Course Specification
(Postgraduate)

Course Title	**Approximation Theory and Boundary Value Problem**
Course Code:	202650-3
Program:	**Master of Pure Mathematics**
Department:	**Mathematics and Statistics**
College:	**Science**
Institution:	**Taif university**
Version:	1
Last Revision Date:	**20/10/2023**

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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
B.	☐Required		☒ Elective	
3. Level/year at which this course is offered: Level 1/First Year				
4. Course general Description:				
Approximation theory and methods for functions' approximation; Discrete Approximation-Continuous Approximations; Chebyshev polynomials; Legendre polynomials and Pad´e approximation; Rational best approximation; Orthogonal polynomials; Adomian decomposition method; homotopy perturbation method (HPM); Reduced differential transform method (RDTM); Homotopy analysis method; Homotopy analysis transform method; Optimal q- homotopy analysis method (oq-HAM**).**				
5. Pre-requirements for this course (if any)**:**				
None				
6. Pre-requirements for this course (if any)**:**				
None				
7. Course Main Objective(s):				

1. **Study approximation theory and methods for functions' approximation.**
2. **Study discrete Approximation-Continuous Approximations.**
3. **Study Chebyshev polynomials.**
4. **Study Legendre polynomials and Pade approximation.**
5. **Study rational best approximation.**
6. **Study orthogonal polynomials**
7. **Study adomian decomposition method.**
8. **Study homotopy perturbation method (HPM).**
9. **Study reduced differential transform method (RDTM).**
10. **Study homotopy analysis method.**
11. **Study homotopy analysis transform method.**
12. **Study optimal q- homotopy analysis method (oq-HAM).**

2. Teaching Mode: (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	√	100%
2	E-learning		
3	Hybrid • Traditional classroom • E-learning		
4	Distance learning		

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

No	Activity	Contact Hours
1.	**Lectures**	**45**
2.	**Laboratory/Studio**	NA
3.	**Field**	NA
4.	**Tutorial**	NA
5.	**Others (specify)……**	NA
	Total	**45**

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	**Recognize** fundamentals of approximation theory and methods for functions' approximation.	K1	Lectures, group discussion `	Exams, Quizzes, Assignments
1.2	**Describe** problems relating to the basic concepts in approximation theory and methods for functions' approximation	K3	Lectures, group discussion	Exams, Quizzes, Assignments
2.0	**Skills**			
2.1	**Apply** appropriate mathematical and statistical theories, models, and tools in solving various problems of approximation theory and methods for functions' approximation.	S1	Lectures, group discussion	Exams, Quizzes, Assignments, report

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
2.2	**Demonstrate** understanding the important mathematical and statistical concepts, principles, theorems, formulas, computational techniques in approximation theory and methods for functions' approximation.	S5	Lectures, group discussion	Exams, Quizzes, Assignments, report
3.0	**Values, autonomy, and responsibility**			
3.1	**Participate** effectively within groups and independently	V1	Lectures, group discussion	Exams, Quizzes, Assignments, report
3.2	**Give** responsibility for learning importance and continuing personal and professional development.	V2	Lectures, group discussion	Exams, Quizzes, Assignments, report

C. Course Content:

No	List of Topics	Contact Hours
1.	Approximation theory and methods for functions' approximation.	6
2.	Discrete Approximation-Continuous Approximations.	3
3.	Chebyshev polynomials.	6
4.	Legendre polynomials-Pad ́e approximation.	3
5.	Rational best approximation, Orthogonal polynomials.	6
6.	Adomian decomposition method.	3
7.	Homotopy perturbation method (HPM).	6
8.	Reduced differential transform method (RDTM);	6
9.	Homotopy analysis method, Homotopy analysis transform method.	3
10.	Optimal q-homotopy analysis method (oq-HAM).	3
Total		**45**

D. Students Assessment Activities:

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Quizzes and HomeWorks	Continues	10 %
2.	Midterm exam	8^{th} -9^{th}	20 %
3.	Final exam	16^{th}	70%

*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	Numerical Approximation Methods for Elliptic Boundary Value Problems: Finite and Boundary Elements (Texts in Applied Mathematics), 2008th Edition, by Olaf Steinbach
Supportive References	Mathematical Theorems Boundary Value Problems and Approximations Edited by Lyudmila Alexeyeva, Published: December 9th 2020; DOI: 10.5772/intechopen.83329
Electronic Materials	DOI: 10.5772/intechopen.83329
Other Learning Materials	None

2. Educational and Research Facilities and Equipment Required:

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	Classrooms
Technology equipment (Projector, smart board, software)	Data show, Blackboard, Maple and MATLAB software
Other equipment (Depending on the nature of the specialty)	Wi-Fi internet connections

F. Assessment of Course Quality:

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	Students	Indirect
Effectiveness of students assessment	Students	Indirect

Assessment Areas/Issues	Assessor	Assessment Methods
Quality of learning resources	Students	Indirect
The extent to which CLOs have been achieved	Peer reviewer	Direct
Other		

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

Assessment Methods (Direct, Indirect)

G. Specification Approval Data:

COUNCIL /COMMITTEE	Department of Mathematics and Statistics
REFERENCE NO.	11
DATE	17-3-1445 H

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