DEPARTMENT OF MATHEMATICS
Punjab Engineering College, Chandigarh
(Deemed to be University)

M.TECH COURSES

Sr.No.	Course Code	Course Name	L	T	P	Credits
1	EMR 1001	FOURIER TRANSFORMS AND OPTIMIZATION TECHNIQUES	2	1	0	3
2	EMR 1002	NUMERICAL METHODS AND FOURIER TRANSFORMS	2	1	0	3
3	EMR1003	NUMBER THEORY AND ALGEBRA	2	1	0	3

Course Name	**:**	**FOURIER TRANSFORMS AND OPTIMIZATION TECHNIQUES**
Course Code	**:**	**EMR 1001**
Credits	**:**	**03**
L T P	**:**	**2-1-0**

Course Objectives:
The main objectives of this course are:

1.To make the students understand the concept of Fourier Transform and be able to compute it for standard examples.
2. describe the need of Optimization Techniques, apply and to describe the limitations of classical/iterative methods to solve nonlinear models for optimization problems, to solve optimization problems using Genetic Algorithm and Particle Swarm Method.

Total No. of Lectures –28

	Lecture wise breakup	Number of Lectures
1	FOURIER TRANSFORMS Fourier Integral as the limit of a Fourier series, Dirichlet conditions, Fourier Integral Theorem, Fourier sine and cosine integrals, Fourier transform and its inverse, Basic properties, Convolution Theorem, Parseval's relation, Dirac Delta Function and its Fourier transform, Fourier transform of partial derivatives, Fourier cosine and sine transforms and their inverse, Basic properties of Fourier cosine and sine transforms, Applications to Engineering problems.	07
2	OPTIMIZATION **Unconstrained problems -** (Single and multivariable optimization) Necessary and sufficient conditions for extreme points. **Constrained problems - (**multivariable optimization) Equality constraints - Jacobian and Lagrangean methods, Application of Jacobian method to linear problems. Inequality constraints – extension of Lagrangean method, Karush Kuhn tucker Conditions.	12
3	UNCONSTRAINED OPTIMIZATION ALGORITHMS Direct methods: Dichotomous and Golden search; Univariate search methods Gradient methods: Cauchy's steepest ascent method and Newton's method	5
4	EVOLUTIONARY ALGORITHMS Genetic Algorithms: Binary and Real coded Genetic Algorithms, Coding and decoding of variables, Key steps in a GA, starting population, fitness evaluation, reproduction, crossover, mutation. Particle Swarm Method	4

Course Outcomes:
At the end of the course, students will be able to:

1.Solve differential equations by using Fourier Transforms.
2.Solve problems using classical / iterative methods.
3. Apply Genetic Algorithm and Particle Swarm method to solve problems

Suggested Books:

Sr.No	Name of Book/ Authors/ Publisher	Year of Publication/ Edition
1	Advanced Engineering Mathematics, Wylie and Barret, McGraw Hill, 6th edition	1995
2	Integral Transforms and Their Applications, Loknath Debnath, CRC Press, Inc.	1995
3	Integral Transforms and Their Applications, Brain Davies, 3rd Edition, Springer Verlag, New York, Inc.	2001
4	Fourier Transform and its Applications, Ronald N Bracewell, 2nd Edition, McGraw Hill Inc., US	1996
5	Operations Research, Ravindran, Phillips, and Solberg, 2nd edition, John Wiley & sons.	2000
6	Operations Research by Hamady Taha, 8th edition	2012
7	Engineering Optimization, S S Rao, 3rd Edition, New Age.	2000
8	Engineering Optimization", Ranjan, Ganguli, University Press.	2009

Course Name	**:**	**NUMERICAL METHODS AND FOURIER TRANSFORMS**
Course Code	**:**	**EMR 1002**
Credits	**:**	**03**
L T P	**:**	**2-1-0**

Course Objectives:
At the end of this course, the student should be able to 1.describe errors involved in computations and to estimate these errors. The students should be able to apply numerical methods to interpolate, extrapolate, differentiate and integrate functions. They should be able to solve differential equation using numerical methods . 2.To make the students understand the concept of Fourier Transform and be able to compute it for standard examples

Total No. of Lectures –28

	Lecture wise breakup	Number of Lectures
1	ERRORS Errors in numerical calculations, Absolute, relative and percentage errors, Round off and truncation errors, Error propagation, Loss of significant digits.	2
2	INTERPOLATION Lagrange Interpolation, Finite differences, Newton's, Bessel's, difference formulae.	4
3	SOLUTION OF EQUATIONS Bisection method, Fixed point iteration and its convergence, Acceleration of convergence using Aitken's method; Regula-Falsi, Newton-Raphson, Generalized Newton's, Chebyshev's and Halley's methods.	7
4	NUMERICAL DIFFERENTIATION & INTEGRATION Differentiation using differences, Integration using Newton -cote's formulas with errors.	4
5	NUMERICAL METHODS FOR DIFFERENTIAL EQUATIONS Solution of first order differential equations using Taylor's series, Euler's, Picard's and Runge-Kutta method upto 4^{th} order, Predictor-Corrector methods (Adam's and Milne's method).	4
6	FOURIER TRANSFORM Fourier Integral as the limit of a Fourier series, Dirichlet conditions, Fourier Integral Theorem, Fourier sine and cosine integrals, Fourier transform and its inverse, Basic properties, Convolution Theorem, Parseval's relation, Dirac Delta Function and its Fourier transform, Fourier transform of partial derivatives, Fourier cosine and sine transforms and their inverse, Basic properties of Fourier cosine and sine transforms, Applications to Engineering problems.	07
	Course Outcomes:	
	At the end of this course, the students will be able to 1. describe errors involved in computations and to estimate these errors. 2.Solve algebraic and transcendental equations	

	3. apply numerical methods to interpolate, extrapolate, differentiate and integrate functions. 4. solve differential equation using numerical methods . 5.Solve differential equations by using Fourier Transforms	

Suggested Books:		
S.No	Name of Book/ Authors/ Publisher	Year of Publication/ Reprint
1	Advanced Engineering Mathematics, E. Kreyszig, John Wiley	2006
2	Numerical Methods for Mathematics, Science and Engineering, Mathews, Prentice Hall	1992
3	An Introduction to Numerical Analysis, Atkinson, John Wiley	2012
4	Advanced Engineering Mathematics, Wylie and Barret, McGraw Hill, 6th edition	1995
5	Integral Transforms and Their Applications, Loknath Debnath, CRC Press, Inc.	1995
6	Integral Transforms and Their Applications, Brain Davies, 3rd Edition, Springer Verlag, New York, Inc.	2001
7	Fourier Transform and its Applications, Ronald N Bracewell, 2nd Edition, McGraw Hill Inc., US	1996
8	Advanced Engineering Mathematics, Wylie and Barret, McGraw Hill, 6th edition	1995

Course Name	**:**	**NUMBER THEORY AND ALGEBRA**
Course Code	**:**	**EMR1003**
Credits	**:**	**03**
L T P	**:**	**2-1-0**

Total No. of Lectures– 28

Course Objectives:
The main objectives of this course are:

1. To make the students understand the fundamental properties of integers.
2. To make the students able to prove basic theorems and solve congruences.
3. To make the students understand the basic concepts of group theory.
4. To make the students able to understand the basic concepts related to rings, fields and finite fields..

Lecture wise breakup		**No. of Lectures**
NUMBER THEORY:		
1	**BASICS OF NUMBER THEORY:** Introduction, Divisibility, Greatest common divisor, The Euclidean algorithm, primes, Fundamental theorem of Arithmetic, Congruences, Residue classes and reduced residue classes,	05
2	**IMPORTANT THEOREMS:** Fermat's theorem, Euler's theorem, Wilson Theorem, Solution of congruences , congruences of degree1, Chinese Remainder theorem with applications. Euler's φ-function,	05
ALGEBRA:		
3	**FUNDAMENTALS OF GROUP THEORY:** Definition of a group, examples, some preliminary lemmas, Subgroups, Examples, Cosets, Order of a group, Lagrange's Theorem, Euler's Theorem, Normal subgroups and quotient groups, Homomorphisms	10
4	**RINGS AND FIELDS:** Definitions of a ring and a field, subfield, examples, finite fields, polynomial rings, structure of finite fields.	08

Course Outcomes:

By the end of the course, the students will be able to

1. Describe the fundamental properties of integers.
2. Prove basic theorems and solve congruences.
3. Apply fundamental concepts of group theory.
4. Use the basic concepts related to rings, fields and finite fields to solve engineering problems.

Suggested Books:		
Sr.No.	Name of Book / Authors / Publishers	**Year of Publication/ Edition**

1	“An introduction to theory of numbers”, Niven I., Zuckerman S. H. and Montgomary L. H., John Wiley and Sons.	1991
2	“Theory of Numbers”, Hardy and Wright W. H., Oxford University Press.	1979
3	“Topics in Algebra”, Herstein, I.N., Wiley Eastern Limited, New Delhi.	1981
4	“Coding Theory” San Ling and C Xing, Cambridge University Press	2004