



University of Engineering & Management, Kolkata
University of Engineering & Management, Jaipur
Institute of Engineering & Management, Kolkata
Department of Computer Science

DETAILED SYLLABUS

Batch: 2024-2028

Semester III (Second year) Curriculum								
Sl. No	Type of course	Course Code	Course Name	Hours per week				Credit Points
				Lecture	Tutorial	Practical	Sessional	
Theory Papers								
1	Engineering Science Course	ESC301	Analog Electronic Circuits	3	0	0	0	3
2	Engineering Science Course	ESC302	Digital Electronics	3	0	0	0	3
3	Professional Core Course	PCCCS301	Data structure & Algorithms	3	0	0	0	3
4	Professional Core Course	PCCCS372	IT Workshop (MATLAB)	3	0	0	0	3
5	Basic Science course	BSM301	Mathematics - III	3	0	0	0	3

6	Humanities & Social Sciences including Management course	HSMCS301	Humanities - I (Principles of Management)	3	0	0	0	3
7	Humanities & Social Sciences including Management course	ESP301	Essential Studies for Professionals - III	2	0	0	0	0.5
Total				20	0	0	0	18.5
Practical Papers								
1	Engineering Science Course	ESC391	Analog Electronic Circuits Laboratory	0	0	4	0	2
2	Professional Core Course	PCCCS391	Data Structure & Algorithms Laboratory	0	0	4	0	2
3	Engineering Science Course	ESC392	Digital Electronics Laboratory	0	0	4	0	2
Total				0	0	12	0	6
Sessional Papers								
1	Humanities & Social Sciences including Management course	SDP381	Skill Development for Professionals - III	0	0	0	2	0.5
2	Innovative Project	PRJCS381	Innovative Project – I	0	0	0	0	1
	Total			0	0	0	2	1.5
Mandatory Requirements								

Sl. No	Type of course	Course Code	Course Name	Hours per week				Score/Credit /Count
1	Co-curricular & Extra Curricular Activities	MAR	Mandatory Additional Requirements (Score)	-	-	-	-	-
2	Honours	MOOCs	Massive Open Online Course (Credit)	-	-	-	-	-
3	Certification	IFC	Industry and Foreign Certification (Count)	-	-	-	-	-
Total				20	0	12	2	26



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DETAILED SYLLABUS

Course Code- ESC301

Course Title – Analog Electronic Circuits

Credit – 3

Category – Engineering Science Course

Semester – III

L:T:P:S – 3:0:0:0

Pre-requisite – Basic Electronics

Course Outcomes:

CO1	Design and analyze various rectifiers, amplifier circuits and oscillators.
CO2	Understand the characteristics and applications of transistors.
CO3	Understand the functioning of OP-AMP and design OP-AMP based circuits.
CO4	Understand the concept of Multivibrator and timer.

<u>Study Material</u>	<u>Coursera1</u> <u>Coursera2</u> <u>Coursera3</u>	<u>NPTEL</u>	<u>Linkedin Learning</u>	<u>InfosysSpringboard1</u> <u>InfosysSpringboard2</u> <u>InfosysSpringboard3</u>
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Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments	Textbook Mapping
1	1. Rectifiers, Filters and Regulators	Introduction to full-wave and half-wave rectifiers. Capacitor filter. Inductor filter, LC and π -section filter. Series and Shunt voltage regulator, percentage regulation. Regulator ICs 78xx and 79xx series. Introduction to SMPS.	International Academia: (https://explorecourses.stanford.edu/search?q=EE101A) (https://explorecourses.stanford.edu/search?q=EE101B) (https://ocw.mit.edu/courses/6-101-introductory-analog-electronics-laboratory-spring-2007/pages/syllabus/) AICTE-prescribed syllabus:	4	Simulation of full-wave and half-wave rectifiers with and without filter using LT-SPIICE software to study of Ripple and Regulation characteristics.	Boylestad & Nashelsky (11th edition) Chapter: 15

			https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: <i>LT-SPICE software, LabView, Proteus.</i> Hardware Chipset: <i>IN4001/4007, 7815, 7915.</i>			
	2. Transistor Biasing and Stability of Q-point	Introduction to transistor biasing, Q point selection, Diode Compensation. Bias stabilization and stability factors. h-parameter model of transistors. Analysis of transistor amplifiers, expression for voltage gain, current gain, input and output impedance. Design of transistor amplifier. High frequency model of transistor, short circuit current gain and β cut off frequency.	International Academia: https://explorecourses.stanford.edu/search?q=EE101A https://explorecourses.stanford.edu/search?q=EE101B https://ocw.mit.edu/courses/6-101-introductory-analog-electronics-laboratory-spring-2007/pages/syllabus/ AICTE-prescribed syllabus:	6	Simulation of transistor circuit with self bias using LT-SPICE software to study parameters of Q-point. Simulation of transistor amplifier with potential divider bias using LT-SPICE software to study output voltage and gain for an input signal.	Boylestad & Nashelsky (11th edition) Chapters: 4 and 5

			https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: <i>LT-SPICE software, LabView, Proteus.</i> Hardware Chipset: <i>BC547, SL100</i>			
2	1. RC coupled amplifier and Tuned amplifier	Introduction to RC coupled amplifier, equivalent circuit, analysis of R C coupled amplifier for voltage and current gains, input and output impedances at three frequency ranges, frequency response characteristics, lower and upper cut off frequencies, bandwidth, and concept of wide band amplifier.	International Academia: https://explorecourses.stanford.edu/search?q=EE101A https://explorecourses.stanford.edu/search?q=EE101B https://ocw.mit.edu/courses/6-101-introductory-analog-electronics-laboratory-spring-2007/pages/syllabus/ AICTE-prescribed syllabus:	6	Simulation of two stages R-C coupled amplifier using LT- SPICE software to study of its gain and bandwidth.	Boylestad & Nashelsky (11th edition) Chapter: 9 Chattopadhyay and Rakshit Chapter: 9

			https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: <i>LT-SPICE software, LabView, Proteus.</i> Hardware Chipset: <i>SL 100, BC547.</i>			
	2. Feedback Amplifiers & Oscillators	Introduction to Feedback concept, negative & positive feedback, voltage/current, series/shunt feedback topologies. Introduction to Oscillators, Barkhausen criterion, pole-zero concepts, Colpitts, Hartley, Phase shift, Wein	International Academia: (https://explorecourses.stanford.edu/search?q=EE101A) (https://explorecourses.stanford.edu/search?q=EE101B) (https://ocw.mit.edu/courses/6-101-	4	Simulation of Phase shift oscillator using OPAMP and LT-SPICE software to study frequency of oscillation by varying component values.	Chattopadhyay and Rakshit Chapters: 10 and 11

		bridge and crystal oscillators.	<u>introductory-analog-electronics-laboratory-spring-2007/pages/syllabus/</u> AICTE-prescribed syllabus: <u>https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf</u> Industry Mapping: LT-SPICE software, LabView, Proteus. Hardware Chipset: SL100, IC 741.			
3	1. Operational Amplifier	Introduction to operational amplifier, Ideal OP AMP, Differential Amplifier, Constant current source (current mirror etc.), level shifter, CMRR, Open & Closed loop circuits, importance of feedback loop (positive & negative), inverting & non inverting amplifiers, voltage follower/buffer circuit.	International Academia: <u>https://explorecourses.stanford.edu/search?q=EE101A</u> <u>https://explorecourses.stanford.edu/search?q=EE101B</u> <u>https://ocw.mit.edu/courses/6-101-</u>	6	Simulation of ADC using IC AD570, and using LT-SPICE software. Simulation of DAC using DAC 0808 and using LT-SPICE software.	R.A. Gayakwad Chapter: 3

			<u>introductory-analog-electronics-laboratory-spring-2007/pages/syllabus/</u> AICTE-prescribed syllabus: <u>https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_CE.pdf</u> Industry Mapping: LT-SPICE software, LabView, Proteus. Hardware Chipset: IC741, IC328.		Simulation of Inverting and Non Inverting Amplifier using Op-Amp and using LT-SPICE software.	
	2. Applications of Operational Amplifiers	Applications of Operational Amplifiers: adder, integrator & differentiator, comparator. Instrumentation Amplifier, Log & Anti-log amplifiers, Trans-conductance multiplier, Precision Rectifier, voltage to current and current to voltage	International Academia: <u>https://explorecourses.stanford.edu/search?q=EE101A</u> <u>https://explorecourses.stanford.edu/search?q=EE101B</u> <u>https://ocw.mit.edu/courses/6-101-introductory-</u>	6	Simulation of differentiator and integrator circuit using Op-Amp and using LT-SPICE software. Simulation of Logarithmic and Anti Logarithmic Amplifier circuit	R.A. Gayakwad Chapter: 6

		converter, free running oscillator.	<i>analog-electronics-laboratory-spring-2007/pages/syllabus/</i> AICTE-prescribed syllabus: <i>https://www.aicte-india.org/sites/default/files/Model Curriculum/Final ECE.pdf</i> Industry Mapping: <i>LT-SPICE software, LabView, Proteus.</i> Hardware Chipset: <i>IC741, IC328, Multiplier IC AD633, Logarithmic Multiplier IC TL441, Anti Logarithmic Amplifier ICL 8049.</i>		using IC TL441, ICL8049 and with LT-SPICE software.	
4	Multivibrator	Introduction to multivibrators, Monostable, Bistable, Astable multivibrators using transistor and op-	International Academia: <i>(https://explorecourses.stanford.edu/s</i>	4	Simulation of Monostable Multivibrator using IC555 and using LT SPICE	Chattopadhyay and Rakshit Chapter: 11

		amp; Monostable and astable operation using 555 timer.	earch?q=EE101A) earch?q=EE101B) (https://ocw.mit.edu/courses/6-101-introductory-analog-electronics-laboratory-spring-2007/pages/syllabus/) AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/Final_ECE.pdf Industry Mapping: <i>LT-SPICE software, LabView, Proteus.</i> Hardware Chipset: <i>IC555</i>		software. Simulation of Astable Multivibrator using IC555 and using LT SPICE software. Simulation of Schmitt trigger circuit using IC555 and using LT SPICE software.	
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Textbooks:

1. Boylestad, Robert L., and Louis Nashelsky. Electronic devices and circuit theory. Prentice Hall, 2012.
2. Electronics Fundamentals and Applications, D. Chattopadhyay and P. C. Rakshit.

3. Op-amps and Linear IC's, R.A. Gayakwad, PHI.

Reference books:

1. Microelectronic Circuit- Analysis & Design, Rashid, Cengage Learning.
2. Electronic Circuits: Discrete & Integrated, 3rd Edition, Schilling & Belove, Mc Graw Hill Company.
3. Electronic principles, 6th Edition, Malvino, Mc Graw Hill Company.
4. Operational Amplifier & Linear IC's, Bell, Oxford University Press.
5. 2000 Solved Problems in Electronics, Jimmie J. Cathey, Mc Graw Hill Inc.
6. Electronic Devices -System & Application, Robert Diffenderfer, Cengage Learning.
7. Op- Amps & Linear Integrated Circuits, Ravi Raj Dudeja & Mohan Dudeja, Umesh Publication

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	1	1	-	-	-	-	1	-	3
CO2	3	3	2	2	2	1	-	-	-	1	-	3
CO3	3	3	3	3	3	2	1	-	1	1	3	3
CO4	3	3	2	1	-	-	-	-	-	-	-	3

3: Strong correlation

2: Medium correlation

1: Weak correlation



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Department of Computer Science

DETAILED SYLLABUS

Course Code- ESC302

Course Title – Digital Electronics

Credit – 3

Category – Engineering Science Course

Semester – III

L:T:P:S – 3:0:0:0

Pre-requisite – Fundamental concepts of Basic Electronics

Course Outcomes:

CO1	Students would be able to convert from one number system to another, work out and design problems related to Boolean algebra, minimization etc.
CO2	Have the ability to identify basic requirements for a design application and propose a cost-effective solution.
CO3	Have the ability to understand, analyse and design various combinational and sequential circuits.
CO4	Have the ability to understand, analyse and design various A/D and D/A conversion techniques.

<u>StudyMaterial</u>	<u>Coursera</u>	<u>NPTEL</u>	<u>InfosysSpringboard</u>
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Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments	Textbook Mapping
1	Introduction to Number System and Boolean Logic	Number System: [2L] Decimal, binary, octal, hexadecimal number system and conversion. Binary weighted codes: BCD, Excess-3, Gray codes and their conversions, ASCII, EBCDIC [2L]; Signed binary number representation with 1's and 2's complement methods, Binary arithmetic [1L]; Boolean algebra, Various properties (associative, distributive properties), DeMorgan's theorem, the realization of functions using logic gates [2L]; Representation in SOP and POS forms,	International Academia: 1. <u>https://ocw.mit.edu/courses/6-111/introductory-digital-systems-laboratory-spring-2006/</u> 2. <u>https://online.stanford.edu/courses/ee273-digital-systems-engineering</u> AICTE-prescribed syllabus: <u>https://www.aicte-india.org/sites/default</u>	12	Hardware Experiments (Experiments can be performed in 7400 series IC or 4000 series IC) Familiarity with basic gates ICs and Realization of NOT, AND, OR and XOR operations by using universal gates (both NAND and NOR) Design a logic circuit of	Text Book 1: Chapters: 1, 2 and 3

		[2L]; Minimization of logic expressions by KMAP (function with two, three, and four variables)[2L]; Quine-McCuskey Minimization Technique (Tabular Method) [1L].	<u>ult/files/Model Curriculum/AICTE%20-%20UG%20CSE.pdf</u> Industry Mapping: Proteus software for simulation <u>https://www.labcenter.com/</u>	function $F=A'B+C'D$ Design a circuit to indicate 4 bits odd and even numbers. Realization of a circuit to display prime and non-prime numbers (4 bit) Software Experiments Above mentioned experiments can be performed in an online simulation platform. Circuitverse (<u>https://circuitverse.org/simulator</u>) Design of basic digital circuits using Tinkercad.	
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					https://www.tinkerCAD.com/login?next=%2Fthings%2Fb91zk1E9SHy-bodacious-maimu-tumelo%2Fedit%3Ftenant%3Dcircuits	
					Proteus software for simulation	
					Logisim simulator platform	
2	Analysis & design of Combinational Logic	Combinational circuits - Adder and Subtractor circuits (half and full adder, half and full subtractor) [2L]; Design of Code converters, Encoder, Decoder, Magnitude Comparator, Multiplexer, De Multiplexer, Parity Generator, Parity Checker [10L].	International Academia: 1. https://ocw.mit.edu/courses/6-111/introductory-digital-systems-laboratory-spring-2006/ 2. https://online.stanford.edu/courses/ee273-digital	12	Hardware Experiments Familiarity with basic gates ICs and Realization of NOT, AND, OR and XOR operations by using universal gates (both NAND and NOR) Design a logic circuit of	Text Book 1: Chapters: 4 and 5 Text Book 2: Chapters: 5 and 6

			<u>systems engineering</u> AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf Industry Mapping: Proteus software for simulation https://www.labcenter.com/		function $F=A'B+C'D$ Design a circuit to indicate 4 bits odd and even numbers. Realization of a circuit to display prime and non-prime numbers (4 bit) Software Experiments Above mentioned experiments can be performed in an online simulation platform. Circuitverse (https://circuitverse.org/simulator) Design of basic digital circuits using Tinkercad.	
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					https://www.tinkerCAD.com/login?next=%2Fthings%2Fb91zk1E9SHy-bodacious-maimu-tumelo%2Feditel%3Ftenant%3Dcircuits)	
					Proteus software for simulation	
					Logisim simulator platform	
3	Sequential Logic Circuit	Sequential Circuits - Latch & Basic Flip-flops [1L]; Types of Flip-flops -SR, JK, D, T and JK Master slave Flip-flops[3L]; Finite State Machine: State equations, State table, State diagram[2L] Basic concept of Synchronous and Asynchronous counters, Up counter and down counter [2L]; Design of Mod N Counter [3L]; Ring counter, Johnson counter [1L]; Shift	International Academia: 1. https://ocw.mit.edu/courses/6-111/introductory-digital-systems-laboratory-spring-2006/ 2. https://online.stanford.edu/courses/ee273-digital	14	Hardware Experiments Design of R-S, J-K, D and T Flip flops using universal gates and also study master-slave J-K flip flop Design of synchronous and asynchronous counter	Text Book1: Chapters: 6 and 7 Text Book3: Chapters: 7 and 8

		Registers (SISO, SIPO, PIPO, PISO) [2L].	<u>systems engineering</u> AICTE-prescribed syllabus: <u>https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf</u> Industry Mapping: Proteus software for simulation <u>https://www.labcenter.com/</u>		Design of 4-bit shift register (SISO, SIPO, PIPO, PISO) Software Experiments Above mentioned experiments can be performed in an online simulation platform. Circuitverse (<u>https://circuitverse.org/simulator</u>) Design of basic digital circuits using Tinkercad. (<u>https://www.tinkercad.com/login?next=%2Fthings%2Fb91zk1E9SHy-bodacious-maimu-tumelo%2Fedit</u>)	
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					<u>l%3Ftenant%3Dcircuits)</u> Proteus software for simulation Logisim simulator platform	
4	Digital integrated circuits	Logic families- TTL, ECL, MOS, and CMOS - basic concepts; Logic levels, propagation delay time, power dissipation fan-out and fan-in, noise margin, logic families and their characteristics Basics of A/D and D/A converters.	<i>International Academia:</i> 1. <u>https://ocw.mit.edu/courses/6-111/introductory-digital-systems-laboratory-spring-2006/</u> 2. <u>https://online.stanford.edu/courses/ee273-digital-systems-engineering</u> <i>AICTE-prescribed syllabus:</i> <u>https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%</u>	2	Design of ADC and DAC using IC ADC AD570, DAC 0808 Design of ADC and DAC using TinkerCad	Text Book 3: Chapters: 4 and 13

			<u>20-%20UG%20CS</u> <u>E.pdf</u> Proteus software for simulation <u>https://www.labcenter.com/</u>			
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Textbooks:

1. Digital Logic and Computer Design, M. Morris Mano PHI, 1st Edition, ISBN 978-01-32-4510-7
2. Modern Digital Electronics, R.P.Jain 2/e , McGraw Hill
3. Digital Circuits and Design- S. Salivahanan, S. Arivazhagan, 5th Edition Oxford University Press.

Reference books:

4. Digital Systems Principles and Applications, Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Pearson Prentice Hall.
5. Digital Design, M. Morris Mano and Michael D. Ciletti, 4th Edition , PHI
6. Fundamental of Digital Circuits- A. ANAND KUMAR, PHI
7. D.Ray Chaudhuri- Digital Circuits-Vol-I & II, 2/e- Platinum Publishers
8. Leach & Malvino—Digital Principles & Application, 5/e, McGraw Hill
9. Floyed & Jain- Digital Fundamentals-Pearson
10. Digital Electronics, As per AICTE: Principles and Integrated Circuits



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Department of Computer Science

DETAILED SYLLABUS

Course Code- PCCCS301

Course Title – Data structure & Algorithms

Credit – 3

Category – Professional Core Course

Semester – III

L:T:P:S – 3:0:0:0

Pre-requisite – Introduction to Programming

Course Outcomes:

CO1	Students will be able to acquire and remember the knowledge of fundamental data structures.
CO2	Students will be able to implement any problem by writing their own algorithms.
CO3	Students will be able to analyze the algorithm for a given problem using different data structures.
CO4	Students will be able to learn various data structure approaches and techniques to develop and design projects.

<u>StudyMaterial</u>	<u>Coursera</u>	<u>NPTEL</u>	<u>LinkedIn Learning</u>	<u>InfosysSpringboard</u>
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Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments	Textbook Mapping
1	Introduction	Why do we need data structure? Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type Applications Algorithms and programs. The basic idea of pseudo-code. Algorithm efficiency and analysis. Time and space complexity analysis of algorithms – order notations.	International Academia: <u>https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/</u> AICTE-prescribed syllabus: <u>https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CS%20E.pdf</u> Industry Mapping: Various web-based and standalone compilers,	10	1) Write a Program to generate the Armstrong numbers from N to M. 2) Write a Program to print the following sequence of numbers: 0,1,1,2,3,5,8,13,21,34... 3) Twenty-five numbers are entered from the keyboard. Write a program to find out how many of them	1. Reema Thareja Chapter: 2 2. Debasis Samanta Chapter: 1 3. Aaron M. Tannenbaum Chapter: 1

			Programming practice in Hackerrank, Leetcode, GeeksforGeeks platform.		are positive, how many are negative, how many are even and how many odd. 4) WAP a program to check if a given string is palindrome or not (the user may choose an example string).	
2	Linear Data Structures	Array: Different representations – row-major, column-major [1L]; Sparse matrix - its implementation and usage [1L]; Array representation of polynomials [1L]; Linked List: Singly linked list, circular linked list, doubly linked list, linked list representation of polynomials and applications [2L]; Stack and Queue: Stack and its implementations (using array, using linked	International Academia: https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CS E.pdf	10	1) Write a program using array where we can find maximum and second maximum number. 2) Write a program to search the location of a given element in array and after searching delete that element from array.	1. Reema Thareja Chapters: 3, 6, 7 and 8 2. Debasis Samanta Chapters: 2, 3 and 4 3. Aaron M. Tannenbaum Chapters: 1, 2, 3 and 4

		list), applications (Infix to Postfix conversion, Evaluation of Postfix expression etc.) [2L]; Queue, circular queue, dequeue [1L]; Implementation of queue- both linear and circular (using array, using linked list), Applications [1L]; Recursion: Principles of recursion – use of the stack, differences between recursion and iteration, tail recursion. Applications - Tower of Hanoi [1L].	Industry Mapping: Various web-based and standalone compilers, Programming practice in Hackerrank, Leetcode, GeeksforGeeks platform.		3) Write a program to perform the push and pop operations in a stack. 4) Write a program for infix to postfix conversion using stack. 5) Write a program for performing the insert and delete operations in a queue. 6) Write a menu driven program for the following operation of a Singly Linked List. A) Insert a node at beginning B) Insert a node as per given position. C) Insert a node at	
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					the end of the linked list. D) Delete a node at beginning E) Delete a node as per given position. F) Delete a node at the last of the linked list. 7) Write a C program to concatenate two doubly linked lists. 8) Write a Program to implement the procedure of Tower of Hanoi using recursion. 9) You are given an array of size N. You can perform an operation in which you will remove the largest and the smallest	
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					elements from the array and you will add their difference at the end of the array. So, finally the array size will be decreased by 1 after each such operation. You are given Q tasks and, in each task, you are given an integer K. For each task, you have to print the sum of all the elements in the array after such k operations. 10) Suppose there is a circle. There are N petrol pumps on that circle. You will be given two sets of data. 1. The amount of petrol that every petrol	
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					pump has. 2. Distance from that petrol pump to the next petrol pump. Find a starting point where the truck can start to get through the complete circle without exhausting its petrol in between. Note: Assume for 1 litre petrol, the truck can go 1 unit of distance.	
3	Nonlinear Data structures	Trees: Basic terminologies, tree representation (using array, using linked list); Binary trees - binary tree traversal (pre-, in-, post-order), recursive and non-recursive traversal algorithms of binary tree, threaded binary tree (left, right, full), and expression tree; Binary search tree-operations (creation, insertion, deletion, searching); Height balanced binary tree –	International Academia: https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/ AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%	12	1) Write a Program to insert and delete a node from the BST. 2) Write a Program for Tree Traversal in Pre-order. 3) Write a Program for Tree Traversal in In-order.	1. Reema Thareja Chapters: 9 and 13 2. Debasis Samanta Chapters: 7 and 8 3. Aaron M. Tannenbaum

		AVL tree (insertion, deletion with examples only); B- Trees – operations (insertion, deletion with examples only); B+ Trees – operations (insertion, deletion with examples only) [1L]; Graphs: Graph definitions and concepts (directed/undirected graph, weighted/un-weighted edges, subgraph, degree, cut vertex/articulation point, pendant node, clique, complete graph, connected components – strongly connected component, weakly connected component, path, shortest path, and isomorphism); Graph representations / storage implementations – adjacency matrix, adjacency list, adjacency multi-list; Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, backedge, cross	<u>20-%20UG%20CS E.pdf</u> Industry Mapping: Various web-based and standalone compilers, Programming practice in Hackerrank, Leetcode, GeeksforGeeks platform.		4) Write a Program to implement the Tree Traversal in Post-order. 5) Write a Program to implement the BFS procedure. 6) Write a Program to implement the DFS procedure. 7) Robert lives in a town. He has made some crafts and want to make some money out of it. So he decides to visit every city on the state and sell his crafts. Now there are multiple routes to visit every city in that state and each route has different	Chapters: 5 and 8
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		edge, forward-edge); applications. Minimal spanning tree – Prim's algorithm, Kruskal's algorithm (basic idea of greedy methods).			travel fares. Robert knows all the routes and the travel fares. Help Robert to identify a route where he can spend less money while going to each city and returning home. Take the User Input Format as following: N = no of cities in the state fare[][] = 2D matrix showing the fares for each route.	
4	Searching and Sorting	Sorting Algorithms: Bubble sort, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap, application – priority queue), radix sort; Time and space complexity derivations; Searching: Sequential search, binary search,	International Academia: https://ocw.mit.edu/courses/6-851-advanced-data-structures-spring-2012/ AICTE-prescribed syllabus:	4	1) You are given a list of n-1 integers in the range from 1 to n. There are no duplicates in the list. One of the integers from 1 to n is missing in the list. Write a program in C	1. Reema Thareja Chapters: 14 and 15 2. Debasis Samanta Chapters: 6 and 10 3. Aaron

		interpolation search. Time and space complexity derivations. Hashing: Hashing functions, collision resolution techniques.	https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CSE.pdf Industry Mapping: Various web-based and standalone compilers, Programming practice in Hackerrank, Leetcode, GeeksforGeeks platform.		to find the missing integers. Note the user input format as: p = size of array a = enter the array elements. 2) A class has “n” number of students. They are standing in a queue and not roll number wise. Write a program in C to let them enter the classroom in a Sorted Manner based on their roll number (in ascending order). Note the User input format as: n = number of students in the queue. a = enter their roll numbers in the array as they are standing (random order).	M. Tannenbaum Chapters: 6 and 7
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Textbooks:

1. Classic Data Structures by Debasis Samanta.
2. Data Structures using C by Aaron M. Tanenbaum.
3. Data Structures using C by Reema Thareja.

Reference books:

1. Data Structures, by Mark Allan Weiss.
2. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.
3. Data Structures - Schaum – ASE by Seymour Lipschutz.



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Department of Computer Science

DETAILED SYLLABUS

Course Code- PCCCS372

Course Title – IT Workshop (MATLAB)

Credit – 3

Category – Professional Core Course

Semester – III

L:T:P:S – 3:0:0:0

Pre-requisite – Basic Mathematics

Course Outcomes:

CO1	Students would be able to understand basic commands, syntax and mathematical operation in MATLAB.
CO2	Students would be able to solve different mathematical problems using matrix operations in MATLAB.
CO3	Students would be able to develop script and function by using complex programming concepts i.e. decision making, looping etc.
CO4	Students would be able to learn data visualization and GUI development in MATLAB.

<u>Study Material</u>	<u>Coursera</u>	<u>NPTEL</u>	<u>LinkedIn Learning</u>	<u>InfosysSpringboard</u>
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Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments	Textbook Mapping
1	Introduction to MATLAB	Introduction, Why MATLAB? History, its strengths, Competitors, Starting MATLAB, Using MATLAB as a calculator, Quitting MATLAB Basics commands in MATLAB, Basic Operations, MATLAB-Data types, Rules about variable names, Predefined variables etc.	International Academia: <u>https://ocw.mit.edu/courses/6-057-introduction-to-matlab-january-iap-2019/pages/syllabus/</u> <u>https://stanford.edu/class/cme192/index.html</u> AICTE-prescribed syllabus: <u>https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%</u>	4	• Create One Account in MATLAB Online and Sign In (Use Institutional email e.g. <u>abc@iem.edu.in</u>) Link: <u>https://in.mathworks.com/products/matlab-online.html</u> • Explore MATLAB Layout • Using MATLAB as a Basic Calculator • Variables: create, view,	MATLAB Programming for Engineers, 6E Author(s): Stephen J. Chapman Chapter: 1

			20-%20UG%20CS E.pdf <i>Industry Mapping:</i> https://matlabacademy.mathworks.com/details/matlab-fundamentals/mlbe		edit, and display • Predefined Variables • Keywords • Operators • Execute Basic Commands: clc, clear all, clear , close all, quit, help version, who, whos, date, delete, cd, dir, save, load	
2	Vector, Matrix, Array, Cell and String Operations	Vector, Matrix, Array Addressing, Built-in functions, Mathematical Operations, Dealing with strings (Array of characters), Array of array (cell) concept.	<i>International Academia:</i> https://ocw.mit.edu/courses/6-057-introduction-to-matlab-january-iap-2019/pages/syllabus/ https://stanford.edu/class/cme192/index.html <i>AICTE-prescribed syllabus:</i> https://www.aicte-india.org/sites/default/files/Model_Cu	8	• User Input: Numeric & String • Vector: create and display • Matrix: create, concatenate, indexing in a matrix (insert, update, and delete), arithmetic operations (addition, subtraction, multiplication, and division) on matrix • String: create, display,	MATLAB Programming for Engineers, 6E Author(s): Stephen J. Chapman Chapters: 2, 9 and 10

			rriculum/AICTE%20-%20UG%20CS E.pdf Industry Mapping: https://matlabacademy.mathworks.com/details/matlab-fundamentals/mlbe		concatenation, finding length, and string operations (uppercase, lowercase, split, join, unique) • Cell Array: create, indexing in cell array (insert, update, and delete), conversion from cell to matrix	
3	Script, Function, and Debugging	Script file, Input commands, Output commands, Structure of function file, Inline functions, feval command, Comparison between script file and function file, Debugging scripts.	International Academia: https://ocw.mit.edu/courses/6-057-introduction-to-matlab-january-iap-2019/pages/syllabus/ https://stanford.edu/class/cme192/index.html AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default	6	• Script: explore script editor, create and execute a script, include multiple sections in a script, and execute separately • Function: create and call a function, inline function, feval command • Debugging: Debug a MATLAB script and mention all	MATLAB Programming for Engineers, 6E Author(s): Stephen J. Chapman Chapters: 1 and 6

			ult/files/Model Curriculum/AICTE%20-%20UG%20CS E.pdf <i>Industry Mapping:</i> https://matlabacademy.mathworks.com/details/matlab-fundamentals/mlbe		the necessary steps	
4	Complex programming and working with dataset	Conditional statements and Loop, Relational and Logical Operators, if-else statements, switch-case statements, for loop, while loop, Special commands (break and continue), Table, import data from a large database, Export data to own file or database.	<i>International Academia:</i> https://ocw.mit.edu/courses/6-057-introduction-to-matlab-january-iap-2019/pages/syllabus/ https://stanford.edu/class/cme192/index.html <i>AICTE-prescribed syllabus:</i> https://www.aicte-india.org/sites/default/files/Model Curriculum/AICTE%20-%20UG%20CS E.pdf	6	• Problems to explore conditional statements • Problems to explore iteration • Problems to explore recursion • Table: create, insert, and delete a column, display and join two tables • Import & Export Files: – Import from a spreadsheet – Export to a spreadsheet – Import from a text file	MATLAB Programming for Engineers, 6E Author(s): Stephen J. Chapman Chapters: 4 and 5

			<u>20-%20UG%20CS E.pdf</u> <i>Industry Mapping:</i> <u>https://matlabacademy.mathworks.com/details/matlab-fundamentals/mlbe</u>		– Export to a text file	
5	Data Visualization using MATLAB	2D Plotting: In-built functions for plotting, Multiple plotting with special graphics, Curve fitting, Interpolation, Basic fitting interface. 3D Plotting: Use of meshgrid function, Mesh plot, Surface plot, Plots with special graphics.	<i>International Academia:</i> <u>https://ocw.mit.edu/courses/6-057-introduction-to-matlab-january-iap-2019/pages/syllabus/</u> <u>https://stanford.edu/class/cme192/index.html</u> <i>AICTE-prescribed syllabus:</i> <u>https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CS E.pdf</u> <i>Industry Mapping:</i>	6	• 2D Plots: – Line plot-multiple lines, line style, color, marker, axis, title, marker – Subplot-changing row and column – Bar plot-categorical, ordering categorical, stacked, color, horizontal – Pie chart-explode, label, legend, color – Histogram plot – Rader plot • Polynomial & Curve Fitting: polyval, polyint, polyfit	MATLAB Programming for Engineers, 6E Author(s): Stephen J. Chapman Chapters: 3 and 8

			https://matlabacademy.mathworks.com/details/matlab-fundamentals/mlbe		• 3D Plots: mesh plot, surface plot, quiver plot	
6	Graphical User Interface Design	GUI in MATLAB, App designer, Component library (Edit Field, Text Area, Label, Button, Check Box, Drop Down, List Box, Button Group, Slider, Spinner etc.), Containers (Panel, Tab Group), Instrumentation, Component browser, Design view and code view, Call back function, Exporting App.	International Academia: https://ocw.mit.edu/courses/6-057-introduction-to-matlab-january-iap-2019/pages/syllabus/ https://stanford.edu/class/cme192/index.html AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Model_Curriculum/AICTE%20-%20UG%20CS E.pdf Industry Mapping: https://matlabacademy.mathworks.com	6	• Components and callbacks – Create a simple calculator app – Create an app for student registration data entry using different form components • Containers and instrumentation – Create an app to display the output in a gauge where input is given by a knob. – Create an app to control light with a switch MATLAB Project Ideas: https://in.mathworks.com/academia/students/project-ideas.html	MATLAB Programming for Engineers, 6E Author(s): Stephen J. Chapman Chapter: 14

			<u>m/details/matlab-fundamentals/mlbe</u>			
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Textbooks:

1. “MATLAB Programming for Engineers (6e)” by Stephen J. Chapman

Reference books:

1. “MATLAB: Easy Way of Learning” by S. Swapna Kumar and S. V. B. Lenina
2. “MATLAB for Beginners: A Gentle Approach” by Peter Issa Kattan
3. “Get Started with MATLAB (7e)” by Rudra Pratap
4. “A Guide to MATLAB for Beginners and Experienced Users (3e)” by Brian R. Hunt, Ronald L.Lipsman, Jonathan M. Rosenberg



University of Engineering & Management, Kolkata
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Institute of Engineering & Management, Kolkata
Department of Computer Science

DETAILED SYLLABUS

Course Code- BSM301

Course Title – Mathematics - III

Credit – 3

Category – Professional Core Course

Semester – III

L:T:P:S – 3:0:0:0

Pre-requisite – Permutation & Combination, Concept of Basic Probability, Evaluation of definite, improper and infinite integrals, Concept of β & Γ functions.

Course Outcomes:

CO1	Illustrate the ideas of probability and random variables, various discrete and continuous probability distributions with their properties and their applications in physical and engineering environment that will make a bridge between elementary statistical tools and probability theory.
CO2	Find the inter-relation between two or more phenomena with the help of curve fitting.

CO3	Understand the basic components of sampling and have the knowledge on exact sampling distributions which are essential for estimating and testing hypothetical statements. Know the various sampling methodologies and their efficiencies in theoretical and practical aspects.
CO4	Estimate and test the parameters associated with the relevant areas for forecasting and verification of economic theory.
CO5	Apply the statistical tools in business, economical and commercial areas for analyzing problems and to make better decisions for future in their fields.

StudyMaterial	Coursera	NPTEL	LinkedIn Learning	InfosysSpringboard
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Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments	Textbook Mapping
1	Random Variables and Probability Distributions	Discrete Random Variable: Discrete Probability Distribution, Expectation and Variance of random variables; Binomial and Poisson Distributions; Mean, Variance and Moment Generating Functions of Binomial and Poisson Variates; Convergence of Binomial to Poisson Variate. Continuous Random Variable;	<i>International Academia:</i> https://drive.google.com/drive/folders/19umgy3stib1-wuHy0h-p0arM0NkIzdxC	12	"R" software for statistical computing	Text Book 1: Chapters: 2 and 3 Text Book 2: Chapter: 12

		Continuous Probability Distributions, Expectation and Variance of random variables, Exponential, Normal Distributions; Mean, Variance and Moment Generating Functions of the corresponding variates.				
2	Method of Least Squares and Curve Fitting	Principle of Least Squares, Curve fitting by the method of Least Squares - fitting of straight lines, second degree parabolas and exponential curves.	<i>International Academia:</i> https://drive.google.com/drive/folders/19umqy3stib1-wuHy0h-p0arM0NkIzdxC	4	"stata": statistical software for data science	Text Book 1: Chapter: 9 Text Book 2: Chapter: 8
3	Sampling and Sampling Distributions	Population and Sample, Sampling With and Without Replacement (SRSWR and SRSWOR); Random Samples, Population Parameters, Sample Statistics, Sampling Distributions, Standard Error and Probable Error; Sample Mean, Sampling Distribution of Means; Sample Proportion,	<i>International Academia:</i> https://www.cl.cam.ac.uk/teaching/2021/IntroProb/materials.html	8	"stata": statistical software for data science	Text Book 1: Chapter: 11 Text Book 2: Chapter: 13

		Sampling Distribution of Proportions, Sample Variances, Sampling Distribution of Variances; Case where Population Variance is unknown; Central Limit Theorem (Statement only); Degrees of freedom, Chi-square distribution, Mean & Variance of Chi-square variate.				
4	Estimation of Parameters	Point and Interval estimations, Biased and Unbiased estimators, Minimum Variance Unbiased Estimator (MVUE), Consistent Estimator, Maximum Likelihood Estimation of Parameters, Applications in populations following theoretical distributions (Binomial, Poisson and Normal), Calculation of confidence limits for population mean and population proportions.	<i>International Academia:</i> https://ocw.mit.edu/courses/1-010-uncertainty-in-engineering-fall-2008/	4	"R" software for statistical computing	Text Book 1: Chapter: 12 Text Book 2: Chapter: 14
5	Testing of Hypothesis	Large Sample Test: Statistical Hypotheses, Test Statistic, Best Critical Region, Test for single mean, difference of means, single proportion, difference of proportions,	<i>International Academia:</i> https://ocw.mit.edu/courses/6-041-probabilistic-systems-analysis-	12	"R" software for statistical computing	Text Book 1: Chapter: 13 Text Book 2:

		and difference of standard deviations. Small Sample Test: Test for single mean, difference of means and correlation coefficients, Test for ratio of variances, Chi-square test for goodness of fit and independence of attributes.	<u>and-applied-probability-fall-2010/</u>			Chapter: 14
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Textbooks:

1. Saktipada Nanda and Sibashis Nanda, "A Course on Probability & Statistics", 2nd Edition (2024), Mindprobooks Academic Series [Available in flipkart.com/amazon.in]
2. N.G.Das, "Statistical Methods", Combined Edition Vol. 1 &2 (2017) McGraw Hill Education

Reference books:

1. Sheldon M. Ross, "Introduction to Probability and Statistics for Engineers and Scientists", 6th Edition (2020), Academic
2. Douglas C, Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, 7th edition (2018), John Wiley & Sons.
3. Murray R. Spiegel, John J. Schiller and R. Alu Srinivasan, "Schaum's Outline of Probability & Statistics" , 4th Edition (2012), McGraw Hill Education.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	1	1	1	1	1	2	1
CO2	3	3	3	3	2	1	1	1	1	1	2	1
CO3	3	3	3	3	2	1	1	1	1	1	2	1
CO4	3	3	3	3	2	1	1	1	1	1	2	1
CO5	3	3	3	2	2	2	1	2	2	2	3	2

3: Strong correlation

2: Medium correlation

1: Weak correlation



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Department of Computer Science

DETAILED SYLLABUS

Course Code- HSMCS301

Course Title – Humanities - I (Principles of Management)

Credit – 3

Category – Humanities & Social Sciences including Management course

Semester – III

L:T:P:S – 3:0:0:0

Pre-requisite – Basic understanding of Communication.

Course Outcomes:

CO1	Students would gain a thorough grounding in the fundamentals of business management.
CO2	Enabled students to predict corrective business approach and educate detailed process to start up a venture.
CO3	Developed the ability of students to apply current trends in business for better performance.
CO4	The deeper understanding and evaluate the business environment and predict corrective business model for cost effective business performance.

<u>StudyMaterial</u>	<u>Coursera</u>	<u>NPTEL</u>	<u>LinkedIn Learning</u>	<u>InfosysSpringboard</u>
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Module No.	Topic	Sub-topics	Mapping with Industry and International Academia	Lecture Hours	Corresponding Lab Assignments	Textbook Mapping
1	Basic concepts of management	Definition–Essence, Functions, Roles, Level. Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organisation Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Organisational Effectiveness.	International Academia: <u>https://learn.saylor.org/course/BUS208</u> AICTE-prescribed syllabus: <u>https://www.aicte-india.org/sites/default/files/Vol.%20IUG.pdf</u> Industry Mapping: <u>https://www.forbes.com/advisor/business/software/best-erp-systems/</u>	7	Mostly ERP Software: <u>https://www.forbes.com/advisor/business/software/best-erp-systems/</u>	Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP). Chapters: 1 and 2
2	Management and Society	Concept, External Environment, CSR, Corporate Governance, Ethical Standards. People Management – Overview,	International Academia: <u>https://learn.saylor.org/course/BUS208</u>	8	Mostly ERP Software: <u>https://www.forbes.com/advisor/business/software/best-erp-systems/</u>	Management: Principles, Processes & Practices – Bhat, A &

		Job design, Recruitment & Selection, Training & Development, Stress Management. Managerial Competencies – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship. Leadership: Concept, Nature, Styles	<i>AICTE-prescribed syllabus:</i> https://www.aicte-india.org/sites/default/files/Vol.%20IUG.pdf <i>Industry Mapping:</i> https://www.forbes.com/advisor/business/software/best-erp-systems/		/business/software/best-erp-systems/	Kumar, A (OUP). Chapters: 3 and 4
3	Decision making	Concept, Nature, Process, Tools & techniques. Economic, Financial & Quantitative Analysis – Production, Markets, National Income Accounting, Financial Function & Goals, Financial Statement & Ratio Analysis, Quantitative Methods – Statistical Inference, Forecasting, Regression Analysis, Statistical Quality Control.	<i>International Academia:</i> https://learn.saylor.org/course/BUS208 <i>AICTE-prescribed syllabus:</i> https://www.aicte-india.org/sites/default/files/Vol.%20IUG.pdf <i>Industry Mapping:</i> https://www.forbes.com/advisor/business/software/best-erp-systems/	15	Mostly ERP Software: https://www.forbes.com/advisor/business/software/best-erp-systems/	Essentials for Management – Koontz, Revised edition, Tata McGraw Hill (TMH) Chapters: 7, 8 and 9

4	Customer Management	Market Planning & Research, Marketing Mix, Advertising & Brand Management. Operations & Technology Management – Production & Operations Management, Logistics & Supply Chain Management, TQM, Kaizen & Six Sigma, MIS.	International Academia: https://learn.saylor.org/course/BUS208 AICTE-prescribed syllabus: https://www.aicte-india.org/sites/default/files/Vol.%20IUG.pdf Industry Mapping: https://www.forbes.com/advisor/business/software/best-erp-systems/	10	Mostly ERP Software:	https://www.forbes.com/advisor/business/software/best-erp-systems/ Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP). Chapters: 11, 12 and 13
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Textbooks:

Management: Principles, Processes & Practices – Bhat, A & Kumar, A (OUP).

Reference books:

1. Essentials for Management – Koontz, Revised edition, Tata McGraw Hill (TMH)
2. Management – Stoner, James A. F. (Pearson)
3. Management - Ghuman, Tata McGraw Hill(TMH)