هيئة تقويم التعليم والتدريب
Education & Training Evaluation Commission

2023
TP-153

Course Specification
(Bachelor)

Course Title:	**Differentiation & Integration 3**
Course Code:	**MATH 2302-3**
Program:	**Bachelor of Engineering**
Department:	**Engineering' Departments**
College:	**College of Engineering**
Institution:	**King Khalid University**
Version:	*Course Specification Version Number*
Last Revision Date:	**3 Feb 2024**

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A. General information about the course:

1. Course Identification

1. Credit hours: (3)					
2. Course type					
A.	☒ University	☐ College	☐ Department	☐ Track	☐ Others
B.	☒ Required		☐ Elective		
3. Level/year at which this course is offered: (1st level / 1st year)					
4. Course general Description:					
The course is roughly divided into two parts. The first part deals with advanced calculus, where functions of several variables are deeply studied. Indeed, students learn limits continuity and partial differentiation for such kind of functions as well as technique, double integral evaluation and their applications. In the second part, the focuses on sequences, which are used to build series. Finally, power series are addressed with an application into representation of functions and Taylor approximations.					
5. Pre-requirements for this course (if any):					
219MATH-3					
6. Corequisite for this course (if any):					
None					
7. Course Main Objective(s):					
The aim of the course is to learn the theory of functions of several variables including topics ranging from limits and continuity, partial differentiation up to double integrals (integrals for functions of two variables). The second perspective is to train students to manipulate sequences and series together with different tests for convergence. Finally, we make bridges between series and functions of one variable with addressing power series theory and applications.					

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	**2**	**66**
2	E-learning	--	--
3	Hybrid • Traditional classroom • E-learning	**1**	**34**
4	Distance learning	--	--

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	**48**

2.	**Laboratory/Studio**	--
3.	**Field**	--
4.	**Tutorial**	--
5.	**Others (specify)**	--
Total		**48**

B. Course Learning Outcomes (CLOs), Teaching Strategies and Assessment Methods

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.0	**Knowledge and understanding**			
1.1	By the end of the first part of this course, the student will learn functions of several variables and precisely: Limits, the two-path rule; continuity; partial differentiation; implicit differentiation for functions of two and three variables; chain rule; extrema (local minima and maxima and saddle points); tangent planes and normal lines; double integrals and their applications.	K1	• Lectures • Self-learning • Collaborative learning • Problem solving	• Exams • Assignments • Discussions • Projects
1.2	By the end of the second part of this course, the student will learn: Sequences; convergence tests for sequences (substitution, geometric, equivalence, sandwich theorem, absolute convergence); series and recurrent series; convergence tests for series and positive term series (nth term test, geometric, p-series, comparison, limit comparison, ratio, root, alternating, absolute convergence); power series (convergence radius and convergence interval), power series representation of functions; Maclaurin and Taylor series	K2		
1.3	Recognition of the differences between • Techniques of partial differentiation • Techniques of double integration • Sequences, series and power series.	K1		
1.4	Some application of the course : solution methods for partial differential equations supporting real problems, area and volume	K3		
2.0	**Skills**			
2.1	Ability to differentiate between properties of functions of one variable and several	S1	• Lectures • Self-learning	• Exams • Assignments

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	variables. Ability to differentiate between sequences, series and power series.		• Collaborative learning • Problem solving	• Discussions • Projects
2.2	Ability to choose and use the adequate calculus technique.	S1		
2.3	Use of learned techniques to solve modeling life issues.	S2		
2.4	Ability to write and implement algorithms to solve different numerical issues.	S3		
3.0	**Values, autonomy, and responsibility**			
3.1	Discussions; Work in a team; Time management; Self reliance	V1	• Instructor practices • Discussion • Working groups	• Observations, • Peer assessment, • self-assessment.
3.2	Recognize and appreciate the elegance and power of calculus	V2		
3.3	Ability to use the adequate calculus techniques	V3		

C. Course Content

No	List of Topics	Contact Hours
1.	**Functions of several variables of several variables, domain and range, level curve of a function.**	5
2.	**Limits and continuity: limit notation, definition of limit, two-path rule, definition of continuous functions.**	4
3.	**Partial derivatives: Definition of the first partial derivatives, notations for partial derivatives, second partial derivatives.**	3
4.	**Chain rules: chain rule Lines.**	3
5.	**Extrema of functions of several variables extrema, test for local extrema**	3
6.	**Double Integration: Definitions and evaluation theorems for double integrals**	3
7.	**Area and Volume**	3
8.	**Sequences: Notation, definitions and theorems**	3
9.	**Convergent or Divergent Series: Definitions, theorems, nth-term test.**	3
10.	**Positive- Term Series: Definitions, theorem, Basic and limit comparison tests**	3
11.	**The Ratio and Root tests**	3
12.	**Alternating series and absolute convergence: Definitions, theorems, alternating series test, absolute convergence.**	3
13.	**Power series: Definitions, theorems**	3
14.	**Power series representations of functions: Definitions, theorems.**	3
15.	**Maclaurin and Taylor series.**	3
Total		**48**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (In week no)	Percentage of Total Assessment Score
1.	Homework and Quizzes	Weekly starting from the 3rd week	30
2.	Midterm exam	9-10	30
3.	Final exam	18-19	40

*Assessment Activities (i.e., Written test, oral test, oral presentation, group project, essay, etc.).

E. Learning Resources and Facilities

1. References and Learning Resources

Essential References	E. W. Swokowski, M. Olinick, D. Pence & J. A. Cole, Calculus, 6th Edition, PWS Publishing Company, Boston. 1994.
Supportive References	• H. Anton, "Calculus with Analytic Geometry", 6th edition, Wiley,1998.
Electronic Materials	• Websites on the internet that are relevant to the topics of the course. • E-learning lms.kku.edu.sa
Other Learning Materials	Any book on the topics of the course available at the Central Library.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Lecture room for 25 students
Technology equipment (Projector, smart board, software)	• Data show device, Video Conference system and Smart boards • Computers loaded with modern software and connected to Internet service
Other equipment (Depending on the nature of the specialty)	Not Applicable

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students/Program coordinator/Faculty/HoD	Surveys & Interviews
Effectiveness of Students' assessment	Students/Program coordinator/Faculty/HoD	Surveys & Interviews
Quality of learning resources	Students and Faculty	Surveys & Interviews
The extent to which CLOs have been achieved	Course coordinator/Q&D committee	CLOs assessment form

Assessors (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify)

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	