Course Specification
— (Bachelor)

Course Title: Number Theory	
Course Code: MTH3231	
Program: BSc. in Mathematics	
Department: Mathematics	
College: Al-Qunfudah University College	
Institution: Umm Al-Qura University	
Version: 2	
Last Revision Date: 17/07/2024	

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A. General information about the course:

1. Course Identification

1. Credit hours: (4)

2. Course type

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

3. Level/year at which this course is offered: (7/3)

4. Course general Description:

German mathematician Carl Gauss said "Mathematics is the queen of sciences and Number Theory is the queen of Mathematics" This course provides an introduction to the important basic topics of number theory: Prime Numbers, Divisibility, Fundamental Theorem of Arithmetic, Greatest Common Divisor (GCD), Least Common Multiple (LCM), Euclidean Algorithm, Congruences, Chinese Remainder Theorem, Quadratic Residues, Legendre's Symbol, Quadratic Reciprocity Law, Arithmetic Functions, Diophantine Equations, Continued Fractions. Finally, some famous number in Mathematics such as Perfect, Deficient, Abundant, Mersenne and Fermat Numbers.

5. Pre-requirements for this course (if any): MTH1201

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

7. Course Main Objective(s):

The course objective is to achieve an elementary knowledge of number theory and to become more familiar with prime numbers, finding the GCD by using Euclidean Algorithm, solving systems of linear congruences, using Wilson's and Fermat Theorems to find the least residue of a linear congruence, determine if an arithmetic function is a multiplicative/ completely multiplicative function.

2. Teaching mode (mark all that apply)

No	Mode of Instruction	Contact Hours	Percentage
1	Traditional classroom	4	100 %
2	E-learning	0	0
3	Hybrid	0	0

No	Mode of Instruction	Contact Hours	Percentage
	• Traditional classroom • E-learning		
4	Distance learning	0	0

3. Contact Hours (based on the academic semester)

No	Activity	Contact Hours
1.	**Lectures**	36
2.	**Laboratory/Studio**	0
3.	**Field**	0
4.	**Tutorial**	0
5.	**Others (***Exam, Quizzes, Activities…***)**	4
Total		**40**

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	Find the GCD of two natural numbers by using Euclidean Algorithm	$K1, K3$	Lecture and Tutorials	Exams, quizzes
1.2	Write the GCD as a linear combination.	$K3, K5$	Lecture and Tutorials	Exams, quizzes
1.3	Solve systems of linear congruences.	$K1, K5$	Lecture and Tutorials	Exams, quizzes
1.4	Using Wilson's and Fermat Theorems for investigation in problems.	$K3, K5$	Lecture and Tutorials	Exams, quizzes
2.0	**Skills**			
2.1	Be able to prove if an arithmetic function is a multiplicative/ completely multiplicative function.	$S1, S2, S8$	Lecture/ Individual or group work	Exams, quizzes
2.2	Solve linear Diophantine equation of two variables.	$S2, S4, S5$	Lecture/ Individual or group work	Exams, quizzes
2.3	Investigate the distribution of prime numbers.		Lecture/ Individual or group work	Exams, quizzes

Code	Course Learning Outcomes	Code of CLOs aligned with program	Teaching Strategies	Assessment Methods
		S4,S5,S8		
3.0	Values, autonomy, and responsibility			
3.1	Investigate the proof of the Fundamental Theorem of Arithmetic.	*V2,V5*	Lecture/ Individual or group work	Exams, quizzes
3.2	Using the Chinese Remainder Theorem to solve systems of linear congruences.	*V2,V3*	Lecture/ Individual or group work	Exams, quizzes
3.3	Be able to write a number as a continued fraction.	*V3, V4*	Lecture/ Individual or group work	Exams, quizzes
3.4	Using the sum of the divisor function to determine if a number is a perfect, deficient, or abundant number.	*V3,V4*	Lecture/ Individual or group work	Exams, quizzes

C. Course Content

No	List of Topics	Contact Hours
1.	Introduction to operations research and linear programming problem (LPP)	4
2.	Convex sets, Convex function, vertex points, and optimization theory	4
3.	Graphical method for solving LPP	4
4.	Simplex methods	4
5.	Special cases of simplex method Duality Problem, sensitivity analysis	4
6.	Special cases of simplex method Two Phase Method	4
7.	Applications of the linear programming problem (Transportation problems, Game Theory, Network)	4
8.	Use software applications to solve LPP	4
Total		**40**

D. Students Assessment Activities

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
1.	Midterm exam	6th	30 %
2.	Quizzes and homework's	During semester	20 %

No	Assessment Activities *	Assessment timing (in week no)	Percentage of Total Assessment Score
3.	**Final exam**	**End of semester**	**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	• Apostol, Tom M. Introduction to analytic number theory. Springer Science & Business Media, 1998. • Koshy, Thomas. Elementary number theory with applications. Academic press, 2002. • Introduction to Number Theory by Mathew Crawford. • Art of Problem-Solving ISBN 978 1 934124 12 3 MIST Academy Mathematics Olympiad Year 2015
Supportive References	• Tattersall, James J. Elementary number theory in nine chapters. Cambridge University Press, 1999.
Electronic Materials	
Other Learning Materials	*None*

2. Required Facilities and equipment

Items	Resources
facilities (Classrooms, laboratories, exhibition rooms, simulation rooms, etc.)	**Classrooms**
Technology equipment (projector, smart board, software)	**Data Show, Smart Board**
Other equipment (depending on the nature of the specialty)	**None**

F. Assessment of Course Quality

Assessment Areas/Issues	Assessor	Assessment Methods
Effectiveness of teaching	**Students**	**Courses Assessment survey**
Effectiveness of Students assessment		**Courses Assessment survey**
Quality of learning resources	**Students**	**Courses Assessment survey**
The extent to which CLOs have been achieved	**Faculty Member**	**Post-Rubric and Course report**

Assessment Areas/Issues	Assessor	Assessment Methods
Periodically reviewing course effectiveness and planning for improvement	Course committee	Annual report

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

Assessment Methods (Direct, Indirect)

G. Specification Approval

COUNCIL /COMMITTEE	Curriculum Committees
REFERENCE NO.	1
DATE	17/07/2024