University of Asia Pacific (UAP)
Department of Basic Science and Humanities

Course Outline

Program:	Computer Science and Engineering (CSE)
Course Title:	Multivariable Calculus
Course Code:	MTH 201
Semester:	Spring 2020**1**
Level:	2nd Year 1st Semester
Credit Hour:	3.0
Name & Designation of Teacher:	Samen Bairagi, Lecturer, Department of B&H
Office/Room:	Department of BS&H, 2nd floor, UAP campus
Class Hours:	Section A: Monday: 03:30 pm-05:00 pm Wednesday: 03:30 pm-5:00 pm Section B: Monday: 11:00 am - 12:30 pm Thursday: 02:00 pm -03:30 pm
Consultation Hours:	
E-mail:	samen@uap-bd.edu
Mobile:	01832663058

Rationale:

Calculus is the study of how things change. It provides a framework for modeling systems in which there is change, and a way to deduce the predictions of such models. Multivariable calculus is the extension of calculus in one variable to calculus with functions of several variables. Use of multivariable calculus is widespread in science, engineering, business and many other fields. It can be applied to analyze deterministic systems that have multiple degrees of freedom. It is used in the optimal control of continuous time dynamic systems. It also provides tools in regression analysis to derive formulas for estimating relationships among various sets of empirical data.

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Pre-requisite (if any)**:** MTH 101, MTH 103

Course Synopsis:

Vectors and the Geometry of Space: Cylinders and Quadric Surfaces. **Vector Functions:** Vector Functions and Space Curves, Derivatives and Integrals of Vector Functions, Arc Length and Curvature, **Motion in Space:** Velocity and Acceleration.

Partial Derivatives: Functions of Several Variables, Limits and Continuity, Partial Derivatives, Tangent Planes and Linear Approximations, The Chain Rule, Directional Derivatives and the Gradient Vector, Maximum and Minimum Values, Lagrange Multipliers.

Multiple Integrals: Double Integrals over Rectangles, Iterated Integrals, Double Integrals over General Regions, Double Integrals in Polar Coordinates, Applications of Double Integrals, Surface Area, Triple Integrals, Triple Integrals in Cylindrical Coordinates, Triple Integrals in Spherical Coordinates, Change of Variables in Multiple Integrals.

Vector Calculus: Vector Fields, Line Integrals, The Fundamental Theorem for Line Integrals, Green's Theorem, Curl and Divergence, Parametric Surfaces and Their Areas, Surface Integrals, Stokes' Theorem, The Divergence Theorem.

.**Course Objectives:** The objectives of this course are to:

1. Provide clear concept of vector calculus, partial derivatives and multiple integrals.
2. Show the equation of cylinders and different types of quadrics and draw them.
3. Demonstrate the ability to manipulate vectors.
4. Analyze some common problems using vector calculus and multiple integrals.

Course Outcomes (CO) and their mapping with Program outcomes (PO) and Teaching-Learning Assessment methods:

CO No.	CO Statements: Upon successful completion of the course, students should be able to:	Corresponding POs (Appendix-1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CO1	Understand basic concept of vector calculus, partial derivatives and multiple integrals.	1	1	Lecture, multimedia	Quiz, Written exam
CO2	Analyze multiple integrals.	3	1	Lecture, Problem Solving	Quiz,Written exam
CO3	Solve various problems using the basic concepts of vectors.	2	1	Lecture, Problem Solving	Assignment, Written exam

CO4	Apply multiple integrals and vector calculus to analyze common problems relating to engineering.	5	1	Lecture, Problem Solving	Written exam

Weighting COs with Assessment methods:

Assessment Type	% weight	CO1	CO2	CO3	CO4	CO5
Final Exam	**50%**	10	10	10	10	10
Mid Term	**20%**	5	10	5		
Class performance, Quizzes, Presentation, case study, open book exam, Assignment, Project, reports on field trip/workshop attended Others..	**30%**			10	15	5
Total	**100%**	15	20	25	25	15

Grading Policy: As per the approved grading policy of UAP (Appendix-3)

Course Content Outline and mapping with COs

Weeks	Topics / Content	Course Outcome	Delivery methods and activities	Reading Materials
1	Cylinders & Quadrics, vector functions, space curves.	CO1	Lecture, multimedia	Multivariable Calculus by J. Stewart, Calculus by H. Anton
2	Derivatives and Integrals of Vector Functions, Arc Length and Curvature	CO3	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
3	Velocity and Acceleration,	CO3	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus

	Vector Fields			by H. Anton
4	Functions of Several Variables, Limits and Continuity, Partial Derivatives.	CO1	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
5	Tangent Planes and Linear Approximations, The Chain Rule.	CO1	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
6	Gradient, Directional Derivatives, Divergence, Curl	CO3	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
7	Maximum and Minimum Values using Lagrange Multipliers.	CO4	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
		Mid Exam		
8	Line Integrals, The Fundamental Theorem for Line Integrals.	CO3	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
9	Green's Theorem and its application to line integrals.	CO4	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
10	Double Integrals over Rectangles, in Polar Coordinates, Iterated Integrals, Double Integrals over General Regions. Applications of Double Integrals.	CO2, CO4	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
11	Parametric Surfaces and Their Areas, Surface Integrals.	CO1, CO3	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
12	Triple Integrals, Triple Integrals in Cylindrical Coordinates, Triple Integrals in Spherical Coordinates,	CO2	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton

	Change of Variables in Multiple Integrals.			
13,14	Stokes' Theorem, The Divergence Theorem and their application to the evaluation of surface integrals.	CO4	Lecture, Problem Solving	Multivariable Calculus by J. Stewart, Calculus by H. Anton
		Final Exam		

Required Reference(s): .

1.James Stewart, Multivariable Calculus [7th Ed.], Cengage Learning.
2. H. Anton, I. Bivens & S. Davis, Calculus [10th Ed.], John Wiley & Sons.

Recommended Reference(s): Edwards, Henry C., and David E. Penney, Multivariable Calculus, Prentice Hall.

Special Instructions:

- Minimum 70% Attendance is required to attend the final exam
- Late presence is not allowed
- Assignment must be submitted on time
- Must be aware of the *Plagiarism Policy* as spelt out in the curriculum.
- No late or partial assignments will be acceptable
- No make-up quiz is allowed

Prepared by	Checked by	Approved by
Samen Bairagi, Lecturer, Department of BS&H	Chairman, PSAC committee	Head of the Department

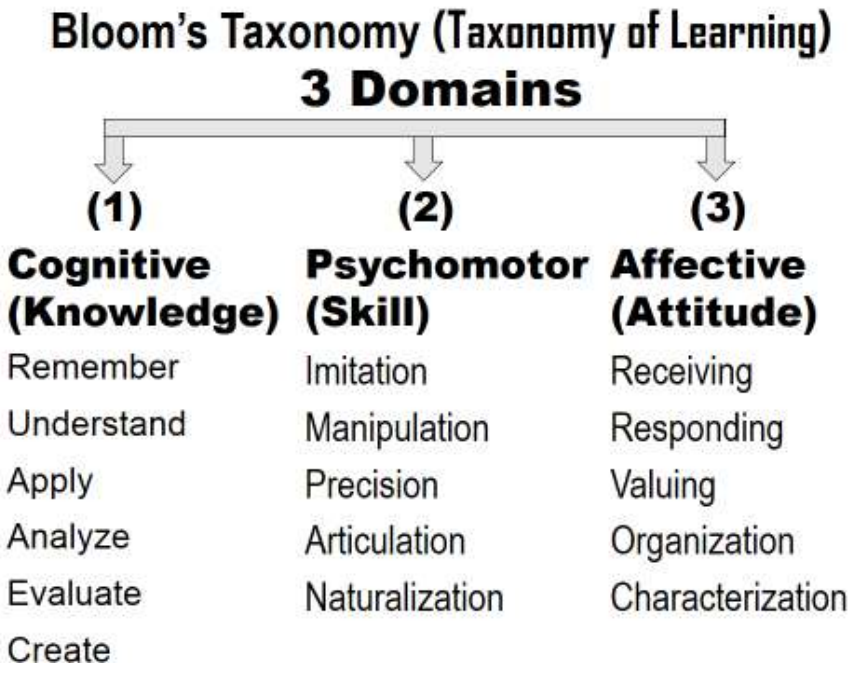
Appendix-1:

Washington Accord Program Outcomes (PO) for engineering programs:

No.	PO	Differentiating Characteristic
1	Engineering Knowledge	Breadth and depth of education and type of knowledge, both theoretical and practical
2	Problem Analysis	Complexity of analysis
3	Design/ development of solutions	Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified
4	Investigation	Breadth and depth of investigation and experimentation

5	Modern Tool Usage	Level of understanding of the appropriateness of the tool
6	The Engineer and Society	Level of knowledge and responsibility
7	Environment and Sustainability	Type of solutions.
8	Ethics	Understanding and level of practice
9	Individual and Team work	Role in and diversity of team
10	Communication	Level of communication according to type of activities performed
11	Project Management and Finance	Level of management required for differing types of activity
12	Lifelong learning	Preparation for and depth of Continuing learning.

Appendix-2



Appendix-3

UAP Grading Policy:

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75

50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00