Subject: Mathematics II
Instructor: Dr. Mohanad Farhan Hamid
References: 1. Thomas' Calculus, 11th edition
2. Stewart Calculus, 8th edition
3. Kreyszig Advanced Engineering Mathematics, 10th edition

Description: The course continues the material the students learnt in their first year. The topics include vectors in 2 and 3-dimensional space, vector-valued functions, partial derivatives, double and triple integrals, infinite series and an introduction to differential equations.

Week no.	Lecture	Topics
1	Space coordinate systems	1. Points in three-dimensional space 2. Vectors in two and three-dimensional space 3. Analytic geometry in space
2	Operations on vectors	1. Addition of vectors (geometrically and algebraically) 2. Dot product
3	Cross product	Geometric and algebraic meaning of cross product
4	Equations of lines in space	1. Parametric equations of a line in space 2. Relation between two lines (parallel, intersecting or skew) 3. Distance from a point to a line 4. Distance between two parallel lines
5	Planes	1. Equations of planes 2. Relation between two planes (parallel or intersecting) 3. Distance from a point to a plane 4. Distance from a line to a parallel plane 5. Distance between two parallel planes
6	Vector-valued functions	1. Their derivatives and integrals 2. (Unit) tangent vector 3. Tangent line
7	Quadric surfaces	1. Recognizing the quadric surface from its equation 2. Sketching quadric surfaces
8	Cylinders	Recognizing cylinders that are parallel to one of the coordinate axes and sketching them.

9	Multivariable functions	Functions of two or more variables
10	Partial derivatives	1. The two partial derivatives $\frac{\partial f}{\partial x}$ and $\frac{\partial f}{\partial y}$ 2. Their geometric meanings 3. Computing them
11	Tangent plane and linear approximation	Using partial derivatives to find the tangent plane to a surface and the linear approximation at a point.
12	Chain rule	1. Differentials of x, y and z and total differentials 2. Chain rule
13	Directional derivative	Finding the derivative in the direction of a given vector
14	Gradient	1. Gradient vector 2. Direction of maximum and minimum rate of change
15	Partial derivatives with constrained variables	Finding the partial derivatives of a function if there are some constraints on the variables
16	Double integrals I	Meaning, technique and applications of double integrals over rectangular regions
17	Double integrals II	1. Finding double integrals over non-rectangular regions 2. Reversing the order of the variables 3. Dividing the region of integration
18	Polar coordinates	1. Review of polar coordinates 2. Transforming from cartesian to polar coordinates and vice-versa 3. Sketching curves in polar coordinates
19	Double integrals in polar coordinates I	Finding double integrals in polar coordinates
20	Double integrals in polar coordinates II	Converting double integrals into polar coordinates
21	Triple integrals I	Triple integrals over rectangular boxes
22	Triple integrals II	Reversing the order of a triple integral
23	Triple integrals III	Triple integrals in cylindrical coordinates
24	Infinite series	Definition and examples of infinite series
25	Convergence tests I	1. n-the term test 2. Comparison tests

26	Convergence tests II	1. Limit comparison test 2. Ratio test
27	Convergence tests III	Alternating series: conditional and absolute convergence
28	Differential equations	1. Physical problems stated as differential equations 2. Solutions of differential equations
29	Solution techniques I	1. Separation of variables 2. Linear 1^{st} order differential equations
30	Solution techniques II	1. Bernoulli equations 2. Exact differential equations