।। सा विद्या या विमुक्तये ।।
स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड
"ज्ञानतीर्थ" परिसर, विष्णुपूरी, नांदेड - ४३१६०६ (महाराष्ट्र)
SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED
"Dnyanteerth", Vishnupuri, Nanded - 431606 Maharashtra State (INDIA)
Established on 17th September 1994 – Recognized by the UGC U/s 2(f) and 12(B), NAAC Re-accredited with 'A' Grade
25 1994 - 2019 SILVER JUBILEE YEAR

ACADEMIC (1-BOARD OF STUDIES) SECTION

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विज्ञान व तंत्रज्ञान विद्याशाखेतील पदवी स्तरावरील द्वितीय वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०१९–२० पासून लागू करण्याबाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, **दिनांक ०८ जून २०१९ रोजी संपन्न झालेल्या ४४व्या मा. विद्या परिषद बैठकीतील ऐनवेळचा विषय क्र.११/४४–२०१९** च्या ठरावानुसार **प्रस्तुत विद्यापीठाच्या विज्ञान व तंत्रज्ञान विद्याशाखेतील** खालील विषयांचे अभ्यासक्रम शैक्षणिक वर्ष २०१९–२० पासून लागू करण्यात येत आहे.

1. B.E. – II Year – Mechanical Engineering
2. B.E. – II Year – Electrical Engineering
3. B.E. – II Year – Civil Engineering
4. B.E. – II Year – Computer Engineering

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेत–स्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी.

'ज्ञानतीर्थ' परिसर,
विष्णुपुरी, नांदेड – ४३१ ६०६.
जा.क्र.: शैक्षणिक–०१/परिपत्रक/विज्ञान व तंत्रज्ञान अभ्यासक्रम/२०१९–२०/**२४१**
दिनांक : २८.०६.२०१९.

स्वाक्षरित/–
उपकुलसचिव
शैक्षणिक (१–अभ्यासमंडळ) विभाग

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. कुलसचिव यांचे कार्यालय, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) मा. प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) उपकुलसचिव, पदव्युत्तर विभाग, प्रस्तुत विद्यापीठ.
५) साहाय्यक कुलसचिव, पात्रता विभाग, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ.

CURRICULUM FOR
UNDERGRADUATE DEGREE COURSE
IN
ENGINEERING &TECHNOLOGY
[2019-2020]

B. E. Second year (Computer Engineering)

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY

Nanded-431606, Maharashtra State, India

Semester –III **Branch /Course-Computer Engineering / B.E.**

Sr No	Category	Code	Course Title	Hours per Week				Marking Scheme					Total
				L	T	P	CR	PR	OR	TW	MSE	ESE	
1.	Engineering Science Courses	ESC 301	Analog Electronic Circuits	3	-	2	4	25#	-	25	30	70	150
2.	Professional Core Courses	PCC- CS 302	Data structure & Algorithms	3	1	2	4	25#	25@	25	30	70	175
3.	Engineering Science Courses	ESC 303	Digital Electronics	3	-	2	4	25#	-	25	30	70	150
4.	Professional Core Courses	PCC-CS 304	IT Workshop (Sci Lab/MATLAB)	2	-	4	4	25#	25@	50	-	-	100
5.	Professional Core Courses	PCC-CS 305	Discrete Mathematics	4	1	0	4	-	-	-	30	70	100
6.	Humanities and Social Sciences including	HSMC 306	Humanities-I (Effective Technical Communication)	2	-	2	3	-	25@	50	-	-	75
7.	Humanities and Social Sciences including Management	HSMC 307	Seminar-I	-	-	2	1	-	-	50	-	-	50
Total				**17**	**2**	**14**	**24**	**100**	**75**	**225**	**120**	**280**	**800**
Grand Total				**33**									

Symbols to remember: - ***@ - Internal Assessment, # - External Assessment, $ - Audit Pass, T – Theory , P- Practical, T – Tutorial , CR – Credit , PR/OR – Practical/Oral, MSE – Minor Semester Examination, ESE – End Semester.***

Semester –IV **Branch /Course-Computer Engineering / B.E.**

Sr No	Category	Code	Course Title	Hours per Week				Marking Scheme					Total
				L	T	P	CR	PR	OR	TW	MSE	ESE	
1.	Professional Core Courses	PCC-CS 401	Computer Organization	3	1	2	5	25#	-	25	30	70	150
2.	Professional Core Courses	PCC-CS402	Operating Systems	4	1	2	5	50#	25@	25	30	70	200
3.	Professional Core Courses	PCC-CS 403	Design $ Analysis of Algorithms	3	1	2	5	50#	25@	25	30	70	200
4.	Humanities and Social Sciences including Management Courses (Non-Credit)	HSMC 404	Management 1 (Organizational Behavior/ Finance & Accounting)	3	-	-	-	-	-	-	15	35	50
5.	Basic Science Courses	BSC-405	Mathematics-III (differential Calculus)	3	-	-	3	-	-	-	30	70	100
6.	Mandatory Courses(Non-Credit)	MC 406	Environmental Sciences	2	-	-	-	-	-	-	15	35	50
7.	Humanities and Social Sciences including Management Courses	HSMC 407	Interpersonal Skills and Personality development	-	-	2	1	-	-	50	-	-	50
Total				**18**	**3**	**8**	19	**125**	**50**	**125**	**150**	**350**	**800**
Grand Total				**29**									

Symbols to remember: - ***@ - Internal Assessment, # - External Assessment, $ - Audit Pass, T – Theory , P- Practical, T – Tutorial , CR – Credit , PR/OR – Practical/Oral, MSE – Minor Semester Examination, ESE – End Semester.***

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SEMESTER III

ESC 301 Analog Electronics Circuits

Teaching Scheme:

Category	Code	Course Title	Hours per Week				Marking Scheme				
			L	T	P	CR	PR	OR	TW	MSE	ESE
Engineering Science Courses	ESC 301	Analog Electronic Circuits	3	0	2	4	25#	0	25	30	70

Course Objectives:

1. The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the electronics devices.
2. Know broadly the concepts and functionalities of the electronic devices and switches.
3. Understand use, general specifications and deploy abilities of the analog electronic devices, and assemblies.
4. Confidence in handling and usage of analog electronic devices, tools and instruments in engineering applications.

Course Contents:

Module 1: Diode circuits – (4 lectures)

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits.

Module 2: BJT circuits – (4 lectures)

Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits.

Module 3: MOSFET circuits – (6 lectures)

MOSFET structure and I-V characteristics. MOSFET's as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers;

small signal equivalent circuits - gain, input and output impedances, trans conductance, high frequency equivalent circuit.

Module4: Differential, multi-stage and operational amplifiers – (5 lectures)

Differential amplifier; power amplifier; direct coupled multi-stage amplifier; internal structure of an operational amplifier, ideal op-amp, non-idealities in an op-amp (Output offset voltage, input bias current, input offset current, slew rate, gain bandwidth product).

Module 5: Filters (5 Lectures)

Types of filters, active and passive filters ,First order Low pass filter, first order high pass filter, Second order low pass and high pass filter with their equations. Band pass and band reject filter, narrow band filters.

Module 6: Linear applications of op-amp – (5 lectures)

Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift),analog to digital Conversion.

Module7: Nonlinear applications of op-amp- (5 lectures)

Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector.

Module 8: Negative Feedback amplifier- (6 lectures)

Feedback -principles of negative feedback, gain of negative feedback amplifier, advantages of negative feedback, types of negative feedback, input and output impedance of emitter follower.

List of Practical's:- (Any 12)

1. To build transistor based RC phase shift oscillator circuit, and measure and verify its frequency of operation.
2. Measurement of input and output offset voltage of 741 ICs.
3. To configure op-amp in voltage follower mode and to measure its slew rate.
4. To configure op-amp in inverting and non-inverting amplifier mode and measure their gain and bandwidth.
5. To prepare precision rectifier using op-amp and verify its operation using measurements.
6. To prepare full-wave rectifier using op-amp and verify its operation using measurements.
7. To measure PSRR and CMRR of given op-amp.
8. To design Schmitt trigger circuit using op-amp and take measurements.
9. To design, build as table and mono stable multi vibrators using 741 IC and verify their operation using measurements by observing waveforms.
10. To design, build and obtain the frequency responses of first order low pass and band pass active filters.

11. To build op-amp based Wein bridge oscillator circuit, and measure and verify its frequency of operation.
12. Design the following amplifiers:
    a. “A unity gain amplifier
    b. A non-inverting amplifier with a gain of ’A’
    c. An inverting amplifier with a gain of ‘A’ Apply a square wave of fixed amplitude and study the effect of slew rate on the three type of amplifiers”.
13. Design and test the integrator for a given time constant.
14. Design a second order butter-worth band-pass filter for the given higher and lower cut-off frequencies.
15. Design and test a notch filter to eliminate the 50Hz power line frequency.
16. Design and test a function generator that can generate square wave and triangular wave output for a given frequency.
17. Design and test voltage controlled oscillator for a given specification (voltage range and frequency range).
18. Design and test a Low Dropout regulator using op-amps for a given voltage regulation characteristic and compare the characteristics with standard IC available in market.
19. Design and test an AGC system for a given peak amplitude of sine-wave output.
20. Design and test a PLL to get locked to a given frequency ‘f’. Measure the locking range of the system and also measure the change in phase of the output signal as input frequency is varied within the lock range.

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Understand the characteristics of transistors.(BT-1)
2. Remembering and understanding the functioning of OP-AMP (BT-2)
3. Design and analyze various rectifier and amplifier circuits.(BT-4)
4. Design sinusoidal and non-sinusoidal oscillators. (BT-5)
5. Design OP-AMP based circuits.(BT-5)

Text Books:

- P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
- P.R. Gray, R. G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated
- Circuits”, John Wiley & Sons, 2001.
- Analog Electronics-Shinde P.S.

Reference Books:

- A.S. Sedra and K.C. Smith, “Microelectronic Circuits”, New York, Oxford UniversityPress, 1998.
- J.V. Wait, L.P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U.S., 1992.
- J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.

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SEMESTER III

Teaching Scheme:

Category	Code	Course Title	Hours per Week				Marking Scheme				
			L	T	P	CR	PR	OR	TW	MSE	ESE
Professional Core Courses	PCC- CS 302	Data structure & Algorithms	3	1	2	4	25#	25@	25	30	70

Course Objectives:

1. To understand the fundamentals of data structures and data representation.
2. To define high level of abstraction of various linear and nonlinear data structures.
3. To study the representation, implementation and application of linear data structure.
4. To study the representation, implementation and application of nonlinear data structure.
5. To study and understand different Sorting methods.
6. To understand the fundamentals hashing.

Course Contents:

Module 1: **(5 lectures)**

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Module 2: **(3 lectures)**

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Module 3: **(7 lectures)**

Stacks: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis.

Module 4: **(5 lectures)**

Queues: ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

Module 5: **(5 lectures)**

Linked Lists: Singly linked lists: Representation in memory, Algorithms of several operations:

Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

Module 6: (5 lectures)

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

Module 7: (3 lectures)

Sorting: Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort, Performance and Comparison among all the methods

Module 8: Hashing: (7 lectures)

Hashing, Hash function, Hash Tables, Static and perfect Hash function. Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

List of Practical's:- (Any 12)

1. Write a program which accept information about five student and display same information according to ascending order of their name.
2. Write a program to implement stack.
3. Write a program to convert infix expression into postfix expression.
4. Write a program to check balanced parentheses for a given infix expression.
5. Write a program to evaluate postfix expression.
6. Write a program to implement queue.
7. Write a program to implement circular queue
8. Write a program to implement link list with insert, delete, search, view, and delete function.
9. Write a program to implement ordered link list.
10. Write a program to implement Joseph problem.
11. Write a program to add two polynomials.
12. Write a program to create doubly link list.
13. Write a recursive program to find factorial and to print Fibonacci series.
14. Write a program for Hanoi Tower problem.
15. Write a program to implement tree with insert, delete and search function.
16. Write a program for in order, post order and preorder traversal of tree.
17. Write a program for binary search and sequential search.
18. Write a program for bubble sort and sequential search.
19. Write a program for insertion sort and quicksort.

20. Write a program for shortest path diagram.

Course Outcomes:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness. (BT1 and BT2)
2. For a given Search problem (Linear Search and Binary Search) student will able to implement it. (BT2 and BT3)
3. For a given problem of Stacks, Queues and linked list student will able to implement it and analyze the same to determine the time and computation complexity.(BT3 and BT4)
4. For a given problem of Queues student will able to implement it and analyze the same to determine the time and computation complexity. (BT4)
5. For a given problem of linked list student will able to implement it and analyze the same to determine the time and computation complexity. (BT4 and BT5)
6. Student will able to implement Tree and tree traversal algorithms and determine the time and computation complexity.
7. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, and Heap Sort and compare their performance in term of Space and Time complexity. (BT2 and BT3)
8. Student will able to implement Graph search and traversal algorithms and determine the time and computation complexity. (BT3)

Text Book:

1. “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.

Reference Books:

1. Algorithms, Data Structures, and Problem Solving with C++”, Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company “How to Solve it by Computer”, 2nd Impression by R.G. Dromey, Pearson Education.
2. “Fundamentals of Data Structures”, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, and Computer Science Press.
3. “Basics of Data structure and analysis of algorithm” -Bihade P.S

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SEMESTER III

Teaching Scheme:

Category	Code	Course Title	Hours per Week				Marking Scheme				
			L	T	P	CR	PR	OR	TW	MSE	ESE
Engineering Science Courses	ESC 303	Digital Electronics	3	0	2	4	25#	0	25	30	70

Course Objective:

1. To acquire the basic knowledge of digital logic level and applications of knowledge to understand digital electronics circuits.
2. Explain Concept and terminology of digital electronics.
3. Design the simple digital system based on the digital abstractions, using the digital paradigm, including discrete sampled information.
4. Communicate the purpose and result of a design project in written and oral presentations.
5. Describe the operation and timing constraints for latches and registers.

Course Contents:-

Module 1: Fundamentals of Digital Systems and logic families – (4 lectures)

Number systems - binary, signed binary, octal hexadecimal number, conversion of number systems. BCD Arithmetic - Addition, subtraction, binary arithmetic, one's and two's complements arithmetic, codes - binary to excess 3, binary to gray codes, gray to binary, error detecting and correcting codes.

Module 2: Digital signals, digital circuits – (4 lectures)

AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra design by using basic gates, design by using universal gates, examples of IC gates, , characteristics of digital ICs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri- state logic.

Module 3: Combinational Circuits – (5 lectures)

Standard representation for logic functions, K-map representation, and simplification of logic functions using K-map, minimization of logical functions. Don't care conditions, multiplexer, De-Multiplexer/Decoders.

Module 4: Digital Circuits (5 lectures)

Adders, Subtractor, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

Module 5: Sequential circuits and systems – (08 lectures)

A 1-bit memory, the circuit properties of bi-stable latch, the clocked SR flip flop, J- K-T and D types flip flops, applications of, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple (Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

Module 6: A/D and D/A Converters – (6 lectures)

Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, examples of D/A converter ICs, sample and hold circuit, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter, A/D converter using voltage o frequency and voltage to time conversion, specifications of A/D converters, example of A/D converter ICs.

Module 7: Semiconductor memories and Programmable logic devices. – (8 lectures)

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

List of Practical's:-. (Any 12)

1. Getting familiar with various digital integrated circuits of different logic families. Study of data sheet of these circuits and see how to test these circuits using Digital IC Tester.
2. Digital IC Testers and Logic State Analyzer as well as digital pattern generators should be demonstrated to the students.
3. Configure diodes and transistor as logic gates and Digital ICs for verification of truth table of logic gates.
4. Configuring NAND and NOR logic gates as universal gates.
5. Implementation of Boolean Logic Functions using logic gates and combinational circuits.
6. Measure digital logic gate specifications such as propagation delay, noise margin, fan in and fan out.
7. Study and configure of various digital circuits such as adder, substractor, decoder, encoder, code converters.

8. Study and configurations of multiplexer and demultiplexer circuits.
9. Study and configure of flip-flop, registers and counters using digital ICs. Design digital system using these circuits.
10. Perform an experiment which demonstrates function of 4 bit or 8 bit ALU.
11. Introduction to HDL. Use of HDL in simulation of digital circuits studied in previous sessions using integrated circuits. Illustrative examples using FPGA or CPLD boards.
12. Develop understanding of number systems and Boolean algebra.
13. Understand the functioning of logic gates, their implementation and verification of truth table.
14. Develop the understanding of the working of different combinational logic circuits.
15. Understand and verify the working of various sequential logic circuits.
16. Understand simulation tools for digital logic circuits and simulation of digital logic circuits.
17. Understand logic analyzer for testing the logic circuits.
18. Understand and verify the working of Various Types of D/A and A/D converters.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

1. Understand working of logic families and logic gates.(BT-2)
2. Design and implement Combinational and Sequential logic circuits.(BT-3)
3. Understand the process of Analog to Digital conversion and Digital to Analog conversion.(BT-3)
4. Be able to use PLDs to implement the given logical problem.(BT-4)
5. Work in a design team that can propose, design successfully implement and report on a digital system projects.(BT-4)

Text Book:

1. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
2. Combinational and Sequential Circuits -Syed S.D

Reference Books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

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SEMESTER III

Teaching Scheme:

Category	Code	Course Title	Hours per Week				Marking Scheme				
			L	T	P	CR	PR	OR	TW	MSE	ESE
Professional Core Courses	PCC-CS 304	IT Workshop (Sci Lab/MATLAB)	2	0	4	4	25#	25@	50	0	0

Course Objective:

The main objectives are:

1. Understanding the MATLAB environment
2. Being able to do simple calculations using MATLAB
3. Being able to carry out simple numerical computations and analyses using MATLAB

Course Contents:-

Module 1: Introduction to MATLAB Programming: - **(4 lectures)**

Basics of MATLAB programming, Array operations in MATLAB, Loops and execution control, Working with files: Scripts and Functions, Plotting and program output. Approximations and Errors-Defining errors and precision in numerical methods, Truncation and round-off errors, Error propagation, Global and local truncation errors.

Module 2:- Numerical Differentiation and Integration: - **(5 lectures)**

Numerical Differentiation in single variable, Numerical differentiation: Higher derivatives, Differentiation in multiple variables, Newton-Cotes integration formulae, Multi-step application of Trapezoidal rule, MATLAB functions for integration, Linear Equations-Linear algebra in MATLAB, Gauss Elimination, LU decomposition and partial pivoting, Iterative methods: Gauss Siedel, Special Matrices: Tri-diagonal matrix algorithm, Nonlinear Equations:- Nonlinear equations in single variable, MATLAB function fzero in single variable, Fixed-point iteration in single variable, Newton-Raphson in single variable, MATLAB function fsolve in single and multiple variables, Newton-Raphson in multiple variables, Regression and Interpolation- Introduction, Linear least squares regression(including lsqcurvefit function), Functional and nonlinear regression (including lsqnonlin function), Interpolation in MATLAB using spline and pchip.