Course Specification

(Postgraduate)

Course Title: Approximation Theory
Course Code: 630 MATH
Program: MSC APPLIED MATHEMATICS
Department: Mathematics
College: College of Science and Humanities
Institution: Prince Sattam bin Abdulaziz University
Version: 1
Last Revision Date: 13-9-2024

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:

Polynomial Interpolation: Lagrange interpolation formula, error in polynomial interpolation, Newton's interpolation method, Hermite interpolation. The approximation problem, existence of best approximation and uniqueness: approximation in a metric space, approximation in normed space, conditions for uniqueness of the best approximation, the uniform convergence of polynomial approximations, Least Squares approximation, Chebyshev approximation, Spline approximation..

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

 Nil

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

Nil

7. Course Main Objective(s):

1. Objectives : To make the students gain skills in the Concept of Approximation theory such as Polynomial Interpolation, Lagranges formula and its application etc., and able to apply the concepts in various types of physical problems.

   ILO:

At the end of the course, the students shall :
- gain knowledge about polynomial interpolation
- understand the concept of Lagrange's Interpolation formula and its applications
- be able to apply newton's interpolation method to solve mathematical problems
- be able to reproduce the theories and apply associated results to approximation problem, and existence of best approximation and uniqueness conditions
- be able to find approximation in various spaces such as metric spaces, normed space etc.
- gain knowledge about uniform convergence of polynomial approximations
- be able to apply various approximation techniques such as Least Squares approximation, Chebyshev approximation, Spline approximation etc.

- be able to make presentation in a given topic

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
	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	Recall and reproduce of the concepts of interpolation, different approximating functions and best approximation	**K1, K2**	1. Classroom lectures 2.Interactive sessions 3.Exclusive Office Hours for clearing doubts in small groups	1. Two Internal Exams 2.Atleast two Quiz 3.End Semester Exam
1.2	Identify different types of interpolations and	**K3**		

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
	approximations and describe the appropriate methods to evaluate the same			
2.0	**Skills**			
2.1	Apply appropriate methods to interpolate data and approximate functions and its derivatives	**S1, S2**	1. Application oriented exercises during tutorial session. 2. Homework to improve the analytical skills	1.Homework 2.Assignments 3.Quiz 4. Mid Term and Final Exam
2.2	Compare and contrast different interpolation and appropriation techniques	**S3**		
3.0	**Values, autonomy, and responsibility**			
3.1	Work effectively with honesty to exhibit integrity and professional value to the assigned task	**V1**	Group Discussion/Task during lectures and Interactive Session Brain Storming session	1.Seminars 2.Oral Presentation

C. Course Content:

No	List of Topics	Contact Hours
1.	Polynomial Interpolation: Lagrange interpolation formula,	**6**
2.	error in polynomial interpolation, Newton's interpolation method	**6**
3.	, Hermite interpolation.	**6**
4.	The approximation problem, existence of best approximation and uniqueness	**6**
5.	approximation in a metric space, approximation in normed space, conditions for uniqueness of the best approximation,	**6**

6.	the uniform convergence of polynomial approximations	6
7.	Least Squares approximation,	4
8.	Chebyshev approximation,	4
9.	Spline approximation	4

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 etc.		10%
	End Semester Exam	18	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	**Powell, M. J. D. (1981).** *Approximation theory and methods.* **Cambridge university press..**
Supportive References	**Christensen, Ole, and Khadija L. Christensen. "APPROXIMATION THEORY FROM TAYLOR POLYNOMINALS TO WAVELETS." (2006).**
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 20 students
Technology equipment (Projector, smart board, software)	- Smartboard, Internet Connection for Blackboard - Computer Lab with 40 terminals

Items	Resources
	• Visual Studio software.
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	**13-9-2024**