GOVT. COLLEGE OF ENGINEERING AMRAVATI

B. TECH. (Information Technology)

Second, Third, Final Year Curriculum

Department of Information Technology

2021-22

Semester I

Member Secretary
(Prof. D.R. Uike)

Chairman, BoS
(Prof. A.W. Bhade)

Principal
(Prof. A.M. Mahalle)

Teaching Scheme							Evaluation Scheme						
Category	**Course Code**	**Course Title**	**Theory**	**Tutorial**	**Practical**		**Theory**			**Practical**		**Total**	**Credits**
			Hrs/week	**Hrs/week**	**Hrs/week**	**Total**	**MSE**	**TA**	**ESE**	**ICA**	**ESE**		
MC	SHU100	Induction Program	Two weeks mandatory audit course										0
BSC	SHU121	Physics	3	1	---	4	30	10	60	---	---	100	4
BSC	SHU122	Calculus and Linear Algebra	3	1	---	4	30	10	60	---	---	100	4
ESC	EEU121	Basic Electrical Engineering	3	---	---	3	30	10	60	---	---	100	3
ESC	CEU121	Engineering Mechanics	3	---	---	3	30	10	60	---	---	100	3
HSMC	SHU123	English	2	---	---	2	---	---	60	---	---	60	2
BSC/LC	SHU124	Physics Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	EEU122	Basic Electrical Engg Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CEU122	Engineering Mechanics Lab	---	---	2	2	---	---	---	50	---	50	1
HSMC/LC	SHU125	English Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	MEU121	Workshop Practice I	---	---	2	2	---	---	---	50	---	50	1
		Total	14	2	10	26	120	40	300	250	0	710	21

Semester II

Teaching Scheme							Evaluation Scheme						
Category	**Course Code**	**Course Title**	**Theory**	**Tutorial**	**Practical**		**Theory**			**Practical**		**Total**	**Credits**
			Hrs/week	**Hrs/week**	**Hrs/week**	**Total**	**MSE**	**TA**	**ESE**	**ICA**	**ESE**		
BSC	SHU221	Chemistry	4	--	---	4	30	10	60	---	---	100	4
BSC	SHU222	Integral calculus and Differential Equations	3	1	---	4	30	10	60	---	---	100	4
ESC	CSU221	Programming for Problem Solving	3	---	---	3	30	10	60	---	---	100	3
ESC	MEU221	Engineering Graphics	2	---	---	2	30	10	60	---	---	100	2
ESC	MEU222/ ETU221	Basic Mechanical Engineering/ Basic Electronics Engineering	2	---	---	2	30	10	60	---	---	100	2
BSC/LC	SHU223	Chemistry Lab	---	---	2	2	---	---	---	50	---	50	1
ESC/LC	CSU222	Programming for Problem Solving Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU223	Engineering Graphics Lab	---	---	4	4	---	---	---	50	---	50	2
ESC/LC	MEU224	Workshop Practice II	---	---	2	2	---	---	---	50	---	50	1
		Total	14	1	12	27	150	50	300	200	0	700	21

TA: Teacher Assessment MSE: Mid Semester Examination ESE: End Semester Examination ICA: Internal Continuous Assessment

MSE Duration: 1.30 Hrs all courses

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Important Note:

MEU222 for only Electrical, Electronics & TC, Computer Science, Information Technology and Instrumentation Engineering branch

ETU221 for only Civil and Mechanical Engineering branch

In Semester I, the students of Civil, Mechanical, Electrical & Instrumentation Engineering shall be offered group A courses, and that of

Electronics & TC, Computer Science and Information Technology shall be offered group B courses. In Semester II, vice versa.

In addition following courses are offered

SHU122 and MEU121 for all students in Semester I. SHU222 and MEU224 for all students in Semester II.

There should be direct correspondence of group A and group B courses.

Sr. No.	**Group A Courses**		**Group B Courses**	
	Course Code	**Title of Course**	**Course Code**	**Title of Course**
1	SHU121	Physics	SHU221	Chemistry
2	EEU121	Basic Electrical Engineering	CSU221	Programming for Problem solving
3	CEU121	Engineering Mechanics	MEU221	Engineering Graphics
4	SHU123	English	SHU223	Chemistry Lab
5	SHU124	Physics Lab	CSU222	Programming for Problem solving Lab
6	EEU122	Basic Electrical Engineering Lab	MEU223	Engineering Graphics Lab
7	CEU122	Engineering Mechanics Lab		
8	SHU125	English Lab		

Category of Course	**Definition**	**Credits**
BSC	Basic Science Courses	**18**
ESC	Engineering Science Courses	**21**
HSMC	Humanities and Social Sciences including Mgt. Courses	**3**
	Total Credits	**42**

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GOVERNMENT COLLEGE OFENGINEERING, AMRAVTI
Department of Information Technology
Scheme for B. Tech. (Information Technology) SEM III

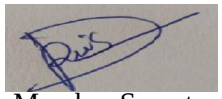
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	Credits
PCC	ITU321	Computer Organization & Architecture	3	-	-	3	30	10	60	--	--	100	3
PCC	ITU322	Data Structure & Algorithms	4	--	-	4	30	10	60	--	--	100	4
ESC	ITU323	Digital Logic Design	3		-	3	30	10	60	--	--	100	3
BSC	SHU321B *SHU322B	Transform and Linear Algebra Differential Equation and Transform	3	1	-- -	4	30	10	60	--	--	100	4
MC	SHU323	Introduction to Constitution of India	1	--	-	1	30	20	--	-	--	50	-
HSMC	SHU334	Effective Technical Communication	3		-	3	30	20	--	--	--	50	3
PCC-LC	ITU324	Data Structure & Algorithms Lab	-		2	2	--	--	--	25	25	50	1
ESC-LC	ITU325	Digital Logic Design Lab	-	--	2	2	--	--	--	25	25	50	1
PCC-LC	ITU326	Object Oriented Technology Lab	2	--	4	6	--	--	--	50	50	100	4
	Total		19	1	08	28	150	70	330	100	100	700	23

SEM IV

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	Credits
PCC	ITU421	Discrete Mathematics	3	1	--	4	30	10	60	---	--	100	4
PCC	ITU422	Database Management Systems	3	--	--	3	30	10	60	---	--	100	3
PCC	ITU423	Operating System	3	--	--	3	30	10	60	---	--	100	3
PCC	ITU424	Design & Analysis of Algorithms	3	--	--	3	30	10	60	---	--	100	3
HSMC	ITU425	Organizational Behavior	3	--	--	3	30	10	60	---	--	100	3
MC	SHU422	Environmental Studies	1	--	--	--	30	20	--	---	-	50	-
PCC-LC	ITU426	Database Management Systems Lab	---	--	2	2	---	--	---	25	25	50	1
PCC-LC	ITU427	Operating System Lab	---	--	2	2	---	--	---	25	25	50	1
PCC-LC	ITU428	Design & Analysis of Algorithms Lab	---	--	2	2	---	--	---	25	25	50	1
PCC-LC	ITU429	Python Programming Lab	---	--	4	4	---	--	---	25	25	50	2
	Total		16	1	10	27	150	70	330	100	100	750	21

TA : Teacher Assessment **CT: Class Tests** **ESE: End Semester Examination** **ICA :Internal Continuous Assessment**

Department of Information Technology



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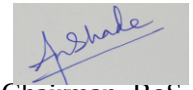

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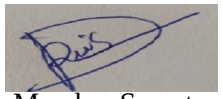
Proposed Scheme for B. Tech.
(Information Technology) SEM V

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	Credits
	ITU521	Software Engineering	3	1	-	4	30	10	60	---	---	100	4
PCC	ITU522	Computer Network	3	---	-	3	30	10	60	---	---	100	3
PCC	ITU523	Formal Languages & Automata Theory	3	1	-	4	30	10	60	---	---	100	4
PCC	ITU524	Machine Learning	3		-	3	30	10	60	---	---	100	3
PEC	ITU525	Program Elective- I	3	---	-	3	30	10	60	--	--	100	3
PCC	ITU526	Data Warehousing &Data Mining	3	1	-	4	30	10	60	--	--	100	4
PCC	ITU527	Computer Network Lab	-	---	2	2	---	--	---	25	25	50	1
PCC	ITU528	Machine Learning Lab	-	---	2	2	---	--	---	25	25	50	1
PCC-LC	ITU529	Software Engineering Lab	-	--	2	2	---	--	---	25	25	50	1
PCC-LC	ITU530	Data Warehousing &Data Mining Lab			2	2	--	--	--	25	25	50	1
	Total		18	3	8	29	180	60	360	100	100	800	25

SEM VI

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						
							Theory			Practical			
			Theory hrs/wee	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	Credits
PCC	ITU621	Geo Spatial Technologies	3	--	-	3	30	10	60	---	---	100	3
PCC	ITU622	Artificial Intelligence	3	**1**	-	4	30	10	60	---	---	100	4
PEC	ITU623	Program Elective- II	3	---	-	3	30	10	60	---	---	100	3
PEC	ITU624	Program Elective- III	3	---	-	3	30	10	60	---	---	100	3
PCC	ITU625	Cloud Computing	3	--	-	3	30	10	60	---	---	100	3
OEC	ITU633	Open Elective-I	3	---	-	3	30	10	60	---	---	100	3
PCC	ITU627	Geo Spatial Technologies Lab	-	---	2	2	---	--	---	25	25	50	1
PCC	ITU628	Artificial Intelligence Lab	-	-	2	2	---	--	---	25	25	50	1
PCC	ITU629	Web & Internet Technology Lab	-	---	4	4	---	--	---	25	25	50	2
PROJ	ITU630	Minor Project	-	---	6	6	---	--	---	50	50	100	3
	Total		18	1	14	33	180	60	360	125	125	850	**26**

TA: Teacher Assessment **CT: Class Tests** **ESE: End Semester Examination** **ICA: Internal Continuous Assessment**



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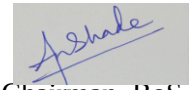

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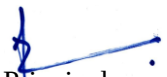

Principal
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Program Elective- I - ITU525

A) Information Retrieval

B) Parallel Architecture

C) Internet of Things

Program Elective- II - ITU623

A) Web Mining

B) Parallel Programming

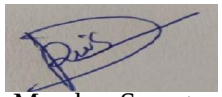
C) Wireless & Mobile Computing

Program Elective- III - ITU624

A) Network Architecture and Wireless Protocols

B) Software Project Management- Industry Perspective

C) Distributed Computing



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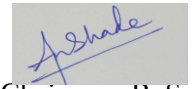

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Department of Information Technology
Proposed Scheme for B. Tech.
(Information Technology) SEM VII

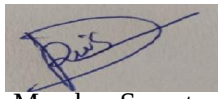
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical			
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	
PEC	ITU721	Program Elective-IV	3	-	--	3	30	10	60	---	---	100	3
PEC	ITU722	Program Elective-V	3	-	--	3	30	10	60	---	---	100	3
OEC	ITU733	Open Elective-II	3	-	--	3	30	10	60	---	---	100	3
HSMC	SHU725	Human Values and Ethics	2	-	--	2	30	20	--	---	---	50	-
PROJ	ITU724	Seminar	-	-	2	2	-	-	-	50	---	50	1
	Total		11	-	02	13	90	50	210	50	---	400	10

SEM VIII

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical			
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE	Total	
PEC	ITU821	Program Elective-VI	3	-	--	3	30	10	60	---	---	100	3
PROJ	ITU822	A) Project **OR** B) Industry Internship Project	-	-	28	28	--	--	--	150	200	350	14
	Total		3	-	28	317	30	10	60	150	200	450	17

TA: Teacher Assessment **CT: Class Tests** **ESE: End Semester Examination** **ICA: Internal Continuous Assessment**

1. Students are allowed to complete theory courses through online platform such as MOOC, NPTEL/SWAYAM etc.
2. Students going for internship at industry are allowed to complete theory courses through self-study mode or by through online platform such as MOOC, NPTEL/SWAYAM and will either directly appear for ESE only (Total Internal marks (MSE+TA) will be awarded proportional to marks secured in ESE) or they can appear for MSE & TA.



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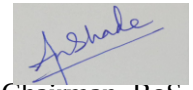

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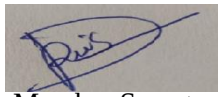
Program Elective- IV ITU721	Program Elective -V ITU722	Program Elective –VI ITU821	Open Elective- I	Open Elective-II
A) Data Analytics	A) Digital Forensics	A) Cryptography and Network Security	A) Computer Oriented Operation Research	A) Software Engineering
B) Ad-Hoc Networks	B) Advances in Programming Languages	B) Graph Mining	B) Introduction to Data Structures	B) Data Communication
C) Natural Speech & Language Processing	C) Advance Project management and ICT in Agri-rural development	C) Real Time Systems		
D) Information Security	D) Human Computer Interaction	D) Augmented Reality		
		E) Blockchain Technology		



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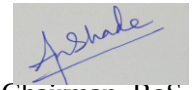

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Government College of Engineering, Amravati

Department of Information Technology

Program Educational Objectives

PEO 1: To formulate, analyze and solve real life problems in software industry, research academia and society at large.

PEO 2: To provide opportunity to learn the latest trends in information technology and prepare for lifelong learning process.

PEO 3: To exhibit strong communication and interpersonal skills, broad knowledge, and global perspectives to work effectively and ethically in multidisciplinary teams.

Program Specific Outcomes

PSO 1: To produce technically sound human resource that shows inclination to pursue IT career in profession, research and higher education.

PSO 2: To exhibit the knowledge of algorithms, data structures /management, software design, information security, Computer Networks, programming languages, computer organization and architecture and data science and analytics as an IT professional.

PSO 3: To develop an attitude of solving real-world problems in constructive ways by applying IT knowledge

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ITU321 COMPUTER ORGANIZATION AND ARCHITECTURE

Teaching Scheme : 03 L + 00T Total 03 **Credits : 03**
Evaluation Scheme: 30MSE +10TA+ 60ESE **Total Marks: 100**
Duration of ESE: 2Hrs.30min

Course Objectives

I. To understand the structure, function and characteristics of computer systems.
II. To understand the design of the various functional units and components of computers.
III. To identify the elements of modern instructions sets and their impact on processor design.
IV. To explain the function of each element of a memory hierarchy,
V. To identify and compare different methods for computer I/O.

Computer Organization: Computer types, Structure with basic computer components, Function in brief with instruction fetch and execute, Interrupts and I/O communication, Interconnection structure, bus interconnection, Multiple Bus hierarchies, Elements of bus design Performance metrics and measurement.

Computer Memory System: Characteristics of memory system, Memory hierarchy, Cache Memory- Cache memory principles, Elements of cache design- cache address, size, mapping functions, replacement algorithms, write policy, Internal Memory- semiconductor memory, External Memory- Hard Disk organization, RAID.

Input and Output System: I/O modules- Module function and I/O module structure, Programmed I/O , Polling I/O, Interrupt driven I/O , DMA function, Synchronous and Asynchronous serial data communication, Computer peripherals like keyboard, mouse, printer, scanner and display devices.

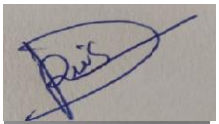
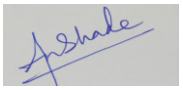
Processor Organization: Evolution of Intel processor architecture- 4 bit to 64 bit, Control unit Hardwired and microprogrammed, concept of pipelining, Study of microprocessor 8085, Functional pins and Register organization, Memory mapped I/O and I/O mapped I/O schemes.

Instruction Set and Assembly Language Programming: Addressing modes and Formats- immediate, direct, indirect, register, register indirect, displacement and stack, Instruction Cycle machine cycle and Data flow, 8086 instruction set and assembly programming, Time delay concept , stack and subroutines, Interrupt handling, Instruction set architecture RISC and CISC.

Text books

1. "Computer Organization and Architecture", William Stallings, 7th edition, Prentice Hall of India, 2008
2. "The 8086/8088 Microprocessor: Architecture, Programming, and Interfacing", Barry B. Brey, Merrill Publishing Company, 1987

Reference books

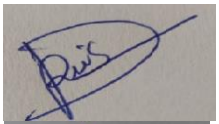
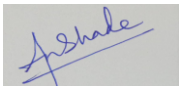




1. "Computer Organization", C. Hamacher, V. Zvonko, S. Zaky, 5th edition, McGraw Hill, 2002,
2. "Computer Architecture and Organization", Hayes, J.P., 3rd Edition, Tata Mc-Graw Hill, 1998.
3. "Structured Computer Organization", A. Tannenbaum,6th edition, Pearson Education, 2013

Course outcomes

On completion of the course, student will be able to:

ITU321.1 Describe the organization of a computer system in terms of its main components.
ITU321.2 Demonstrate computer architecture concepts related to design of modern processors memories and I/Os.
ITU321.3 Identify various parts of a system memory hierarchy.
ITU321.4 Analyze the performance of commercially available computers.
ITU321.5 Develop logic for assembly language programming.


ITU 322 DATA STRUCTURE AND ALGORITHMS

Teaching Scheme : 04L Total 04 **Credits : 04**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE : 2Hrs.30min

Course Objectives

I. To impart the basic concepts of data structures and algorithms.

II. To understand concepts about searching and sorting techniques

III. To understand basic concepts about stacks, queues, lists, trees and graphs.

IV. To enable them to write algorithms for solving problems with the help of fundamental data structures

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis.

Stacks and Queues: ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

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 ,Circular linked list: operations on it.

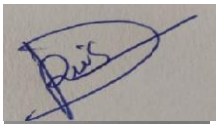
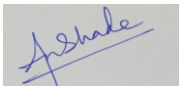
Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees .Applications of Binary Trees. B Tree, B+ Tree(Theoretical aspect only)

Sorting and Hashing: 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, Hashing.

Graph: Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

Text books

1. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. "Data structures A Pseudo code Approach with C", Richard Gilberg and Behrouz Forouzan, 2nd edition, 2005,Cengage Learning.


Reference books

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R.G. Dromey, Pearson Education.
3. "Data structures with C", Seymour Lipschutz, 1st Edition, 2017, Schaum Series,Tata MacGraw Hill

Useful link:

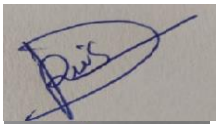
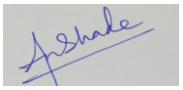
http://nptel.ac.in/courses/106106130/, IIT Madras

http://nptel.ac.in/courses/106103069/, IIT Guwahati

http://nptel.ac.in/courses/106106127/, Prof. Shankar Balachandran, IIT Madras

Course outcomes

ITU 322.1	For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness.
ITU 322.2	For a given Search problem (Linear Search and Binary Search) student will able to implement it.
ITU 322.3	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.
ITU 322.4	Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity.
ITU 322.5	Student will able to implement Graph, Trees search and traversal algorithms and determine the time and computation complexity.


ITU323 DIGITAL LOGIC DESIGN

Teaching Scheme : 03 L Total 03 Credits : 03
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE Total Marks: 100
Duration of ESE : 2Hrs.30min

Course Objectives

I. Systematically use mathematical processes to convert any value between any number systems.
II. Apply knowledge of logic gates to select the appropriate gate for the circuit design.
III. Create truth tables by analyzing existing circuits. Design a circuit based on a truth table.
IV. Solve novel problems by applying the combinational logic design process.
V. Implement sequential logic to improve digital circuit design.
VI. Design a state machine to accomplish specified design task.

Introduction to Number systems and codes: Binary number systems, Signed binary numbers, Binary arithmetic,1's and 2's complement, Octal number system, hexadecimal number system, Introduction to gates, Minimization of Boolean function using Karnaugh Map (up to four variable), SOP- POS, Quine - Mclusky methods, Code conversions- Binary code to gray code and gray to binary, BCD to Excess – 3, Excess – 3 to BCD code.

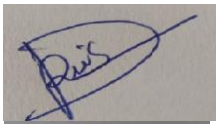
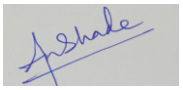
Design of Combinational Logic Circuits: Modular combinational logic elements, Overview & implementation of multiplexer/ demultiplexer, Implementation of Combinational Logic Circuits using mux / demux, Decoders, Encoders, Priority encoders. Design of Ripple carry adder and Carry look ahead adder, Design of Combinational Circuits using Programmable Logic Devices (PLDs): Programmable Read Only Memories (PROMs), Programmable Logic Arrays (PLAs), Programmable Array Logic (PAL) device.

Design of Sequential Logic Circuits: Latches: RS latch and JK latch, Flip-flops-RS, JK, T and D flip flops, Master-slave flip flops, Edge-triggered flip-flops. Analysis and Design of Synchronous Sequential Circuits: Introduction to sequential circuits, Characteristic table, Characteristic equation and Excitation table.

Modular sequential logic circuits: Registers, Design of Synchronous / Asynchronous using different flip-flops. Overview of Shift registers. Counters- Synchronous / Asynchronous, Up-down, Ring, Johnson counter.

Algorithm State Machines: ASM charts, notation, RTL notation and implementation design of simple controller, multiplexer controller method. VHDL: Introduction to HDL, VHDL-Library.

Memories: Random access memory, TTL RAM cell, parameter read write cycles, ROMs EPROM, MOS-static RAM cell, dynamic RAM cell, refreshing, memory cycles.


Text Books

1 M Morris Mano, "Digital Design" 3rd Edition Prentice Hall 2001 ISBN-10 / ASIN: 0130621218 ISBN-13 / EAN: 9780130621214.

2 R.P. Jain, "Modern Digital Electronics", 3rd Edition, Tata McGraw-Hill, 2003, ISBN 0 – 07 – 049492 – 4.

3 A.P. Malvino, D. P. Leach and G.Saha, "Digital Principles and Applications," 7/e, McGraw Hill, 2010. 37.

Reference Books

1 Wakerly Pearon, "Digital Design: Principles and Practices", 3rd edition, 4th reprint, Pearson Education, 2004.

2 A. Anand Kumar, "Fundamentals of digital circuits" 1st edition, PHI publication, 2001.

3 Mark Bach, "Complete Digital Design", Tata MCGraw Hill, 2005.

4 Stephen Brown, "Fundamentals of digital logic design with VHDL" 1st edition, TMH Publication 2002.

Course Outcomes

Students will be able to:

ITU 323.1 Apply the knowledge of number systems and codes in problem solving related to code conversion and number system.

ITU 323.2 Learn the simplification of logical statements with karnaugh maps.

ITU 323.3 Learn and understand the basic concepts of combinational logic devices and apply the concepts in designing them.

ITU 323.4 Learn the working principles of decoder, encoder.

ITU 323.5 Learn and understand the fundamentals of sequential logic devices and apply the concepts in designing them.

ITU 323.6 Apply and design the logical devices by using all these concepts along with implementation knowledge of hardware and peripheral design.

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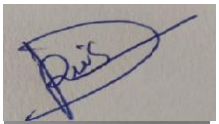
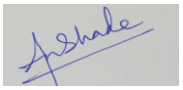




SHU321B TRANSFORM AND LINEAR ALGEBRA

Teaching Scheme: 03Th+ 01Tut = 04 Total **Credits: 04**
Evaluation Scheme: 30MSE+60ESE+10TA **Total Marks: 100**
Duration of ESE : 2Hrs.30min

Course Objectives

I. To study about the mathematical tool like z-transform and its properties.
II. To introduce the concept of linear algebra which is important in computer software.
III. To introduce the concept of orthogonality and inner product.
IV. To familiarize the students with basic concepts of probability and conditional probability.
V. To study continuous and discrete probability distributions.

Z-transform:

Definition, Region of Convergence, Properties of Z-transform, Inverse Z-transform: Partial fraction method, Residue method; Convolution Theorem, Application to solution of difference equations with constant coefficients.

Vector spaces:

Vector spaces and subspaces, null spaces, column spaces and linear transformations, Linear dependence and independence, bases, coordinate systems, dimensions of vector space.

Orthogonality and least squares:

Inner product, length and orthogonality, orthogonal sets, orthogonal projections, Gram-Schmidt process, least square problems, inner product spaces.

Random variables and Probability Distributions:

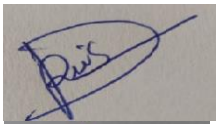
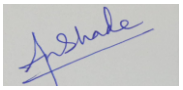
Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, distribution functions, Mean and variance of Binomial, Poisson and Normal distributions.

Text Books

1. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint,2010.
2. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 44th edition, 2020.
3. Engineering Mathematics (for semester III),Veerarajan T., Tata McGraw-Hill, New Delhi,2010.

Reference Books

1. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
2. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003(Reprint).
3. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India,2002.

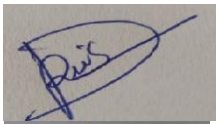
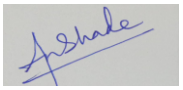




4. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley,1968.

Course Outcomes

After successful completion of the course the students will be able to

SHU321 B.1 Use the concept of probability and random variables and various discrete and continuous probability distributions in practical problems.
SHU321 B.2 Apply the tool of transform in solving engineering problems.
SHU321 B.3 Analyze the problems related to engineering with the knowledge of linear algebra.


SHU322B DIFFERENTIAL EQUATION AND TRANSFORM

Teaching Scheme: 03Th+ 01Tut = 04 Total **Credits: 04**
Evaluation Scheme: 30MSE+60ESE+10TA **Total Marks: 100**
Duration of ESE: 2Hrs.30min

Course Objectives:

I. To study about the mathematical tool like z-transform and its properties.
II. To introduce the concept of linear algebra which is important in computer software.
III. To introduce the concept of orthogonality and inner product.
IV. To familiarize the students with basic concepts of probability and conditional probability.
V. To study continuous and discrete probability distributions.

Z-transform: (10hrs)

Definition, Region of Convergence, Properties of Z-transform, Inverse Z-transform: Partial fraction method, Residue method; Convolution Theorem, Application to solution of difference equations with constant coefficients.

Vector spaces: (10hrs)

Vector spaces and subspaces, null spaces, column spaces and linear transformations, Linear dependence and independence, bases, coordinate systems, dimensions of vector space.

Random variables and Probability Distributions:(10hrs)

Basic concepts of probability and its properties; Conditional probability and independent events; Random variables, discrete and continuous random variables, distribution functions, Mean and variance of Binomial, Poisson and Normal distributions.

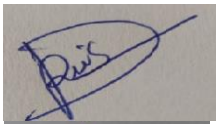
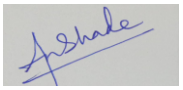
Basic Statistics: (10 lectures)

Measures of Central tendency: Moments, skewness and Kurtosis - Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions, Correlation and regression

Course Outcomes

After successful completion of the course the students will be able to

1. use the concept of probability and random variables and various discrete and continuous probability distributions in practical problems.
2. apply the tool of transform in solving engineering problems.
3. Analyze the problems related to engineering with the knowledge of linear algebra.


Text Books:

4. A text book of Engineering Mathematics, N.P. Bali and Manish Goyal, Laxmi Publications, Reprint,2010.
5. Higher Engineering Mathematics, B.S. Grewal, Khanna Publishers, 44th edition, 2020.
6. Engineering Mathematics (for semester III), Veerarajan T., Tata McGraw-Hill, New Delhi,2010.

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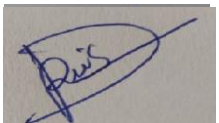
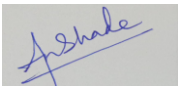
5. Advanced Engineering Mathematics, Erwin Kreyszig, 9th Edition, John Wiley & Sons, 2006.
6. Introduction to Probability Theory, P. G. Hoel, S. C. Port and C. J. Stone, Universal Book Stall, 2003(Reprint).
7. A First Course in Probability, S. Ross, 6th Ed., Pearson Education India,2002.
8. An Introduction to Probability Theory and its Applications, W. Feller, Vol. 1, 3rd Ed., Wiley,1968.


SHU323 INTRODUCTION TO CONSTITUTION OF INDIA

Teaching Scheme: 1TH **Credit:00**
Evaluation scheme: 30 MSE + 20TA **Total Marks:50**
Duration of ESE: 1Hrs.30min

Course Objectives

I. To acquaint students about constitution of India, Fundamental rights, fundamental duties, electoral process and role of central, state and local government and its administration.

Introduction to Constitution of India

Salient features of the Constitution of India, Preamble of the Constitution, fundamental rights and fundamental duties, Directive Principles of State Policy and relevance of directive principles. Parliamentary Form of Government in India- President, Vice-President, Prime Minister along with council of Minister, Parliament, Supreme court, Electoral process in India, Amendment Procedure.

State executives, Governor, chief minister, state legislature, high courts of state,

Role and functions of local self government- Municipalities in India, with special reference to 73rd amendment. Panchayat Raj in India with special reference to 74th amendment.

Reference Books

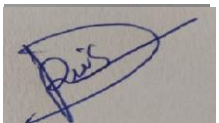
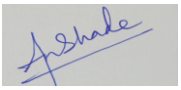
1. An Introduction to Constitution of India, M.V. Pylee, Vikas Publishing, 2002
2. Constitution of India, Dr. B. R. Ambedkar, Government of India Publication
3. Latest Publications of Indian Institute of Human Rights, New Delhi

Course outcomes

On the successful completion of this course, Students shall be able to

SHU322.1 Understand and remember the knowledge of basic information about Indian Constitution.

SHU322.2 Apply the knowledge of fundamental rights and fundamental duties.


SHU334 EFFECTIVE TECHNICAL COMMUNICATION

Teaching Scheme: 3 TH **Credit: 03**
Evaluation scheme: 30MSE+20TA **Total Marks: 50**

Course Objectives

I. To understand the basics of technical writing and editing
II. To understand and analyse the self-development

Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.

Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language. Basics of grammar, study of advanced grammar, editing strategist o achieve appropriate technical style. Introduction to advanced technical communication, Usability, Hunan factors, Managing technical communication projects, time estimation, Single sourcing, Localization.

Self-Development and Assessment- Self assessment, Awareness, Perception and Attitudes, Values and belief, Personal goal setting, career planning, Self-esteem. Managing Time; Personal memory, Rapid reading, Taking notes; Complex problem solving; Creativity

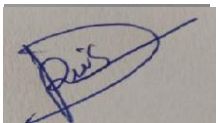
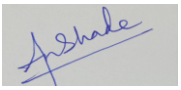
Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development. Writing reports, project proposals, brochures, newsletters, technical articles, manuals, official notes, business letters, memos, progress reports, minutes of meetings, event report.

Ethics- Business ethics, Etiquettes in social and office settings, Email etiquettes, Telephone Etiquettes, Engineering ethics, Managing time, Role and responsibility of engineer, Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.

Text Books

1. David F. Beer and David McMurrey, Guide to writing as an Engineer, John Willey. NewnYork, 2004
2. Diane Hacker, Pocket Style Manual, Bedford Publication, New York, 2003. (ISBN0312406843)

Course outcomes

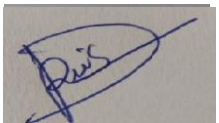



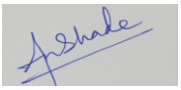

On the successful completion of this course, Students shall be able to-

SHU334.1 Understand how critically analyse data from research and incorporate it into assigned technical writing or documents clearly, concisely, logically with effective style and grammar in précised form.

SHU334.2 Exhibit integrates sense of ethical values and personal accountability to form realistic development plans to achieve identified goals with creative analysis of self assessment and awareness.

SHU334.3 Manifest gained self-confidence, skill of verbal communication along with form ethical values not only to meet the demand of professional world as a coherent whole but to present their prowess/ employability skills in various workplaces effectively in global world as well.





ITU324 DATA STRUCTURE AND ALGORITHMS LAB

Teaching Scheme : 02 P **Total 02** **Credit : 01**
Evaluation Scheme: 25 ICA+25ESE **Total Marks: 50**
Duration of ESE : 03Hrs.

Course Objectives

I. Have a good understanding of how several fundamental algorithm works, particularly those concern with searching and sorting.
II. Have a good understanding of fundamental data structures used in computer science.
III. Be able to analyze space and time efficiency of most algorithms.
IV. To be able to design new algorithms or modify existing one for new applications

Suggested List of Experiments/Assignments but not limited to the given list of experiments: Students have to perform Minimum 10 practical's, One mini project (Simulation)

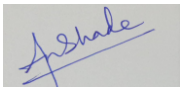
1. Implementation of Linear Search and Binary Search and its Applications
2. Implementation of Stack and its Applications
3. Implementation of Queue/Circular Queue/Priority Queue and its Applications
4. Implementation of Singly Linked List and its Applications
5. Implementation of Doubly Linked List and its Applications
6. Implementation of Binary Tree/Binary Search Tree/Tree traversal techniques and its Applications
7. Implement Sorting algorithm and their applications
8. Implement Graph/Graph Traversal and their applications
9. Write following applications using custom designed data structures.
    - Simulate an air traffic controller.
    - Create the game of maze.
    - Write a program to generate and solve Sudoku problems.
    - Implement an editor**.**

Web References

1. http://www.tutorialspoint.com/data_structures_algorithms
2. http://www.geeksforgeeks.org/data-structures/
3. http://www.studytonight.com/data-structures/
4. http://www.coursera.org/specializations/data-structures-algorithms

Course Outcomes

At the end of the course, a student will be able to

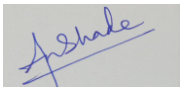




ITU 324.1 Interpret and compute asymptotic notations to describe work done by an algorithm and relate to the consumption of resources (time/space).

ITU 324.2 Exemplify and implement how abstract data types such as stack, queue and linked list can be implemented to manage the memory using static and dynamic allocations.

ITU 324.3 Apply various data structures trees(Binary tree, Binary Search trees), graphs to solve programming challenges

ITU 324.4 Develop and compare the comparison-based search algorithms and sorting algorithms.


ITU325 DIGITAL LOGIC DESIGN LAB

Teaching Scheme: 02 P **Total 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs.

Course Objectives

I. Students will learn and understand the Basics of digital electronics.
II. Student will learn to design basic logic circuits, combinational and sequential circuits.
III. To test/verify the functionality of the logic circuits.

List of Experiments:

1. Implementation of Boolean function using Gates.

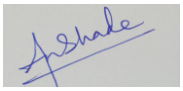
2. Code converters:
   - Binary to gray
   - Gray to binary Excess – 3 code to BCD
   - BCD to Excess – 3 code.
3. Design of -
   - Half adder, full adder.
   - Design of half subtract or, full subtract or.
   - K-map examples implementation
   - Quine-Mc'clusky examples implementation.
4. Design of:
   - 3 bit odd Parity Checker
   - 4 bit odd Parity Checker
   - 3 bit even Parity Checker
   - 4 bit even Parity Checker
5. Implementation of Multiplexer and Demultiplexer.

6. BCD adder using 4 bit adder IC.

7. Study of flip flops-
   - RS flip-flop
   - D flip-flop
   - T flip-flop
   - J-K flip-flop
8. Design of Synchronous Counter.
   - Design of up / down counters.
   - Design of Sequence generator.
   - Design of Ring counter.
   - Design of Johnson Counter
9. Study practicals on VHDL programming.

Course Outcomes

The students will be able to:

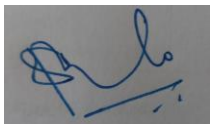

ITU 325.1 Distinguish between analog and digital systems.

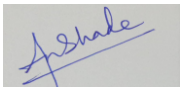
ITU 325.2 Identify the various digital ICs and understand their operation.

ITU 325.3 Apply Boolean laws and K-map to simplify the digital circuits.

ITU 325.4 Understand the function of elementary digital circuits under real and simulated environment.

ITU 325.5 Prepare a report on basics of digital electronics and handling of ICs.





ITU326 OBJECT ORIENTED TECHNOLOGY LAB

Teaching Scheme : 02 L + 00T+04P Total 06 Credits : 04
Evaluation Scheme: 50 ICA+ 50 ESE Total Marks: 100
Duration of ESE: 03Hrs.

Course Objectives

I. Gain knowledge about basic language syntax and semantics to write programs
II. Understand the fundamentals of object-oriented programming in C++, Java including defining classes, objects, invoking methods.
III. Understand the principles of inheritance, polymorphism, friend function , virtual function.
IV. Understand the principles of file handling, exception handling.

Object Oriented Programming: Design Principles: Objects, classes, Messages and methods, Implementation of Object-oriented Programming,

Object oriented programming with Java/C++: Program structure, Object and class declarations, constructors, inheritance, polymorphism, access specification, interfaces, packages, Friend Function, Friend Class, Virtual Functions, Virtual Class , exception handling, I/O, GUI development, threads and multithreads, Socket Programming, Collection, STL.

The sample list of programs is given below. This list can be used as guideline for problem statements but the scope of the laboratory should not be limited to the same.

Experiment 1 Implementation of Array, string and structure

Experiment 2 Implementation of Class Objects, Constructor, destructor, constructor overloading.

Experiment 3 Implementation of Multiple and multilevel inheritance with function overriding.

Experiment 4 Implementation of Virtual base class and Virtual function

Experiment 5 Implementation of static variable and static function.

Experiment 6 Implementation of friend function and friend class.

Experiment 7 Implementation of function over loading and operator overloading.

Experiment 8 Implementation of dynamic memory allocation using New and delete operators

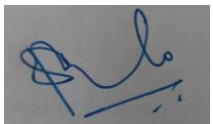
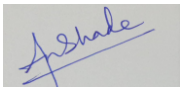
Experiment 9 Implementation of Virtual function and pure virtual function

Experiment 10 Implementation of exception handling.

Experiment 11 Implementation of java packages.

Experiment 12 Implementation of Graphics and color classes.

Experiment 13 Implementation of Applets.

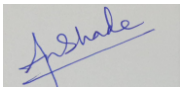

Experiment 14 Implementation of GUI

Experiment 15 Implement a mini project based on above experiments.

Course Outcomes

At the end of the course, the student will be able to

ITU 326.1 To identify classes, objects, members of a class and relationships among them needed for a specific problem.
ITU 326.2 To write application programs using OOP principles and proper program structuring.
ITU 326.3 To demonstrate the concepts of polymorphism and inheritance.
ITU 326.4 To implement concept of I/O ,GUI, exception handling.
ITU 326.5 To demonstrate concept of socket programming.


ITU421 DISCRETE MATHEMATICS

Teaching Scheme : 03 L+ 01 T Total 04 Credits : 04
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE Total Marks: 100
Duration of ESE : 2Hrs.30min

Course Objectives

I. Introduce students to the techniques, algorithms, and reasoning processes involved in the study of discrete mathematical structures.
II. Introduce students to set theory, inductive reasoning, elementary and advanced counting techniques, equivalence relations, recurrence relations, graphs, and trees.
III. Express a logic sentence in terms of predicates, quantifiers, and logical connectives.
IV. Apply rules of inference, tests for validity, and methods of proof including direct and indirect proof forms, proof by contradiction, proof by cases, and mathematical induction and write proofs using symbolic logic and Boolean Algebra.
V. Determine if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic, and determine the connectivity of a graph.

Set Theory , Logic and Proofs : Propositions, Conditional Propositions, Logical Connectivity, Propositional calculus, First order logic, Proofs: Proof Techniques, Mathematical Induction. Set, Combination of sets, Principle of inclusion and exclusion , strong Induction .

Relations, Functions, Recurrence Relations: Definitions, Properties of Binary Relations, Equivalence Relations and partitions, Partial ordering relations and lattices, Chains and Anti chains. Theorem on chain, Recurrence relations. Functions: Definition, Domain, Range, Image, etc. Types of functions: Surjection, Injection, Bijection, Inverse, Identity, Composition of Functions.

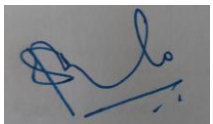
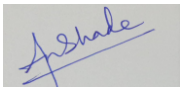
Number Theory: Basics of Modulo Arithmetic, Basic Prime Number Theory, GCD, LCM, Divisibility, Euclid's algorithm, Factorization, Chinese Remainder Theorem Fields: Naturals, Integers, Rationals, Reals, Complex Numbers Properties of operations: associative, commutative, distributive, identity, inverse .

Counting Basic Counting Techniques (sum, product, subtraction, division, exponent): Pigeonhole and Generalized Pigeonhole Principle with many examples, Permutations and Combinations and numerical problems,Identity and Triangle, Generating Permutations and Combinations

Graphs & Trees Basic terminology:multi graphs and weighted graphs, paths and circuits, shortest path Problems, Euler and Hamiltonian paths and circuits, factors of a graph, planar graph, independent sets, graph coloring. Trees, rooted trees, path length in rooted trees, binary search trees, spanning trees and cut set, theorems on spanning trees, cut sets , circuits, minimal spanning trees, Kruskal's and Prim's algorithms for minimal spanning tree.

Algebraic Systems: Algebraic Systems, Groups, Semi Groups, Monoids, Subgroups, Permutation Groups, Codes and Group codes, Isomorphism and Automorphisms, Homomorphism and Normal Subgroups, Ring, Field.

Text Books

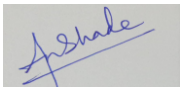




1. C. L. LIU, “Elements of Discrete Mathematics”, 2nd Edition, Tata McGraw-Hill, 2002, ISBN: 0-07- 043476-X.
2. G. Shanker Rao, ”Discrete Mathematical Structures”, New Age International, 2002, ISBN: 81-224- 1424-9 Reference Books:
3. Lipschutz, Lipson, Discrete Mathematics, 2nd Edition, Tata McGraw-Hill, 1999, ISBN 0-07- 463710--X.
4. V. K. Balakrishnan, Graph Theory, TMH (Recommended for Graph), ISBN 0-07-058718-3
5. B. Kolman, R. Busby and S. Ross, “Discrete Mathematical Structures”, 4th Edition, Pearson Education, 2002, ISBN 81-7808-556-9
6. J. Tremblay, R. Manohar, “Discrete Mathematical Structures with application to Computer Science”, McGraw-Hill, 2002 ISBN 0-07-065142-6 (Recommended for prepositional Calculus).
7. Kenneth H. Rosen: Discrete Mathematics and Its Applications, 5th Edition, Tata McGraw-Hill, 2003, ISBN 0-07-053047-5.

Course Outcomes

Students will be able to:

ITU 421.1	Explain basic terminology, formal logic, proofs, sets, relations, functions, recursion
ITU 421.2	Use formal logic proof and logical reasoning to solve problems
ITU 421.3	Relate the ideas of mathematical induction to recursion and recursively defined structures
ITU 421.4	Solve problems based on graphs, trees and related algorithms
ITU 421.5	Relate, interpret and apply the concepts to various areas of computer science


ITU422 DATABASE MANAGEMENT SYSTEMS

Teaching Scheme : 03 L Total 03 Credits : 03
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives

I. Analyze database requirements and determine the entities involved in the system and their relationship to one another.
II. Design ER-models to represent simple database application scenarios
III. Devise queries using Relational Algebra, Relational Calculus and SQL
IV. To be familiar with basic database storage structures
V. Develop an understanding of essential DBMS concepts such as: database integrity, concurrency

Database system architecture: Introduction to database management system, Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, network model, relational and object oriented data models, integrity constraints, data manipulation operations.

Relational query languages: Relational algebra, tuple and domain relational calculus, SQL and QBE.

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms (1NF,2NF,3NF), Dependency preservation, Lossless design.

Query processing and optimization: Forms of a basic SQL query Evaluation of relational algebra expressions, Query equivalence, Join strategies.

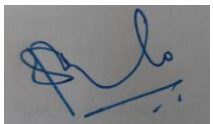
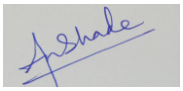
Storage structures: Indices, B-trees, hashing.

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Text books

1. "Database System Concepts", 5th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.
2. "Fundamentals of Database Systems", 5th Edition by R. Elmasri and S. Navathe, Pearson Education

Reference books


1. “Principles of Database and Knowledge – Base Systems”, Vol 1 by J. D. Ullman, Computer Science Press.
2. “Database Management Systems”, Raghu Ramakrishnan, Mcgraw-Hill Education
3. “Fundamentals of Database Systems”, By: Elmasri and Navathe, 4th Edition Practical PostgreSQL O’REILLY

Useful link:

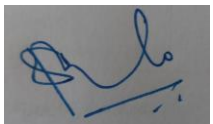
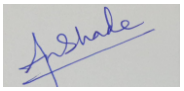
https://nptel.ac.in/courses/106105175/, IIT Kharagpur

https://nptel.ac.in/courses/106106093/, IIT Madras

https://nptel.ac.in/content/storage2/courses/106106095/pdf/1_Introduction.pdf

Course outcomes

ITU422.1	Design E-R Model for given requirements and convert the same into database tables and normalization.
ITU422.2	Create databases in an RDBMS and enforce data integrity constraints using SQL.
ITU422.3	Solve real world problems using appropriate set, function, and relational models.
ITU422.4	Understand the principles of storage structure and recovery management.
ITU422.5	For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.
ITU422.6	Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling


ITU 423 OPERATING SYSTEM

Teaching Scheme: 03 L+00T **Total:03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives

I. To learn the mechanisms of OS to handle processes and threads and their communication. Perform operations on processes and threads.
II. To learn the mechanisms involved in memory management in contemporary OS.
III. To gain knowledge on distributed operating system concepts that includes Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols.
IV. To know the components and management aspects of file management.
V. To learn to implement simple OS mechanisms.

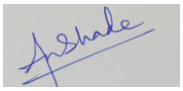
Introduction: Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

Processes: Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads, Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

Inter-process Communication: Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\ Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

Memory Management: Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction; Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Disadvantages of paging. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault , Working Set , Dirty page/Dirty bit – Demand paging, Page


Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

I/O Hardware: I/O devices, Device controllers, Direct memory access, Disk structure, Disk scheduling algorithms File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods (contiguous, linked, indexed), Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN.

Text books

1. Operating System Concepts Essentials, 9th Edition by Avi Silberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Reference books

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing.
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, AddisonWesley.
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India.
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates.

Course Outcomes

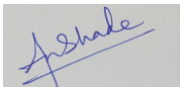
ITU 423.1 Create processes and threads.

ITU 423.2 Develop algorithms for process scheduling for a given specification of CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time.

ITU 423.3 For a given specification of memory organization develop the techniques for optimally allocating memory to processes by increasing memory utilization and for improving the access time.

ITU 423.4 Simulate file management system.

ITU 423.5 For a given I/O devices and OS (specify) develop the I/O management functions in OS as part of a uniform device abstraction by performing operations for synchronization between CPU and I/O controllers.


ITU424 DESIGN AND ANALYSIS OF ALGORITHMS

Teaching Scheme : 03 L Total: 03 Credits : 03
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE Total Marks: 100
Duration of ESE : 2Hrs.30min

Course Objectives

I Analyze the asymptotic performance of algorithms
II Write rigorous correctness proofs for algorithms.
III Demonstrate a familiarity with major algorithms and data structures.
IV Apply important algorithmic design paradigms and methods of analysis.
V Synthesize efficient algorithms in common engineering design situations.

Introduction: Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Divide and Conquer Technique

General Method, Revision and analysis of merge sort, quick sort and binary search, counting inversions, Finding closest pair of points, Integer multiplication.

Greedy Method

Elements of greedy technique, Activity selection problem, Fractional Knapsack Problem, Job Sequencing problem, Huffman Coding, Finding Single Source Shortest path in graph: Dijkstra's Algorithm, Revision and analysis of minimum spanning tree algorithms.

Dynamic Programming

Elements of Dynamic Programming, Principles of Dynamic programming- memorization or iteration over sub problems, Assembly line scheduling, Matrix chain multiplication, Longest common subsequence, All pair shortest path algorithm- Floyd-Warshall's Algorithm..

NP-Completeness

Matching , Introduction to NP-Complete , Search/Decision, SAT, Independent Set, 3VC ,Exact Cover, Multi Set, Subset Sum & Partition, Hamiltonian Circuit.

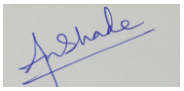
Approximation Algorithms

The vertex-cover problem, The set-covering problem, The subset sum problem.

Text Books

1 T. H. Cormen, C. E. Leiserson, R. L.Rivest and C. Stein, "Introduction to Algorithms", MIT Press/McGraw Hill, Second Edition.
2 Jon Kleinberg, Eva Tardos, "Algorithm Design", Pearson, Addison Wesley

Reference books


1 V. Aho, J. E Hopecroft and J.D. Ullman, The design and analysis of algorithm, Addision- Wesley, 1974

Course Outcomes

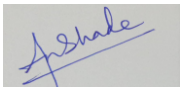
ITU 424.1 For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms.

ITU 424.2 Describe the greedy paradigm and explain when an algorithmic design situation calls for it. For a given problem develop the greedy algorithms.

ITU 424.3 Describe the divide-and-conquer paradigm and explain when an algorithmic design situation calls for it. Synthesize divide-and-conquer algorithms. Derive and solve recurrence relation.

ITU 424.4 Describe the dynamic-programming paradigm and explain when an algorithmic design situation calls for it. For a given problems of dynamic-programming and develop the dynamic programming algorithms, and analyze it to determine its computational complexity.

ITU 424.5 Student will develop ability to identify weather given problem is NP-Complete or not, and develop efficient algorithm that gives good solution.


ITU425 ORGANIZATIONAL BEHAVIOUR

Teaching Scheme: 03 L + 00T **Total: 03** **Credits : 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 02 Hrs. 30 min

Course Objectives

To expose the students to the following:

I. To familiarize students with the principles of business management and organizational behaviour in general.
II. To understand individual and group actions in the workplace in particular in order to increase an organization's effectiveness.
III. The course will use Indian and global organizational perspectives, strategies and range of other case studies and examples to have a global view of the subject.
IV. To imbibe a correct sense of organization and roles to be played during career.
V. To inculcate a sense of cognitive and behavioral understanding of the world as a workplace.

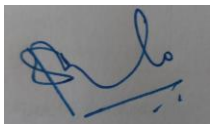
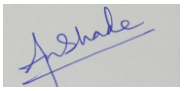
Meaning and concept of organizational behaviour: Theories of the Organization; Personality: meaning, factors affecting personality, Big five model of personality; Learning: concept and theories of learning (Classical conditioning, operant conditioning and social learning theory), concept of reinforcement; Perception: concept, factors affecting perception, process of perception, perceptual errors.

Motivation: Concept, importance, Content theories; Maslows Need Theory, Alderfers ERG theory (Existence, Relatedness and Growth), McCllelands Theory of Needs, Herzbergs Dual-Factor Theory and Process theories; Adams Equity Theory, Vrooms Expectancy Theory

Leadership: Concept, Theories (Trait, Behavioural, Contingency, Charismatic, Transactional and Transformational Leadership; Emotional Intelligence: Concept, Importance, Dimensions.

Teams and Groups: Definition, Team Structure and Effectiveness, Stages of Team/Group Development, Team/Group Cohesiveness;Goal-Setting, Beyond Self-Interest, Analysis of Interpersonal Relationship: Transactional Analysis, Conflict: Concept, Sources, Types, Stages of Conflict, Management of Conflict.

Organizational Power: Sources of Power and Dysfunctional uses of Power; Organizational Change: Concept, Resistance to change, Managing resistance to change, Kurt Lewin Theory of Change; Organizational Development (OD): Meaning and types of OD Interventions.


Text Books

1. Robbins, Stephen P and Judge T.A. (2013). Organisational Behaviour,15th Edition, Pearson.
2. Stephen, P. Robbins and Mary, Coulter (2010). Management ,9th Edition, Pearson
3. Kaul, Vijay Kumar (2012). Business Organisation and Management - Text and Cases. Pearson
4. Singh, Kavita. Organisational Behaviour,3rd Edition,Vikas Publication.

Reference Books

1. De Cenzo, D.A. and Robbins.(2010). Fundamentals of Human Resource Management (10th Edition). New York: John Wiley and Sons
2. ArunMonappa and Miza S Saiyadain (1999).Personnel Management (2 nd Edition). New Delhi: Tata McGraw-Hill publishing Company Limited

Course Outcomes

ITU 425.1 Understand the dynamics of organizational behaviour, and explain management roles with a comprehensive view of organizational behaviour.

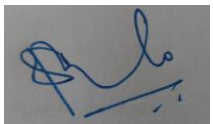
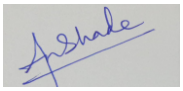
ITU 425.2 Knowing the specific aspects of contemporary organizational behavior.

ITU 425.3 Gain an appreciation of the different approaches to organizational structures.

ITU 425.4 Understand personality, learning and emotional function at work along with team formation and working.

ITU 425.5 Comprehending the concept of motivation, leadership, power and conflict and team building.

ITU 425.6 Understand the fundamentals of group actions and the organizational change and growth process.


SHU 422 ENVIRONMENTAL STUDIES

Teaching Scheme: 1 Th **Credit: 00**
Evaluation scheme: 20TA+30MSE **Total Marks: 50**
ESE Duration: 1Hr30 Min.

Course objectives

The objectives of offering this course are to-

I. Be aware of various environmental factors and there preservation.
II. Teach them how to protect Environment and natural resources.
III. How to make equitable use of energy resources.

The Multidisciplinary Nature of Environmental Studies: Definition, scope and importance, Need for public awareness.

Social issues and Environment: From Unsustainable to sustainable development, urban problems related to energy, Water conservation, rainwater harvesting, and watershed management Resettlement and rehabilitation of people, problems.

Environmental ethics: Issues and possible solution, Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Wasteland reclamation. Consumerism and Waste products, Environment protection act, Air (prevention & control) act, Water (prevention and control) act, Wildlife protection act, Forest conservation act, Issues involved in enforcement of environmental legislation.

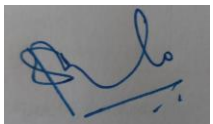
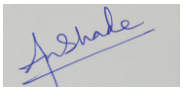
Human population and environment: Environment and human health, Human rights, Role of Information Technology in Environment and human health, Public awareness.

Natural Recourses: Conventional energy resources: definition, classification, composition, energy content types: coal, petroleum, natural gases, hydrogeothermal, nuclear, environmental implication of energy uses. Non conventional energy resources: solar energy, wind energy, tidal energy, geothermal energy, hydropowers and biogas.

Ecosystem and Biodiversity: Concept of ecosystem, Structure and function of ecosystem, Producer, consumer, decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystem: Forest ecosystem, Grass land ecosystem, Desert ecosystem Aquatic ecosystem (Rivers and ocean).

Introduction- definition: genetics, species and ecosystem, diversity.

Biogeographically classification of India. Conservation of biodiversity- In-situ and Ex-situ conservation of Biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man wildlife conflicts. Endangered and endemic species of India. Value of biodiversity:


consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, national and local level. India as mega diversity nation. Hot spot of biodiversity.

Environmental Pollution: Definition, Causes, effects and control measures of Air pollution, Water pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear hazards, Solid waste, Management, Causes effects and control measures, Role of individual in prevention of pollution, Hazardous waste management, Biomedical waste management, Disaster management: floods, earthquake, cyclone and landslides.

Recommended Books

1. The Biodiversity of India, BharuchaErach ,Marin Publishing Pvt. Ltd., Ahmedabad
2. Brunner R.C., 1989,Hazardous Waste Incineration, McGraw Hill Inc.
3. Marine pollution, Clark R.S., Clanderson Press Oxford (TB)
4. Environmental Chemistry, De A.K. Wiley EsternLmt.
5. Environmental Chemistry, Sharma B.K., 2001 Goel Publ., House, Meerat.
6. Environmental Management, Wagner K.D., 1998, W.B. Saunders Co., Philadelphia, USA
7. Environmental Studies, Benny Joseph, 1st edition,2005,TataMcgraw-Hill Publ.

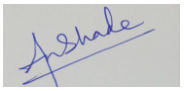
Course outcomes

After studying the course, the students will be able to

SHU 422.1 Convey the Environmental awareness among peoples.

SHU 422.2 Apply Conservation of various natural resources and environmental factors.

SHU 422.3 Aware about social and environmental issues.



ITU426 DATABASE MANAGEMENT SYSTEMS LAB

Teaching Scheme : 02 P **Total 02** **Credit : 01**
Evaluation Scheme: 25 ICA+25ESE **Total Marks: 50**
Duration of ESE : 3Hrs.

Course Objectives

I. Develop the logical design of the database using data modeling concepts such as entity-relationship diagrams.
II. Be able to understandbasic database concepts, applications, data models, schemas and instances.
III. To demonstrate the use of constraints and utilize a wide range of features available in a DBMS package.
IV. Manipulate a database using SQL.

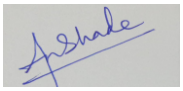
Suggested List of Experiments but not limited to the given list of experiments:

Students have to perform minimum 10 practical's, which should include one mini project.

1. Student should decide on a case study and formulate the problem statement.
2. Conceptual designing using ER diagrams (identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.

3. To execute and verify the data definition language commands
    1. create
    2. alter
    3. drop
    4. truncate
    5. comment
    6. rename
4. Create table employee(empno number(4) primary key, ename varchar2(10), job varchar2(6), sal number(5),deptno number(7));operate following queries on employee table:
    1) write a query to add a new column in to employee
    2) write a query to add multiple columns in to employee

5. To execute and verify the dml and tcl language commands dml (data manipulation language)

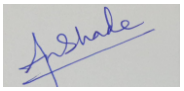

1. select
2. insert
3. delete
4. update

6. Normalization -to remove the redundancies and anomalies in the above relational tables, normalize up to third normal form.
7. To execute and verify the dcl language commands tcl (transaction control language)
    1. commit
    2. roll back
    3. Savepoint
8. To execute and verify the sql commands for nested queries.
9. To execute and verify the sql commands using join queries.
10. To execute and verify the sql commands for views.
11. To write a pl/sql block using different control (if, if else, for loop, while loop.) statements.
12. Mini Project

Course Outcomes

At the end of the course the students are able to:

ITU426.1	Apply the basic concepts of Database Systems and Applications.
ITU426.2	Use the basics of SQL and construct queries using SQL in database creation and interaction.
ITU426.3	Design a commercial relational database system (Oracle, MySQL) by writing SQL using the system.
ITU426.4	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
ITU426.5	Formulate, using SQL, solutions to a broad range of query and data update problems.


ITU427 OPERATING SYSTEM LAB

Teaching Scheme : 02 P **Total 02** **Credits : 01**
Evaluation Scheme: 25 ICA +25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs.

Course Objectives

I. To familiarize the students with the Operating System.
II. To demonstrate the process, memory, file and directory management issues under the LINUX operating system.
III. To introduce LINUX basic commands for operating system concepts.
IV. To make students how to make simple programs in LINUX and administrative task of LINUX.

List of Experiments

1. Basic Concepts : Introduction to Linux Operating System , basic commands in Linux and Writing shell scripts in Vi Editor.
2. Process Management:

   i)Use **ps** to search for the **init** process by name.

   ii) What is the **process id** of the **init** process?

   iii) Use the **who am i** command to determine your terminal name.

   iv) Using your terminal name from above, use **ps** to find all processes associated with your terminal.

   v) What is the **process id** of your shell?

   vi) What is the **parent process id** of your shell ?

   vii) Start two instances of the **sleep 3342** in background.

   viii) Locate the **process id** of all **sleep** commands.

   ix)Display only those two **sleep** processes in **top**. Then quit top.

   x)Use a **standard kill** to kill one of the **sleep** processes.

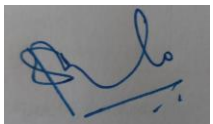
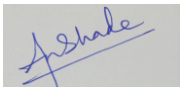
3. Process Priorities

   i). Create a new directory and create six **pipes** in that directory.

   ii). Bounce a character between two **pipes**.

   iii). Use **top** and **ps** to display information (pid, ppid, priority, nice value, ...) about these two cat processes.

   iv). Bounce another character between two other pipes, but this time start the commands **nice**. Verify that all **cat** processes are battling for the cpu. (Feel free to fire up two more cats with the remaining pipes).


V. Use **ps** to verify that the two new **cat** processes have a **nice** value. Use the -o and -C

options of **ps** for this.

vi). Use **renice** te increase the nice value from 10 to 15. Notice the difference with the usual commands.

4. Disk partitions

i). Use **fdisk -l** to display existing partitions and sizes.

ii). Use **df -h** to display existing partitions and sizes.

iii). Compare the output of **fdisk** and **df**.

iv). Create a 200MB primary partition on a small disk.

v). Create a 400MB primary partition and two 300MB logical drives on a big disk.

vi). Use **df -h** and **fdisk -l** to verify your work.

vii). Compare the output again of **fdisk** and **df**. Do both commands display the new partitions?

viii). Create a backup with **dd** of the **mbr** that contains your 200MB primary partition.

ix). Take a backup of the **partition table** containing your 400MB primary and 300MB logical drives. Make sure the logical drives are in the backup.

x). Remove all your partitions with fdisk. Then restore your backups.

5. Logical Volume Management:

i). Create a volume group that contains a complete disk and a partition on another disk.

ii). Create two logical volumes (a small one and a bigger one) in this volume group. Format them with ext3, mount them and copy some files to them.

6. File systems

i). List the file systems that are known by your system.

ii).Create an **ext2** file system on the 200MB partition.

iii).Create an **ext3** file system on one of the 300MB logical drives.

iv).Create an **ext4** on the 400MB partition.

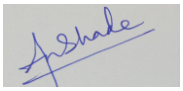
v).Set the reserved space for root on the ext3 file system to 0 percent.

vi).Verify your work with **fdisk** and **df**.

vii).Perform a file system check on all the new file systems.

7. Scheduling

i). Schedule two jobs with **at**, display the **at queue** and remove a job.


ii). As normal user, use **crontab -e** to schedule a script to run every four minutes.

iii). As root, display the **crontab** file of your normal user.

iv). As the normal user again, remove your **crontab** file.

v). Take a look at the **cron** files and directories in **/etc** and understand them. What is the **runparts** command doing ?

8. Memory Management

i). Use **dmesg** to find the total amount of memory in your computer.

ii). Use **free** to display memory usage in kilobytes (then in megabytes).

iii). On a virtual machine, create a swap partition (you might need an extra virtual disk for this).

iv). Add a 20 megabyte swap file to the system.

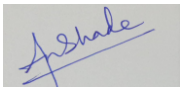
v). Put all swap spaces in **/etc/fstab** and activate them. Test with a reboot that they are mounted.

vi). Use **free** to verify usage of current swap.

Course outcomes

Upon the completion of Operating Systems Concepts practical course, the student will be able to:

ITU427.1	Apply basic commands in Linux for understanding OS concepts.
ITU427.2	Recognize CPU Scheduling, synchronization, and deadlock.
ITU427.3	Use Linux commands, and develop various system programs under Linux to make use of OS concepts related to process synchronization, shared memory, file systems.


ITU428 DESIGN AND ANALYSIS OF ALGORITHMS LAB

Teaching Scheme : 02 P **Total 02** **Credits : 01**
Evaluation Scheme: 25 ICA +25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs.

Course Objectives

I. Analyze Algorithm depending upon its time complexity & Space complexity

II. Study of various types of Algorithms :-

   a. Greedy Algorithm,

   b. Divide & conquer Algorithm,

   c. Dynamic Programming.

III. Identifying the type of problems NP, NP hard

List of Experiments:-

1.Apply Heap sort technique on a given set of elements.

2.Develop a simulator for a given set of elements using Merge sort technique / Selection sort technique .

3. Develop a simulator for a given set of elements using Quicksort technique .

4. Check whether a graph is connected using Depth first Search technique.

5.Implement 0/1 knapsack problem using greedy method.

6. Find shortest paths to other vertices using Dijkstra's algorithm.

7. A minimum cost spanning tree for a given undirected graph using Prim's algorithm or Kruskal's algorithm.

8. Print all the nodes reachable from a given starting node in a digraph using Breadth first search technique.

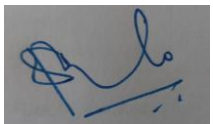
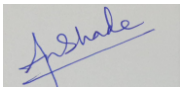
9. Develop a simulator for a pair shortest paths problem using Floyd's algorithm.

10. Design a simulator for n-Queens problem using backtracking technique.

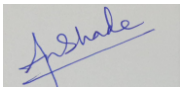
Course outcomes:

ITU 428.1 Ability to write programs to solve problems using algorithm design techniques such as Divide and Conquer.

ITU 428.2 Ability to write programs to solve problems using algorithm design techniques such as Greedy.


ITU 428.3 Ability to write programs to solve problems using algorithm design techniques such as Dynamic programming.


ITU 429 PYTHON PROGRAMMING LAB

Teaching Scheme: 04 P **Total: 04** **Credit: 02**
Evaluation Scheme: 25 ICA+ 25 ESE **Total Marks: 50**
Duration of ESE: 3 Hrs.

Course Objective

I Exposing students to free open source software, Python and to open source packages freely available.
II Enabling students to learn many open source aspects of python and help them learn to implement these to variety of problems including real-life problems and solution finding process
III Introduce open source software paradigm to the students to review popular open source software licenses, the structure of an open source project, establishing a collaborative team and software creation and current open source world events.
IV Motivation to learn variety of programming languages to be able to compete with peers around the world and participate in world programming events.

Suggested List of Experiments/Assignments but not limited to the given list of experiments:

(Note: a. Experiments/assignments can be given to students by the instructor as per current scenario of workability and availability of the technology with a flexibility of students' choice in selecting the experiments from the given list. b. Experiments aim can be updated or modified or scaled up as per the requirements of the lab sessions and can be chosen from the reference websites.)

Introduction: Open Source definition, open source technology importance in a perspective of Free and open Source Software (FOSS)

I: Introduction and syntax of Python programming

II: Python operators and Looping structures

III: Data Structures in Python

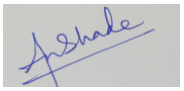
IV: Python Functions, Modules and Packages

V: Object Oriented Programming in Python

I. Experiment on basic control structures & loops.

a) Write a program for checking the given number is even or odd.

b) Using a for loop, write a program that prints the decimal equivalents of 1/2, 1/3, 1/4 ,..... 1/10


c) Write a program for displaying reversal of a number.

d) Write a program for finding biggest number among 3 numbers.

e) Write a program using a while loop that asks the user for a number, and prints a countdown from that number to zero.

II. Experiment on operators & I/O operations.

a) Write a program that takes 2 numbers as command line arguments and prints its sum.

b) Implement python script to show the usage of various operators available in python language.

c) Implement python script to read person's age from keyboard and display whether he is eligible for voting or not.

d) Implement python script to check the given year is leap year or not.

III. Experiment on Python Script.

a) Implement Python Script to generate first N natural numbers.

b) Implement Python Script to check given number is palindrome or not.

c) Implement Python script to print factorial of a number.

d) Implement Python Script to print sum of N natural numbers.

e) Implement Python Script to check given number is Armstrong or not.

IV. Experiment on Lists.

a) Finding the sum and average of given numbers using lists.

b) To display elements of list in reverse order.

c) Finding the minimum and maximum elements in the lists.

d) Write a program to count frequency of characters in a given file. Can you use character frequency to tell whether the given file is a Python program file, C program file or a text file?

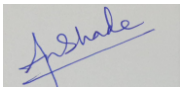
e) Write a program to compute the number of characters, words and lines in a file.

V. Experiment on Strings.

a) Implement Python Script to perform various operations on string using string libraries.

b) Implement Python Script to check given string is palindrome or not.

c) Implement python script to accept line of text and find the number of characters, number of vowels and number of blank spaces in it.


VI. Experiment on functions.

a) Define a function max_of_three() that takes three numbers as arguments and returns the largest number

b) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between 1000 and 2000.

c) Write a program to perform addition of two square matrices.

VII. Experiment on recursion & parameter passing techniques.

a) Define a function which generates Fibonacci series up to n numbers.

b) Define a function that checks whether the given number is Armstrong

c) Implement a python script for Call-by-value and Call-by-reference

d) Implement a python script for factorial of number by using recursion.

VIII. Experiment on Tuples.

a) Write a program which accepts a sequence of comma-separated numbers from console and generate a list and a tuple which contains every number. Suppose the following input is supplied to the program: 34, 67, 55, 33, 12, 98. Then, the output should be: ['34', '67', '55', '33', '12', '98'] ('34',67', '55', '33', '12', '98').

b) With a given tuple (1, 2, 3, 4, 5, 6, 7, 8, 9, 10), write a program to print the first half values in one line and the last half values in one line.

IX. Experiment on files.

a) Write Python script to display file contents.

b) Write Python script to copy file contents from one file to another.

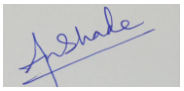
X. Experiment on searching & sorting Techniques.

a) Implement a python script to check the element is in the list or not by using Linear search & Binary search.

b) Implement a python script to arrange the elements in sorted order using Bubble, Selection, Insertion and Merge sorting techniques.

XI. Experiment on Exception handling concepts.

a) Write a python program by using exception handling mechanism.


b) Write a python program to perform various database operations (create, insert, delete, update).

XII. Experiment on:

a) Write a program to calculate overtime pay of 10 employees. Overtime is paid at the rate of Rs.12.00 per hour for every hour worked above 40 hours. Assume that employee do not work for fractional part of an hour. Write a program to calculate overtime pay of 10 employees. Overtime is paid at the rate of Rs.12.00 per hour for every hour worked above 40 hours. Assume that employee do not work for fractional part of an hour.

b) Write a function that receives marks received by a student in 3 subjects and returns the average and percentage of these marks. Call this function from main() and print the result in main.

c) Write a program to demonstrate database connectivity in python.

d) Write a script that imports requests and fetch content from the page. Eg. (Wiki)

XIII. Experiments on python Framework.(Architecture of any python Framework (Flask, Django etc.)

a) Create a virtual environment and start a project by installing necessary packages

b) Connect Database with your project.

c) Generate HTML Forms with Form class and store data into the database.

d) Create a Word Counter in any Framework. (The counter will count the number of occurrence of each word in a paragraph).

e) Create an application to send an emails using any framework.

f) Create a Login System using any Framework.

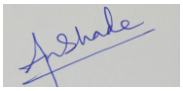
g) Create an Online School System where teacher can create assignments that students can complete and view their results.

h) Create a Weather Application using any Framework and integrate it with some APIs (Application Program Interface).

i) introduction and small exercises on packages such as - Matplotlib (for the graph plotting), Tkinter (Python GUI programming package), Python web application using Flask, Web2py packages.

j) Introduction to Anaconda Navigator for python.

XIV. Mini Project on:



a) Develop front pages of a website showing introductory details of an organization.

XV. Mini Project on:

1. Develop a mini-project of students' choice to demonstrate creativity. Eg. music player, game-station, student management systems, library management system etc.

a) Create a To-Do List app with registration, login, and CRUD Functionality.

b) Create a Chatting Application with Python.

c) Create a Token-based authentication system to work.

d) Create a Resume Builder and download that resume.

e) Create an app to take notes and store those notes in the backend database.

f) Automatic Tweet Posting

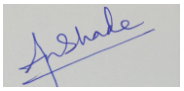
g) Railway Enquiry System.

h) Online Quiz Application

i) Ecommerce website, etc

Course Outcomes

ITU429.1 Implement various applications using open source system of Python
ITU429.2 Create simple GUI applications and develop experiments using Python
ITU429.3 Understand configuration and virtual environment of open source systems and Python
ITU429.4 To be able to explain open source project structure and how to successfully setup a project


ITU521 SOFTWARE ENGINEERING

Teaching Scheme: **03 L + 01T** **Total: 04** **Credits : 04**
Evaluation Scheme: **30 MSE +10 TA+ 60 ESE** **Total Marks: 100**
Duration of ESE: **02 Hrs. 30 min**

Course Objectives:
To expose the students to the following:

VI. To familiarize students with the principles of software engineering in general.
VII. Understand efficient techniques for managing systems development lifecycle.
VIII. To imbibe a correct sense of SE principles and role during development processes.
IX. To inculcate a sense of team-work and team-leadership in a software development team.
X. To gain a better understanding of software development processes in general and to learn different techniques and methodologies for developing large software systems

Introduction: Software Characteristics, Software Engineering: A Layered Technology, Software Process Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Agile Process Models
Software Engineering Principles and Practice: Communication Practices, Planning Practices, Requirements Engineering, Case study on feasibility and requirement analysis.
Software Quality Management and Software Testing: Quality concepts, Evolution of Quality Management, Quality assurance, Software Reviews, Testing Fundamentals, Black Box Testing, White Box Testing
Software Project Management: Introduction to Software Project Management, Project Planning, Project Scheduling, Risk Management, Software Teams and Role of Leadership, Case study on project planning and case study on the role of leadership.
Agile Software Development: Introduction to Agile development, Agile Process, Extreme Programming, Agile Process models, Object Oriented Concepts in software engineering, Case study on agile development.

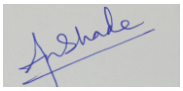
Text Books:
1. Software Engineering: A Practitioner's Approach, Roger Pressman, TMH ,Sixth Edition
2. Software Engineering, Ian Summerville, Pearson Education, Ninth Edition
3. An integrated approach to Software Engineering, Pankaj Jalote, Springer/Narosa

Reference Books:
1. Schaum's Outline of Software Engineering by David Gustafson (Tata Mc. Hill)
2. Fundamentals of Software Engineering, Rajib Mall, Prentice Hall India
3. Software Project Management, Sanjay Mohapatra, Cengage Learning India Pvt Ltd

Course Outcomes:

On completion of the course, students will be able to:

ITU521.1. Considering the general understanding of software engineering from a wider viewpoint.
ITU521.2. Apply methodically the skills learned during the course to actual circumstances of problem understanding and software development.
ITU521.3. Understand the processes of software development as an effective role player.

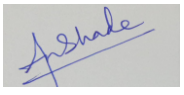

ITU521.4. Good communication in software development activities.

ITU521.5. Understand the technical and ethical obligation of developing contemporary software and engaging in lifelong learning.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU521.1	3	2	0	0	2	0	0	0	0	0	0	0	0	3	2
ITU521.2	0	2	3	2	0	0	0	0	0	0	0	0	0	3	2
ITU521.3	0	1	1	2	2	3	3	2	3	0	0	0	0	3	1
ITU521.4	1	0	0	0	0	0	0	0	2	3	2	2	2	2	3
ITU521.5	2	0	0	0	0	3	0	1	2	0	2	3	2	2	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU522 COMPUTER NETWORK

Teaching Scheme : 03 L + 00T Total 03 **Credits : 03**
Evaluation Scheme: 30MSE+10TA+ 60ESE **Total Marks: 100**
Duration of ESE: 2Hrs.30min

Course Objectives:

I. To develop an understanding of modern network architectures from a design and performance perspective.
II. To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
III. To provide an opportunity to do network programming
IV. To provide a WLAN measurement ideas.

Data communication Components: Representation of data and its flow Networks , Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

Data Link Layer and Medium Access Sub Layer: Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA

Network Layer: Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

Transport Layer: Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm

Application Layer: Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

Text Books:

1. Data Communication and Networking, Behrouz A. Forouzan, McGrawHill. 4th Edition.
2. Data and Computer Communication, William Stallings, Pearson Prentice Hall India, 8th Edition.

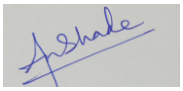
Reference Books:

1. Computer Networks, Andrew S. Tanenbaum, Pearson New International Edition, 8th Edition.
2. Internetworking with TCP/IP, Douglas Comer, Prentice Hall of India, 6th Edition.
3. TCP/IP Illustrated, W. Richard Stevens, Addison-Wesley, United States of America.

Course Outcomes:

On completion of the course, students will be able to:

ITU522.1 Interpret the functions of the different layer of the OSI Protocol.
ITU522.2 Draw the functional block diagram of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) describe the function of each block.


ITU522.3 Demonstrate design concept for a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) .

ITU522.4 Apply solution to problems related TCP/IP protocol.

ITU522.5 Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using opensource available software and tools.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU522.1	2	2	0	0	0	0	0	0	0	0	0	0	0	3	0
ITU522.2	2	2	0	0	3	0	0	1	0	0	0	0	0	2	0
ITU522.3	2	3	0	1	3	0	0	0	0	0	0	0	0	3	1
ITU522.4	2	3	2	1	3	2	0	1	0	0	0	0	1	2	2
ITU522.5	3	1	0	0	3	0	0	0	0	0	0	0	0	2	3

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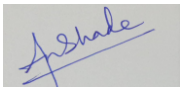



ITU523 FORMAL LANGUAGES AND AUTOMATA THEORY

Teaching Scheme: 03 L+01T **Total-04** **Credits: 04**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. Model of Language acceptors like Finite Automata for Regular Language and Push Down Automata for Context Free Language.
II. Understand formal languages like Regular Language and Context Free Language.
III. Interpret Grammar, Languages and their relationships.
IV. Design of Automata as language descriptors and recognizers.

Finite Automata: Alphabet, Language, Operations, Finite state machine, definitions, Finite automation model, Acceptance of strings and languages. Non deterministic finite automation, deterministic finite automation, equivalence between NFA and DFA, Conversion of NFA into DFA, minimization of FSM, equivalence between two FSM's, Moore and Mealy machines.

Regular expressions: Regular sets, regular expressions, identity rules, Manipulation of regular expressions, equivalence between RE and FA, Inter conversion, pumping lemma, Closure properties of regular sets.

Regular grammars: right linear and left linear grammars, equivalence between regular linear grammar and FA, inter conversion between RE and RG Context free grammar, derivation trees, Chomsky normal form, Greibach normal form, push down automata, definition, model, acceptance of CFL, equivalence of CFL and PDA, interconversion, enumeration of properties of CFL .

Turing machine: Definition, model, design of TM, computable functions, recursive enumerable language, Church's hypothesis, counter machine, types of TM's, Chomsky hierarchy of languages, linear bounded automata and context sensitive language, introduction of DCFL and DPDA, LR (O), grammar, decidability of problems.

Undecidability: properties of recursive & non-recursive enumerable languages, universal Turing machine, post-correspondence problem, introduction to recursive function theory.

Text Books :

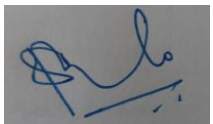
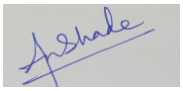
1. Introduction to Automata Theory, Languages and Computation , John E. Hopcroft,Rajeev Motwani, Jeffrey D.Ullman ,3rd Edition, Addison-Wesley Publishing Co.,2007.
2. An Introduction to Formal Languages and Automata by Peter Linz,4th Edition, Jones & Bartlett Publication, 2006 .

Reference Books:

1. Introduction to Languages and the Theory of Automata, John C.Martin,2nd Edition, McGraw- Hill Publication, 2003.
2. Elements of Theory of Computation , Lewis H.P. and Papadimition C.H. ,2nd Edition, Prentice Hall Publication, 1997.

Course Outcomes:

On completion of the course, students will be able to:


ITU523.1. To acquire a full understanding and mentality of Automata Theory as the basis of all computer science languages design.

ITU523.2. Have a clear understanding of the Automata theory concepts such as RE's, DFA's, NFA's, Stack's, Turing machines, and Grammars.

ITU523.3. Design FAs, NFAs, Grammars, languages modeling, small compilers basics.

ITU523.4. Design sample automata. Be able to minimize FA's and Grammars of Context Free Languages.

ITU523.5. Design finite automata to recognize a given regular language. Transform a language into regular expression or finite automata or Transition graph.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU523.1	3	2	0	0	3	0	0	0	0	0	0	0	0	2	1
ITU523.2	2	2	0	0	3	0	0	0	0	0	0	0	0	2	2
ITU523.3	2	2	0	0	3	0	0	0	0	0	0	0	0	2	1
ITU523.4	2	2	3	0	3	0	0	0	0	0	0	0	0	2	1
ITU523.5	2	2	3	0	3	0	0	0	0	0	3	0	0	2	2

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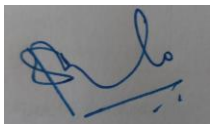
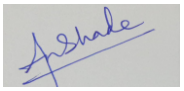




ITU524 MACHINE LEARNING

Teaching Scheme : 03 L + 00T Total 03 Credits : 03
Evaluation Scheme: 30MSE +10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives:

I. Understanding Human learning aspects.
II. Understanding primitives in learning process by computer.
III. Understanding nature of problems solved with Machine Learning.

Introduction to Machine Learning: Why Machine learning, Examples of Machine Learning Problems, Structure of Learning, Learning versus Designing, Training versus Testing, Characteristics of Machine learning tasks, Predictive and descriptive tasks, Machine learning Models: Geometric Models, Logical Models, Probabilistic Models.

Features: Feature types, Feature Construction and Transformation, Feature Selection.

Classification and Regression Classification: Binary Classification- Assessing Classification performance, Class probability Estimation Assessing class probability Estimates, Multiclass Classification.

Regression: Assessing performance of Regression- Error measures, Overfitting- Catalysts for Overfitting, Case study of Polynomial Regression.

Theory of Generalization: Effective number of hypothesis, Bounding the Growth function, VC Dimensions, Regularization theory.

Linear Models: Least Squares method, Multivariate Linear Regression, Regularized Regression, Using Least Square regression for Classification. Perceptron, Support Vector Machines, Soft Margin SVM, Obtaining probabilities from Linear classifiers, Kernel methods for non- Linearity. Logic Based and Algebraic Models

Distance Based Models: Neighbours and Examples, Nearest Neighbours Classification, Distance based clustering-K means Algorithm, Hierarchical clustering, Rule Based Models: Rule learning for subgroup discovery, Association rule mining.

Tree Based Models: Decision Trees, Ranking and Probability estimation Trees, Regression trees, Clustering Trees. Probabilistic Models Normal Distribution and Its Geometric Interpretations, Naïve Bayes Classifier, Discriminative learning with Maximum likelihood, Probabilistic Models with Hidden variables: Estimation-Maximization Methods, Gaussian Mixtures, and Compression based Models.

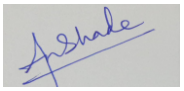
Trends in Machine Learning: Model and Symbols- Bagging and Boosting, Multitask learning, Online learning and Sequence Prediction, Data Streams and Active Learning, Deep Learning, Reinforcement Learning.

Text Books:

1. Machine Learning: The Art and Science of Algorithms that Make Sense of Data, Peter Flach, Cambridge University Press, Edition 2012.
2. Introduction to Statistical Machine Learning with Applications in R, Hastie, Tibshirani, Friedman, Springer, 2nd Edition-2012.

Reference Books:

1. Pattern Recognition and Machine Learning, C. M. Bishop, Springer 1st Edition-2013.
2. Introduction to Machine Learning, Ethem Alpaydin, PHI 2nd Edition-2013.
3. Reinforcement and Systematic Machine Learning for Decision Making, Parag Kulkarni, Wiley IEEE Press, Edition July 2012.


Course Outcomes:

On completion of the course, students will be able to:

ITU524.1. Students will be able to model the learning primitives.

ITU524.2. Students will be able to build the learning model.

ITU524.3. Student will be able to tackle real world problems in the domain of Data Mining, Information Retrieval, Computer vision, Linguistics and Bioinformatics.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU524.1	2	2	0	0	3	0	0	0	0	0	0	0	2	3	3
ITU524.2	2	2	1	0	3	0	0	0	0	0	0	0	2	3	2
ITU524.3	2	3	3	2	3	2	0	0	0	0	0	0	2	3	3

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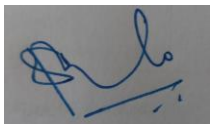
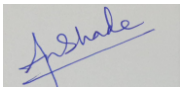




PROGRAM ELECTIVE-I

ITU525 (A) INFORMATION RETRIEVAL

Teaching Scheme: 03 L + 00T **Total 03** **Credits: 03**
Evaluation Scheme: 30MSE +10TA+ 60ESE **Total Marks: 100**
Duration of ESE: 2Hrs. 30min

Course Objectives:

I. To become familiar with important concepts of Information Retrieval.
II. To learn different indexing techniques to apply data Base systems
III. To understand common text compression algorithms and their role in the efficient building and storage of inverted indices.
IV. To understand how statistical models of text can be used to solve problems in Information Retrieval.

Introduction to Information Retrieval: Information Retrieval, History of Information Retrieval, Information Retrieval vs Data Retrieval, Inverted index and Boolean queries. Nature of unstructured and semi structured text.

Retrieval Evaluation: Recall and Precision, Alternative Measures, Reference Collections and Evaluation of IR systems. Query Languages for IR: Keywords, Boolean Queries, Context Queries, Natural Language Queries, Structural Queries.

Text Indexing and Text Searching: tokenization, stop words, stemming, thesauri, index optimization. Text statistics (properties), Text compression. Knuth-Morris-Pratt, Boyer-Moore family, Suffix automaton, Phrases and Proximity.

Retrieval Model : Boolean, vector space, TFIDF, Okapi, probabitistic, language modeling, latent semantic indexing, Vector space scoring, the cosine measure, Efficiency considerations. Document length normalization. Relevance feedback and query expansion.

Text Categorization and Filtering: Introduction to text classification. Naïve Bayes models. Spam filtering. Vector space classification using hyperplanes; centroids; k Nearest Neighbors. Support vector machine classifiers. Kernel functions. Boosting.

Text Clustering: Clustering versus classification. Partitioning methods. Mixture of Gaussians model. Hierarchical agglomerative clustering. Clustering terms using documents.

Text Book:

1. An Introduction to Information Retrieval, C. D. Manning, P. Raghavan H. Schutze Cambridge University Press, 2009.
2. Search Engines: Information Retrieval in Practice, B. Croft, D. Metzler, T. Strohman (2010), Pearson Education.

Reference Book:

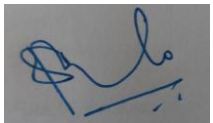
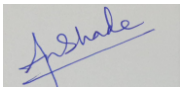
1. Modern Information Retrieval R. Baeza-Yates and B. Ribeiro-Neto Pearson Education, 1999

Useful link:

1.https://nptel.ac.in/courses/106/101/106101007/
2.https://slideplayer.com/slide/10878555/ IIT Kharagpur

Course Outcomes:

On completion of the course, students will be able to:


ITU525(A).1. Student will understanding the basic concept and techniques in Information Retrieval

ITU525(A).2. Student will be able to apply Information Retrieval principles to locate relevant information from collections of data

ITU525(A).3. Student will be able to implement different Retrieval Models like Boolean model, vector space model

ITU525(A).4. Student will design document clustering and Text classification methods.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU525(A).1	3	0	0	0	0	0	0	0	0	0	0	0	2	0	0
ITU525(A).2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3
ITU525(A).3	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0
ITU525(A).4	0	0	0	3	0	0	0	0	0	2	0	0	0-	3	3

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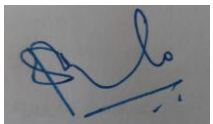
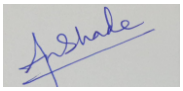




ITU525 (B) PARALLEL ARCHITECTURE

Teaching Scheme: 03 L + 00T **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 02 Hrs. 30 min

Course Objectives:

I. To train students to design and evaluate parallel architectures/systems for scientific/engineering/enterprise application domains.

II. Will be covering the main architectural components in a parallel computer, including midrange SMPs, high-performance scalable distributed memory machines, and parallel single-chip designs

III. The programming models deployed on parallel machine and automatically parallelizing compilers.

IV. Recent emerging trends and ideas in parallel machine designs on a single-chip, proposed for billion transistor multiprocessor-on-a-chip architectures, are also discussed, including coarse-grained chip-multiprocessors, fine-grained reconfigurable tiled designs, as well as speculative parallel architectures.

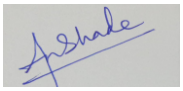
Introduction to Parallel and Pipeline Processing: Evolution of Computer Systems, Necessity of high performance, Constraints of conventional architecture .Parallelism in Uniprocessor Systems, Instruction level Parallelism and Thread Level Parallelism. Evolution of Parallel processors, Parallel Computer Structures, Future Trends. Processor - Architectural Classification Schemes Memory Subsystems in parallel environment. Hierarchical Memory Structure: Interleaved memory - structure, performance.Virtual Memory - utilisation, locality of reference, performance. Cache Memory - structure, performance, implementation, optimisation I/O and secondary storage. I/O techniques- polling, interrupts, direct memory access.

I/O channels, I/O processors: Structures, bandwidth issues Pipelining and Vector Processing Pipelining : An Overlapped Parallelism, Principles and implementation of Pipelining. Classification of pipelining processors. Study and comparison of processors with and without pipelining. General pipelining reservation table. Instruction and Arithmetic Pipelining : Design Aspects

Principles of Designing Pipelined Processors: Pipelining hazards and resolving techniques, Data buffering techniques, Job sequencing and Collision detection. Data level parallelism:Vector processing. Superscalar Architecture. SIMD Computer Organization. SIMD Array Processors: Masking and Data network mechanism, Inter PE Communication . Communication: SIMD Interconnection networks, Static Vs Dynamic Network, Cube, hyper cube, Mesh Interconnection Network. Associative Array Processors. Parallel Algorithms for Array Processors: Matrix Multiplication algorithm, Sorting algorithm and their analysis.

Performance Enhancement Methods of SIMD Array Processors Multiprocessor and Multicore Architectures. Functional Structures:Loosely and Tightly coupled multiprocessors, Processor characteristics of multiprocessors. Interconnection Networks: Time shared bus, Crossbar switch, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency. Parallel Memory Organizations for multiprocessors.

Exploiting Concurrency for Multiprocessing: Implementation issues of a program on multiprocessor system, critical sections, semaphores, monitor, producer-consumer problem.


Deadlocks: prevention, avoidance, detection. Parallel Algorithms for Multiprocessors, Parallel Programming Languages: Fortran 90. Multicore systems: Structure, performance, complexity, power consumption, memory utilization g. GPU based Architecture, CPU-GPU integration.

Text Books:

1 Computer Architecture: A Quantitative Approach (Third Edition), John Hennessy and David Patterson, Morgan Kaufmann Publishers, 2003.
2 Computer Architecture and Parallel Processing, Kai Hwang, Faye A. Briggs, McGrawHill international Edition.
3 Parallel Computer Architecture, D. E. Culler and J. P. Singh with A. Gupta,Morgan-Kaufmann publishers.

Reference Books:

1 Parallel Computers, V. Rajaraman, L Sivaram Murthy, PHI.
2 Scalable Parallel Computing, Kai Hwang.
3 High performance computer Architecture, Harrold Stone.
4 Advanced Computer Architecture, Richard Y. Kain.
5 Advanced Computer Architecture, Kai Hwang, Tata McGraw-Hil

Course Outcomes:

On completion of the course, students will be able to:

ITU525(B).1. Understand the critical methods and techniques related to parallel computing.

ITU525(B).2. The students will have a deep understanding of how parallel systems are designed and what are the fundamental methods to program and analyze them.

ITU525(B).3. Understand the components and operation of a memory hierarchy & I/O and the performance issues influencing its design.

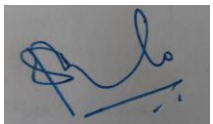
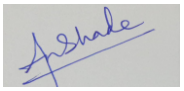
ITU525(B).4. Explain how large-scale parallel systems are architecture and how massive parallelism are implemented in accelerator architectures.

ITU525(B).5. Write parallel programs for large-scale parallel systems, shared address space platforms, and heterogeneous platforms.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU525(B).1	3	2	0	0	2	0	3	0	0	0	0	0	1	2	1
ITU525(B).2	0	2	3	2	0	0	0	0	0	0	0	0	0	3	1
ITU525(B).3	0	1	1	2	2	3	3	2	3	0	0	0	0	3	3
ITU525(B).4	1	0	0	0	0	0	0	0	2	3	2	2	1	2	3
ITU525(B).5	2	0	0	0	0	3	0	1	2	0	2	3	1	2	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU525 (C) INTERNET OF THINGS

Teaching Scheme : 03 L + 00T Total 03 Credits : 03
Evaluation Scheme: 30MSE +10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives:

VI. To understand the structure, function and characteristics of computer systems.
VII. To understand the design of the various functional units and components of computers.
VIII. To identify the elements of modern instructions sets and their impact on processor design.
IX. To explain the function of each element of a memory hierarchy,
X. To identify and compare different methods for computer I/O.

Introduction to IoT: Overview of Internet of Things, building blocks of IoT, characteristics of IoT systems and IoT levels. IoT and M2M, IoT design methodology, Technology Considerations- IoT Problem Statement, IoT , Technology Enablers, IoT Technology Stack, IoT, Data Considerations, IoT Projects, Introduction to Complexity, IoT Challenges, future of IoT, Applications of IoT, Advantages of IoT.

Retail, Healthcare & Agriculture, IoT Architecture: Reference Architecture, Study and usage of various types of sensors and actuators, IoT devices, gateways

IoT Physical Devices & Endpoints: Microprocessor, Microcontroller, Microcomputer hardware and software concepts. Study and usage of Prototyping boards like, Arduino, Intel edison, raspberry pi etc. (from software and hardware perspective) programming using sketches and python. Other programming languages used for IoT. A generic design methodology for Internet of Things

Communication: Introduction to communication architecture- Network protocol stack, Different protocols: RF: ZigBee, Blue Tooth, BLE, Zwave, Mesh network. Communication Channels: GSM/GPRS, 2G, 3G, LTE, WiFi , IoT protocols: MQTT/MQTTS, CoAP, 6LoWPAN, like TCP, UDP, HTTP/S., Comparison of the different IoT protocols,

Application issues with RF protocol - power consumption, LOS, reliability. Security aspects. Showcase the GSM module, Cloud platform and framework for developing IoT: An introduction to the use of cloud platforms and frameworks for developing IoT applications. Data Analytics for IoTCloud.

Text Books:

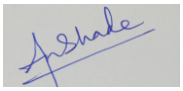
1. Internet of Things: A Hands-on Approach, ArshdeepBahga, Vijay Madisetti, Universities Press, 2015.

Reference Books:

1. Getting Started with Intel Edison, Stephanie Moyerman,Published by Maker Media, Inc., San Francisco, 2016. CA 94111.
2. Internet of Things (A Hands-onApproach), Vijay Madisetti and ArshdeepBahga, 1st Edition, VPT, 2014

Supplementary Resources: References Web

a)https://www.udemy.com/internet-of-things-iot-for-beginners-getting-started/
b)http://playground.arduino.cc/Projects/Ideas
c) http://runtimeprojects.com
d)http://www.megunolink.com/articles/arduino-garage-door-opener


e) http://www.willward1.com/arduino-wifi-tutorial
f)http://www.makeuseof.com/tag/pi-overdose-heres-5-raspberry-pi-alternatives
g) http://www.electronicshub.org/arduino-project-ideas
h) http://homeautomationserver.com
i) http://www.toptechboy.com/arduino-lessons
j)https://www.eprolabs.com
YouTube
b)https://www.youtube.com/watch?v=kLd_JyvKV4Y
c) https://www.youtube.com/watch?v=TkA2LJctU1c

Course Outcomes:

On completion of the course, student will be able to:

ITU321.6 Understand general concepts of Internet of Things (IoT)
ITU321.7 Recognize various devices, sensors and applications
ITU321.8 Apply design concept to IoT solutions
ITU321.9 Analyze various M2M and IoT architectures
ITU321.10 Evaluate design issues in IoT applications

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU525(C).1	3	0	0	0	0	2	0	0	0	0	0	0	1	2	1
ITU525(C).2	1	2	0	0	0	1	0	0	0	0	0	0	3	3	1
ITU525(C).3	1	0	3	0	2	0	0	0	0	0	0	0	2	3	2
ITU525(C).4	0	3	0	0	3	3	0	0	0	0	0	0	1	2	2
ITU525(C).5	0	2	0	0	0	2	0	3	0	0	0	0	2	2	3

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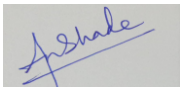



ITU526 DATA WAREHOUSING AND DATA MINING

Teaching Scheme: 03 L+ 01T **Total: 04** **Credits: 04**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. This course will introduce the concepts, techniques, design and applications of data warehousing and data mining.
II. Some systems for data warehousing and/or data mining will also be introduced.
III. The course is expected to enable students to understand and implement classical algorithms in data mining and data warehousing.
IV. Students will learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply.
V. Then, they will be able to assess the strengths and weaknesses of the algorithms and analyze their behavior on real datasets.

Data ware house and OLAP Technology for data mining: Data ware house, multidimensional data model, data ware house architecture, data warehouse storage, data ware house implementation.
Data mining: Data mining functions, classification and major issues. Data Preprocessing Data cleaning, data integration and transformation, data reduction, discrimination & concept hierarchy generation.
Data mining primitives: Concept, Data mining query language. Concept description: data generalization, Analytical characterization, mining class comparison.
Data Mining Functions: Mining frequent patterns, Market Basket Analysis, Frequent Pattern Mining, The Apriori Algorithm ,Introduction to Classification and prediction, Issues regarding classification and prediction, Classification by decision tree induction, Bayesian classification,Introduction to cluster analysis, types of data in clustering analysis, a categorization of major clustering methods, partitioning methods, hierarchical methods, outlier analysis.
Application and Advances in data mining: Data mining applications, Social Network Analysis, Text Mining.

Text Books:

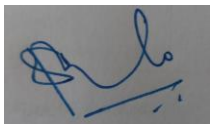
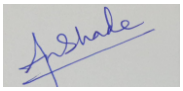
1. Data Mining Concepts and Technique's, Han and M.Kamber, 1st edition, Elsevier Pub. Indian Reprint, 2004.
2. Data Ware Housing, Data Mining and OLAP, Berson, 2nd Edition, Tata McGraw- Hill, 2004.

Reference Books:

1. The Data Ware House Life Cycle Tool Kit, R. Kimball , 1st Edition, Wiley Press, John Wiley and Sons (ASIA) Pvt. Ltd,2001.
2. Data Mining Techniques, Arun K. Pujari, 2nd Edition, University Press (Orient Longman), 2003.

Course Outcomes:

On completion of the course, students will be able to:

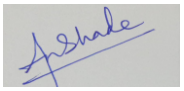




ITU526.1. Identify and apply the data warehouse and OLAP technology for data mining.
ITU526.2. Understand the data preprocessing issues and data mining functions.
ITU526.3. Analyze different data mining primitives for the functions.
ITU526.4. Implement the different algorithms of classification and prediction.
ITU526.5. Implement the different algorithms for data clustering.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU526.1	3	2	0	0	3	0	0	0	0	0	0	0	0	2	1
ITU526.2	2	2	0	0	3	0	0	0	0	0	0	0	1	2	1
ITU526.3	2	2	0	2	3	0	0	0	0	0	0	0	0	2	2
ITU526.4	2	2	2	2	3	0	0	0	0	0	0	0	2	2	3
ITU526.5	2	2	3	2	3	0	0	0	0	0	3	0	1	2	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU527 COMPUTER NETWORK LAB

Teaching Scheme : 02 P **Total 02** **Credit : 01**
Evaluation Scheme: 25 ICA+25ESE **Total Marks: 50**
Duration of ESE : 3Hrs.

Course Objectives:

V. Students will be able to use simulation tools
VI. Student will be able to understand the various protocols
VII. Students will be able to implement the various protocols
VIII. Student will be able to analyze various routing algorithms.

Minimum Eight Experiments to be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments

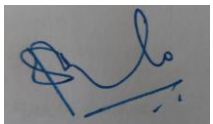
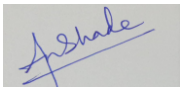
10. Implementation of Stop and Wait Protocol and Window Protocol.
11. Study of Socket Programming and Client – Server model.
12. Write a code for simulating ARP /RARP protocols.
13. Write a code for simulating PING and TRACE ROUTE commands.
14. Create a socket for HTTP for web page upload and download.
15. Write a program to implement RPC (Remote Procedure Call)
16. Implementation of Subnetting.
17. Applications using TCP Sockets like
    A. Echo client and echo server
    B. Chat
    C. File Transfer
18. Applications using TCP and UDP Sockets like
    A. DNS
    B. SNMP
    C. File Transfer
10. Perform a case study about the different routing algorithms to select the network path with its optimum and economical during data transfer.
    A. Link State routing
    B. Flooding
    C. Distance vector
11. Study of Implementation Internet Services by telnet, ssh, ftp, scp utilities.
12. Study of Network simulator (NS) and Simulation of Congestion Control Algorithms using NS.

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes:

On completion of the course, students will be able to:


ITU527.1. Use simulation tools

ITU527.2. Understand the various protocols

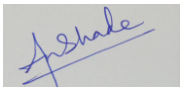
ITU527.3. Implement the various protocols

ITU527.4. Analyze various routing algorithms

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU527.1	3	2	0	0	2	0	0	0	0	0	0	0	0	2	1
ITU527.2	2	2	0	0	2	0	0	0	0	0	0	0	0	2	1
ITU527.3	2	2	0	0	3	0	0	0	0	0	0	0	0	2	1
ITU527.4	2	2	0	0	3	0	0	0	0	0	0	0	0	2	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU528 MACHINE LAERNING LAB

Teaching Scheme : 02 P **Total 02** **Credit : 01**
Evaluation Scheme: 25 ICA+25ESE **Total Marks: 50**
Duration of ESE : 3Hrs.

Course Objectives:

I. Use of Data sets in implementing the machine learning algorithms
II. Understand and Apply the machine learning concepts and algorithms.

Minimum Eight Experiments to be performed to achieve course outcomes.

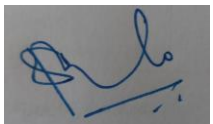
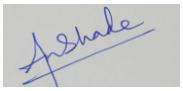
It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments:

1. Introduction to various datasets provided with sklearn and keras : Structured Vs unstructured data, iris dataset, olivetti faces dataset, MNIST dataset, CIFAR-10 dataset and <any other datasets being used in the labs> , Feature extraction, using sklearn for train-test split, standardization and normalization
2. Implementation of Linear regression.
3. Implementation of Logistic regression.
4. Write a program to implement k-Nearest Neighbor algorithm to classify the object. Use an appropriate data set for classification.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set.
6. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set.
8. Write a program to calculate the distance between objects using any one distance calculation method.
9. Write a program to implement K-Means algorithm. Use an appropriate data set for clustering.
10. Implementation of SVM(Weather forecasting/Image segmentation etc)
11. Write a program for association rule mining.
12. Write a program to calculate the Information Gain (for Decision Tree Induction).
13. Implementation of Rule-Based Classification.
14. Students have to try for ongoing competitions on the websites like Kaggle and submit the report(e.g. this project https://www.kaggle.com/c/digit-recognizer/overview)

Software: Students have to use any open source software like R/Python, TensorFlow, Scikit-learn for implementation of above practical

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.


ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course outcomes:

On completion of the course, students will be able to:

ITU528.1 Understand Machine Learning concepts in solving problems of regression, clustering, classification and SVMs nature

ITU528.2 Understand the use of various open-source/free-to-use global datasets being used for Machine Learning concepts and its implementation.

ITU528.3 Identify and understand the areas /domains in which Machine Learning can be utilized as a solution finding process.

ITU528.4 Apply appropriate Machine Learning algorithms in tackling real life problems.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU528.1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ITU528.2	0	3	0	0	3	0	0	0	0	0	0	0	0	0	1
ITU528.3	0	0	3	0	3	0	0	0	0	0	0	2	2	0	2
ITU528.4	0	0	0	0	3	0	0	0	0	0	0	0	0	3	3

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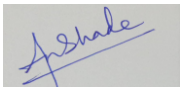



ITU529 SOFTWARE ENGINEERING LAB

Teaching Scheme: 02 P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3hrs.

Course Objectives:

I. To study object oriented analysis features.
II. To study CASE tools
III. To study the design of test cases
IV. To study the understanding of agile techniques

Minimum Eight Experiments to be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments:

1. Draw one or more Use Case diagrams for capturing and representing requirements of the system. Use case diagrams must include template showing description and steps of the Use Case for various scenarios.
2A. Draw Package diagram to organize and manage your large and complex systems as well as their complex models.
OR
2B. Draw activity diagrams to display either business flows or like flow charts.
3A. Draw basic class diagrams to identify and describe key concepts like classes, types in your system and their relationships. OR
3B. Draw advanced class diagrams to depict advanced relationships and interfaces.
4A. Draw sequence diagrams OR
4B. Communication diagrams with advanced notation for your system to show objects and their message exchanges.
5A. Draw component diagrams assuming that you will build your system reusing existing components along with a few new ones. OR
5B. Draw deployment diagrams to model the runtime architecture of your system.
6. Case study and use of appropriate CASE tools in Software engineering.
7. Case study and use of program analysis tools in the software life cycle.
8. Case study and use of test case design in software development.
9. Case study of Agile development scenario of software development.
10. Mini-project on a brief problem statement (to be decided by students)

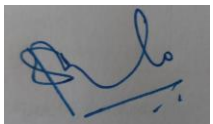
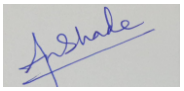
ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes:

On completion of the course, students will be able to:

ITU529.1. Able to create object oriented analysis features in SE program development


ITU529.2. Apply CASE tools for SE scenario

ITU529.3. Understand to implement program analysis tools in SELife Cycle

ITU529.4. Able to develop test cases for effective software development

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU529.1	1	2	3	2	0	0	0	0	0	0	0	0	2	2	1
ITU529.2	0	0	0	2	3	0	1	0	0	0	1	0	2	2	1
ITU529.3	2	1	2	2	3	0	0	0	0	0	1	0	1	2	3
ITU529.4	0	0	2	1	2	1	0	0	1	0	1	2	2	3	2

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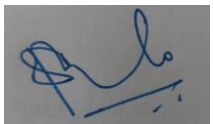
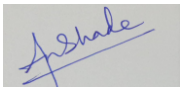




ITU530 DATA WAREHOUSING AND DATA MINING LAB

Teaching Scheme: 02 P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3hrs.

Course Objectives:

I. This course will introduce the concepts, techniques, design and applications of data warehousing and data mining.
II. Some systems for data warehousing and/or data mining will also be introduced.
III. The course is expected to enable students to understand and implement classical algorithms in data mining and data warehousing.
IV. Students will learn how to analyze the data, identify the problems, and choose the relevant algorithms to apply.
V. Then, they will be able to assess the strengths and weaknesses of the algorithms and analyze their behavior on real datasets.

Minimum Eight Experiments to be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

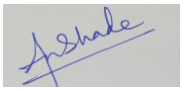
List of Experiments:

1. Implementation of Binning Methods for DATA SMOOTHING
2. Implementation of MIN/MAX normalization and Z-SCORE normalization.
3. Write a program for finding MEAN and MEDIAN of the given Data Set.
   DATA SET-(4,8,9,15,21,21,24,25,26,28,29,34)
4. Generate/Prepare HISTOGRAMS for given data using STATISTICA/WEKA software.
   DATA SET-(1,1,5,5,5,5,5,8,8,10,10,10,12,14,14,14,15, 15, 15, 15, 15, 15,18, 18, 18, 18, 18, 18, 18, 18,20, 20, 20, 20, 20, 20, 20,25, 25, 25, 25, 25,28,28,30,30,30)
5. Prepare Regression Analysis of User Data Set using STATISTICA software.(linear &non linear)
6. Implement the STAR Schema of a DATAWAREHOUSE for Sales (Consider one example).
7. Implementation of any one algorithm of Clustering.
8. Prepare Correlation analysis using CHI-SQUARE method in STATISTICA software using given Data set
9. Write a program for calculating Term Frequency and Inverse Document Frequency for given table.
10. Write a program for predicting a class Label using any one algorithm of Classification for a given data set

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes:


On completion of the course, students will be able to:

ITU530.1. Identify the data warehouse and OLAP technology for data mining.

ITU530.2. Identify the data preprocessing issues, data mining functions.

ITU530.3. Analyze different data mining primitives for the functions.

ITU530.4. Implement the different algorithms for classification and prediction.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU530.1	3	2	0	0	2	0	0	0	0	0	0	0	1	2	0
ITU530.2	2	2	0	0	2	0	0	0	0	0	0	0	2	2	1
ITU530.3	2	2	3	3	3	0	0	0	0	0	0	0	0	2	3
ITU530.4	2	2	3	3	3	0	0	0	0	0	0	0	2	2	3

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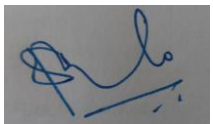
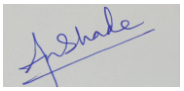




ITU621 GEOSPATIAL TECHNOLOGIES

Teaching Scheme : 03 L + 00T Total 03 Credits : 03
Evaluation Scheme: 30MSE +10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives:

At the end of course Students will be able to

I. Understand basic, practical understanding of GIS concepts, techniques and real world applications.
II. Explore on geo-referencing, projection systems, mapping, satellite data systems, and spatial data acquisition systems.
III. Apply the spatial data analysis and visualise using GIS tools and softwares.
IV. Develop the solve societal problems using Geo spatial technologies, tools and programming language like webGIS and MobileGIS.

Geographic Information Systems, Science and Study: Introduction: Why GIS, Science and Technology of problem solving, GIS Systems, GIS Science, GIS applications, GIS Components, Geographic data representation, Geographic data models: Raster and Vector data models.

Geo referencing and projection system: Early measurements, The Geoid, Measuring the Earth: latitude and Longitude, Map projection and coordinate System, Digitizing: Coordinate capture, coordinate transformation, GNSS basics, GNSS control points, Map Projections vs Transformation. Geo-referencing, satellite based positioning.

Data acquisition and assimilation: Data Sources: Aerial images, Satellite images, LiDAR , Digital data, remote sensing, Data acquisition methods: Field survey, Control survey, old records, Integration challenges in geospatial systems

Visualizing spatial data: Introduction to maps, visualizing process, cartographic toolbox, Maps types, Map scales, Map Generalization, Map boundaries, maps and cartography, Principles of map design, how to map: qualitative, quantative, terrain elevation, time series, geo visualization, map stories.

Spatial Analysis: Introduction: what is spatial analysis? Selection and Classification, Proximity Functions and Buffering, Fundamental spatial analysis techniques such as overlay, extraction and interpolation, Raster analysis: Map Algebra, Local Functions, global Functions, terrain analysis.

Web GIS: Introduction to Web GIS, Introduction to Web GIS, Introduction to Mobile GIS, Scripting Languages for GIS.

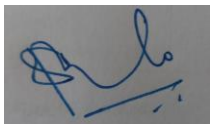
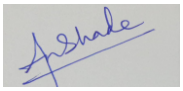
Advances in GIS: Data Standards, Data Quality, Data Accuracy, Advances and Currents developments

Text Books:

1. GIS Fundamentals_A First Text on Geographic Information Systems, Paul Bolstad– XanEdu(2016)/
2. Geographic information systems and science. , Longey, Good Child, Paul A.,et al. ,John Wiley & Sons, 2005.
3. Principals of GIS, Otto Huisman.

Reference Books:

1. Fundamentals of Geographic Information Systems, Michael N. DeMers,4th edition.Hoboken, NJ: Wiley.


2. Concepts and techniques of geographic information systems, Lo, C.P.,Yeung Albert, 2007,2nd edition, Upper Saddle River, NJ: Pearson Prentice Hall.
3. Textbook of remote sensing and geographical information systems, Reddy, M.Anji Reddy, Hyderabad: BS Publications, 2008.
4. Geospatial Infrastructure ,Application and Technologies:India case Studies, Sarda, N.L.,Acharya, P.S., Sen, Sumit(Eds.),2019.

Course Outcomes:

On completion of the course, students will be able to:

ITU621.1 Analyze spatial data, using GIS analysis tool

ITU621.2 Create maps, images and apps to communicate spatial data in a meaningful way to others

ITU621.3 Workplace competencies are strengthened as students apply the analytical and evaluative tools to GIS mapping and apps

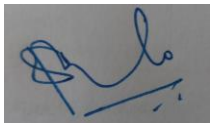
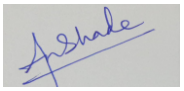
ITU621.4 Explore mapped data & Relate GIS with remote sensing technologies

ITU621.5 Develop and manage geodatabases

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU621.1	3	2	0	0	2	0	3	0	0	2	0	0	0	2	3
ITU621.2	0	2	3	2	0	0	0	0	0	0	0	0	0	3	3
ITU621.3	3	1	1	2	2	2	3	2	9	0	0	0	1	3	1
ITU621.4	1	0	2	0	0	1	0	0	2	3	2	2	2	2	1
ITU621.5	2	0	0	0	0	3	0	1	2	0	2	3	2	2	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU622 ARTIFICIAL INTELLIGENCE

Teaching Scheme: 03 L + 01T Total 04 Credits: 04
Evaluation Scheme: 30MSE +10TA+ 60ESE Total Marks: 100
Duration of ESE: 02Hrs.30min

Course Objectives:

I. To gain a historical perspective of AI and its foundations
II. To become familiar with basic principles of AI toward problem solving, inference, perception, knowledge representation, and learning.
III. To investigate applications of AI techniques in intelligent agents, expert systems and other machine learning models.

Introduction: Introduction to Artificial Intelligence, Foundations and History of Artificial Intelligence, Applications of Artificial Intelligence, Intelligent Agents, Structure of Intelligent Agents. Computer vision, Natural Language Possessing.

Knowledge Representation & Reasoning : Syntax and semantics for propositional logic, Syntax and semantics for first order logic, Inference in First order logic, Forward & Backward chaining, Resolution, Probabilistic reasoning, Utility theory, Hidden Markov Models (HMM), Bayesian Networks.

Knowledge organization and manipulation: Preliminary concept, Examples of search problems, Uniformed and blind search. Informed search. Searching AND-OR graphs, structure used in matching. Measures for matching: distance matrices, qualitative measures, similarity measures. Partial matching, Indexing and retrieval technique, integrating knowledge in memory. Memory organization system.

Knowledge Acquisition: General concept in knowledge acquisition, learning by induction. Analogical and explanation-based learning: Analogical learning and reasoning, Explanation and learning.

Expert system: Expert system architectures: Introduction, Rules based system architecture. Nonproductive system architecture, dealing with uncertainty. Knowledge acquisition and validation. Knowledge system building tools.

Text Books:

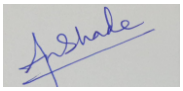
1. Artificial Intelligence, P.H.Winston, 2nd Edition Addison- Wesley Publication Company, 1984.
2. Introduction to Artificial Intelligence E.Charniac and D.McDermott, 2nd Edition, Addison Wesley Publishing Company, 2002.

Reference Book:

1. Introduction to expert systems, Peter Jackson, 3rd Edition, Addison-Wesley Publishing Company, 1986.
2. Artificial Intelligence, E.Rich, K.K.Knight,2nd Edition, Tata McGraw Hill, New Delhi, 1991.
3. LISP-The language of Artificial Intelligence, F.Holtz, TAB Books Inc. 1985.
4. Principles of Artificial Intelligence & Expert Systems Development,D.W.Rolston, McGraw Hill, 1988.

Useful link:

https://nptel.ac.in/courses/106/105/106105077/


https://nptel.ac.in/courses/106/105/106105078/

Course Outcomes:

On completion of the course, students will be able to:

ITU622.1. Student will be able to demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.

ITU622.2. Student will apply basic principles of AI in solutions that require problem solving, inference, perception.

ITU622.3. Student will apply basic principles of AI in knowledge representation, and learning.

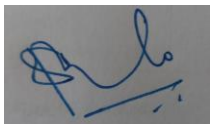
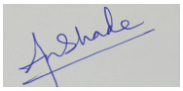
ITU622.4. Students will able to demonstrate proficiency in applying scientific method to models of machine learning.

ITU622.5. Students will apply AI techniques to real-world problems to develop intelligent systems.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU622.1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ITU622.2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	2
ITU622.3	0	0	3	0	0	0	0	0	0	0	0	0	0	3	0
ITU622.4	0	0	3	3	0	0	0	0	0	0	0	0	0	0	1
ITU622.5	0	0	0	0	2	0	0	0	0	0	0	0	2	0	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


PROGRAM ELECTIVE-II

ITU623 (A) WEB MINING

Teaching Scheme : 03 L + 00T Total 03 Credits : 03
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE Total Marks: 100
Duration of ESE : 2Hrs.30min

Course Objectives:

I. To focus on a detailed overview of the data mining process and techniques, specifically those that are relevant to Web mining

II. To Understand the basics of Information retrieval and Web search with special emphasis on web

III. Crawling To appreciate the use of machine learning approaches for Web Content Mining

IV. To understand the role of hyper links in web structure mining

V. To appreciate the various aspects of web usage mining

Information Retrieval and Web Search: Basic Concepts of Information Retrieval, Information Retrieval Models, Relevance Feedback, Text and Web Page Pre-Processing, Inverted Index and Its Compression, Latent Semantic Indexing, Web Search, Meta-Search: Combining Multiple Rankings, Web Spamming.

Social Network Analysis: Co-Citation and Bibliographic Coupling, PageRank, HITS, Community Discovery, A Basic Crawler Algorithm, Implementation Issues, Universal Crawlers.

Opinion Mining and Sentiment Analysis: The Problem of Opinion Mining, Document Sentiment Classification, Sentence Subjectivity and Sentiment Classification, Opinion Lexicon Expansion, Aspect-Based Opinion Mining, Mining Comparative Opinions, Opinion Search and Retrieval, Opinion Spam Detection.

Web Usage Mining: Data Collection and Pre-Processing, Data Modeling for Web Usage Mining, Discovery and Analysis of Web Usage Patterns, Recommender Systems and Collaborative Filtering, Query Log Mining, Computational Advertising.

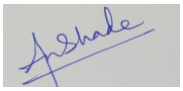
Web Content Mining: Supervised Learning, Naïve Bayesian Text Classification. Unsupervised Learning, Hierarchical Clustering, Partially Supervised Learning, Markov Models, Probability-Based Clustering, Evaluating Classification and Clustering.

Text Books:

1. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data (Data-Centric Systems and Applications), Bing Liu, Springer; 2nd Edition, 2009.
2. Web Mining and Social Networking: Techniques and Applications, Guandong Xu ,Yanchun Zhang, Lin Li,Springer; 1st Edition.2010 .

Reference Books:

1. Data Mining the Web: Uncovering Patterns in Web Content, Structure, and Usage, Zdravko Markov, Daniel T. Larose, John Wiley & Sons, Inc., 2007
2. Mining the Web: Discovering Knowledge from Hypertext Data, Soumen Chakrabarti, Morgan Kaufmann; edition 2002


3. Graph-Theoretic Techniques for Web Content Mining, Adam Schenker,World Scientific Pub Co Inc , 2005

Course Outcomes:

On completion of the course, students will be able to:

ITU623(A).1 Apply machine learning concepts to web content mining

ITU623(A).2 Implement Page Ranking algorithm and modify the algorithm for mining information

ITU623(A).3 Process data using the Map Reduce paradigm

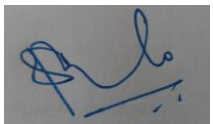
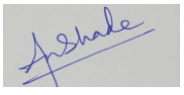
ITU623(A).4 Design a system to harvest information available on the web to build recommender systems

ITU623(A).5 Analyze social media data using appropriate data/web mining

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU623(A).1	2	2	0	0	0	0	3	0	0	0	0	0	2	1	1
ITU623(A).2	2	3	3	2	2	0	1	0	0	1	0	0	2	2	2
ITU623(A).3	0	0	0	3	2	0	0	0	0	0	1	0	2	2	1
ITU623(A).4	0	0	0	2	1	2	2	1	1	1	0	1	2	2	3
ITU623(A).5	0	0	0	0	1	2	1	2	1	1	2	1	1	3	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU623 (B) PARALLEL PROGRAMMING

Teaching Scheme: 03 L + 00T **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 02 Hrs. 30 min

Course Objectives:

I. The course gives an overview of the architectures and communication networks employed in parallel computers.
II. The course covers the foundations for development of efficient parallel algorithms, including examples from relatively simple numerical problems, sorting, and graph problems.
III. This course is intended for students who are interested in learning how to take advantage of parallel and distributed computing.
IV. The students use parallel computing in their research and enable them to write parallel code for their high-performance computing applications.

Introduction to Parallel Processing: Evolution of Computer Systems, Necessity of high performance, Constraints of conventional architecture Parallelism in Uni-processor Systems, Instruction and Thread Level Parallelism. Evolution of Parallel processors, Parallel Computer Structures, Future Trends. Instruction Set Architectures-classification, instruction formats, operations. Processor - Architectural Classification Schemes

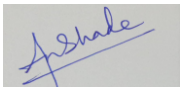
Memory subsystems in parallel environment: Hierarchical Memory Structure: Interleaved memory - structure, performance. Virtual Memory - utilization, locality of reference, performance. Cache Memory - structure, performance, implementation, optimization

I/O subsystems in parallel environment: I/O techniques- polling, interrupts, direct memory access. I/O channels, I/O processors - structures, bandwidth issues

Pipeline and Superscalar micro architecture: Pipelining: An Overlapped Parallelism, Principles and implementation of Pipelining. Classification of pipelining processors. Study and comparison of processors with and without pipelining. General pipelining reservation table. Instruction and Arithmetic Pipelining: Design aspects. Issues of designing Pipelined Processors: Pipelining hazards and resolving techniques, Data buffering techniques, Job sequencing and Collision detection. Data level parallelism: Vector processing . Superscalar Architecture.

SIMD Computer Organization: SIMD Array Processors: Masking and Data network mechanism, Inter PE Communication .Communication: SIMD Interconnection networks, Static Vs Dynamic Networks, Cube, hyper cube, Mesh Interconnection Network. Associative Array Processors. Parallel Algorithms for Array Processors: Matrix Multiplication algorithm, Sorting algorithm and their analysis. Performance Enhancement Methods of SIMD Array Processors

Multiprocessor, Multi-core, GPU Architectures: Functional Structures: Loosely and tightly coupled multiprocessors, Processor characteristics of multiprocessors, centralized and distributed shared memory architectures. Interconnection Networks: Time shared bus, Crossbar switch, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency. Exploiting Concurrency for Multiprocessing:Implementation issues of a program on multiprocessor system. Parallel Algorithms for Multiprocessors, Multiprocessor operating systems. Multi-core systems: Structure, performance. GPU based Architecture, CPU-GPU integration.


Text Books:

1 Computer Architecture: A Quantitative Approach (Third Edition), John Hennessy and David Patterson, Morgan Kaufmann Publishers, 2003.
2 Computer Architecture and Parallel Processing, Kai Hwang, Faye A. Briggs, McGraw-Hill international Edition.
3 Parallel Computer Architecture, D. E. Culler and J. P. Singh with A. Gupta,Morgan Cuffman 1st Edition ,1998.

Reference Books:

1 Parallel Computers, V.Rajaraman, L Sivaram Murthy, PHI.
2 High performance computer Architecture, Harrold Stone.
3 Advanced Computer Architecture, Richard Y. Kain.
4 Advanced Computer Architecture, Kai Hwang, Tata McGraw-Hill.

Course Outcomes:

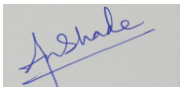
On completion of the course, students will be able to:

ITU623(B).1. Describe different ways of achieving parallelism and different parallel computer systems.
ITU623(B).2. Design Memory and Input/output subsystems in Uniprocessor and Multiprocessor environment considering the performance issues influencing its design.
ITU623(B).3. Analyze the organization and operation of different parallel computer architectures such as Pipelined processor, SIMD Array processor, Multiprocessor and Multi- core systems, superscalar processor & GPU based architectures.
ITU623(B).4. Demonstrate the parallel hardware constructs and operating system support for parallel computing.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU623(B).1	3	2	0	0	2	0	3	0	0	0	0	0	1	2	1
ITU623(B).2	0	2	3	2	0	0	0	0	0	0	0	0	1	3	3
ITU623(B).3	0	1	1	2	2	3	3	2	3	0	0	0	1	3	2
ITU623(B).4	1	0	0	0	0	0	0	0	2	3	2	2	2	2	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU623(C) WIRELESS & MOBILE COMPUTING

Teaching Scheme : 03 L + 00T Total 03 Credits : 03
Evaluation Scheme: 30MSE +10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives:

I. To demonstrate the fundamentals of wireless technology.
II. To apply the layered protocols and fundamentals for the design of wireless.
III. To analyze and apply resource optimization techniques for better performance
IV. To apply the working of different wireless networks.
V. To demonstrate knowledge of the mobile network.

Introduction: History of wireless communication , Frequency spectrum, Applications
Wireless Transmission: Frequency for radio transmission, Signals, Antennas, Signal propagation, Multiplexing, modulation, Spread spectrum, Cellular systems.
Medium Access Control: Motivation for a specialized MAC: Hidden and Exposed terminals. Near and Far terminals, multiplexing techniques.
Wireless LAN: Infrared vs. Radio transmission, Infrastructure and Ad hoc Networks, IEEE 802.11: System architecture, Protocol architecture, Physical layer, Medium access control layer, MAC management, Future development; Brief Overview of HIPERLAN, Bluetooth.
Mobile Network Layer: Mobile IP: Goals, assumptions and requirements, Entities and Terminology, IP packet delivery, Agent advertisement and discovery, Registration, Tunnelling and Encapsulation, Optimizations, Reverse tunnelling, Ipv6; Dynamic host configuration protocol, Ad hoc networks: Routing, Destination sequence distance vector, Dynamic source routing, Hierarchical algorithms, Alternative metrics.
Mobile Transport Layer: Traditional TCP, indirect TCP, Snooping TCP, Fast retransmit/fast recovery, transmission/time out freezing, selective retransmission, transaction oriented TCP.
Support for Mobility: File system , World Wide Web, Wireless application protocol.

Text Books:

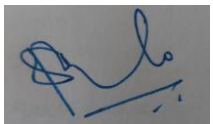
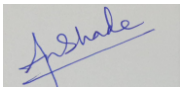
3. Mobile communications, Jochen Schiller,Addison wesley, Pearson education, 2nd Edition, 2002.

Reference Books:

4. Wireless Communications and Networks, Wiiliam Stallings, Prentice Hall, 2nd edition, 2005.
5. Wireless Communications Principals and Practices, Rappaport, 2nd Edition, Pearson Education Pvt. Ltd, 2003.

Course Outcomes:

On completion of the course, student will be able to:
ITU623(C).1. Demonstrate the fundamentals of wireless technology.
ITU623(C).2. Apply the layered protocols and fundamentals for the design of wireless communication.
ITU623(C).3. Analyze and apply resource optimization techniques for better performance.
ITU623(C).4. Apply the working of different wireless networks.


ITU623(C).5. Demonstrate knowledge of the mobile network.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU623(C).1	3	0	0	0	0	2	0	0	0	0	0	0	3	2	0
ITU623(C).2	2	3	0	0	0	1	0	0	0	0	0	0	3	3	1
ITU623(C).3	1	0	3	0	2	0	0	0	0	0	0	0	2	3	1
ITU623(C).4	0	1	0	3	3	3	0	0	0	0	0	0	2	2	2
ITU623(C).5	0	2	0	0	0	2	0	3	0	0	0	0	2	2	2

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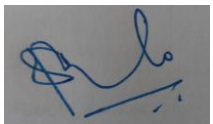
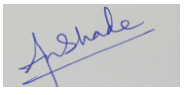




PROGRAM ELECTIVE-III
ITU 624 (A) NETWORK ARCHITECTURE AND WIRELESS PROTOCOLS

Teaching Scheme: 03 L+00T **Total:03** **Credits: 03**
Evaluation Scheme: 30 MSE+10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

VI. To understand the network addressing.
VII. To explain the functions of the routing protocols.
VIII. To identify the elements of wireless networks and its functioning.
IX. To impart the knowledge of mobile Internet protocols.

Network Layer – Addressing: Network layer services, IPv4, Problems with IPv4, strategies to bridge the limitations (IP subnetting, CIDR, DHCP, NAT), Network design with CIDR, IPv6.

Network Layer Protocols: Routing algorithms: Unicast protocols: RIP, OSPF, BGP and multicast routing protocols, ICMP, IGMP, DHCP

Transport Layer Protocols: Services, Transport layer protocols, UDP, TCP: State Transition diagram, flow control, error control, TCP Timers, Queuing disciplines, TCP Congestion control, Quality of Service

Wireless Networks and Protocols: Link Layer: IEEE 802.11 WLAN protocols, CSMA/CA, Wireless Application Protocol, Routing Protocols & Location Awareness Strategies in Wireless Networks, Resource Allocation and management in Wireless Networks, TCP over wireless network.

Mobile IP: Mobile IPv4 and Mobile IPv6. Problems with routing, Quality of Service and security

Applications: Traditional Applications (WWW, HTTP, FTP, Email, Telnet, SSH, DNS), Peer-to-Peer Networks, Socket programming.

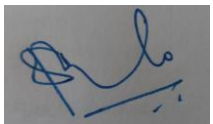
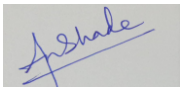
Text Books:

1. Computer Networks, A Top-Down Approach, B. A. Forouzan and Firouz Mosharraf,Tata McGraw-Hill, 2012 ISBN-13: 978-0-07-337622-6
2. IPv6:Theory, Protocol, and Practice, Pete Loshin,Elsevier, 2004 ISBN: 9780080495873.
3. TCP/IP and Network Security: Attacks and Defense Mechanisms with Open Source Tools, Dr. B. B. Meshram, K. A. Shirsath, Shroff Publishers,2017.

Reference Books:

1. Wireless Communications and Networking, Morgan Kaufmann, Vijay K Garg,2008 ISBN:978-0-12-373580-5.
2. Computer Networks: A Systems Approach, Larry L Peterson and B S Davie, Elsevier,2012ISBN 9780123850591.
3. TCP/IP Illustrated, W. Richard Stevens,Vol. 1: The Protocols, 2nd Edition, Pearson, 2012,ISBN-10: 0-321-33631-3.
4. Data Communications and Networking, B. A. Forouzan, 4th Edition, Tata McGraw-Hill,2010, ISBN-13: 978-0-07-337622-6.

Course Outcomes:


On completion of the course, students will be able to:

ITU624(A).1. Describes fundamental concepts of computer networking and functionality of layered network architecture

ITU624(A).2. Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies.

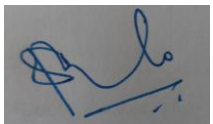
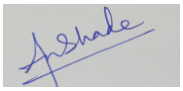
ITU624(A).3. Describe wireless and mobile networking concepts.

ITU624(A).4. Apply networking concepts to various situations, classifying networks, analyzing performance and implementing new technologies.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU624(A).1	2	2	0	0	3	0	0	0	0	0	0	0	0	3	0
ITU624(A).2	2	2	1	0	3	2	0	1	0	0	0	0	0	3	2
ITU624(A).3	2	3	0	1	3	1	0	0	0	0	0	0	0	3	1
ITU624(A).4	2	3	2	1	3	2	0	1	0	0	0	0	1	2	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU624 (B) SOFTWARE PROJECT MANAGEMENT- INDUSTRY PERSPECTIVE

Teaching Scheme: 03 L + 00T **Total: 03** **Credits : 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 02 Hrs. 30 min

Course Objectives:

To expose the students to the following:

I. To introduce advanced principles, methods and tools for software project management in a realistic engineering context.
II. Improve students' ability to manage complex product and system development projects.
III. To imbibe a sense of role of IT in addressing the issues of real-life problems.
IV. To introduce a systemic environment of team-work and influential leadership.
V. To give students an appreciation of inter and intra-company cross-functional coordination necessary to deliver successful projects.

Introduction: Software Project Management in a perspective of software industry, Organization and management of large software projects, Modernizing project management: Introducing agile project management.

The communication in project: Managing Team Dynamics and Communication, Organization and team structures, choosing the right project team members, Influential leadership: concept and understanding, Ethics for IT professionals and IT users.

Project Planning and Project Scheduling: Project monitoring and control.

Software project evaluation and program management: Risk management and software quality, software reliability.

The impact of IT: on the quality of human life, standards of human living and productivity, health care, education, agriculture, environmental factors, digital divide, mobile and internet, case studies on various topics.

Text Books:

1. Software Engineering: A Practitioner's Approach (Sixth Edition) Roger Pressman (TMH)
2. Software Engineering (Ninth Edition) Ian Summerville (Pearson Education)
3. Pankaj Jalote, An integrated approach to Software Engineering, Springer/Narosa
4. Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India

Reference Books:

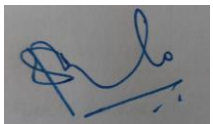
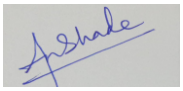
1. Schaum's Outline of Software Engineering by David Gustafson (Tata Mc. Hill)
2. Software Project Management Sanjay Mohapatra (Cengage Learning India Pvt Ltd)
3. Ethics in information Technology, George Reynolds, Cengage Learning
4. A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet, Sara Baase, PHI Publications.

Course Outcomes:

On completion of the course, students will be able to:

ITU624(B).1. Able to use the concepts of SPM to find solutions to general problems of the world.

ITU624(B).2. Apply methodically the skills learned during the course to actual circumstances of problem understanding and software development.

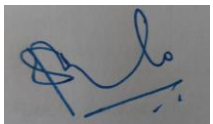
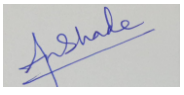

ITU624(B).3. Create in themselves abilities of thoughtful managers and team members through augmented understanding of the intricacies of software project management with inter,multi and cross-disciplinary approach.

ITU624(B).4. Understand the distinctive challenges integral in planning, executing and monitoring projects, which provide quality results for their stake-holders.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU624(B).1	1	2	1	1	2	2	2	0	2	0	0	0	2	2	3
ITU624(B).2	1	3	2	2	2	0	0	0	0	0	0	0	2	2	1
ITU624(B).3	0	0	0	2	1	3	2	2	3	2	2	1	2	3	3
ITU624(B).4	1	0	0	0	0	3	2	1	2	2	3	2	2	3	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU624 (C) DISTRIBUTED COMPUTING

Teaching Scheme: 03 L+ 00T **Total 03** **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min.

Course Objectives:

I. To expose students to both the abstraction and details of distributed file systems.
II. To introduce concepts related to distributed computing systems.
III. To focus on performance and flexibility issues related to systems design decisions.
IV. To expose students to details of message passing system and remote procedure call in distributed systems.
V. To expose students to current literature in distributed systems.

Distributed Computing System: DCS models, Distributed systems architecture, Distributed Operating Systems: Definition, Design Issues, Introduction to Distributed Computing Environment, Key characteristics, resource sharing, openness concurrency, scalability, fault tolerance, transparency.

Distributed Systems Models: Client-Server model, Thin Client, Mobile Devices, Software agents. Fundamental models: Interaction, Failure and Security models.

Message passing : Desirable features of a Good Message Passing System, Issue in IPC by message passing Synchronization, Buffering, Multi datagram messages, encoding and decoding of message data, process addressing, failure handling, Group Communication, case study 4.3 BSD UNIX IPC mechanism.

Remote Procedure Call :RPC Model, Transparency of RPC, Implementing RPC mechanism, RPC messages, Marshaling arguments and results, Server management, Parameter passing semantics, Call semantics, Communication protocols for RPC, Client Server binding, Exception handling, Security, RPC in heterogeneous environments, Optimization for better performance.

Distributed Shared Memory: General architecture of DSM system, Design and Implementation, issues of DSM, Granularity, Structure of shared memory space, Consistency models, Replacement strategy, Thrashing, Other approaches to DSM, Advantages of distributed shared memory.

Synchronization: Clock Synchronization, Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms. Resource Management: Features of Global Scheduling Algorithm, Task Assignment Approach, Load Sharing Approach.

Distributed File System : Desirable features of good Distributed file system, file models, File Accessing, Sharing, Caching methods, File replication, Fault tolerance, Atomic transactions, Design principles.

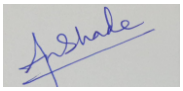
Case study: CORBA.

Text Books :

1. Distributed Operation System, Concepts and Design, P.K. Sinha, 2nd Edition, IEEE Press, Prentice Hall India,1998.
2. Distributed Systems Concepts and Design ,George Coulouris, Jean Dollimore, and Tim Kindberg, 3rd Edition., Addison Wesley, 2002

Reference Books:

1. Distributed Operating System ,A. S. Tanenbaum , 2nd Edition, Prentice Hall India ,2002.


Course Outcomes:

On completion of the course, students will be able to:

ITU624(C).1. Identify the issues in designing distributed operating system.

ITU624(C).2. Identify the desirable features of good message passing system and issues in designing inter process communication system by message passing.

ITU624(C).3. Design and develop distributed programs using RPC.

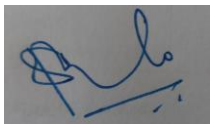
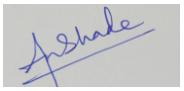
ITU624(C).4. Identify the issues of distributed shared memory system.

ITU624(C).5. Analyze different algorithms and techniques for the synchronization.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU624(C).1	3	2	0	0	2	0	0	0	0	0	0	0	1	2	2
ITU624(C).2	2	2	0	0	3	0	0	0	0	0	0	0	0	2	2
ITU624(C).3	2	2	2	2	2	0	1	0	0	0	0	0	1	2	3
ITU624(C).4	2	2	2	2	3	0	0	1	0	0	0	0	2	2	1
ITU624(C).5	2	2	2	2	3	0	0	0	0	0	3	0	1	2	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU625 CLOUD COMPUTING

Teaching Scheme : 03 L + 00T Total 03 Credits : 03
Evaluation Scheme: 30MSE +10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives:

I. To understand the concepts of Cloud Computing.
II. To learn Taxonomy of Virtualization Techniques.
III. To learn Cloud Computing Architecture.
IV. To acquire knowledge on Aneka Cloud Application Platform.
V. To learn Industry Cloud Platforms.

Introduction to Cloud: Cloud Computing at a Glance, The Vision of Cloud Computing, Defining a Cloud, A Closer Look, Cloud Computing Reference Model. Characteristics and Benefits, Challenges Ahead, Historical Developments.

Virtualization: Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples- VMware and Microsoft Hyper-V.

Before the Move into the Cloud: Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications

Cloud Computing Architecture : Introduction, Cloud Reference Model, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance. **Ready for the Cloud:** Web Application Design, Machine Image Design, Privacy Design, Database Management, Data Security, Network Security, Host Security, Compromise Response. **Defining the Clouds for Enterprise:** Storage as a service, Database as a service, Process as a service, Information as a service, Integration as a service and Testing as a service. Scaling a cloud infrastructure - Capacity Planning, Cloud Scale.

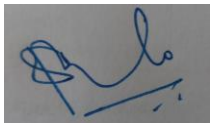
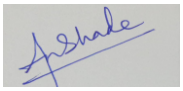
Disaster Recovery: Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.

Aneka: Cloud Application Platform Framework Overview, Anatomy of the Aneka Container, From the Ground Up: Platform Abstraction Layer, Fabric Services, Foundation Services, Application Services, Building Aneka Clouds, Infrastructure Organization, Logical Organization, Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Cloud Programming and Management, Aneka SDK, Management Tools.

Cloud Applications: Scientific Applications – Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming.

Cloud Platforms in Industry: Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model. Microsoft Azure- Azure Core Concepts, SQL Azure.

Text Books:


1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi from TMH 2013.
2. Cloud Application Architectures, George Reese ,First Edition, O‟Reilly Media 2009.

Reference Books:

1. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide , David S. Linthicum, Pearson 2010.
2. Cloud Computing, Dr. Kumar Saurabh, 2 nd Edition, Wiley India 2012.
3. Cloud Computing, web based Applications that change the way you work and collaborate Online, Micheal Miller.Pearson Education.

Course Outcomes:

On completion of the course, students will be able to:

ITU625.1. Understand the concept of virtualization and how this has enabled the development of Cloud Computing

ITU625.2. Know the fundamentals of cloud, cloud Architectures and types of services in cloud

ITU625.3. Understand scaling, cloud security and disaster management

ITU625.4. Design different Applications in cloud

ITU625.5. Explore some important cloud computing driven commercial systems

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU625.1	3	0	0	0	0	2	0	1	0	0	0	0	0	2	0
ITU625.2	2	2	0	0	0	2	0	0	0	0	0	0	0	3	1
ITU625.3	2	0	3	0	2	0	0	2	0	0	0	0	0	3	1
ITU625.4	0	3	0	0	3	3	0	0	0	0	0	0	0	2	2
ITU625.5	0	2	0	0	2	2	0	3	0	0	0	0	0	2	3

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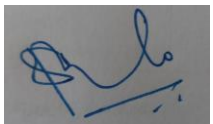
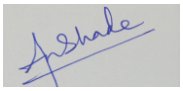




OPEN ELECTIVE-I

ITU633 (A) COMPUTER ORIENTED OPERATION RESEARCH

Teaching Scheme : 03 L+ 00T **Total: 03** **Credits : 03**
Evaluation Scheme : 30 MSE +10 TA+ 60 ESE **Total Marks :100**
Duration of ESE: 2hrs.30min.

Course Objectives:

Students will learn to

I. Formulate a real-world problem as a mathematical programming model
II. Understand the theoretical workings of the simplex method for linear programming and perform iterations of it by hand
III. Understand the meaning, purpose, and tools of Operations Research
IV. Solve specialized linear programming problems like the transportation and assignment problems
V. Solve network models like the shortest path, minimum spanning tree, and maximum flow

Introduction of Operations Research: Introduction, Characteristic, Phases, Scope of OR, Drawbacks and difficulties of OR, OR models, Solving OR models, Queuing and simulation model, Art of modeling.

Simplex Method for Solution of LPP: Standard form of an LP problem, Simplex Algorithm for Maximization case, Simplex Algorithm for Minimization case; Big- M Method, Alternative optimal solution, unbounded solution and Infeasible, solution in terms of the termination of simplex method.

Transportation and Assignment Problem: Mathematical formulation of TP, Initial Basic feasible Solution: North-West Corner-Method (NWCM), Least Cost Method (LCM), Vogel's Approximation Method (VAM), Testing for Optimality and finding Optimum solution by Modi Method, Mathematical formulation of AP, Solving Assignment problem by Hungarian Method

Games Theory and Sequencing Problems: Introduction of Theory of Game, Two-Person Zero-Sum Game Rules to determine the Saddle point and Games with Saddle, point(Pure Strategies), Notations, Terminology and assumptions of Sequencing Problems, Processing n jobs through two Machines and n jobs through m Machines, Processing two jobs through m Machines.

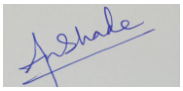
Project Scheduling (CPM and PERT): Introduction, Basic differences between PERT and CPM, Network Diagrams, Critical Path Method, PERT calculations.

Text Books:

1. Operations Research – Theory and Application, J. K. Sharma, 4th Edition, Macmillan Publishers India 2009
2. Operation Research an Introduction, Hamdy A. Haha, 6th Edition, Prentice Hall of India 2001

Reference Books:

1. Operational Research, P. K. Gupta ,3rd Edition, S. Chand and Co. 2006.


2. Introduction to Operations Research - A Computer oriented algorithmic approach, Gillet B.E., McGraw Hill, 1987.

Course Outcomes:

On completion of the course, students will be able to:

ITU626(A).1. Formulate and solve mathematical model (linear programming problem) for a physical situations like production, distribution of goods and economics.

ITU626(A).2. Apply the concept of simplex method and its extensions to dual simplex algorithm.

ITU626(A).3. Solve the problem of transporting the products from origins to destinations with least transportation cost.

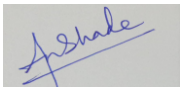
ITU626(A).4. Convert and solve the practical situations into non-linear programming problem.

ITU626(A).5. Identify the resources required for a project and generate a plan and work schedule.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU626(A).1	3	2	0	0	3	0	0	0	0	0	0	0	0	2	1
ITU626(A).2	2	2	0	0	3	0	0	0	0	0	0	0	0	2	0
ITU626(A).3	2	2	0	0	3	0	0	0	0	0	0	0	0	2	3
ITU626(A).4	2	2	0	0	3	0	0	0	0	0	0	0	0	2	0
ITU626(A).5	2	2	0	0	3	0	0	0	0	0	3	0	0	2	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU633 (B) INTRODUCTION TO DATA STRUCTURES

Teaching Scheme : 03 L + 00T Total 03 Credits : 03
Evaluation Scheme: 30MSE +10TA+ 60ESE Total Marks: 100
Duration of ESE: 2Hrs.30min

Course Objectives:

I. To impart the basic concepts of data structures and algorithms
II. To understand basic concepts about stacks, queues, lists, trees and graphs
III. To understand concepts about searching and sorting techniques

Introduction to data structure and Algorithms: Performance analysis of Algorithm, time complexity, Asymptotic Notation-Big O, Omega, and Theta notations, Elementary data organization, data structure operations. Arrays:- Operation on arrays, representation of arrays in memory. Single dimensional and multidimensional arrays, spare matrices.

Stack, Queue and Linked List: Singly and doubly linked list, operations on Linked Lists and implementations. Stack operation, Array representation of stacks, Operation associated with stacks, Application of stacks, Recursion, Polish expression, Representation Queue, operation on Queue, Priority Queue

Trees : Basic terminology, Binary Trees, Binary tree representation, Algebraic/expressions, Complete Binary Trees, Extended binary tree, representing binary tress in memory, linked representation of Binary trees, Traversing binary trees & Searching in binary trees, Inserting in binary search trees, Complexity of searching algorithm, Heaps, general trees, Threaded binary tree. Introduction to B tree and B+ tree

Graphs and their applications: Introduction, Graph Theory Terminology, Sequential Representation of Graphs; Adjacency Matrix, Path Matrix, Shortest Paths, Linked Representation of a Graph, Operation on Graphs, Traversing a Graph. Topological Sorting.

Searching and Sorting: Linear search, binary Search, Internal and External sorting, Bubble sorting, selection sort, Insertion sort, quick sort, Two way merge sort, Heap sort, sorting on different keys. Introduction to hashing.

Text Book:

1. Data Structures ,Trembley and Sorenson 3rd Edition, Tata McGraw Hill,1986.

Reference Book:

1. Theory and Problems of Data Structures, S. Lipschutz, SCHAUM'S OUTLINE SERIES, 2nd edition, Tata McGraw Hill,1986.
2. Data Structures, Horowitz and Sahni 2nd Edition, Galgotia Publication, 1992

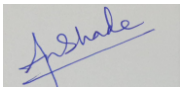
Useful link:

http://nptel.ac.in/courses/106106130/, IIT Madras
http://nptel.ac.in/courses/106103069/, IIT Guwahati
http://nptel.ac.in/courses/106106127/, Prof. Shankar Balachandran, IIT Madras

Course Outcomes:

On completion of the course, students will be able to:

ITU626(B).1 For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity.
ITU626(B).2 For a given problem student will able to apply the concepts of Arrays,Stacks, Queues and linked list
ITU626(B).3 Student will able to understand concepts of Graph and traversal algorithms

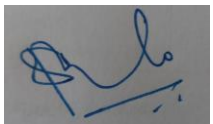

ITU626(B).4 Student will able to summarize searching and sorting techniques

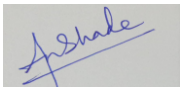
ITU626(B).5 Student will able to apply the concepts of Trees search and traversal algorithms

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU626(B).1	3	0	0	0	0	0	0	0	1	0	0	0	0	2	0
ITU626(B).2	3	2	0	0	0	0	0	0	1	0	0	0	1	2	0
ITU626(B).3	3	0	0	0	0	0	0	0	0	0	0	0	0	2	0
ITU626(B).4	3	0	0	0	0	0	0	0	1	0	0	0	0	2	0
ITU626(B).5	3	0	0	0	0	0	0	0	1	0	0	0	2	3	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated





ITU627 GEOSPATIAL TECHNOLOGIES LAB

Teaching Scheme : 02 P **Total 02** **Credits : 01**
Evaluation Scheme: 25 ICA +25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs

Course Objectives:

I. To understand basic practical understanding of GIS concepts.
II. To apply spatial data analysis and visualize using GIS tools and software.
III. Develop and solve societal problems using Geo spatial technologies and programming languages like webGIS and MobileGIS**.**

Minimum Eight Experiments to be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments:

1. Understanding QGIS and other GIS mapping tools.
2. Working with QGIS.
3. Creating digital maps using geospatial objects.
4. Understanding digital data, data collection techniques and various data formats.
5. Importing various data formats to QGIS to build map and features.
6. Working with basics of spatial data analysis.
7. Working with multiple layers of digital maps and complex query analysis.
8. Developing web pages for webGIS.
9. Working with scripting languages for dynamic webGIS contents.
10. Accessing webGIS/Mobile through private/public hosting infrastructure using GeoNode.

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes:

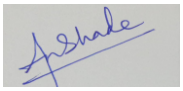
On completion of the course, students will be able to:

ITU627.1. Understand basic practical understanding of GIS concepts.
ITU627.2. Apply spatial data analysis and visualize using GIS tools and software.
ITU627.3. Develop and solve societal problems using Geo spatial technologies and programming languages like webGIS and MobileGIS.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU627.1	3	2	0	0	2	0	0	0	0	0	0	0	0	2	0
ITU627.2	0	2	3	1	0	0	0	0	0	0	0	0	2	2	1
ITU627.3	0	2	2	1	3	0	0	0	0	0	0	0	0	3	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU628 ARTIFICIAL INTELLIGENCE LAB

Teaching Scheme : 02 P **Total 02** **Credits : 01**
Evaluation Scheme: 25 ICA +25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs

Course Objectives:

I. To develop skills for designing and analyzing AI based algorithms.
II. To enable students to work on various AI tools.
III. To provide skills to work towards solution of real life problems

Minimum Eight Experiments to be performed to achieve course outcomes.

It is a representative list of practical/exercises. The instructor may choose experiments to fulfill the course outcomes.

List of Experiments:

1. Installation and working on various AI tools like: Python, R tool, GATE, etc.
2. Data preprocessing and annotation.
3. Learn existing datasets and Treebanks.
4. Searching techniques in AI.
5. Classification of linearly separable data with a perceptron
6. Classification of a 4-class problem with a perceptron
7. AI with Python – Supervised Learning: Classification
8. Support Vector Machines (SVM) Classifier.
9. Back propagation Algorithm
10. Case Study

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes:

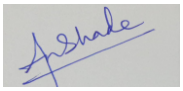
On completion of the course, students will be able to:

ITU628.1. Elicit, analyze and specify software requirements.
ITU628.2. Simulate given problem scenario and analyze its performance.
ITU628.3. Develop programming solutions for given problem scenario.
ITU628.4. Apply AI based algorithms to solve real life problems.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU628.1	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ITU628.2	3	0	0	0	3	0	0	0	0	0	0	0	2	0	2
ITU628.3	0	3	0	3	3	0	0	0	0	0	0	0	0	0	2
ITU628.4	0	0	0	0	3	0	0	0	0	0	0	0	0	3	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated

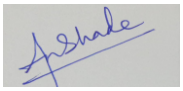

ITU 629 WEB & INTERNET TECHNOLOGY LAB

Teaching Scheme : 04 P **Total 04** **Credits : 02**
Evaluation Scheme: 25 ICA+ 25 ESE **Total Marks: 50**
Duration of ESE: 3Hrs

Course Objectives:

I. To study Cascading Style Sheets (CSS)
II. To study Client-side Programming using JavaScript for validating the data
III. To study Creation of software components (objects used for client and server communication) using Beans.
IV. To study Server-Side Programming using servlets.
V. To study Creating a pure Dynamic Web Application which retrieves the data from Database according to the client request using JDBC.

1. Create a web page with advanced layouts and positioning with CSS and HTML.
2. Design a website with different methods of embedding CSS in a web page.
3. Create a static web page which displays your personal details.
4. Create a web page through which the user can enter his / her details to become an authenticated user of that page.
5. Create a web page that shows different methods of embedding JavaScript.
6. Create a web page with rollover menus. Rollover menus should be created using JavaScript.
7. Validate the registration form with the following criteria:
   - Name and Age should be Mandatory Fields.
   - Password and Re-enter Password fields should contain same value.
   - Name field should accept only character values.
8. Write a PHP program to store current date-time in a COOKIE and display the 'Last visited on' date-time on the web page upon reopening of the same page.
9. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page.
10. Using PHP and MySQL, develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.
11. Create a registration form using Angular JS.
12. Create a simple AngularJS calculator application using Angular Services.
13. Create an application using angular JS filters.
14. Design an XML document to store information about a student in an engineering college. The information must include USN, Name, Name of the College, Branch, Year of Joining, and e-mail id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.
15. Create an XML document with the following sample real estate data
    - Root element real-estate will contain a sequence of sub-elements agencies, owners, properties and flats, all with an empty content


- Ensure well-formedness

16. Create an internal DTD for the previous XML document
- Ensure its validity
- Then try to break it

17. Move the previous DTD to an external file and validate the XML document again
18. Create an application that loads a text string into an XML DOM object, and extracts the info from it with JavaScript.
19. Create an application which reads data from an XML file into XMLDOM object and retrieves the text value of the first element in the xml file.
20. Write a Servlet program which uses JDBC connectivity.

ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes:

On completion of the course, students will be able to:

ITU629.1 Create and Mange static web pages for given scenario.

ITU629.2 Apply server side technologies to establish dynamic applications.

ITU629.3 Implement web applications with effective data management.

ITU629.4 Develop secure web applications with session management API"s.

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU629.1	1	2	3	3	2	0	0	0	0	0	0	0	2	3	1
ITU629.2	0	0	0	2	3	0	0	0	0	0	2	0	1	2	2
ITU629.3	0	0	0	0	3	2	2	1	0	0	2	1	1	2	3
ITU629.4	0	0	2	2	2	0	0	0	0	0	2	0	1	1	3

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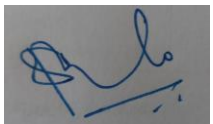
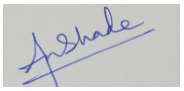




ITU630 MINOR PROJECT

Teaching Scheme : 06 P **Total 06** **Credit : 03**
Evaluation Scheme: 50 ICA+50ESE **Total Marks: 100**
Duration of ESE : 3Hrs.

Course Objectives:

I. To offer students a glimpse into real world problems and challenges that need IT based solutions
II. To enable students to create very precise specifications of the IT solution to be designed and use all concepts of IT in creating a solution for a problem.
III. To introduce students to the vast array of literature available of the various research challenges in the field of IT and create awareness among the students of the characteristics of several domain areas where IT can be effectively used.
IV. To enable students to and improve the team building, communication and management skills of the students.

Minor Project Each batch consists of maximum 2-3 students.
Students can refer following domain list for developing minor project.

1. Web server, DNS Server, Proxy Server, Mail Server.
2. Database connectivity.
3. Cyber Security
4. Client-server Architecture.
5. Networking.
6. Data mining and Data Ware housing.
7. Data Science.
8. Machine Learning, Deep Learning.
9. Internet of Things.
10. Cloud Computing.
11. Artificial Intelligence.
12. Block chain.
13. Network Security.
14. Big Data Analytics.

Workflow to be carried out by the students to develop Minor Project

1. Understand the full background of project study and Identify the statement of the problem.
2. A comprehensive literature review supporting your project study.
3. Data collection, analysis and project design should be carried out.
4. Actual Implementation of project modules should be carried out.
5. The final evaluation and interpretation of your project results.

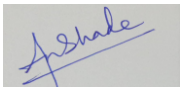
ICA – The Internal Continuous Assessment shall be based on practical record and knowledge or skills acquired. The performance shall be assessed experiment wise by using continuous assessment format, A & B.

ESE- The End Semester Exam for Practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes:

On completion of the course, students will be able to:

ITU630.1. Discover potential research areas in the field of IT


ITU630.2. Conduct a survey of several available literature in the preferred field of study and Formulate and propose a plan for creating a solution for the research plan identified

ITU630.3. Compare and contrast the several existing solutions for research challenge and demonstrate an ability to work in teams and manage the conduct of the research study.

ITU630.4. To report and present the findings of the study conducted in the preferred domain

CO-PO-PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU630.1	3	2	0	3	3	0	0	0	0	0	3	0	0	3	1
ITU630.2	0	3	2	0	0	0	0	0	0	0	0	0	3	0	1
ITU630.3	2	0	0	0	0	0	0	0	3	3	0	0	3	0	2
ITU630.4	0	0	0	0	0	0	0	0	0	0	3	3	0	3	2

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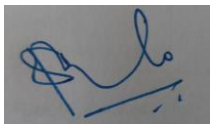
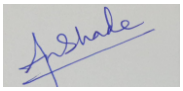




PROGRAM ELECTIVE-IV

ITU721 (A) DATA ANALYTICS

Teaching Scheme: 03 L **Total:03** **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs. 30min

Course Objectives:

VI. Explore the fundamental concepts of data analytics.
VII. Understand descriptive, inferential and predictive data analytic techniques.
VIII. Find meaningful patterns in data.
IX. Understand prescriptive data analytic techniques
X. Implement analytical algorithms.

Descriptive Statistics: Introduction to data analytics, Descriptive Statistics, Probability Distributions, Inferential Statistics through hypothesis tests Permutation & Randomization Test.

Regression and ANOVA: Regression, ANOVA (Analysis of Variance).

Machine Learning: Introduction and Concepts, Differentiating algorithmic and model based frameworks, Regression, Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbors.

Unsupervised Learning and Challenges for Big Data Analytics: Clustering, Associative Rule Mining, Introduction to big data analytics, Challenges for big data analytics.

Prescriptive analytics: Creating data for analytics through designed experiments**,** creating data for analytics through Active learning, creating data for analytics through Reinforcement learning.

Text Books:

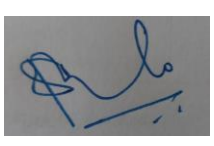
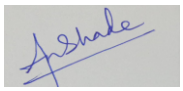
1. The elements of statistical learning, Hastie, Trevor, et al, Vol. 2. No. 1 New York: Springer, 2009.
2. Applied statistics and probability for engineers, Montgomery, Douglas C., and George C. Runger, John Wiley & Sons, 2010

Reference Books:

1. Analytics in a Big Data World: The Essential Guide to Data Science and its Applications (WILEY Big Data Series), Bart Baesens, John Wiley & Sons, 2014.

2. Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics, Bill Franks John Wiley & sons, 2012.

Course Outcomes:


On completion of the course, students will be able to:

ITU721(A).1 Understand the essentials of data analytics and the corresponding terminologies.

ITU721(A).2 Analyze the steps involved in the Analytics process.

ITU721(A).3 Identify meaningful patterns in data.

ITU721(A).4 Understand use of descriptive, predictive and prescriptive analytics.

ITU721(A).5 Simulate algorithms for data analytics.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU721(A).1	3	3	2	2	0	3	1	2	3	2	2	2	0	3	3
ITU721(A).2	3	0	3	2	3	3	2	1	2	3	2	3	3	3	0
ITU721(A).3	0	3	3	2	2	2	1	3	2	3	3	0	0	0	3
ITU721(A).4	2	3	3	3	2	2	2	1	3	3	3	2	3	3	0
ITU721(A).5	3	3	3	3	3	3	3	2	3	3	2	2	3	3	3

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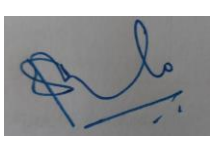
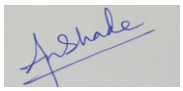




ITU721 (B) AD-HOC NETWORKS

Teaching Scheme: 03 L+ 00T Total: 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. Explain fundamental principles of Ad-hoc Networks.
II. Discuss a comprehensive understanding of Ad-hoc network protocols.
III. Outline current and emerging trends in Ad-hoc Wireless Networks.
IV. Analyze energy management in ad-hoc wireless networks.

Introduction: Introduction to ad-hoc networks – definition, characteristics features and applications. Characteristics of wireless channel, ad-hoc mobility models: indoor and outdoor models.

Medium Access Protocols: MAC Protocols: Design issues, goals and classification. Contention based protocols with reservation, scheduling algorithms, protocols using directional antennas. IEEE standards: 802.11a, 802.11b, 802.11g, 802.15, HiperLan.

Network Protocols: Routing Protocols: Design issues, goals and classification. Proactive Vs reactive routing, unicast routing algorithms, Multicast routing algorithms, hybrid routing algorithm, energy aware routing algorithm, hierarchical routing, QoS aware routing.

End-End Delivery and Security: **Transport Layer:** Issues in designing – Transport layer classification, adhoc transport protocols. Security issues in adhoc networks: issues and challenges, network security attacks, secure routing protocols.

Cross Layer Design: Need for cross layer design, cross layer optimization, parameter optimization techniques, cross layer cautionary perspective. Integration of adhoc with Mobile IP networks.

Text Books:

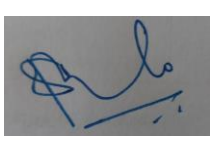
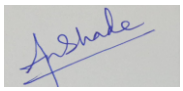
1. Ad hoc Wireless Networks Architecture and Protocols, C. Siva Ram Murthy and B.S. Manoj, 2nd Edition, Pearson, 2007.
2. Ad Hoc and Sensor Networks, Carlos de Morais Cordeiro and Dharma Prakash Agrawal, 2nd Edition, World Scientific, 2013.

References:

1. Ad hoc Networking, Charles E. Perkins, Addison Wesley, 2000.
2. Mobile ad-hoc networking, Stefano Basagni, Marco Conti, Silvia Giordano and Ivan stojmenovic, Wiley-IEEE press, 2004.
3. The handbook of ad-hoc wireless networks, Mohammad Ilyas, CRC press, 2002

Course Outcomes:

On completion of the course, students will be able to:
ITU721.1 Understand characteristics of conventional networks and ad hoc networks.
ITU721.2 Design wireless network as per the requirement.
ITU721.3 Evaluate the existing network and improve its quality of service.


ITU721.4 Choose appropriate protocol for various applications.
ITU721.5 Examine security measures present at different level.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU721.1	3	0	0	1	2	3	2	1	2	2	2	2	3	1	2
ITU721.2	3	2	3	2	2	3	2	2	3	2	2	2	3	3	3
ITU721.3	1	2	0	1	2	2	2	1	1	1	2	2	2	2	2
ITU721.4	3	0	0	1	0	1	0	1	0	0	0	1	3	1	3
ITU721.5	2	2	0	3	2	3	2	3	0	1	0	2	2	3	3

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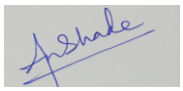



ITU721(C) SPEECH AND NATURAL LANGUAGE PROCESSING

Teaching Scheme: 03 L **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. Fundamental concepts and techniques of speech and natural language processing
II. Understand the computational properties of natural languages and the commonly used algorithms for processing language information.
III. How natural language can be processed and understood by machines.
IV. Basics of Text Summarization, Text Classification and Machine Translation

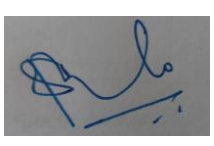
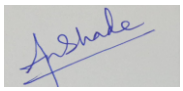
Introduction: NLP tasks in syntax, semantics, and pragmatics. Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field.
Basic Text Processing: Tokenization, Space-based tokenization, Issues in Tokenization, Stemming-Porter Stemmer
Language Modeling: N-grams-Introduction, evaluating Language Models, Generalization and Zeros, smoothing, Kneser-Ney Smoothing, Huge Language Models and Stupid Backoff, Advanced- Perplexity's Relation to Entropy.
Morphology, Parts of Speech Tagging and Sequence Labeling: Lexical syntax. Hidden Markov Models
Syntax: Grammar formalisms and treebanks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs. Neural shift-reduce dependency parsing
Distributional Semantics: Lexical semantics, word senses, Relations between senses, WordNet: A Database of Lexical relations, Word Sense Disambiguation, Alternate WSD algorithms and tasks, Using Thesauruses to improve embedding, word sense induction
Information Extraction: Relation extraction, Event extraction, Named entity recognition and relation extraction. IE using sequence labeling. Text summarization, Text classification
Machine Translation: Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

Text Books

1. Speech and Language Processing, Daniel Jurafsky and James H. Martin, 2nd Edition, Prentice Hall
2. Foundations of Statistical Natural Language Processing, Christopher D. Manning and Hinrich Schütze MIT Press.

Reference Books:

1. Natural Language Understanding, Second Edition, Allen, James ,Benjamin/Cumming, 1995.
2. Statistical Language Learning, Charniack, Eugene, MIT Press, 1993.


Course Outcomes:

On completion of the course, students will be able to:

ITU721(C).1 Describes fundamental concepts and techniques of speech and natural language processing

ITU721(C).2 Apply various Part-of-Speech Tagging algorithms

ITU721(C).3 Identify and apply efficient parsing for context-free grammars (CFGs).

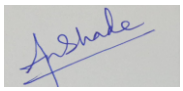
ITU721(C).4 Understand and apply lexical semantics and Information Extraction techniques

ITU721(C).5 Explain Statistical machine translation framework

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU721(C).1	2	1	1	1	0	1	0	1	1	1	2	2	1	1	1
ITU721(C).2	2	1	1	2	0	2	0	1	1	2	3	2	2	2	1
ITU721(C).3	2	3	1	2	0	1	0	1	1	2	3	3	2	2	1
ITU721(C).4	3	3	1	2	0	2	0	1	1	2	2	3	3	2	1
ITU721(C).5	3	2	1	0	0	2	0	1	1	1	2	2	2	1	1

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU721 (D) INFORMATION SECURITY

Teaching Scheme: 03 L Total: 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. Explain the need of information security, its awareness, and history of computer security, threats and attacks associated with it.
II. Understand the various techniques of symmetric encryption, public key and message authentication
III. Identify different functionalities for Email Security
IV. Describe the basics of Web Security, IP Security, Secure Electronic Transaction

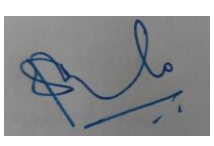
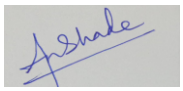
Introduction: Introduction to Privacy Data Protection & Privacy Terminologies - Data Protection Principles and Approaches to Privacy - Code for protection of Personal Information - Information Life Cycle -Data Security Threats and Mitigation. Need of security, Attributes of security, OSI security architecture, Security attacks, Security Services, Model for network security, Internet standard and Internet Society, Classical encryption techniques like substitution ciphers, Transposition ciphers, Steganography.
Symmetric encryption and Message Confidentiality: Symmetric Encryption Principles: Cryptography, Cryptanalysis, Feistel Cipher Structure, Symmetric Block Encryption Algorithms: Data Encryption Standard, Advanced Encryption Standard, Overview of the Algorithms, Key Distribution.
Public Key Cryptography and Message Authentication: Public Key cryptography Principles, Approaches to Message Authentication, Secure Hash Function: Hash function requirements,MD5,Public Key Cryptography Algorithms: RSA, Key Management.
Email Security: Pretty Good Privacy (PGP), MIME: MIME Content Types, MIME Transfer Encodings, S/MIME: Functionality, S/MIME Messages, S/MIME Certificate Processing.
IP and Web Security: Internetworking and Internet protocols: IPv4, IPv6, IP security architecture, Authentication header, Encapsulating security payload, Key management, VPN fundamentals, Secure Socket Layer (SSL) and Transport Layer Security (TLS), Secure Electronic Transaction (SET).

Text Books:

1. Cryptography and Network Security, Principles and Practices, William Stallings, 3rdedition, Pearson Education, Third Edition, ISBN-13: 978-0131873162.
2. Cryptography and Network Security, Atul Kahate, 3rd Edition, TMH, ISBN: 9781259029882.
3. Cryptography and Network Security, Behrouz A Forouzon, 3rd Edition, TMH, ISBN: 9789339220945.

Reference Books:

1. Security architecture, design deployment and operations, Christopher M. King, Curtis patton and RSA Press, ISBN 0072133856


2. INSIDE NETWORK Perimeter Security, Stephen Northcatt, LenyZeltser, Pearson Education Asia, ISBN 8178087618.
3. Network Attack and Defense Mechanisms', Kamini C. Nalavade, Dr. B. B. Meshram, Research India Publications.

Course Outcomes:

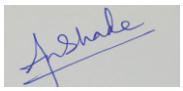
On completion of the course, students will be able to:

ITU721(D).1 Design encryption/ decryption algorithms using open source tools
ITU721(D).2 Understand the various techniques of cryptographic algorithms
ITU721(D).3 Solve various problems in Public Key Encryption algorithms
ITU721(D).4 Understand Secure Email techniques and functionalities
ITU721(D).5 Analyze the various techniques of encryption, key management in security, Secure Electronic Transaction

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU721(D).1	2	3	0	0	3	0	0	0	0	0	0	0	0	3	3
ITU721(D).2	2	2	1	0	3	2	0	1	0	0	0	0	0	3	2
ITU721(D).3	3	2	0	1	1	1	0	0	0	0	0	0	0	3	3
ITU721(D).4	2	3	2	1	3	3	0	1	0	0	0	0	1	2	2
ITU721(D).5	3	2	2	1	1	2	0	1	0	0	0	0	1	2	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


PROGRAM ELECTIVE-V

ITU722 (A) DIGITAL FORENSICS

Teaching Scheme: 03 L Total: 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE Total Marks: 100
Duration of ESE: 2hrs.30min

Course Objectives:

I. Understand digital forensics and investigation.
II. Learn current digital forensics tools
III. Identify the concept of Digital Forensic Acquisition and Authentication
IV. Perform Digital Forensic Analysis in various fields.
V. Understanding Mobile Device Forensics, Acquisition Procedures for Mobile Devices.

Introduction to Digital Forensics: Overview of Digital Forensics, Digital Evidence preparation, Private Sector High tech investigation, Data recovery Workstation and software, conducting an investigation

Digital Forensic Acquisition and Authentication: Storage formats for digital evidence, Image acquisition, acquisition tools, authenticating data acquisition, RAID data acquisition, Remote Network acquisition tools

Current Digital Forensics Tools: Software Tools: Command Line Linux, Other GUI, Hardware Tools: Workstations, Write-Blocker, Validating and Testing Forensics Software

Digital Forensic Analysis and Validation: Principles of Digital Forensic Data collection and Analysis, Validating Forensic Data, Addressing Data Hiding Techniques ,Case Studies

Virtual, Network and Mobile Device Forensics: Overview of Virtual Machine Forensics, Network Forensics: Securing Network- Procedures for Network Forensics, Examining the Honeynet Project, Mobile Device Forensics: Understanding Mobile Device Forensics, Acquisition Procedures for Mobile Devices

Text Books:

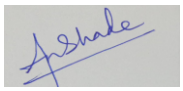
1. Bill Nelson, Amelia Phillips, Christopher Steuart, “Guide to Computer Forensics and Investigations”, Cengage Learning, Fifth Edition, 2016.
2. Eoghan Casey, “Handbook of digital forensics and investigation”, Elsevier Academic Press, First Edition, 2009.

Reference Books:

1. Eoghan Casey, “Digital Evidence and Computer Crime: Forensics Science, Computers and the Internet”, Elsevier Academic Press, Second Edition, 2004.

Course Outcomes:

On completion of the course, students will be able to:


ITU722 (A).1. Explain the role of digital forensics in the business and private world.
ITU722(A).2 Identify potential sources of electronic evidence and explain the importance.
ITU722(A).3 Recognize current techniques and tools for forensic investigations.

ITU722(A).4 Explain and perform forensic analysis in various fields.

ITU722(A). 5 Describe the procedures for virtual, network and mobile device forensics**.**

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU722(A).1	3	2	3	0	2	3	2	1	3	3	2	2	3	3	3
ITU722(A).2	3	2	3	3	2	0	2	1	3	3	2	0	3	3	0
ITU722(A).3	1	2	3	3	2	3	2	1	1	3	2	2	0	3	3
ITU722(A).4	3	1	3	3	2	3	1	1	3	3	2	2	3	3	3
ITU722(A) .5	3	2	3	3	2	3	2	1	3	3	1	2	3	0	3

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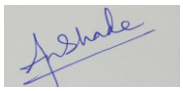



ITU722 (B) ADVANCE PROGRAMMING LANGUAGE

Teaching Scheme: 03 L **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. To understand advanced features of Java Language
II. To understand Java Servlets and their life cycle
III. To develop Web Applications using Servlets
IV. To understand concepts of Hibernate

Introduction to Swing: JFC, MVC Architecture, Applet, Basic swing components: Text Fields, Buttons, Toggle Buttons, Checkboxes, and Radio Buttons,· An Applet with Swing Components

Java Database Connectivity: Introducing JDBC, Exploring JDBC Drivers, Exploring the Features of JDBC, Describing JDBC APIs, Working with Transactions

Network Programming: Networking Basics, Network Programming in Java Client and Server Programs Datagram Socket and Datagram Packet, Remote Method Invocation

Servlets: Introduction to Servlet, Servlet Life Cycle, Server side programming with Java Servlet, HTTP and Servlet, Servlet API, configuration and context, Request and Response objects, Session handling and event handling.

Hibernate: Introduction to Hibernate, Architecture of Hibernate, Hibernate O/R Mapping, Working with Hibernate, Implementing O/R Mapping with Hibernate

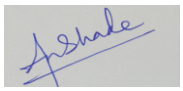
Text Books:

1. Java 6 Programming, Black Book, Dreamtech.
2. Advanced Java Technology, By M.T. Savaliya, Dreamtech

Course Outcomes:

On completion of the course, students will be able to:

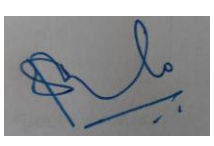
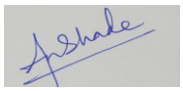
ITU 722(B).1	Design Java Applet and Swing Components
ITU 722(B).2	Update and retrieve the data from the databases using JDBC-ODBC.
ITU 722(B).3	Develop server side programs using Servlets.
ITU 722(B).4	Develop Java applications using networking concepts
ITU 722(B).5	Develop application using Hibernate.


CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU722(B).1	2	3	3	0	2	3	2	1	3	2	3	2	3	3	3
ITU722(B).2	2	3	2	2	0	0	1	1	3	2	2	0	3	2	0
ITU722(B).3	1	2	2	2	3	2	3	1	0	3	2	2	0	2	3
ITU722(B).4	2	3	3	2	3	2	1	1	2	3	2	2	3	3	3
ITU722(B).5	3	3	2	0	2	3	2	1	2	2	3	3	2	2	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU722 (C) ADVANCE PROJECT MANAGEMENT AND ICT IN AGRI-RURAL DEVELOPMENT

Teaching Scheme: 03 L + 00T **Total: 03** **Credits : 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 02 Hrs. 30 min

Course Objectives

XI. To familiarize students with the principles of advance project management
XII. To familiarize students with the principles of ICT in Agri-Rural Development
XIII. To imbibe a correct sense of professional involvement and role of technocrats in overall rural development.
XIV. To inculcate a sense of team-work and team-leadership in project development.
V. To gain a better understanding of development processes and utilization of ICTs for nation building efforts.

Overview of Advance Project Management: Introduction Project Management Process, Role of project leaders and team members in complex and real-life project development, Critical success factors in project implementation

Project Implementation and analysis: project feasibility analysis, techno-economic analysis establishing an organization and start-ups, planning tools (Bar Charts, LOB, CPM and PERT), Developing Project Plan, Social cost-benefit Analysis, project progress and performance control,

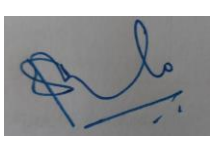
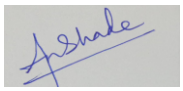
Introduction of ICT in Agri-Rural Development: Agri-Rural Development: Meaning and importance; Technology and development, Information and Communication Technology (ICT) for agriculture and rural development; Integrated Rural Development and government programmes, Rural Development in India, Case studies on Amul India and other relevant success stories.

Role of ICT: Basic concepts of Remote Sensing (RS), Global Positioning System (GPS) and Geographic Information Systems (GIS) and various data formats. Generation of Resource data, structure, transformation into map/diagram/visual presentation for better comprehension. Handling Geospatial Data using Data Analysis Tools (i.e. QGIS, GRASS GIS, and ILWIS).

Applications of ICT in Agri-Rural development: Concepts and information dissemination in the context of E-Gram Panchayat, E-Agriculture, E-Weather Forecasting, E-Education, E-Health, E-Governance, Aadhaar scheme. Case studies on relevant government and other schemes.

Text Books:

1. Project Management: A Managerial Approach: J R Meredith, S J Mantel, 6th Edition, John Wiley, 2005


2. Projects: Planning, Analysis, Implementation and Review: Prasanna Chandra, Tata McGraw-Hill
3. Singh, Katar. : Rural Development – Principles, Policies and Management, Sage Publications. New Delhi.
4. Sundaram, Satya, I.: Rural Development, Himalaya Publishing

Reference Books:

1. Calasso, M. P. (2016). Information and communication technology for sustainable development.
2. Schowengerdt, R. A. (2006). Remote sensing: models and methods for image processing. Elsevier.
3. Chang, K. T. (2015). Introduction to geographic information systems. McGraw-Hill Science/Engineering/Math.
4. Reddy, M. A., & Reddy, A. (2008). Textbook of remote sensing and geographical information systems (p. 453). Hyderabad: BS publications.
5. Abdalla, R. (2016). Introduction to Geospatial Information and Communication Technology (GeoICT). Springer.
6. Goswami, D., Bhattacharya, S., &Barbhuiya, F. A. (2012). Information and Communication Technology for Education, Healthcare and Rural Development. Narosa Pub House.
7. http://bhuvan.nrsc.gov.in/bhuvan_links.php
8. https://elearning.iirs.gov.in/
9. http://www.sac.gov.in/vyom/eoa.jsp

Course Outcomes

ITU722(C).1 Understand the technical and ethical obligation of developing contemporary software for overall project development.

ITU722(C).2 Students will get clear understanding about the Information and Communication Technology (ICT) and its components for Rural Development.

ITU722(C).3 Students will be able to grasp and manage use of ICT in various fields like E-Gram Panchayat, Agriculture, Education, Health, Economic Development etc.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU722(C).1	3	2	3	0	2	3	3	1	3	3	2	2	3	3	3
ITU722(C).2.	3	2	2	3	2	0	2	1	3	3	2	0	3	3	0
ITU722(C).3.	0	2	3	3	3	3	2	1	0	3	2	2	0	3	3
ITU722(C).4	3	0	3	3	3	3	0	1	1	3	2	2	3	3	3
ITU722(C).5.	3	2	3	3	2	3	2	1	3	3	0	2	3	0	3

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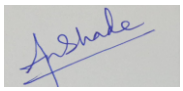



ITU 722 (D) HUMAN COMPUTER INTERACTION

Teaching Scheme: 03 L Total: 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs. 30min

Course Objectives:

I. Fundamentals of Human Computer Interaction.
II. To become familiar with the design technologies for individuals and persons with disabilities.
III. To be aware of mobile HCI.
IV. Understand the guidelines for user interface.

Foundations of HCI: The Human: I/O channels, Memory, Reasoning and problem solving; Interaction: Models, frameworks, Ergonomics, styles, elements, interactivity Paradigms

Design & Software Process: Interactive Design, process scenarios, navigation, screen design, Iteration and prototyping. HCI in software process: Software life cycle, usability engineering, Prototyping in practice, design rationale.

Models And Theories of HCI Models: Cognitive models: Socio-Organizational issues and stakeholder requirements, Communication and collaboration models-Hypertext

Mobile HCI: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games Mobile Design: Elements of Mobile Design, Tools. - Case Studies on M-HCI.

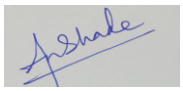
Web Interface Design: Designing Web Interfaces, Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Case Study on WID-HCI

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, ―Human Computer Interaction‖, 3rd Edition, Pearson Education, 2004 (UNIT I, II & III)
2. Brian Fling, Mobile Design and Development, First Edition, O‘Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, ―Designing Web Interfaces, First Edition, O‘Reilly, 2009.

Reference Books:

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning.


On completion of the course, students will be able to:

ITU722(D) 1. Design effective dialog for HCI
ITU722(D) 2. Design effective HCI for individuals and persons with disabilities.
ITU722(D) 3. Assess the importance of user feedback.
ITU722(D) 4. Explain the HCI implications for designing multimedia/e-commerce/e-learning web sites.
ITU722(D) 5. Develop meaningful user interface.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU722.1	3	2	3	0	2	3	2	1	3	3	2	2	3	3	3
ITU722.2.	3	2	3	3	2	0	2	1	3	3	2	0	3	3	0
ITU722.3.	0	2	3	3	2	3	2	1	0	3	2	2	0	3	3
ITU722.4	3	0	3	3	2	3	0	1	3	3	2	2	3	3	3
ITU722.5.	3	2	3	3	2	3	2	1	3	3	0	2	3	0	3

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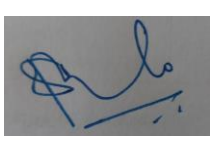
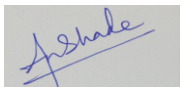




OPEN ELECTIVE-II

ITU733 (A) SOFTWARE ENGINEERING

Teaching Scheme: 03 L + 00T **Total: 03** **Credits : 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 02 Hrs. 30 min

Course Objectives

I. To familiarize students with the principles of software engineering (SE) in general.
II. Understand efficient techniques for managing systems development lifecycle.
III. To imbibe a correct sense of SE principles and role during development processes.
IV. To inculcate a sense of team-work and team-leadership in a software development team.
V. To gain a better understanding of software development processes in general and to learn different techniques and methodologies for developing large software systems

Introduction: Software Characteristics, Software Engineering: A Layered Technology, Software Process Models, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Agile Process Model

Software Engineering Principles and Practice: Communication Practices, Planning Practices, Requirements Engineering, Design practices.

Software Quality Management and Software Testing: Quality concepts, Evolution of Quality Management, Quality assurance, Software Reviews, Testing Fundamentals, Black Box Testing, White Box Testing

Software Project Management: Introduction to Software Project Management, Project Planning & Estimation, Project Scheduling, Risk Management, Software Teams and Role of Leadership

Agile Software Development: Introduction to Agile development, Agile Processes, Extreme Programming, Dynamic Software Development Method

Text Books:

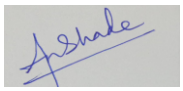
1. Software Engineering: A Practitioner's Approach by Roger Pressman (Tata Mc. Hill)
2. Software Engineering (Ninth Edition) by Ian Summerville (Pearson Education)
3. An Integrated Approach to Software Engineering, by Pankaj Jalote (Springer/Narosa)
4. Fundamentals of Software Engineering, by Rajib Mall, (Prentice Hall India)

Reference Books:

1. Schaum's Outline of Software Engineering by David Gustafson (Tata Mc. Hill)
2. Software Project Management by Sanjay Mohapatra (Cengage Learning India Pvt. Ltd.)

Course Outcomes

ITU723(A).1 Able to interpret a general understanding of software engineering from a professional and wider viewpoint.
ITU723(A).2 Apply methodically the skills learned during the course to actual circumstances of problem understanding and software development.

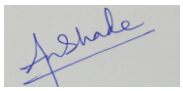




ITU723(A).3 Understand the processes of software development as an effective role player.
ITU723(A).4 Able to practice good communication in software development activities.
ITU723(A).5 Understand the technical and ethical obligation of developing contemporary software and engaging in lifelong learning.

CO/PO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
ITU723(A).1	3	2	--	--	2	--	--	--	--	--	--	--	--	3
ITU723(A).2	--	2	3	2	--	--	--	--	--	--	--	--	--	3
ITU723(A).3	--	1	1	2	2	3	3	2	3	--	--	--	--	3
ITU723(A).4	1	--	--	--	--	--	--	--	2	3	2	2	2	2
ITU723(A).5	2	--	--	--	--	3	--	1	2	--	2	3	2	2

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU733 (B) DATA COMMUNICATION

Teaching Scheme: 03 L+ 00 Total: 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. Gain fundamental knowledge of data communication.
II. Discuss a comprehensive understanding of signals and data encoding.
III. Outline current and emerging trends in network models.
IV. Analyze various multiplexing techniques.
V. Understand working of various networking components.

Data Communication Fundamentals: Data Communication– Components, Data representation, Data Flow, Networks – Definition, Uses, Topologies, Categories, Protocols, Standards, Standards Organizations.

Data & Signals Analog and Digital, Periodic Analog Signals, Digital signals, Transmission Impairments, Data Rate Limits, Performance

Data Encoding Digital Transmission: Digital-to-Digital conversion, –Line coding, Block coding, scrambling, Analog-to-Digital conversion – Pulse code modulation, delta modulation, Transmission Modes, Analog Transmission: Digital-to-Analog conversion – ASK, FSK, PSK, Analog-to-Analog conversion – AM, FM, PM.

Multiplexing & Switching Multiplexing – Frequency-Division, Wavelength-Division, Time division, switching – Circuit switched, Packet switched, Message switched, Structure of switches.

Network Models Layered tasks, the OSI reference model, TCP/IP protocol suit, Addressing, Wireless Networks: Bluetooth, Cellular Telephone, Satellite Network, ATM model.

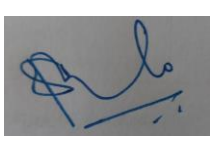
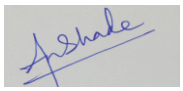
Networking Components Transmission Media, Guided Transmission Media – Twisted pair, Coaxial, OFC, Unguided Transmission Media –Propagation Modes, Radio Waves, Microwave Infrared Connecting devices: Connectors, Transceivers and Media Converters, Repeaters, Hubs, NICs, Bridges and Switches.

Text Books:

1 Data communications and Networking, Behrouz A. Forouzan, 4th Edition , McGraw-Hill Publications.
2 Data and computer communication, William Stallings, 8th Edition, Pearson Education

References:

1 Computer Networks,Andrew S.Tanenbaum, 3rd Edition , Prentice Hall India,
2 Digital and Analog Communication Systems, Shanmugam K, John Wiley & Sons (Asia) Pvt. Ltd. ISBN 9971-51-146-0
3 Data Communications, Gupta P, PHI, 2004, ISBN 81 - 203 - 1118 – 3


4 Introduction to Data Communications and Networking, Wayne Tomasi, Pearson Education, 2007, ISBN 81-317-0930-2
5 Data Communications and Networks, Godbole, Tata McGraw-Hill Publications, 2002,0 - 07 - 047297 – 1

Course Outcomes:

On completion of the course, students will be able to:

ITU723.1 Explain the concepts of data communication.

ITU723.2 Perform various operations on analog and digital signals.

ITU723.3 Evaluate the performance of existing network models.

ITU723.4 Choose appropriate multiplexing technique for various applications.

ITU723.5 Examine the working and applications of networking components.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU723.1	3	0	0	1	2	3	1	0	1	2	0	2	2	3	1
ITU723.2	3	2	2	2	2	1	2	2	2	1	1	2	2	3	2
ITU723.3	3	2	0	3	3	2	2	3	3	2	0	1	1	2	1
ITU723.4	3	3	3	1	3	3	3	3	3	0	0	1	3	2	3
ITU723.5	3	2	0	2	0	0	1	0	0	0	0	2	0	2	0

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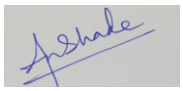



PROGRAM ELECTIVE-VI

ITU821 (A) CRYPTOGRAPHY AND NETWORK SECURITY

Teaching Scheme: 03 L **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. Compare various cryptographic techniques
II. Use mechanisms like authentication, digital signature, MAC to avoid security attacks.
III. Analyze the threats in networks in various layers of networks.
IV. Identify the need for firewalls, intrusion detection and prevention system

Introduction: Security Attacks, Types of Attacks, Active and Passive Attacks, Services and Mechanisms, Classical cryptosystems, Substitution and Transposition Ciphers, Cryptanalysis, Stream and Block Ciphers , Shannon's Theory of Confusion and Diffusion.

Symmetric key Ciphers: Modern Block Ciphers - DES, AES, Modes of Operation of Block Ciphers, Differential Cryptanalysis, Triple DES , Stream Ciphers , Pseudorandom Functions

Asymmetric key Cryptography: RSA Cryptosystem , El Gamal Cryptosystem, Elliptic Curve based Cryptography, Diffie Hellman Key Exchange.

Cryptographic Hash Functions: Merkle Damgard Construction , Applications of Cryptographic Hash Functions, Secure Hash Algorithm, Message Authentication Code-Message Authentication Requirements and Functions, ,HMAC, Digital Signature Schemes

Network Security Applications: Authentication Applications, Needham Shroeder Protocol , Kerberos , X.509 Certificates, Public Key Infrastructure

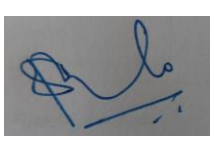
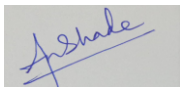
Network Security: Threats in Networks, IP Spoofing, SYN Flooding, Denial of Service Attacks, Smurf Attacks, ARP Spoofing, Transport Layer Security, Secure Socket Layer Protocol, IP Layer Security, IPsec, IKE protocol

System security: Intruders , Malicious software , Viruses, Worms and Trojans, Firewalls , Features of Firewall, Types of Firewalls, Placement of Firewalls , Configuration of Firewalls , Intrusion Detection System Types of IDS, Intrusion Prevention System

Text Books

1. Cryptography and Network Security, Behrouz Forouzan and Debdeep Mukhopadhyay, Tata McGraw Hill, 3rd edition
2. Cryptography and Network Security, William Stallings, 6th Edition, Pearson Education, March 2013

Reference Books


1. TCP/IP and Network Security: Attacks and Defense Mechanisms With Open Source Tools, Dr. B.B. Meshram, Ms K.A. Shirsath, Shrff Publishers & Distributors PVT. LTD, 1st edition, 2017

2. Security in Computing, Charles Pfleeger,4th Edition, Prentice Hall of India, 2006.
3. Cryptography and Network Security, Atul Kahate, 3rd edition, Tata McGraw Hill, 2013

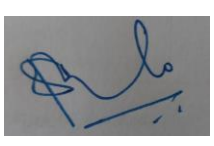
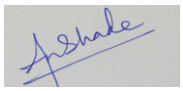
Course Outcomes:
On completion of the course, students will be able to:

ITU821 (A).1 Understand various network security services
ITU821 (A).2 Explain the concepts related to applied cryptography, including plaintext, cipher text, symmetric cryptography, asymmetric cryptography, and digital signatures
ITU821 (A).3 Demonstrate the understanding of common network vulnerabilities and attacks, defence mechanisms against network attacks, and cryptographic protection mechanisms.
ITU821 (A).4 Detect possible threats to different defence mechanisms and different ways to protect against these threats
ITU821 (A).5 Identify the need for System Security like intrusion detection and prevention system

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU821(A).1	2	2	0	0	3	0	0	0	0	0	0	0	0	3	2
ITU821(A).2	2	2	1	0	3	2	0	1	0	0	0	0	0	3	3
ITU821(A).3	2	3	0	1	3	1	0	0	0	0	0	0	0	3	3
ITU821(A).4	2	3	2	1	3	2	0	1	0	0	0	0	1	2	2
ITU821(A).5	2	3	2	1	3	2	0	1	0	0	0	0	1	2	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU821 (B) GRAPH MINING

Teaching Scheme: 03 L+ 00T Total: 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. To provide the basic concepts and important properties of graphs.
II. To learn and explore several methods on algorithms such as graph traversal, shortest paths, minimum spanning tree.
III. To introduce students to the field of graph mining and its application in various domains.
IV. To give the students an opportunity to obtain hands-on experience on applications of graph mining.

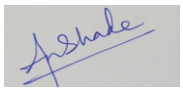
Introduction to graphs: Introduction to graphs and basic terminology, Representations of a graph, types of graphs, basic algorithms for decomposing graphs into parts, connectivity of graphs, matching on graphs, graph databases.
Graph algorithms: Graph colouring, graphs on surface, directed graphs, Shortest path algorithms, algorithms to discover minimum spanning tree, Flows in Networks and some important flow algorithms, Searching Graphs and Related algorithms.
Graph Mining: Motivation for Graph Mining, Applications of Graph Mining, Mining Frequent Subgraphs –Transactions, BFS/Apriori Approach (FSG and others), DFS Approach (gSpan and others), Diagonal and Greedy Approaches.
Constraint-based mining and new algorithms: Mining Frequent Subgraphs, graph visualizations
Applications of Graph Mining: Web mining, centrality analysis, Link analysis algorithms, graph clustering and community detection, Node classification and Link prediction, Influential spreaders, Influence maximization, Geo-social and location based networks

Text Book:

1. Graph Theory, Diestel, R., 4th ed. Springer-Verlag, Heidelberg
2. Data minining–Concepts and Techniques, J. Han and M. Kamber, 2ndEdition, Morgan kaufmanPublishers, 2006
3. Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data, Bing Liu, Springer publishing, 2009

Reference Books:

1. Mining of Massive Datasets, Jure Leskovec, Anand Rajaraman, Jeff Ullman, 2nd edition. Cambridge University Press
2. Networks, Crowds, and Markets, David Easley and Jon Kleinberg, Cambridge University Press, 2010.
3. Graph Mining: Laws, Tools, and Case Studies, Deepayan Chakrabarti and Christos Faloutsos.


Course Outcomes:

On completion of the course, students will be able to:

ITU821(B).1. Understand of the graph theory and graph mining foundations.

ITU821(B).2. Analyse graph mining methods.

ITU821(B).3. Formulate and solve graph-related problems.

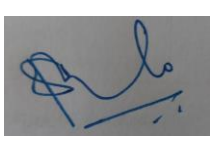
ITU821(B).4. Apply graph mining algorithms to analyze large-scale datasets on various domains.

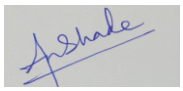
ITU821(B).5. Analyse graph algorithms.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU821(B).1	3	2	3	0	2	3	2	1	3	3	2	2	3	3	3
ITU821(B).2	3	0	3	3	2	0	2	1	3	3	2	0	3	3	0
ITU821(B).3	0	2	3	0	2	3	2	0	0	3	0	2	0	0	3
ITU821(B).4	3	0	0	3	2	3	0	1	3	3	2	2	3	3	3
ITU821(B).5	3	2	3	3	2	3	2	1	3	3	0	2	3	0	0

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated





ITU821(C) REAL TIME SYSTEM

Teaching Scheme: 03 L **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. To expose students to both the abstraction and details of real time operating system.
II. To introduce concepts related to embedded systems.
III. To focus on structural units of processor.
IV. To expose students to details of use of queues, stacks and lists in embedded system programming.
V. To expose students to modeling process of programming and systems.

Introduction to embedded systems: Processor in the system, Hardware units required in the exemplary cases, Software embedded into a system, Final Machine implementable software for a product, Software in Processor specific assembly language and high level language, Device drivers, device management using an operating systems, Software design for scheduling multiple tasks and devices using RTOS, Embedded SoC in VLSI circuits.

Structural units of the processor: Allocation of memory to program segment and blocks, memory map of the system, Memory blocks for different data sets and structures, Virtual Devices, Device drivers for parallel port, serial and timing devices, Context and periods for context switching, deadline and interrupt latency.

Embedded programming in assembly language and High level language: Function pointers, Function queues and ISR queues, Queues for implementing protocol for a network, Queuing of functions on interrupts, Use of FIFO queues, Stacks, Lists and Ordered Lists.

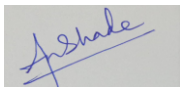
Modeling process: Use of dataflow & control data flow graphs, Programming model for event controlled or response time constraint, Real time programs, Inter process Communication and Synchronization, Multiple processes in an application, Sharing data by multiple tasks, use of finite states machine model & Petri net Model, Use of Semaphores for a task or for Critical section of code, Mutex & P & V, Priority inversion problems & deadlock situations IPC issues, Use of Semaphore flags or Mutex as resource key, use of message queues, mailboxes, pipes, virtual sockets, RPCs.

Introduction to RTOS: RTOS Services, Schedule management for multiple tasks in Real Time, Handling of interrupt source call, RTOS task scheduling models, Cooperative Round Robin Scheduling using a Circular Queue of ready tasks and using ordered list as per precedence constraints, cycling scheduling in Time Sharing, fixed Real Time scheduling, Precedence assignment in Scheduling algorithms, fifteen-point strategy for Synchronization, Embedded Linux Kernel, study of micro C/OS-II, Vx works.

Text Book:

1. Embedded Systems, Architecture, Programming & Design, Rajkamal, 2nd edition, Tata McGraw Hill, 2007.
2. Embedded System Design: A Unified Hardware/Software Introduction by Frank Vahid, Tony Givargis, 1st Edition, John Wiley & Sons publication, 2002.

Reference Books:


1. Real Time Systems, Jane W. S. Liu, 1st Edition, Pearson Education, 2004.

Course Outcomes:

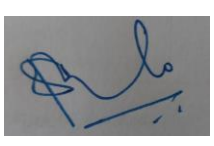
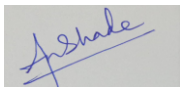
On completion of the course, students will be able to:

ITU821(B).6. Identify the hardware units required in designing embedded system.
ITU821(B).7. Identify the desirable features of processors in embedded system.
ITU821(B).8. Analyze different use of FIFO queues, Stacks, Lists and Ordered Lists.
ITU821(B).9. Analyze different modeling processes in embedded system.
ITU821(B).10. Identify the schedule management in embedded system.

CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU821(C).1	3	2	3	0	2	3	2	1	3	3	2	2	3	3	3
ITU821(C).2	3	2	0	3	2	0	2	1	3	3	2	0	3	3	0
ITU821(C).3	0	2	3	3	0	3	2	1	0	0	2	2	0	3	3
ITU821(C).4	3	0	3	3	2	3	0	1	3	3	2	2	3	3	0
ITU821(C).5	3	2	3	3	2	3	2	1	3	3	0	2	3	0	3

0- Not correlated 1 - Weakly Correlated 2- Moderately Correlated 3- Strongly Correlated


ITU821 (D) AUGMENTED REALITY

Teaching Scheme: 03 L **Total: 03** **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA+ 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30min

Course Objectives:

I. To provide a foundation to the fast growing field of AR
II. To make the students aware of the various AR devices.
III. To use computer vision concepts for AR
IV. To understand the working of various state of the art AR

Introduction to Augmented Reality: Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality. Augmented Reality, Defining augmented reality, history of augmented reality, The Relationship Between Augmented Reality and Other Technologies-Media, Technologies, Other Ideas Related to the Spectrum Between Real and Virtual Worlds, applications of augmented reality, Augmented Reality Concepts, Working of Augmented Reality.

Augmented Reality Hardware: Augmented Reality Hardware, Displays, Audio Displays, Haptic Displays, Visual Displays, Other sensory displays, Visual Perception, Requirements and Characteristics, Spatial Display Model. Processors, Role of Processors, Processor System Architecture, Processor Specifications. Tracking & Sensors, Tracking, Calibration, and Registration, Characteristics of Tracking Technology, Stationary Tracking Systems, Mobile Sensors, Optical Tracking, Sensor Fusion.

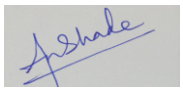
Computer Vision for Augmented Reality & A.R. Software: Computer Vision for Augmented Reality, Marker Tracking, Multiple-Camera Infrared Tracking, Natural Feature Tracking by Detection, Simultaneous Localization and Mapping, Outdoor Tracking Augmented Reality Software, Introduction, Major Software Components for Augmented Reality Systems, Software used to Create Content for the Augmented Reality Application.

AR Techniques Marker based & Markerless tracking: Marker based approach Introduction to marker based tracking, types of markers, marker camera pose and identification, visual tracking, mathematical representation of matrix multiplication Marker types Template markers, 2D barcode markers, imperceptible markers. Markerless approach Localization based augmentation, real world examples Tracking methods Visual tracking, feature based tracking, hybrid tracking, and initialization and recovery.

AR Devices & Components: AR Components, Scene Generator, Tracking system, monitoring system, display, Game scene AR Devices, Optical See Through HMD, Virtual retinal systems, Monitor bases systems, Projection displays, Video see through systems.

Text Books:

1. Allan Fowler-AR Game Development‖, 1st Edition, A press Publications, 2018, ISBN 978-1484236178
2. Augmented Reality: Principles & Practice by Schmalstieg / Hollerer, Pearson Education India; First edition (12 October 2016), ISBN-10: 9332578494


Reference Books:

1. Sanni Siltanen- Theory and applications of marker-based augmented reality. Julkaisija – Utgivare Publisher. 2012. ISBN 978-951-38-7449-0

Course Outcomes:

On completion of the course, students will be able to:

ITU821(D).1 Describe how AR systems work and list the applications of AR.
ITU821(D).2 Understand and analyze the hardware requirement of AR.
ITU821(D).3 Use computer vision concepts for AR and describe AR

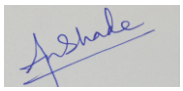
ITU821(D).4 Analyze and understand the working of various state of the art AR

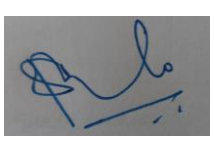
ITU821(D).5 Understand AR devices and components

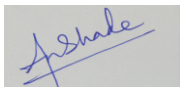
CO – PO –PSO Mapping:

CO	PO / PSO														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
ITU821(D).1	3	2	3	1	2	3	2	1	3	3	2	2	3	3	3
ITU821(D).2	3	2	3	3	2	1	2	1	3	3	2	0	3	3	0
ITU821(D).3	1	2	3	3	2	3	2	1	0	3	2	2	0	3	3
ITU821(D).4	3	1	3	3	2	3	1	1	3	3	2	2	3	3	3
ITU821(D).5	3	2	3	3	2	3	2	1	3	3	0	2	3	0	3

0- Not correlated 1 - Weakly Correlated

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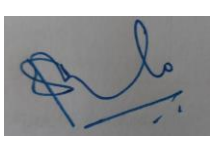

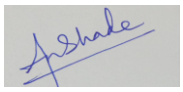


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