Course
 code
MA482
Course Name
APPLIED LINEAR ALGEBRA
L-T-P -
3-0-0-3
Credits
Year of 
Introduction
2016
Prerequisite: NIL

Course Objectives
1. To visualize of vectors in n-space which is useful in representing data.
2. To learn handling of linear system of equations using matrix as a tool.
3. To introduce eigen values and eigen vectors which are significant in dynamic problems.
4. To introduce matrix decompositions methods that reduce a matrix into constituent parts which make it easier to calculate more complex matrix operations.

Syllabus:
Vector spaces, linear equations and matrices, linear transformation, Inner product, eigen values and eigen vectors, matrix decomposition.

Expected outcome:
The students will be able to apply
1. Theory of vector space in representing data.
2. Matrix operations in solving system of linear equations.

Text Books:

References:

<table>
<thead>
<tr>
<th>Module</th>
<th>Content</th>
<th>Hours</th>
<th>End Sem. Exam Marks %</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Vector Spaces: Vector Spaces, Subspaces- Definition and Examples, Linear independence of vectors, Bases and dimension, Linear Span, Field-Definition</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td>Vector space in R^n: System of linear equations, row space, Column space and null space. Four fundamental spaces, relation between rank and nullity, consistency theorem, basis from a spanning set and independent set:</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>III</td>
<td>Linear transformations: General linear transformation, Matrix of transformation, Kernel and range, properties, Isomorphism, change of basis, invariant subspace, Linear functional.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Inner Product: Real and complex inner product spaces, properties of inner product, length and distance, Cauchy-Schwarz inequality, Orthogonality, Orthogonal complement, Orthonormal bases, Gram Schmidt orthogonalization</td>
<td>8</td>
<td>15%</td>
</tr>
</tbody>
</table>

FIRST INTERNAL EXAMINATION

SECOND INTERNAL EXAMINATION
Eigens pace: Properties of Eigen values and Eigen vectors, Eigen values, Eigen vectors, minimal polynomial, Diagonalization, Orthogonal diagonalization, Jordan canonical form

Matrix Factorization: LU decomposition, QR Decomposition and singular value decomposition

END SEMESTER EXAMINATION

QUESTION PAPER PATTERN
(End semester examination)

Time: 3 hours                                  Maximum marks: 100

The question paper shall consist of Part A, Part B and Part C.

Part A shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

Part B shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

Part C shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks)
# Course: Operations Research

<table>
<thead>
<tr>
<th>Course code</th>
<th>Course Name</th>
<th>L-T-P -Credits</th>
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<tr>
<td>MA484</td>
<td>OPERATIONS RESEARCH</td>
<td>3-0-0-3</td>
<td>2016</td>
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**Prerequisite:** NIL

**Course Objectives:**
1. To understand the fundamentals of Operation Research
2. To acquire the knowledge in different Operation Research techniques

**Syllabus:**

**Expected Outcome**
Students will be able to
1. Solve different type LPP
2. Apply the concept of O.R in real life problems
3. Understand how to translate a real-world problem, given in words, into a mathematical formulation
4. Understand design and analysis of algorithms in network techniques and project management.

**Text Books:**
1. G Hadley, Linear programming, Narosa Publishing House, New Delhi, 2002

**References:**
3. R Panneerselvam, Operation Research, PHI, 2006

**Module** | **Syllabus** | **Hours** | **End Sem. Exam Marks**
---|---|---|---
I | Linear programming problem-Basic feasible solutions-Degeneracy dual Linear programming problems. Optimality conditions-The Simplex Method. Artificial Variables-Charnes’M method-Two phase Method. | 7 | 15%
II | Dual of Linear programming problems- Duality principle, The Primal-Duality solutions using Simplex Method. Revised Simplex method | 7 | 15%
FIRST INTERNAL EXAMINATION

<table>
<thead>
<tr>
<th>Module</th>
<th>Topics</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>III</td>
<td>Transportation problem - Formulation - Existence of solutions of Transportation problems - Solutions of Transportation problem - finding an initial basic solution - North west corner method - Least cost Method - Vogel’s Approximation Method - Test for optimality - Modi. Method - Unbalanced transportation problem in Transportation Problems – Transhipment model – Problem with sources and destination acting as transient nodes.</td>
<td>7</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Assignment Problem-Formation-Optimal Solution-Hungarian Assignment Method-Travelling salesman problem-sequencing problem-Basic terms used in sequencing-Processing n Jobs through Two Machines-Processing n Jobs through k machines-Processing 2 Jobs through k Machines.</td>
<td>7</td>
<td>15%</td>
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</table>

SECOND INTERNAL EXAMINATION

<table>
<thead>
<tr>
<th>Module</th>
<th>Topics</th>
<th>Marks</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Project management: Guidelines for network construction, Critical path method (CPM), Project evaluation and review technique (PERT), Network Techniques: Shortest path problem, Dijkstra’s Algorithm, Maximum flow problem, Minimum spanning tree problem, Prim algorithm.</td>
<td>7</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>The Recursive Equation approach- Characteristics of Dynamic programming-Dynamic programming Algorithm-Solution of Discrete D.P.P-Some applications-Solution of L.P.P by Dynamic Programming</td>
<td>7</td>
<td>20%</td>
</tr>
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END SEMESTER EXAMINATION

QUESTION PAPER PATTERN
(End Semester Examination)

Time: 3 hours  Maximum marks: 100

The question paper shall consist of Part A, Part B and Part C.

Part A shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

Part B shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

Part C shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).
Course code | Course Name | L-T-P - Credits | Year of Introduction
---|---|---|---
MA486 | ADVANCED NUMERICAL COMPUTATIONS | 3-0-0-3 | 2016

**Prerequisite: NIL**

**Course Objectives.**
1. To understand the role of approximation theory in engineering problems.
2. To familiarize various numerical methods for computation.
3. To understand the role of optimization in problem solving.

**Syllabus:**
Matrix Computations, Interpolation and approximation, Inner product and Norms, Nonlinear programming, Numerical Solution of Partial differential equations

**Expected outcome**
At the end of the course the student will be able to
(i) solve the linear system of equations
(ii) find the interpolation and approximations
(iii) apply various optimization methods in non linear programming
(iv) analyse the solution by finding the numerical solution of partial differential equations

**Text Books:**

**References:**

<table>
<thead>
<tr>
<th>Module</th>
<th>Syllabus</th>
<th>Hours</th>
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<tbody>
<tr>
<td>I</td>
<td><strong>Matrix Computations:</strong> Solving linear system: Factorization method, Relaxation method. Singular value decomposition, Matrix Eigen Value problem, Power method, Jacobi’s method.</td>
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<td>15%</td>
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<tr>
<td></td>
<td><strong>Inner product and Norms:</strong> Inner product spaces, properties of inner product, length, distance and norms, Matrix norms, Cauchy–Schwarz inequality, Orthogonality, Gram–Schmidt Process, Orthogonal projection.</td>
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<td>15%</td>
</tr>
<tr>
<td>I</td>
<td><strong>First Internal Examination</strong></td>
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<td></td>
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<tr>
<td>III</td>
<td><strong>Interpolation:</strong> Finite difference operators, interpolation using divided difference. Numerical differentiation: derivatives from difference table (finite difference and divided difference). Evaluation of double integrals Trapezoidal and Simpsons rule.</td>
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<td>15%</td>
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<tr>
<td>V</td>
<td><strong>Nonlinear programming (Contd.):</strong> Unconstrained optimization techniques: Direct search method: random search methods, Grid search method, Univariate method. Indirect search methods: Conjugate gradient method( Fletcher –Reeves method), Newton’s method, Marquardt method</td>
<td>7</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td><strong>Numerical Solution of PDE:</strong> Finite difference approximation of partial derivatives, classification of second order P.D.E. Solution of Elliptic equation-Laplace equation. and Poisson equation. Solution of parabolic equation-One dimensional heat equation (Crank Nicholson scheme). Solution of Hyperbolic equation-wave equation.(Method of finite differences)</td>
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<td>20%</td>
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**END SEMESTER EXAMINATION**

<table>
<thead>
<tr>
<th>Question Paper Pattern (End semester examination)</th>
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<tbody>
<tr>
<td><strong>Time:</strong> 3 hours</td>
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</table>

The question paper shall consist of Part A, Part B and Part C.

**Part A** shall consist of three questions of 15 marks each uniformly covering Modules I and II. The student has to answer any two questions (15×2=30 marks).

**Part B** shall consist of three questions of 15 marks each uniformly covering Modules III and IV. The student has to answer any two questions (15×2=30 marks).

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Course code: MA488
Course Name: Cryptography
L-T-P - Credits: 3-0-0-3
Year of Introduction: 2016
Prerequisite: NIL

Course Objective:
1. To understand the fundamentals of Cryptography
2. To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.


Expected Outcome:
Students will be able to
1. Learn standard algorithms used to provide confidentiality
2. Understand how secure encryption techniques work
3. Design security applications in the field of information technology.

Textbook:

References:
3. R. Lidl and H. Niederreiter, Introduction to finite fields and their applications, Cambridge University Press,

<table>
<thead>
<tr>
<th>Module</th>
<th>Syllabus</th>
<th>Hours</th>
<th>End Sem. Exam Marks</th>
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<tbody>
<tr>
<td>I</td>
<td><strong>Number Theory</strong>: Divisibility, The Division algorithm, Euclidean Algorithm, GCD, Extended Euclidean Algorithm, Primes and properties, Fundamental theorem of arithmetic (statement and proof), Modular arithmetic, Euler function, Congruence in one unknown, Solution of congruences, Modular inverse.</td>
<td>8</td>
<td>15%</td>
</tr>
<tr>
<td>II</td>
<td><strong>Algebra</strong>: Definition and examples of Groups, Rings and Fields and finite fields of the form (GF(p)) and (GF(2^n)), Euler’s theorem, Fermat’s little theorem, The Chinese remainder theorem.</td>
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<td>15%</td>
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</table>
# FIRST INTERNAL EXAMINATION

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<thead>
<tr>
<th>Module</th>
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</tr>
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<tbody>
<tr>
<td>III</td>
<td>Symmetric encryption: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, AES cipher, Multiple Encryption and Triple DES</td>
<td>6</td>
<td>15%</td>
</tr>
<tr>
<td>IV</td>
<td>Asymmetric encryption: The discrete logarithm problem, Diffie–Hellman key exchange, The Elgamal public key cryptosystem, Elliptic Curve Cryptography</td>
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# SECOND INTERNAL EXAMINATION

<table>
<thead>
<tr>
<th>Module</th>
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</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Integer Factorization and RSA: Euler’s formula and roots modulo pq, The RSA public key cryptosystem, Implementation and security issues, man-in-the-middle Attack, Primality testing, Miller–Rabin test, Pollard’ $p - 1$ factorization algorithm</td>
<td>8</td>
<td>20%</td>
</tr>
<tr>
<td>VI</td>
<td>Elliptic Curves: Elliptic curves over real numbers, Elliptic curve addition algorithm, Elliptic curves over finite fields, The group of an elliptic curve. The elliptic curve discrete logarithm problem, Elliptic curve cryptography, Elliptic Diffie–Hellman key exchange, Elliptic Elgamal public key cryptosystem</td>
<td>7</td>
<td>20%</td>
</tr>
</tbody>
</table>

# END SEMESTER EXAMINATION

**QUESTION PAPER PATTERN**

(End semester examination)

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**Part C** shall consist of three questions of 20 marks each uniformly covering Modules V and VI. The student has to answer any two questions (20×2=40 marks).