2023
TPG-153

Course Specification

(Postgraduate)

Course Title:	Special Topics in Applied Math
Course Code:	MATH 621
Program:	MSC APPLIED MATHEMATICS
Department:	Mathematics
College:	College of Science and Humanities
Institution:	Prince Sattam bin Abdulaziz University
Version:	1
Last Revision Date:	15-9-2024

Table of Contents

A. General information about the course:

1. Course Identification:

1. Credit hours: 2 (2,1,0)				
2. Course type				
A.	☐University	☐College	☒ Department	☐Track
B.	☒ Required		☐Elective	
3. Level/year at which this course is offered: (first)				
4. Course general Description:				
Difference Equation (Homogeneous, Non-homogeneous), Differential Equations in Mathematical Modeling (Growth, Decay, Newton Law of Cooling), Error Analysis of differentiation formulae, Richardson Extrapolation, Newton Forward, Backward, Lagrange interpolation, Stirling's and Bessel's formulae, Integral Equations (Volterra and Fredholm, first and second kind), Leibnitz Formula for the conversion Volterra integral equation to I.V.P and from I.V.P. to Volterra Integral Equations, Numerical Differentiation (Tabulated points) and numerical Integration, composite numerical integration and error estimations, Solutions of differential equations using power series methods.				
5. Pre-requirements for this course (if any)**:**				
Nil				
6. Pre-requirements for this course (if any)**:**				
Nil				
7. Course Main Objective(s):				
Objectives: To understand and apply some topics in applied mathematics, such as difference equations, integral equations, Polynomial Approximations for finding higher derivatives, maxima-minima from the data sets. Applications of differential equations in daily life problems and solving differential equations using power series. Numerical methods for differentiation and integration. Volterra and Fredholm Integral equations first and second kind. **<u>After Completion of the course</u>, the students will be able to understand, the reasons of studying difference equations, Differential equations, numerical methods for differentiation and integration, polynomial interpolation, and integral equations.**				

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	3 Hours per week	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning	**E-learning**: In case of suspension of regular classes due to any unforeseen eventualities	Not applicable
4	Distance learning		

3. Contact Hours: (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	32
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	16
5.	**Others (Office Hours) ……(16 X 1)**	16
	Total	64

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	**Acquire thorough knowledge about Difference Equations, Integral Equations**	**K1**	1. Classroom lectures 2.Interactive sessions	1. Two Internal Exams 2.Atleast two Quiz 3.End Semester Exam

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
1.2	**Able to recall the formulae and describe Interpolations and Polynomial approximations and their applications**	**K3**	3.Exclusive Office Hours for clearing doubts in small groups	
2.0	**Skills**			
2.1	**Able to find Applications of first and higher order differential equations in daily life problems**	**S3**	Application oriented problems solved during lecture sessions	1.Homework 2.Assignments 3.Quiz 4. Mid Term and Final Exam
2.2	**Carryout a comparison among different types of integral equations and converting Volterra Integral Equations in to I.V.P. and vice versa and solve them**	**S1**		
3.0	**Values, autonomy, and responsibility**			
3.1	Work effectively exhibiting integrity and professional value to the assigned task	**V1**	Group Discussion Brain Storming	Group Assignment Seminar/Presentation Class Participations Continuous Assessment

C. Course Content:

No	List of Topics	Contact Hours
1.	**Linear Difference Equation (Homogeneous and Non-homogeneous)**	**6**

2.	Differential Equations in Mathematical Modeling and applications	6
3.	Numerical Differentiation, numerical Integration, and applications for tabulated data sets. Composite numerical integration, Error estimates for numerical differentiation and integrations.	6
4.	Error Analysis of differentiation formulae, Richardson Extrapolation	6
5.	Solutions of differential equations using power series methods.	6
6.	Polynomial Approximation, Differences, Difference tables, Lagrange interpolation, Newton Forward, Newton Backward formulas, Stirling's and Bessel's formulae.	9
7.	Integral Equations (Volterra and Fredholm, first and second kind), Leibnitz Formula for the conversion Volterra integral equation to I.V.P and from I.V.P. to Volterra Integral Equations	9
Total		48

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quiz 1, 2	4, 10	10%
2.	Mid Term Exam I	6	15%
3.	Mid Term Exam II	13	15%
...	Continuous Assessment – Homework, Assignment, Attendance, Class Participations etc.	----	10%
	End Semester Exam	17	50%

*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	Erwin Kreysizg (2011). "Advanced Engineering Mathematics", 10th Ed., John Wiley & Sons, INC.
Supportive References	1. C.B. Gupta (2009). "Advanced Mathematics", New Age International Limited, Publishers 4835/24, Ansari Road, New Delhi – 110002, www.newagepublishers.com. 2. D.G. Zill (2009). "A first Course in Differential Equations with Modeling Applications 9th Ed. Brokes/Cole USA. 3. D.C. Sharma (2017). "Integral Equations", PHI Learning Private Limited, Delhi.

Electronic Materials	**Saudi Digital Library**
Other Learning Materials	**https://ocw.mit.edu/** **https://bookstore.ams.org/gsm-101**

2. Educational and Research Facilities and Equipment Required:

Items	Resources
FACILITIES (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms with Smart boards with seating facilities for at least 30 students
Technology equipment (Projector, smart board, software)	• Smartboard, Internet Connection for Blackboard
Other equipment (Depending on the nature of the specialty)	NIL

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students** **Peer Review/Classroom Observation**	**Indirect**
Effectiveness of students' Assessment	**Independent member teaching staff**	**Check marking by an independent member teaching staff of samples of student work.**
Quality of learning resources	**Students**	**Indirect**
The extent to which CLOs have been achieved	Quality Assurance Committee	End Semester online survey
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	
REFERENCE NO.	**TERM 1**
DATE	**15-9-2024**