Course Specification
(Bachelor)

Course Title:	Numerical Methods
Course Code:	MTHs 413
Program:	BSc-Applied statistics and data management
Department:	Mathematics
College:	College of Sciences.
Institution:	College of Sciences.
Version:	*Course Specification Version Number*
Last Revision Date:	*Pick Revision Date.*

Table of Contents

A. General information about the course:

1. Course Identification

1. Credit hours: 2(2+1)

2. Course type

A.	☐University	☐College	☐Department	☐Track	Others
B.	☐Required		☒Elective		

3. Level/year at which this course is offered: (Elective)

4. Course general Description:

Numerical methods for solving nonlinear equations (bisection – iteration – Newton - false position …)- errors and rates of convergence- Direct methods for solving linear systems (Gauss elimination, LU decomposition) and iterative methods (Jacobi –Gauss Seidel – Relaxation)-errors- iteration matrices and convergence of iterative methods- Polynomials interpolation (Lagrange-Newton's methods: divided differences- forward and backward differences) and analysis of errors- Numerical differentiation and integration- errors and accuracy- Gaussian integration formulas- Euler and Taylor methods for solving differential equations of first order.

5. Pre-requirements for this course (if any)**:**

`MTHS 211`

6. Co-requisites for this course (if any)**:**

None

7. Course Main Objective(s):

- **Having the knowledge of the ways to solve some problems in numerical ways using computers.**
- **Having the knowledge of how to find the derivatives and integrations using numerical methods**
- **Having the knowledge of how to solve matrix with large dimensions**
- **Having the ability of interpolation to functions and how to find a function if we know only some points**
- **Using numerical methods to solve integrations which have no known solutions**
- **Solving some problems - making some research in Libraries and using internet**

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	20	66%
2	E-learning	0	
3	Hybrid • Traditional classroom • E-learning	10	34%
4	Distance learning		

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	20
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	10
5.	**Others (specify)**	0
Total		30

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	The ability of using R, SPSS and Python programs	K2	Lectures-Presentations. Media Lectures Tutorials	Exam Assessment Quiz Final Exam
1.2	Identifying the role of approximation and mathematical approaches to analyze the real problems using	K2	Lectures-Presentations. Media Lectures Tutorials	Exam Assessment Quiz

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	various statistical tools.?			Final Exam
1.3	**Numerical Integration/ Differentiation** Analyzing the numerical results	K2	Lectures-Presentations. Media Lectures Tutorials	Exam Assessment Quiz Final Exam
2.0	**Skills**			
2.1	**Error Analysis** Monitors Group Effectiveness	S2	Lectures-Presentations. Media Lectures Tutorials	Exam Assessment Quiz Final Exam
2.2	**Algorithms:** Working with Others	S2	Lectures-Presentations. Media Lectures Tutorials	Exam Assessment Quiz Final Exam
2.3	**Use of Software** Personal Organization/Time Management	S2	Lectures-Presentations. Media Lectures Tutorials	Exam Assessment Quiz Final Exam
3.0	**Values, autonomy, and responsibility**			
3.1	Ability for collaboration	V2	Lectures-Presentations. Media Lectures Tutorials	Exam Assessment Quiz Final Exam
3.2	Project management	V2	Lectures-Presentations. Media Lectures Tutorials	Exam Assessment Quiz Final Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
3.3	Problem Solving	V2	Lectures- Presentations. Media Lectures Tutorials	Exam Assessment Quiz Final Exam

C. Course Content

No	List of Topics	Contact Hours
	Numerical methods for solving nonlinear equations (bisection-iteration-Newton-false position….)-errors and rates of convergence.	6
	Direct methods for solving linear systems (Gauss elimination. LU decomposition) and iterative methods (Jacobi-Gauss Seidel- Relaxation) –errors- iteration matrices and convergence of iterative methods	6
3	Polynomials interpolation (Lagrange-Newton's methods: divided differences-forward and backward differences) and analysis of errors	6
4	Numerical differentiation and integration- errors and accuracy- Gaussian integration formulas-	6
5	Euler and Taylor methods for solving differential equations of first order Euler and Taylor methods for solving differential equations of first order	6
Total		**30**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz 1	4th Week	2.5%
2.	Assignment/Home Work 1	5th Week	2.5%
3.	Mid Term 1	7th Week	20%
4	Quiz 2	9th Week	2.5%
5	Assignment /Home Work 2	10th Week	2.5%
6	Class Activities/Discussions	10th Week	5%
7	Mid Term 2	12th Week	20%
8	Electronic Test	13th Week	5%
9	Final Exam	16 th week	40%

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
	Total		100%

*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	R.L. Burden and J.D. Faires: Numerical Analysis. 9th Edition Brooks / cole , 2011.
Supportive References	Endre Süli, David F. Mayers: An Introduction to Numerical Analysis, Cambridge, 2003. Rizwan Butt, Introduction to Numerical Analysis Using MATLAB, David Pallai, 2008
Electronic Materials	1. https://www.wolfram.com/mathematica/ 2. https://www.mathworks.com/discovery/numerical-analysis.html?s_tid=srchtitle
Other Learning Materials	R.L. Burden and J.D. Faires: Numerical Analysis. 9th Edition Brooks / cole , 2011.

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	1. The size of the room should be proportional to the number of students 2. Provide enough seats for students. 3. The number of students not exceed on 30 in the classroom

Items	Resources
Technology equipment (projector, smart board, software)	1. Mathematics Lab is equipped with a computer. 2. Provide overhead projectors and related items i.e smart Board, Wi-Fi, AV. 3. Updated Math Software i. e Mathematica, Matlab, Maple and SPSS.
Other equipment (depending on the nature of the specialty)	

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students/ internal committee	Direct (Students evaluation electronically organized by Deanship of registration and admission)/ Verification of students' papers
Effectiveness of Students assessment	Staff members (Peer Reviewer)	Indirect (Frequent meetings consultation among the teaching staffs)
Quality of learning resources	Staff members (course coordinators)	Direct (Meeting between course coordinators and the tutors)
The extent to which CLOs have been achieved		
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	
REFERENCE NO.	
DATE	