems seek to maximize or minimize a quantity (such as surface area of some object, or the distance a projectile can achieve). Structural reliability is one very broad application of calculus in Civil Engineering. You can determine the

probability of failure of the structure with respect to the loads and other variables which influence the same. A basic example of the use of Calculus in Civil Engineering is, for example, the simple beam formula to calculate the stress in a beam with various forms of end attachment from fixed (buried in concrete for example) to pinned like the attachment points on many bridge supports and with various loads from distributed loads to point loads. The derivation of each comes from a combination of Algebra and Calculus. One can derive the shear stress distribution from algebra and get the moment distribution by integrating the shear stress.

ASSESSMENT SYSTEM:

There will be 8 Homework Assignments, 8 Quizzes, 1 Midterm and 1Final Exam. Date of submission of assignments will be reflected. Late submission will have a penalty (deduction of 20% marks for each day of late submission, zero marks for submission delayed more than 5 days).

To encourage reading (reading assignments are reflected in course schedule) and discourage copying of homework assignments, all quizzes will be 50% from reading assignments and 50% from problem sets in assignments. Relative grading system will be followed to award grades. Weightages are as under:

Theoretical/Instruction	**No**	**Percentage**
Assignments	8	10%
Quizzes	8	10%
Midterm Exam	1	30%
End Semester Exam	1	50%
Total		**100%**

CONDUCT IN THE CLASS:

- Discussion is encouraged in class but cross talking is not allowed.
- Everyone should be seated in the class 2 minutes before the start of the class.
- Leave / Absent will be considered as **"ABSENT"** in class, for which no retake of Assignments, Quiz etc. will be considered.
- Copying / late submission of assignments will result in deduction of marks.
- Phones should be on silent mode.

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INSTRUCTOR:

Name: Dr. Abdul Wahab
Office: NUSASH, Academic Block, 5th floor
Email: wahab@nutech.edu.pk

Class Hours: Check weekly training programs for class timings.
Office Hours: Wed: 12:00 – 13:00 (and by appointments).

INSTRUCTOR'S EXPERIENCE

Dr. Abdul Wahab PhD in Applied Mathematics from École Polytechnique Paris and has research interests in direct and inverse scattering of (electromagnetic, acoustic, elastic) waves in complex media. He usually seeks solutions of inverse problems related to Biomedical Imaging, Non-Destructive Testing, and Exploration Geophysics. He has vast experience of teaching a number of courses including Ordinary Differential Equations, Partial Differential Equations, Numerical Analysis, Calculus and Analytic Geometry, Discrete Mathematics, and Mathematical Methods for Physics.

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DETAILED CONTENTS AND THEIR CONTRIBUTION TO PLOs:

Week	Topic Covered	Reading Assignment/ Home Work	SLO No.	PLO No.	Assessment Methodology	Learning Domain	Level of Learning 1-6
1	Introduction to Calculus-II, Vectors, Basic Vector Operations, Determinants, Dot Product, Cross Product	Ref 1, Chapter 11: Section 11.2 to 11.4		1	Assignment, Quizzes, OHT, Formative Assessments	Cognitive Domain	1-3
2	Matrices, Basic Operations, Inverse Matrices	Lecture Notes Assignment 1					
3	Square systems, Equations of planes, Parametric equations for lines and curves, Velocity, acceleration	Ref 1, Chapter 11: Section 11.5 & 11.6 Quiz 1					
4	Partial derivatives, tangent plane approximation, Chain Rule	Ref 1, Chapter 13: Section 13.3 & 13.5 Assignment 2					
5	Gradient, directional derivative, tangent plane	Ref 1, Chapter 13: Section 13.6 &13.7 Quiz 2					
6	Max-min problems, Least squares, Second derivative test	Ref 1, Chapter 13: Section 13.8 Assignment 3					
7	Lagrange Multipliers	Ref 1, Chapter 13: Section 13.9 Quiz 3					

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8	Partial differential equations (some famous PDE's), Revision for Midterm exam	Ref 2, Chapter 14: Additional and Advance Exercises Assignment 4					
	Midterm Exam						
9	Double integrals, Double integrals in polar coordinates, Applications	Ref 1, Chapter 14: Section 14.1 to 14.3 Quiz 4					
10	Triple integrals in rectangular and cylindrical coordinates	Ref 1, Chapter 14: Section 14.4 to 14.7 Assignment 5					
11	Change of variables, Vector fields and line integrals in the plane	Ref 1, Chapter 15: Section 15.1 & 15.2 Quiz 5					
12	Path independence and conservative fields, Gradient fields and potential functions	Ref 1, Chapter 15: Section 15.3 Assignment 6					
13	Green's theorem, Flux	Ref 1, Chapter 15: Section 15.4 to 15.6 Quiz 6					
14	Divergence theorem applications and proof, Line integrals in space, Curl	Ref 1, Chapter 15: Section 15.7 Assignment 7					
15	Stokes' theorem	Ref 1, Chapter 15: Section 15.8 Quiz 7					
16	Maxwell's equations	Lecture Notes					

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		Assignment 8 Quiz 8					
Final Exam					**End Semester Exam**		

Prepared By: **Dr. Abdul Wahab** _____

Approved By: **Dr. Muhammad Mudassar Gulzar** _____

Vetted By: **Dr. Suhail Akhter** _____