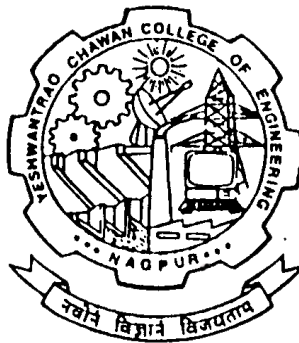


Nagar Yuwak Shikshan Sanstha's
Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)
Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Engineering
SoE & Syllabus 2014
7 & 8 Semester
Computer Technology

Updated on June,2020



Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.E. SCHEME OF EXAMINATION 2014

(Revised Scheme of Examination w.e.f. 2020-21 onward)

**SoE No.
CT-101**

Computer Technology

S. N.	Sub Code	Subject	Contact Hours				CR	% Weightage			ESE Duration
			L	T	P	Total		MSEs*	TA**	ESE	
SEVENTH SEMESTER											
1	CT1415	Network Security	4	0	0	4	4	30	30	40	3
2	CT1451	Artificial Intelligence	4	0	0	4	4	30	30	40	3
3	CT1452	Lab. Artificial Intelligence	0	0	2	2	1		60	40	
Professional Elective II											
4	CT1405	PE II: Embedded Systems	4	0	0	4	4	30	30	40	3
	CT1406	PE II: Neural Network & Fuzzy Logic									
	CT1407	PE II: Ad-hoc Wireless Network									
	CT1453	PE II: Probabilistic Statistical Data Analysis									
Professional Elective III											
5	CT1408	PE III: Cloud Computing	4	0	0	4	4	30	30	40	3
	CT1409	PE III: Operations Research									
	CT1437	PE III: Parallel Computing									
	CT1454	PE III: Machine Learning Techniques									
	CT1457	PE III: Fundamentals of Parallel Computing									
6	CT1413	Industrial Training/ CRT	0	0	0	0	2		100		
7	CT1414	Project Phase I	0	0	4	4	4		60	40	
Total			16	0	6	22	23				

EIGHTH SEMESTER											
1	GE1408	Cyber Laws	4	0	0	4	4	30	30	40	3
2	CT1450	Object Oriented Modeling	3	1	0	4	4	30	30	40	3
Professional Elective IV											
3	CT1418	PE IV: Digital Image Processing	4	0	0	4	4	30	30	40	3
	CT1420	PE IV: Pattern Recognition									
	CT1441	PE IV: Mobile Communication									
	CT1455	PE IV: Cyber Forensics									
Lab. Professional Elective IV											
4	CT1419	Lab.: PE IV: Digital Image Processing	0	0	2	2	1		60	40	
	CT1421	Lab.: PE IV: Pattern Recognition									
	CT1442	Lab.: PE IV: Mobile Communication									
	CT1456	Lab.: PE IV: Cyber Forensics									
Professional Elective V											
5	CT1432	PE V: Software Project Management	4	0	0	4	4	30	30	40	3
	CT1443	PE V: Internet of Things									
	CT1445	PE V: Numerical Computing									
	CT1458	PE V: Introduction to Internet of Things									
Lab.: Professional Elective V											
6	CT1433	Lab.: PE V: Software Project Management	0	0	2	2	1		60	40	
	CT1444	Lab.: PE V: Internet of Things									
	CT1446	Lab.: PE V: Numerical Computing									
	CT1459	Lab.: PE V: Introduction to Internet of Things									
7	CT1425	Comprehensive Viva	0	0	0	0	3			100	
8	CT1426	Project Phase -II	0	0	8	8	8		60	40	
9	CT1427	Extra/Co-curricular / Competitive Examination	0	0	0	0	2		100		
Total			15	1	12	28	31				

* MSEs = 3 MSEs of 15 Marks each will be conducted and marks of better 2 of these 3 MSEs will be considered for Continuous Assessment

TA ** = for Theory : 20 marks on lecture quizzes, 8 marks on assignments, 2 marks on class performance

TA** = for Practical : MSPA will be 15 marks each

Chairperson	<i>G. Mohapatra</i>	Version	1.05	Applicable for AY 2020-21 Onwards
Dean (Acad. Matters)	<i>A. B. Patil</i>	Date of Release	June 2020	

**7th Semester**

CT1415	Network Security	L=4	T=0	P=0	Credits=4
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Objectives	Outcomes
1. Understanding of basic issues, concepts, principles and mechanisms in n/w security, mathematics of cryptography, determine appropriate mechanisms for protecting networks.	1. To identify n/w security threats and determine efforts to counter them. 2. To apply basic Principles, Theorems, Algorithms to solve the problem. 3. To use different encryption Algorithms. 4. To apply appropriate function and protocols for message authentication. 5. To design solution for secured n/w application. 6. To analyze given system with respect to security.
PO, PSO MAPPING:- a,c,d,e,f,h,i,k,l,m	

UNIT I Introduction: Security goals, cryptographic attacks, Services and mechanism, techniques. Mathematics of cryptography: Integer arithmetic, modular arithmetic, matrices, linear congruence. Mathematics of symmetric key cryptography: Algebraic structure, $GF(2^n)$ Fields

UNIT II Traditional symmetric key ciphers: Introduction, substitution ciphers, Transposition ciphers, stream and block ciphers. Introduction to modern symmetric-key ciphers: Modern block ciphers, modern stream ciphers.

UNIT III DES, AES, Encipherment using modern symmetric key ciphers: Use of modern block ciphers, use of stream ciphers: RC4. Mathematics of asymmetric key cryptography: Primes, primality testing, factorization, Chinese remainder theorem, Quadratic congruence, Exponentiation and logarithms. Asymmetric key cryptography: RSA, ElGamal.

UNIT IV Message integrity and authentication: Message integrity, Random oracle model, message authentication. Cryptographic hash functions: Introduction, Description of MD hash family, Whirlpool, SHA-512. Digital signature: Comparison, process, services, attacks on digital signature, Digital signature schemes. Entity authentication: Introduction, passwords, Challenge-Response, Zero knowledge, Biometric. Key management: Symmetric key distribution, Kerberos, symmetric key agreement, Public key distribution.

UNIT V Security at application layer : E-mail, PGP, S/MIME. Security at transport layer: SSL architecture, four protocols, SSL message formats, Transport layer security. Security at network layer IPsec : Two modes, two security protocols, security association, security policy, Internet key exchange, ISAKMP

UNIT VI System security: Description of the system, Users, Trust and trusted systems, Buffer overflow and malicious software, malicious programs, worms, viruses, Intrusion detection systems, Firewalls: Definitions, construction and working principles

TEXT BOOKS:

1. Cryptography and Network Security, by Behrouz A. Forouzan, and Debdeep Mukhopadhyay, McGraw-Hill Publication., 2nd Edition.

REFERENCE BOOKS:

1. Cryptography and Network Security Principles and Practices, by William Stallings, Pearson Edu Asia
2. Networks Security Essentials, Applications and Standards, by William Stalling, Pearson Edu.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	



7th Semester

CT1451	Artificial Intelligence	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
1. The study of Artificial Intelligence course will equip the students with the sound understanding of AI concepts, perspectives to apply the AI themes to the challenging research are as related to AI. 2. To introduce the fundamental concepts in Artificial Intelligence, applications of AI, techniques in AI. 3. To concentrate on the basic algorithms for searching the goal, concepts of representation and control. 4. Provide the ability to assess the applicability, strengths, and weaknesses of the basic knowledge representation, various approaches. 5. To compare various Knowledge Representation methods and to understand Prolog fundamentals for Knowledge Representation. 6. To understand the reasoning process is carried out in Machines. 7. To understand how human thinking be emulated by a machine and Provide the ability to assess the applicability, strengths, and weaknesses of various learning methods.	1. Apply fundamentals of Artificial Intelligence for given problem statements. 2. Use basic algorithms for searching the goal, represent various knowledge structures in various applications of AI and related fields. 3. Assess the applicability, strengths, and weaknesses of the basic knowledge representation, problem solving, and learning methods in solving particular engineering problems. 4. Compare various knowledge representation approaches, solve problems based on knowledge representation methods. 5. Assess Monotonic and Non-monotonic reasoning methods. 6. Assess various learning methods, compare them.
PO, PSO MAPPING :- a,c,e,h,i,k,l	

UNIT I

Introduction to AI: Definition of AI, early work in AI, the importance of AI, AI and related fields, distributed AI, task domain of AI, Problems, problem spaces and searches: defining the problem on a state space search, Introduction to intelligent agents, generic architecture of intelligent agents.

UNIT II

Production systems and control strategies: depth first and breadth first search, back tracking, problem characteristics, issues in the design of search programs.
 Heuristic search techniques: generate and test, hill climbing, best first search, problem reduction, constraint satisfaction, means-ends analysis.

UNIT III

Knowledge representation: issues, representation and mapping approaches, procedural Vs declarative knowledge, introduction to proposition logic, knowledge representation using predicate logic, unification and resolution algorithms.

UNIT IV

Representation of knowledge using rules, logic programming, forward backward reasoning, matching, control knowledge. Knowledge representation using semantics' nets, Prolog: Representation of Predicates, rules, and facts, recursion unification.

UNIT V

Introduction to non-monotonic reasoning, logics for non-monotonic reasoning Statistical reasoning: probability and Bay's theorem, certainty factors and rule based system.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

**7th Semester**

CT1451	Artificial Intelligence	L=4	T=0	P=0	Credits=4
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UNIT VI

Learning: general learning model, overview of different forms of learning, learning decision trees, Artificial Neural Networks (Introduction).

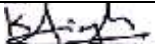
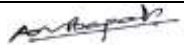
Expert Systems: Design & Development of Expert System, knowledge based Systems, Rule Based Expert System, Expert System Shell, Application Areas of Expert System

TEXT BOOKS:

1. Artificial Intelligence by E. Richard K. Knight and Nair.

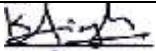
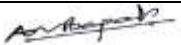
REFERENCE BOOKS:

1. Introduction to Artificial Intelligence and Expert System by D. W. Patterson, PHI. Principles of Artificial Intelligence by N. J. Nilsson, Narosa.
2. Artificial Intelligence by George F. Luger, 4 Edition, Pearson Education.
3. Expert Systems: Design and Development by John Durkin, Macmillan, USA.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

**7th Semester**

CT1452	Lab. : Artificial Intelligence		L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration		
	60	40	100			

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	



7th Semester

CT1405	PE II : EMBEDDED SYSTEM	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
1. To make the students aware of the Embedded Systems surrounding them. 2. Students should know about the types of processors & architectures used, design & co design concepts used in ES. 3. To learn the concept of Real Time Operating System, Mobile Operating System. The working of micro controller to be used in ES.	1. Using the Basics of ES, decide the components of a particular ES. 2. Design & implement the hardware & software and integrate them to develop the final device. 3. Choose appropriate processors and Real Time operating system for ES design. 4. Use assembly or high level languages for S/W development & decide which development & debugging tool will be suitable for ES development. 5. Choose proper microcontroller / microprocessor for a particular ES design. 6. Develop the program for core functionality & communication of ES with other devices.
PO, PSO MAPPING : - a,c,d,e,h,i,k,l,m	

UNIT I

Embedded Systems concepts and definition, Embedded System design: Requirement analysis, Hardware and Software Design, co-design, I/O interface co-design for distributed embedded system, Applications of Embedded system.

UNIT II

Embedded Computing platform Software Development tools and debugging technologies Host and Target machines, Cross Assemble & Cross Compiler, Linker/Loader for embedded software, study and use of simulator, EPROM emulator, In Circuit Emulator, concept of tool chain.

UNIT III

Concept of Real Time Operating System, Real Time IO, R/T Multitasking & multithreading processes, RTOS Task Scheduling models Inter-task Communication, memory management.

UNIT IV

Overview of Embedded Operating Systems, Real Time operating System, Handheld operating system, Some Representative Embedded Systems.

UNIT V

ARM Architecture Block Diagram, Pin Description Memory Organization, Register Description, I/O Ports, Interrupts.

UNIT VI

Thumb Instruction Set and Programming Timers, Serial communication, interfacing with analog and digital circuits.

TEXT BOOKS:

1. An Embedded software primer by David E. Simon, Pearson Edu. Asia.
 2. Embedded System by Raj Kamal.
 3. ARM System on Chip Architecture by Steve Furber, Pearson Edu. Asia.
- REFERENCE BOOKS:**
1. Real-time system: design principles for distributed embedded application by H. Kopetz .
 2. Embedded system design by Krishna & Shinn.
 3. Embedded Real -Time Systems: Concepts, Design & Programming by Dr. K. V. K. K. Prasad.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	



7th Semester

CT1406	PE II : Neural Networks & Fuzzy Logic		T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
1. This course provides introduction various aspect so fneuralnet works, with emphasison element of design no ftrainable systems. The course introduces students to the fundamental theory, mathematics and modeling tools necessary to analyze and simulate natural and engineered systems.	1. Apply training and classification using the discrete perceptron and single layer continues perceptron networks for linearly separable classification. 2. Summarize Operations on fuzzy sets by solving the problem. 3. Compute fuzzy numbers. 4. Construct arithmetic operations on intervals and arithmetic operations on fuzzy numbers. 5. Apply lattice fuzzy numbers and Fuzzy equations to solve fuzzy controller problem.
PO, PSO MAPPING :- a,b,c,e,h,i,j,l	

UNIT I

Fundamentals concepts and model so fartificial neural systems: Biological neurons and their artificial models, models of artificial neural networks, learning and adaptation, neural network learning rules, overview of neural networks, Simple Programming exercise in "C".

UNIT II

Single-layer perceptron classifiers: Discriminant functions, linear machine and minimum distance classification, training and classification sing the discrete perceptron: algorithm and example, single layer continuous perceptron networks for linearly separable classification.

UNIT III

Multi layer feedback networks: linearly non-separable pattern classification, delta learning rule. Feed forward recall and error back-propagation training, learning factors, Hopfield networks, Applications of Neural Networks.

UNIT IV

From classical (CRISP) sets to fuzzy sets: introduction crispsets: an overview, fuzzy sets: basic t ypes, fuzzy sets: basic concepts, characteristics and significant of the paradigms hift. Fuzzy set sversuscrisp sets, representation of fuzzy sets, alpha cuts cardinality, Operations on fuzzy sets: types of operations, fuzzy complements, fuzzy intersection: t- norms, fuzzy unions: t-Conorms, Distinction between Probability, Fuzzy and Random System.

UNIT V

Linguistics variables, linguistic edges, Fuzzy relations, Binary Operation on a single set, projection and cylindrical extension, Extension principles for fuzzy sets, Fuzzy Arithmetic: fuzzy numbers, arithmetic operations on fuzzy numbers, Fuzzy Equations.

UNIT VI

Defuzzification methods, design fuzzy rule base, Fuzzy Inference Systems: Mamdani Vs Sugeno, Steps indesign of a fuzzy controller, applications of fuzzy logic, Use of MATLAB for Design and Arguments

TEXT BOOKS:

1. Introduction to Artificial Neural System by J. M. Zurada, Jaico Publishing House, India.
2. Fuzzy logic & Neural Network b y T. J. Ross, TMH.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	



Yeshwantrao Chavan College of Engineering

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BE SoE and Syllabus 2014

Computer Technology

7th Semester

CT1407	PE II : Ad-hoc Wireless Network	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
1. Understand the design issues and application areas of Ad hoc network. 2. Understand the design goals of MAC protocols, classification of MAC protocols. 3. Introduce design issues and various types of routing protocols. 4. Understand design issues, operation and classification of multicast routing protocol. 5. Understand issues and challenges in the design of transport protocol and security aspect of communication in ad hoc network. 6. Introduce Quality of Service and energy management techniques in Ad-hoc network.	1. Identify the need of Adhoc network compare infrastructure base and infrastructure less wireless network 2. Identify the design issues involved in the design of MAC protocol and classify the different MAC protocols. 3. Compare proactive and reactive routing protocols, Classify routing protocols. 4. Compare tree based and mesh based multicast routing protocols, identify advantage and drawback involved in each protocol. 5. Identify the various types of attack in ad hoc network and classify various types of transport layer protocol. 6. Classify QoS approaches and Identify the need of energy management in ad hoc network.
PO, PSO MAPPING :- a,c,d,f,h,k,l	

UNIT I

Adhoc Wireless Networks: Introduction, Issues in Ad hoc wireless Networks, Ad hoc Wireless Internet.

UNIT II

MAC Protocols for Ad hoc Wireless Networks: Introduction, issues in designing MAC protocol, Design goals of MAC protocols, classification, Contention based protocols: MACAW. Floor acquisition multiple access Protocols. Contention based protocols with reservation mechanism: Distributed Packet reservation multiple access protocol, Collision avoidance Time allocation protocol. Contention based MAC protocols with scheduling mechanism: Distributed priority scheduling and medium access in ad hoc networks.

UNIT III

Routing Protocols for Ad hoc Wireless Networks: Introduction, Issues in designing routing protocol, classification, table driven routing protocols: DSDV, cluster head gateway switch routing protocol. On demand routing protocols: DSR, AODV. Hybrid routing protocols: core extraction distributed routing protocol, Zone routing protocol. Routing protocols with efficient flooding mechanisms, hierarchical routing protocols, Power aware routing protocols.

UNIT IV

Multicast routing in adhoc wireless networks: Introduction, Issues in designing multicast routing protocol, operation of multicast routing protocols, An architecture reference model, classification, Tree based multicast routing protocol: Bandwidth efficient multicast routing protocol, Multicast routing protocol based on zone routing, Multicast core extraction distributed Ad hoc routing, MAODV. Mesh based multicast routing protocols: on demand multicast routing protocol, Dynamic core based multicast routing protocol. Energy efficient Multicasting: Energy efficient reliable broadcast and multicast protocols, A distributed power aware multicast routing protocol. Multicasting with Quality of Service guarantees, Application dependent multicast routing.

UNIT V

Transport layer and security protocols: Introduction, Issues in designing transport layer protocol, design goals of transport layer protocol, Classification of transport layer solutions, TCP over ad hoc wireless networks, Other transport layer protocols for ad hoc wireless network, security in ad hoc wireless network, network security requirements, Issues and challenges in security provisioning, Network security attacks, Key man agement, Secure routing in AD hoc Wireless networks: Requirements of secure routing protocol, security aware ad hoc routing protocol.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

**7th Semester**

CT1407	PE II : Ad-hoc Wireless Network	L=4	T=0	P=0	Credits=4
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UNIT VI

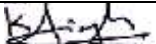
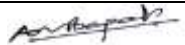
Quality of service and energy management in Ad hoc Wireless networks: Introduction, Issues and challenges in providing Quality of service, classification of Quality of service solutions. Introduction to energy management, Need for energy management, classification, Battery management schemes, transmission power management schemes, system power management schemes.

TEXT BOOKS:

1. Ad Hoc Wireless Networks Architecture and protocols by C. Siva Ram Murthy, B. S. Manoj. Pearson Publication.

REFERENCE BOOKS:

1. Ad hoc Networking by Charles E. Perkins Addison Wesley.
2. The hand book of ad hoc wireless networks by Mohammad Ilyas, CRC press.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	



7th Semester

CT1453	PE II : Probabilistic Statistical Data Analysis	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
<ol style="list-style-type: none"> To introduce basic statistical formulae to find out the tendency of data To introduce probability and probability distribution concepts To introduce the concepts of sampling and estimation To introduce hypothesis testing and various scenarios for testing hypothesis To introduce the statistical method for comparing more than two proportions To introduce the modeling technique, regression to perform the predictive analysis 	<ol style="list-style-type: none"> Able to analyze the hidden meaning in the data using some basic formulae and able to implement it using 'R Statistics' Able to find out the probability and probability distribution for the given samples Able to analyze the data using sampling technique Able to take the decisions by using hypothesis testing on samples Able to compare the population proportions Able to create the model for predictive analysis

UNIT I

[7 Hrs]

Introduction: Grouping and displaying data to convey meaning: Raw data, arranging data, frequency distribution, Measures of central tendency and dispersion in frequency distribution: arithmetic mean, weighted mean, geometric mean, Median, mode, dispersion, ranges, Exploratory data analysis(EDA). Introduction to R Statistics

UNIT II

[8 Hrs]

Probability and Probability distribution: Basic terminology in probability, probability rules, Probabilities under conditions of statistical independence, probabilities under conditions of statistical dependence. Probability distribution: What is probability distribution, random variables, use of expected value in decision making, and various distributions.

UNIT III

[7 Hrs]

Sampling and Sampling Distribution and Estimation: Introduction to sampling, random sampling, Introduction to sampling distribution. Estimation: Introduction, Point estimates, Interval estimates and confidence interval, interval estimates using t distribution, determining the sample size in estimations

UNIT IV

[8 Hrs]

Testing Hypothesis: One sample test, Two sample tests: Introduction, testing hypothesis, hypothesis testing of means when the population standard deviation is known, measuring power of hypothesis, hypothesis testing of proportions, HT when standard deviation is not known, hypothesis testing for means and proportions, test for difference between means for various sample sizes.

UNIT V

[7 Hrs]

Chi-square and analysis of Variance: Introduction, chi-square as a test of independence, chi-square as a test of goodness of fit: testing the appropriateness of a distribution, analysis of variance, inference about a population variance, Inference about two population variance

UNIT VI

[8 Hrs]

Simple Regression and Correlation and Multiple Regression and Modeling: Estimation using regression line, correlation analysis, making inference about population parameters, multiple regression and correlation analysis, finding the multiple regression equation, making inference about population parameters, modeling techniques

Text Book:

- "Statistics for Management", Richard I. Levin & David S. Rubin, 7th Edition, Pearson Education.

Reference Book:

- "Practical Statistics for Data Scientists, 50 Essential Concepts", Peter Bruce & Andrew Bruce, O'Reilly Media
- "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer Press

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

**7th Semester**

CT1408	PE III: CLOUD COMPUTING	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
Main objective is to create, promote and exploit an open-source Cloud API and platform targeted for designing and developing multi- Cloud-oriented applications.	<ol style="list-style-type: none"> 1. Explain software and hardware support for enterprise and cloud computing. 2. Perform data modeling for enterprise and cloud knowledge bases. 3. Design enterprise and cloud software applications. 4. Implement and run distributed and cloud applications. 5. Ensure security and privacy in enterprise and cloud applications.
PO, PSO MAPPING :- a,b,c,d,e,f,g,h,i,k,l,m	

UNIT I

Introduction to Cloud Computing: Defining Cloud Computing; Cloud Types and different models-The NIST model, The Cloud Cube Model, Deployment models, Service models; Examining the Characteristics of Cloud Computing; Benefits of cloud computing; Disadvantages of cloud computing; Assessing the Role of Open Standards.

UNIT II

Cloud Architecture, Services and Applications: Exploring the Cloud Computing Stack, Connecting to the Cloud, Infrastructure as a Service, Platform as a Service, SaaS Vs. PaaS, Using PaaS Application Frameworks, Software as a Service, Identity as a Service, Compliance as a Service .

UNIT III

Abstraction and Virtualization: Introduction to Virtualization Technologies, Load Balancing and Virtualization, Understanding Hypervisors, Understanding Machine Imaging, Porting Applications, Virtual Machines Provisioning and Manageability Virtual Machine Migration Services, Virtual Machine Provisioning and Migration in Action, Provisioning in the Cloud Context.

UNIT IV

Exploring Cloud Infrastructures: Managing the Cloud Administering the Clouds, Management responsibilities, Lifecycle management Cloud Management Products, Emerging Cloud Management Standards, understanding Service Oriented Architecture- Introducing Service Oriented Architecture.

UNIT V

Managing & Securing the Cloud: Administering the Clouds, Cloud Management Products, Emerging Cloud Management Standards, Securing the Cloud, Securing Data, The security boundary, Security service boundary, Security mapping, Brokered cloud storage access, Establishing Identity and Presence.

UNIT VI

Cloud Computing Cost Analysis, Selecting an IaaS Provider, Capacity Planning and Disaster Recovery in Cloud Computing, basic AWS Cloud architectural principles, basic/core characteristics of deploying and operating in the AWS Cloud, the key services on the AWS Platform and their common use cases, Define the billing, account management, and pricing models, Introduction to Amazon EC2. Case Studies: Microsoft Azure, Dropbox

TEXT BOOKS:

1. Cloud Computing Bible, by Sosinsky B. Wiley India.
2. Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online by Miller Michael, Pearson Education India.

REFERENCE BOOKS:

1. Cloud Computing: Principles and Paradigm by Buyya R. Broberg, J. Goscinski, A. John Wiley & Sons.
2. Cloud Computing – A practical Approach by T. Velte, A. Elsenpeter, R. Tata McGraw Hill.
3. Cloud Computing and SOA Convergence in Enterprise by Linthicum D. Pearson Education India.
4. Enterprise Cloud Computing by Shroff G, Cambridge University Press
5. Private Cloud Computing by Smooth S. Tan, N. Morgan Kauffman.
6. Cloud Computing: Web Based Applications that Change the Way You Work and Collaborate Online by Miller Michael, Pearson Education India .

Chairperson		Version	1.01	Applicable for AY 2018-19
Dean (Acad. Matters)		Date of Release	APRIL 2018	Onwards



7th Semester

CT1409	PEIII: Operations Research	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
1.To provide knowledge about basic deterministic methods of operations research (linear programming, network flows, integer programming and nonlinear programming) and their applications to resource allocation problems in business and industrial organizations. 2.To develop an ability to analyze any engineering problem in a simple and logical manner and to apply appropriate basic principles to its solution.	1.Describe at an intuitive level the process of operations research: a real-time cycle of problem understanding, formulation, solution and implementation. 2.Identify and develop operational research models from the description of the real system. 3.Formulate simple reasoning, learning and optimization problems, in terms of the representations and methods presented. 4.Manipulate the basic mathematical structures underlying these methods, such as system state, search trees, plan spaces, model theory, constraint systems, linear programs and integer programs. 5.Demonstrate the hand execution of basic reasoning and optimization algorithms on simple problems. 6.Use the mathematical tools that are needed to solve optimization problems. 7.Use mathematical software to solve the proposed models.
PO, PSO MAPPING :- a, b, c, d, e, h, i, k, l, m	

- UNIT I MODELING APPROACH**
Definitions, Characteristics, Scope and Limitations of OR, phases of OR modeling OR tools and techniques of OR
- UNIT II LINEAR PROGRAMMING**
Linear Programming, assumptions and formulation of LP model, solution of LPP by graphical method, simplex method, Dual Simplex Method, Two Phase Simplex Method, Big M Method, Duality in LP.
- UNIT III ALLOCATION MODELS**
Assignment models: Definition and assumptions, formulation and solution, multiple optimum solutions, prohibited assignment.
- UNIT IV ALLOCATION MODELS**
Transportation model
Definition, Solution of Transportation Model, prohibited and preferred routes, and degeneracy in transportation problem.
- UNIT V INTEGER PROGRAMMING**
Definition, applications, Branch and Bound Method to solve Travelling Salesman Problem.
- UNIT VI Machine Sequencing:** n jobs through two machines, n jobs through three machines, n jobs through m machines, two jobs through m machines sequencing problem.
Constrained Optimization: Karush-Kuhn-Tucker Conditions for Constrained Optimization, exposure to tools e.g. Mathematica.

TEXT BOOKS:

1. Optimization technique by Radrin pearson ,Ed. Publication.
2. Problems in Operation Research by P.K.Gupta & Man Mohan ,Khanna Pub.
3. Mathematical Models in Operation Research by J. K. Sharma, Mac millan Pub.

REFERENCE BOOKS:

1. Introduction to Operation research by Hiller & Liberman (Holden Day Inc. San Francisco).
2. Operation Research by Kantiswaroop & Gupta, S.Chand Pub.
3. Principles of Operation Research by Wagner ,PHI Pub.
4. Operation Research by Dr. B. S. Goel & S. K. Mittal , Pragati Prakashan.
5. Optimization Technique by S. S. Rao.

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Computer Technology

7th Semester

CT1437	PE III : Parallel Computing	L=4	T=0	P=0	Credits = 4
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OBJECTIVES	OUTCOMES
<ol style="list-style-type: none"> To provide basics of concepts related to parallel computing To understand principles of parallel algorithm design To understand performance measuring metrics for parallel system To understand basics of thread programming To familiarize different directives of parallel programming framework i.e OpenMp To understand concepts of Dynamic Programming 	<ol style="list-style-type: none"> identify areas where parallel computing is applicable design parallel algorithm for real life problems find the speedup factor by analyzing parallel programs implement parallel programs using thread programming implement different algorithms using OpenMp implement dynamic programming problems using parallel programming

PO, PSO MAPPING

Unit I :

Introduction to Parallel Computing: Motivating Parallelism Scope, Applications, Parallel Programming Platforms: Implicit Parallelism: Limitations of Memory System Performance, Dichotomy of Parallel Computing Platforms, Physical Organization of Parallel Platforms, Communication Costs in Parallel Machines, Routing Mechanisms for Interconnection Networks, Impact of Process Processor Mapping and Mapping Techniques

Unit II :

Principles of Parallel Algorithm Design: Preliminaries Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models, Basic Communication operations: One to All Broadcast and All to One Reduction, All to All Broadcast and Reduction, All Reduce and Prefix Sum Operations, Scatter and Gather, All to All Personalized Communication, Circular Shift, Improving the Speed of Some Communication Operations

Unit III :

Analytical Modeling of Parallel Programs: Performance Metrics for Parallel Systems, The Effect of Granularity on Performance, Scalability of Parallel Systems, Minimum Execution Time and Minimum Cost Optimal Execution Time, Asymptotic Analysis of Parallel Programs, Other Scalability Metrics, Programming Using the Message Passing Paradigm: Principles of Message Passing Programming, The Building Blocks: Send and Receive Operations, MPI: the Message Passing Interface, Topologies and Embedding, Overlapping Communication with Computation, Collective Communication and Computation Operations, Groups and Communicators,

Unit IV :

Programming Shared Address Space Platforms: Thread Basics, Why Threads? The POSIX Thread API, Thread Basics: Creation and Termination, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs, Tips for Designing synchronous Programs,

Unit V

OpenMP: a Standard for Directive Based Parallel Programming, Dense Matrix Algorithms: Matrix Vector Multiplication, Matrix Matrix Multiplication, Solving a System of Linear Equations Sorting: Issues in Sorting on Parallel Computers, Sorting Networks, Bubble Sort and its Variants, Quicksort, Bucket and Sample Sort, Other Sorting Algorithms, Graph Algorithms: Minimum spanning tree Prims Algorithm, Single Source Shortest Paths: Dijkstra's Algorithm

Search Algorithms for Discrete Optimization Problems: Sequential Search Algorithms, Search Overhead Factor, Parallel Depth-First Search, Parallel Best-First Search, Speedup Anomalies in Parallel Search Algorithms

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**7th Semester**

CT1437	PE III: Parallel Computing	L=4	T=0	P=0	Credits = 4
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Unit VI

Dynamic Programming: Overview of Dynamic Programming, Serial Monadic DP Formulations, Monadic DP Formulations, The Longest Common Subsequence Problem, Serial Polyadic DP Formulations, Floyd's All Pairs Shortest-Paths Algorithm, Nonserial Polyadic DP Formulations, The Optimal Matrix Parenthesization Problem, Fast Fourier transform:

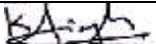
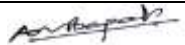
The Serial Algorithm, The Binary Exchange Algorithm, The Transpose Algorithm 27

Books :

1. Introduction to Parallel Computing, Ananth Grama, Pearson Education

Reference Books:

1. Fundamental of Paralle Processing, Harry F. Jordan, Gita Alaghband, Pearson Education
2. Parallel Programming, Michael Allen, Barry Wilkinson, Pearson Ed

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7th Semester

CT1454	PE III : Machine Learning Techniques	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
<ol style="list-style-type: none"> To introduce basic concepts of machine learning and explain the relative strengths and weaknesses of different machine learning Methods. To understand the different aspects of supervised learning To understand the concepts of unsupervised learning To introduce the concepts of decision tree machine learning To understand the different methods of evaluation of machine learning algorithms To introduce advance topics of machine learning 	<ol style="list-style-type: none"> Analyze a problem and identify the machine learning algorithm appropriate for its solution Able to apply supervised learning for the given set of samples and design the model to meet desired needs Able to apply unsupervised for the given set of samples Able to design predictive model Able to compare the different machine learning techniques demonstrates comprehension of the trade-offs involved in design choices Able to apply other hybrid machine learning techniques

UNIT I

[7 Hrs]

Introduction to machine learning. Introduction, machine learning classes (i.e., supervised, unsupervised and reinforced), well posed and ill posed learning problems, designing a learning system, perspective and issues in machine learning, applications

UNIT II

[8 Hrs]

Supervised Learning: Learning a class from Bayesian learning, learning theory (bias/variance tradeoffs; VC theory; large margins), Generative/discriminative learning, parametric/non-parametric learning, linear and logistic regression, SVM

UNIT III

[7 Hrs]

Unsupervised Learning: Introduction, Density Estimation, Clustering, Dimensionality reduction, PCA, kernel methods

UNIT IV

[8 Hrs]

Decision Tree Learning: Introduction, decision tree representation, appropriate problems for Decision Tree learning, the basics decision tree learning algorithm, hypothesis space search, inductive bias in decision tree learning, issues in decision tree learning.

UNIT V

[8 Hrs]

Design and Analysis of Machine Learning Algorithms. Introduction, Factors, Response, and Strategy of Experimentation, Guidelines for Machine Learning Experiments, Cross-Validation and Resampling Method, Measuring Classifier Performance, Interval Estimation, Hypothesis Testing, Assessing a Classification Algorithm's Performance, Comparing Two Classification Algorithms, Comparing Multiple Algorithms: Analysis of Variance, Comparison over Multiple Datasets

UNIT VI

[7 Hrs]

Advance Topics. Ensemble methods, Introduce the concepts behind deep learning and benefits of deep over shallow networks, introduce the concepts of reinforcement learning

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**7th Semester**

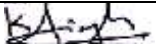
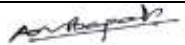
CT1454	PE III : Machine Learning Techniques	L=4	T=0	P=0	Credits=4
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Text Book:

1. "Introduction to Machine Learning", Ethem Alpaydin, The MIT Press, second edition.
2. "Machine Learning", Tom Mitchell, McGraw-Hill Science/Engineering/Math, 1997

Reference Book:

1. Christopher M. Bishop, Pattern Recognition and Machine Learning. <http://research.microsoft.com/en-us/um/people/cmbishop/prml/>.
2. R. Sutton and A. Barto, An Introduction to Reinforcement Learning (<http://webdocs.cs.ualberta.ca/~sutton/book/ebook/thebook.html>)
3. C. Szepesvari, Algorithms for Reinforcement Learning (<http://www.sztaki.hu/~szcsaba/papers/RLAlgsInMDPslecture.pdf>)
4. Deep learning:
Ian Goodfellow, Yoshua Bengio, and Aaron Courville, Deep Learning (<http://www.deeplearningbook.org/>)

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Nagar Yuwak Shikshan Sanstha's

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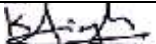
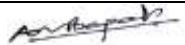
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Computer Technology

7th Semester

CT 1413	Industrial Training / CRT				L=0	T=0	P=0	Credits = 3
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
			100		100			

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Nagar Yuwak Shikshan Sanstha's

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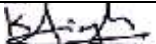
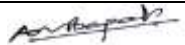
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Computer Technology

7th Semester

CT1414	Project Phase-i				L=0	T=0	P=0	Credits = 4
Evaluation Scheme	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		
			60	40	100			

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Computer Technology

8th Semester

GE1408	Cyber Laws				L=4	T=0	P=0	Credits = 4
Evaluation	MSE-I	MSE-II	TA	ESE	Total	ESE Duration		

OBJECTIVES	OUTCOMES
PO, PSO MAPPING:	

UNIT I

Evolution of the Law relating to information Technology –Legal environment in Information Age-Technology and law-The international regime, The National regime and initiatives in internet legislation-Issues of jurisdiction in cyber space – International Convention on cyber space 2001 OECD model treaty and E-commerce.Internet Jurisdiction

UNIT II

The basics of IT Act - Objectives, Scope and application of the Act of 2000, Application of the IPCode as a measure of penal statute to regulate cyber activities and cyber contracts. Basic foundations in the Information Technology Act for the protection of E commerce, E Contracts and E documents, Digital signatures and identity-Access requirements, contract formation related nomenclature as defined in Section 2 of the IT Act.Basic Contract Law – Formation of contracts, performance and discharge of contractual obligations under the Indian Contract Act, 1872., SLA, KPI

UNIT III

Legal aspect of Digital signature and Electronic signature:

Authentication of electronic record by electronic signature (5.3 and 3A),Legal recognition of econtract sand e-documents of the governments-ss.4, 5, 6 ,7A and 10A, Securing e-records and e-signatures, Duties of subscriber ss.40-42 ss. 14 and 15, Certification of e-signature (s.35,36,37,38,39), Regulation of certifying authorities through licensing application for license ,renewal of license, procedure for grant or rejection of license, suspension or revolution of license. Esign, Digital Locker.

UNIT IV Privacy and Security, basic Principal of Data Protection Act, Health Insurance Portability Accountability Act, concepts of ISO 27001 security Audit, Payment Card Industry Data Security Standard (PCI DSS), Computer crime investigation process and evidence collection, Incident Response Procedures, Net Neutrality

UNIT V Treatment of cyber crimes under the IT Act -2008

Offence and penalties prescribed in I.T Act 2008, Controller"s powers with respect to offences And their regulation. Law relating to Cyber crime Under Indian Penal Code (IPC) 1860 Making false electronic record (S.464 IPC) Punishment for forgery (S.465 IPC); forgery of public record etc. (S.466 IPC) and Forgery for purpose of cheating (S.468) Forged document or electronic record (S.470); Using as genuine a forged document or electronic record (S.471); Counterfeiting device or mark used for authenticating documents or electronic record or possessing counterfeit marked material, Falsifying accounts. (S.474 and S.477A).

UNIT VI

Implication of cyber law on intellectual property related issues and commercial transaction Copyright Act-definition of computer and computer program (S.2ffb), Subsistence of copyright in computer programs, Copyright and Internet, Copyright in digital medium, Copyright in computer databases Trade mark Act –Search engine and meta tags- Domain Names: digital marks in the online medium, Resolving domain name disputes, Cyber Squatting /TYPO squatting Domain name in Indian law, Uniform dispute resolution policy.Other important issue like IP PANAROMA., BITCOINS, digital divide, Global Commans, Auto SAR, GIWG Guide line WIPO copyright treaty (WCT) 1996,WIPO performance and phonograms treaty (WPPT) 1996.

1. Satyam infoway Ltd. Vs Sifynet solution Pvt. Ltd (2004) 6SCC145
2. The Napster"s story
3. Other case study

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Computer Technology

8th Semester

CT1450	Object Oriented Modeling	L=4	T=0	P=0	Credits = 4
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OBJECTIVES	OUTCOMES
<ol style="list-style-type: none"> To distinguish between procedure oriented and Object Oriented Methodology. To understand the features of Object Oriented Programming. To understand the basic building blocks of C++ language. To understand the Utility and difference of various Data Structure. To understand the need of Exception. Exception Handling Mechanisms of OOP Methodology using C++. To study the concept of Templates . To understand the OOP methodology and relate to it day to day applications. To relate various practical examples with the OOP Methodology. 	<ol style="list-style-type: none"> Compare different types of Programming Languages Describe Real World object, Structure and Class. Implement the Programming Examples. Implement the Concept of abstract class Concept of Interface. Define and classify Data Structure. Implement the Mechanisms and Concept of Exception , Types of Exception Define stream, the Concept of File, Opening and Closing of File
PO, PSO MAPPING: a,c,e,g,i,j,k,l,m	

UNIT I

Introduction: object orientation, Object Oriented development, modeling as a design technique, Class modeling:- the three models, object, classes, links and associations, navigation of class models, aggregation, abstract classes, metadata, packages.

UNIT II

State Modeling: events & states, transitions and conditions, state diagrams behavior, concurrency advanced state modeling concepts, nested state diagrams, concurrency, relation of class & state models. Interaction modeling: Use case. Sequence and activity models, relationships among the models.

UNIT III

System Analysis: Development life cycle and development style, system conception, domain analysis application analysis

UNIT IV

System Design: Overview, estimating performance, making are use plan, breaking into sub systems, identifying concurrency, allocation of sub systems, management of data storage, handling global resources, choosing software control strategy, handling boundary conditions, setting trade off priorities, common architectural styles.

UNIT V

Class Design, implementation modeling, object oriented languages.

UNIT VI

Databases: implementing structures basic and advanced, implementing functionality, object oriented databases. Object oriented programming style, reusability, extensibility, robustness.

TEXT BOOKS:

1. Object oriented modeling and design with UML by James Rumbaugh, Michal Blaha, Pearson Prentice Hall Second Edition.

REFERENCE BOOKS:

1. Practical Object Oriented Design with UML by Mark Priestley TMH 2nd Edition
 2. The Unified Modeling Language user guide by Booch , Rumbaugh, Jacobson Addison Wesley 2nd Edition

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Computer Technology

8th Semester

CT1418	PE IV: Digital Image Processing	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
1. To provide understanding of basics of Digital Image Processing, discuss fundamental concepts of neighborhood pixel, Spatial Domain Image Processing, provide insight of histogram processing, study the frequency Domain Image Processing, provide the details of segmentation and provide the regional and descriptors concept.	1. Apply Image Enhancement techniques in Spatial Domain. 2. Know and Apply Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging on images. 3. Perform Fourier Transform on images. 4. Understand and apply Homographic Filtering. 5. Apply different segmentation techniques on images.

PO, PSO MAPPING :- a,b,c,d,e,i,k,l

UNIT I

Introduction: Fundamental Steps in Image Processing, Elements of DIP systems, Elements of Visual Perception, Fundamentals of Image processing, A Simple Image Model, Sampling and Quantization, Some Basic Relationships. between Pixels, Image Geometry in 2D.

UNIT II

Image Enhancement in the Spatial Domain: Introduction to Spatial and Frequency methods, Basic Gray Level Transformations, Histogram Equalization, Histogram Processing, Local Enhancement, Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

UNIT III

Transforms: Introduction to the Fourier Transform, Discrete Fourier Transformation, Fast Fourier Transformation, Fourier Properties, 2DFT, inverse Fourier transform, Discrete Cosine Transform, Typical Applications

UNIT IV

Image Enhancement in the frequency Domain: Filtering in the Frequency Domain, Correspondence between Filtering in the Spatial and Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering, Implementation.

UNIT V

Image Segmentation: Point Detection, Line Detection, Edge Detection, Gradient Operator, Edge Linking and Boundary Detection, Thresholding, Region-oriented Segmentation.

UNIT VI

Image Representation: Chain Codes, Polygonal Approximations, Signatures, Boundary Segments, Skeleton of a Region. Description: Boundary Descriptors, Shape Numbers, Fourier Descriptors, Regional Descriptors, Simple Descriptors, Topological Descriptors. Introduction to color image processing: RGB and HSI color models, introduction to image file formats: TIFF, JPEG, BMP, etc.

TEXT BOOKS:

1. Digital Image Processing by Rafael C. Gonzalez and Richard, E. Woods, 3rd edition, Prentice Hall.
2. Digital Image Processing by Jayaraman, S. Esakkirajan, T. Veerakumar, publication Tata McGrawHill.

REFERENCE BOOKS:

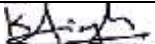
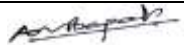
1. Fundamentals of Digital Image Processing by A.K.Jain, Prentice Hall.
2. Image Processing Principles & Applications by Tinku Acharya & Ajo y K. Ray, Wille y Inter-Science.

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**8th Semester**

CT1419	Lab. : PE IV: Digital Image Processing	L=0	T=0	P=2	Credits=1
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Sr.No.	Practical Name
1	Study Practical on basic gray level transformation.
2	Write a program to create a contrast of image.
3	Create a histogram of given image.
4	Resize a given Image.
5	Write a program to create negative of an image.
6	Create a Binary Image.
7	Write a program to smooth an image.
8	Write a program to Sharpe an image.
9	Segment a given image.
10	Create a skeleton of region.
Beyond Syllabus Practical List:	
1	Apply wavelet transform to decompose an image.
2	Apply gabor filter to enhance an image.

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**8th Semester**

CT1420	PE IV: PATTERN RECOGNITION	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
1. The study of Pattern Recognition to equip the students with the brief knowledge of Statistica. 2. Decision Theory, Image processing, clustering, different error at esin pattern recognition, decision making techniques and application of pattern recognition in different fields.	1. Apply Pattern Recognition techniques for recognition n. 2. Know and Apply knowledge of Statistical Decision Theory. 3. Perform Image processing concepts on images. 4. Understand and apply clustering concepts on raw 5. Apply decision making techniques.
PO, PSO MAPPING: a,b,d,e	

UNIT I

Introduction: Statistical Decision Theory, Image Processing and Analysis, Probability- probabilities of events, random variables, joint distribution & densities.

UNIT II

Moments of random variables, estimation of parameters from samples, minimum risk estimators.

UNIT III

Non parametric decision Making- Histograms, kernel and window estimators, nearest neighbor classification techniques, adaptive decision boundaries, adaptive discriminate functions, minimum squared error, estimation functions, choosing a decision making technique.

UNIT IV

Linear Classifier Introduction, Linear Discriminant Functions and Decision Hyperplanes, The Perceptron Algorithm, Least Squares Methods, Mean Square Estimation Revisited, Support Vector Machines .

UNIT V

Feature Generation Introduction, Basis Vectors and Images, The Karhunen-Loeve Transform, The Singular Value Decomposition, Independent Component Analysis, The Discrete Fourier Transform, The Haar Transform.

UNIT VI

Clustering-Introduction, hierarchical clustering, partition clustering.

TEXT BOOKS:

1. Pattern recognition & Image Processing by Ealr Gose, Richard Johnson daugh & Steve Jost. (PHIPub).
2. Richard O. Duda, Peter E. Hart and David G. Stork, "Pattern Classification" 2nd Edition, John Wiley.

REFERENCE BOOKS:

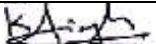
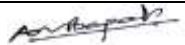
1. Pattern recognition by Sergios Theodoridis, Konstantinos Koutroumbas 3rd Ed.

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**8th Semester**

CT1421	Lab. : PE IV: Pattern Recognition	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	60	40		100	

Sr.No.	Practical Name
1	Enhance an image using Average Filter.
2	Detect the edges using Sobel operator.
3	Plot a histogram of a given image.
4	Classify an objects based on adadptive desion boundary technique.
5	Classify an objects based on nearest neighbor classification techniques.
6	Implement The Perceptron Algorithm.
7	WAP to implement SVM.
8	Extract features using ICA.
9	Extract features using DFT.
10	Extract features using Haar Transform.

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8th Semester

CT1441	PE IV: Mobile Communication	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
To provide an in depth understanding of wireless access, mobility in cellular, to study wireless networks using standards like GSM, CDMA, GPRS and IEEE 802.11 etc., to understand the quantitative techniques to evaluate the different, protocols, network architecture.	Students should be able to select appropriate standards for the given situation. evaluate different protocols using quantitative techniques.
PO, PSO MAPPING: a,b,c,d,e,i,k,l	

UNIT I:

[7Hrs]

Introduction to wireless communication, introduction to cellular system, wireless transmission: frequencies for radio transmission, signal propagation. Introduction to medium access control: TDMA, CDMA GSM: System architecture protocols, localization and calling, handover, Modulation Techniques.

UNIT II:

[8Hrs] Wireless

LAN: IEEE 802.11, Bluetooth, Zigbee etc. Satellite Systems: GEO, LEO, MEO routing, localization and handover Mobile network Layer: Mobile IP, dynamic host, configuration protocol, adhoc networks, IPv6. Mobile transport layer: traditional TCP, indirect TCP & mobile TCP,

UNIT III:

[7Hrs]

2G-Global System for mobile communication (GSM) Introduction, GSM Architecture, Database and Data Elements, GSM Interfaces, GSM Protocol Architecture, GSM Versions.

UNIT IV:

[7Hrs]

2G: IS95 cellular system (CDMA): Introduction, Motivation for CDMA to use in Mobile Communication, IS95 cellular System (CDMA) forward Channel, Reverse Channel Parameters of CDMA, wireless Local Loop Radio System. 4G LTE, 5G Introduction, LIFI

UNIT V:

[8Hrs]

2.5 G: General Packet Radio service (GPRS) Introduction, Advantages of GPRS, GPRS Application, GPRS Architecture, GPRS Interfaces Logical Channels in GPRS, Protocol Architecture, Internetworking with IP Networks, GPRS terminals

UNIT VI:

[8Hrs]

3G: Universal Mobile Telecommunication System (UMTS) Introduction, UMTS Services, UMTS Architecture, UMTS Core Network, 4G introduction, Architecture of wireless Application protocol (WAP), Issues of Mobile Application.

TEXT BOOKS:

1. "Mobile communication", Jochen Schiller (Addison Wesley pub)
2. "Mobile Communication Systems", Krzysztof Wesolowski (Wiley Publication)
3. "Wireless Communication principles & Practice", T.S.Rappaport (PHI pub)

REFERENCE BOOKS:

1. "Mobile communications Design Fundamentals", William C.Y.Lee (John Wiley & Sons pub)
2. "Wireless Sensor Network", Zhou & Guibas

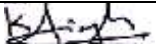
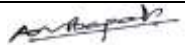
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**8th Semester**

CT1442	Lab. : PE IV: Mobile Communication	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	60	40		100	

LIST OF PRACTICAL

1. Installation of JDK1.6 and SDK1.3.
2. Study of JDK (Eclipse) Tool kit and software development kit.
3. Study of WML: Wireless Markup Language and its examples.
4. Develop an application in Android to store contacts in mobile handheld device.
5. Develop an application in Android to read an user input text.
6. Develop a Standup Timer in an Android that acts as a simple, stand-up meeting stop watch.
7. Study of Wireless Application protocol (WAP)
8. To study Pervasive Computing.

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8th Semester

CT1455	PE IV :Cyber Forensics	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
<ol style="list-style-type: none"> To study various accepts of Information security and protect the IT asset from outside word. To study different modern techniques for with respect to Computer System and Networks Ethical Hacking accepts for protecting information security. To make comparative analysis of different forensics techniques for wireless technology To study different legal web attacking technique for securing web servers To study and compilation of report writing tool and technique used in digital forensics. 	<ol style="list-style-type: none"> Able to apply various accepts of Information security and Information technology with respect to cyber laws Able to analyse various tool and methodology for cyber forensics Able to explorer ethical hacking and its countermeasure Able to apply various technique for protecting data in wireless technology Able to evaluate various web attacking technique and there countermeasure Able to design report for different forensic cases for submitting in court of laws

Unit I

[7 Hrs]

Types of Cyber Crime, security Attacks, Overview and Computer forensics in today's world computer hard ware basics Computer forensics investigation process, understanding hard disks and file systems, Types of computer forensics.

Unit II

[7 Hrs]

Computer forensic: Data acquisition and duplication, Defeating anti-forensics techniques, operating system forensics, Log analysis and event viewer, File auditing, identifying rogue machines, Malware forensic Database forensic.

Unit III

[7 Hrs]

IT fraud, Recovery of deleted files, Live Data collection and investigating Linux environment. Password recovery (tools like John the ripper, L0phtcrack, and THC-Hydra), email crimes.

Unit IV

[7 Hrs]

Network forensics, investigating web attacks, Gathering Tools to create a response toolkit. Hidden files and unauthorized access points. Analyzing network traffic, sniffers Hardware forensic tools like Port scanning and vulnerability assessment tools like Nmap, Netscan etc.

Unit V

[7 Hrs]

Mobile Forensics, Live Data collection and investigating on android, ios, windows environment, Investigating report generation, investigation process, acquisition types, tools, report generation

Unit VI

[7 Hrs]

Forensics report writing and presentation, Case studies

Text Books:

- Mandia, K., Prosis, C., Pepe, M., Incident Response & Computer Forensics. 2nd edition, Tata-McGraw Hill,
- Bill Nelson, Amelia Phillips, Frank Enfinger, and Chris Steuart, Guide to Computer Forensics and Investigations, 2nd edition, Thomson Learning

Reference Books:

- Eoghan Casey ,Digital Evidence and Computer Crime, 2nd Edition , academic Press File System Forensic Analysis by Brian Carrier, addition Wesley
- Harlan Carvey Windows Forensic Analysis DVD Toolkit (Book with DVD-ROM), Syngress Publication
- Steve Bunting, EnCE: The Official EnCase Certified Examiner Study Guide, 2nd Edition, Sybex Publication

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**8th Semester**

	Lab : PE IV :Cyber Forensics	L=0	T=0	P=2	Credits=1
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Objectives	Outcomes
<ol style="list-style-type: none"> To study various accepts of Information security and protect the IT asset from outside word. To study different modern techniques for with respect to Computer System and Networks Ethical Hacking accepts for protecting information security. To make comparative analysis of different forensics techniques for wireless technology To study different legal web attacking technique for securing web servers To study and compilation of report writing tool and technique used in digital forensics. 	<ol style="list-style-type: none"> Able to apply various accepts of Information security and Information technology with respect to cyber laws Able to analyse various tool and methodology for cyber forensics Able to explorer ethical hacking and its countermeasure Able to apply various technique for protecting data in wireless technology Able to evaluate various web attacking technique and there countermeasure Able to design report for different forensic cases for submitting in court of laws
Mapped Program Outcomes:	

List of Practical:

- Study practical on cyber-crime and generation of Hash values on file system
- Perform data accusation and imaging on digital evidences
- Perform recovery and data carving on digital evidence
- Explore and analyses tools on Email analysis an investigation
- Password recovery tools, from RAR, DOC, PDF, windows password.
- Mobile forensics SIM card analysis,
- Mobile data Analysis AND Fraud Detection,
- Vulnerability Analysis on Windows
- Report and Evidence Submission using Tools

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8th Semester

CT1432	PE V:Software Project Management	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
1 To learn basic concepts project contract and to get an overview of various activities under project planning. 2 To understand techniques for cost benefit analysis and risk evaluation. 3 To understand project scheduling and various network planning models. 4 To understand Risk Management, Risk Planning and control. 5 To understand various activities like visualizing progress, earned value analysis etc. under monitoring and controlling of a project. 6 To understand the role of continuing training and learning, to improve group working and to select appropriate leadership styles.	1 To understand basic concepts about project, project management and project planning. 2 To assess given requirements and perform cost benefit analysis. 3 To create a project schedule using some network planning model for given requirements. 4 To identify and create a risk management plan for given requirements. 5 To perform earned value analysis for given requirements and current completion state of project. 6 To form teams for any given exercise, work as a team and understand leadership qualities.
PO, PSO MAPPING :- a,b,c,d,e,f,g,h,i,j,k,l,m	

UNIT I

Introduction to Software Project Management: Project Definition, Contract Management, Activities Covered By Software Project Management, Overview of Project Planning, Stepwise Project Planning.

UNIT II

Project Evaluation: Strategic Assessment, Technical Assessment, Cost Benefit Analysis, Cash Flow Forecasting, Cost Benefit Evaluation Techniques, Risk Evaluation.

UNIT III

Activity Planning: Objectives, Project Schedule, Sequencing and Scheduling Activities, Network Planning Models, Forward Pass, Backward Pass, Activity Float, Shortening Project Duration, Activity on Arrow Networks.

UNIT IV

Risk Management: Risk Management, Nature Of Risk, Types Of Risk, Managing Risk, Hazard Identification, Hazard Analysis, Risk Planning And Control.

UNIT V

Monitoring and Control: Creating Framework , Collecting The Data , Visualizing Progress, Cost Monitoring, Earned Value, Prioritizing Monitoring, Getting Project Back To Target, Change Control, Managing Contracts, Introduction, Types Of Contract, Stages In Contract Placement, Typical Terms of A Contract, Contract Management, Acceptance.

UNIT VI

Managing People and Organizing Teams: Introduction, Understanding Behavior, Organizational Behaviour: A Background, Selecting The Right Person For The Job, Instruction In The Best Methods , Motivation, The Oldman – Hackman Job Characteristics Model, Working In Groups– Becoming A Team, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety.

TEXT BOOKS:

1. Bob Hughes, Mikecoterell, "Software Project Management", Third Edition, Tata McGraw Hill.

REFERENCE BOOKS:

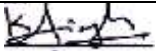
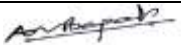
1. Ramesh, Gopalaswamy, «Managing Global Projects, Tata McGraw Hill.
2. Royce, "Software Project Management", Pearson Education.
3. Jalote, "Software Project Manangement in Practive", Pearson Education.

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**8th Semester**

CT1433	Lab. : PE V : Software Project Management	L=0	T=0	P=2	Credits=1
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Sr.No.	Practical Name
1	Introduction to Software Project Management fundamentals.
2	To analyze requirements for a given case study .
3	To create a WBS for the given case study.
4	To perform risk management for the case study – 1.
5	To perform risk management for the case study – 2.
6	Overview of Planning tool.
7	To create Project Schedule for the case study -1.
8	To create Project Schedule for the case study -2.
9	To perform cost benefit analysis for case study.
10	To study contract management and contract document.
Beyond Syllabus Practical List:	
1.	To study and calculate Software Project Metrics.
2.	To study implementation of change control.

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8th Semester

CT1443	PE V : Internet of Things	L=4	T=0	P=0	Credits=4
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OBJECTIVES	OUTCOMES
To provide the details about the IoT(Internet of Things) and let understand and implements the emerging concepts about Internet of things	Students should be able to use, implements various platform from IoT and proficient to design and development of Smart Cites concepts.
PO, PSO MAPPING :- a,b,c,e,h,k,l,	

UNIT I APPLICATION DEVELOPMENT

Introduction – Concepts behind the Internet of Things.

The IoT paradigm, Smart objects, Bits and atoms, Goal orientation, Convergence of technologies, In IoT architectures, IoT enabling technologies, IoT Big Data Analytics, IoT security and privacy concerns. Computing paradigms: Virtualization Vulnerabilities, Hypervisor Security-Related Issues, Side Channel Attacks, Data Segregation, ubiquitous, grid, cloud, pervasive, green, ad hoc (*mobile, vehicular, flying*) networks.

UNIT II

Governance of Inter of things, Bodies subjects to Governing principal, substantive Principe of IoT Governance IoT Infracture Governance, Future Governance Issue, implementation of Smart city and smart villages projects , challenges and issues in SMART Projects

UNIT III cloud computing enable technology

Radio frequency Identification technology

Radio frequency Identification technology overview, Principle of RFID, Components of RFID technology Overview, Wireless sensor network tencnology overview, connecting node, networking securing communication, Power line communication technology overview, PLC Technology standard, archecture of home technology overview, RFID Research and related issue

UNIT IV Advance Cloud computing

Internet of things and cloud computing, IoT integration with Enterprise system, (XaaS) Everthing As a Services, Distributed business process in IoT, Distributed business processs in IoT, ubiquitous technology in cloud, middlewae for IoT, standards for SCDA, Standards for M2M, Unified mult tire WoT Architecture, SOA/EAI verus SODA MAI, Mobile cloud computing, four technology pillar, WoT Portal and Business Architectural

UNIT V ADVANCED SOCKETS-I

Routing sockets – Datalink socket address structure – Reading and writing – sysctl operations –get_ifi_info function – Interface name and index functions- Key Management sockets – Reading and writing – Dumping Security Association Database – Creating static Security Association – Dynamically maintaining SA's – Broadcasting – Broadcast addresses – Unicast versus Broadcast – (Client) Application development for broadcasting – Race conditions – Multicasting – Multicast addresses- Multicasting versus Broadcasting on a LAN – Multicasting on a WAN – Source specific Multicast – Multicast socket options – mcast_join, (Client) Application development for multicasting – Receiving IP multicast infrastructure session announcements – Sending and receiving.

UNIT VI Case Study and Projects

Introduction to Raspberry Pi, Setup and operate the Raspberry Pi ,Understand the basics of the Linux OS used on the Pi ,Understand the basics of the X Windows System (the GUI environment) , Program the Pi for a simple GUI-based game , Program the Pi to access a network, Raspberry Pi ARM ARM Architecture, ARM 11 future, Arduinio Basics Project and case study based on Arduinio and Pi

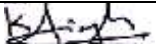
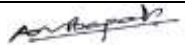
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**8th Semester**

CT1443	PE V : Internet of Things	L=4	T=0	P=0	Credits=4
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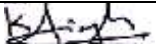
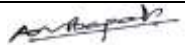
REFERENCES

1. W. Richard Stevens, "Unix Network Programming Vol-I", Second Edition, Pearson Education, 1998.
2. D.E. Comer, "Internetworking with TCP/IP Vol- III", (BSD Sockets Version), Second Edition, Pearson Education, 2003.
3. Michael Donahoo, Kenneth Calvert, "TCP/IP Sockets in C, A practical guide for programmers", Second Edition, Elsevier, 2009
4. Forouzan, " TCP/IP Protocol Suite" Second Edition, Tata MC Graw Hill, 2003.

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**8th Semester**

CT1444	Lab. : PE V: Internet of Things	L=0	T=0	P=2	Credits=1
Evaluation Scheme	Continuous Evaluation	ESE		Total	ESE Duration
	60	40		100	

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
Dean (Acad. Matters)		Date of Release	May 2017	

**8th Semester**

CT1445	PE V : Numerical Computing	L=3	T=1	P=0	Credits=4
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Objectives	Outcomes
To develop in the engineering students the ability to analyze any engineering problem in simple mathematical manner and to apply to its solution, to understand basic mathematical principles.	Students should be able to apply various numerical techniques to solve engineering problems.
Mapped Program Outcomes: a,b,c,e,g,i,k,l,m	

UNIT I : [6Hrs]

Introduction to numerical computing: Characteristics of Numerical computing, Approximations and errors in numerical computations, types of errors, analysis, error estimation, numerical instabilities in computation, convergence (convergence of iterative method),

UNIT II: [8Hrs]

Roots of Non-linear equations: Methods of solutions, Iterative methods, Horner's rule, Bisection method, Regula Falsi method, Iteration method, Newton Raphson method, Secant method, Muller method.

UNIT III :[8Hrs]

Solutions to System of Linear Algebraic Equations:

Existence of Solution, Solution By Elimination, Cramers rule, Basic Gauss Elimination Method, Gauss Elimination With Pivoting, Gauss – Jordan Method, Tringularization Methods, Choleskey's Method, Gauss Siedel method of iteration. Round Off Errors And Refinement, Ill – Conditioned System, Matrix Inversion Method.

UNIT IV :[8Hrs]

Interpolation and Approximation: Linear interpolation and high order interpolation using Lagrange and Newton Interpolation methods, finite difference operators and interpolation polynomials using finite differences.

UNIT V: [8 Hrs]

Numerical Differentiation and Integration: Numerical differentiation and errors in numerical differentiation, Newton-Cotes formulae, trapezoidal rule, Simpson's rule, Double integrals by Trapezoidal and Simpson rule, Romberg Integration.

UNIT VI:[8Hrs]

Numerical Solution of Ordinary Differential Equation: Solution By Taylor's Series, Picard's Method Of Successive Approximation, Euler's Method, Error Estimates For The Euler Method, Runge-Kutta Method for 2nd and 4th order, Predictor-Corrector Methods, Initial and boundary value problems.

Matrix Eigen – Equations: Concept of Eigen-System, Polynomial Method, Power Method for Eigen Values and Eigen-vector,

Text Books:

1. Sastry, S. S. "Introductory Methods of Numerical Analysis", 3rd Edition. Prentice- Hall of India, New Delhi (2002).

Reference Books:

1."Numerical Methods" , E. Balagurusamy, Tata McGraw hill.

2."Schaum's Outlines: Numerical Analysis", 2nd Edition, Tata McGraw Hill Publishing Co. Limited.

3."Numerical Computational Methods" P.B. Patil, U.P. Verma, Narosa Publishing, New Delhi, 2006.

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
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**8th Semester**

CT1446	Lab. : PE V: Numerical Computing	L=0	T=0	P=2	Credits=1
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Objectives	Outcomes
To apply the numerical methods to real life scenario.	Students should be able to apply theoretical numerical methods to solve real life problems.
Mapped Program Outcomes: b,c,e,g,i,k,l,m	

COURSE OBJECTIVES

1. To apply the theoretical numerical methods to real life scenario.

LIST OF PRACTICAL

1. Write A Program To Find The Root Of The Equation $X^3 - 2x - 5 = 0$ By Using Bisection Method.
2. Write A Program To Find The Root Of The Equation $X^3 - 2x - 5 = 0$ By Using False Position Method.
3. Write A Program To Find The Root Of The Equation $X^2 - 3x + 2 = 0$ By Using Newton Raphson Method
4. Write A Program To Find The Root Of The Equation $X^2 - 3x + 2 = 0$ By Using Muller Method.
5. Write A Program To Solve The System Of Equation By Using Gauss Elimination Method.
6. Write A Program To Solve The System Of Equation By Using Triangular Factorization Method.
7. Write A Program To Find The Square Root By Using The Second Order Lagrange Interpolation Polynomial Equation.
8. Write A Program To Fit A Line $Y = A + Bx$ To Given Set Of Data Point By Least Squares Method
9. Write A Program For Integrating A Given Function By Using Simpson 1/3rd Rule
10. Write A Program To Estimate The Solution In The First Order Differential Equation $Y = F(X, Y)$ At Given Point By Using Euler's Method

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
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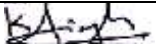
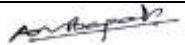
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BE SoE and Syllabus 2014

Computer Technology

8th Semester

CT1425	Comprehensive Viva	L=0	T=0	P=0	Credits=3
Evaluation Scheme	Continuous Evaluation	ESE	Total	ESE Duration	
		100	100		

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
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Nagar Yuwak Shikshan Sanstha's

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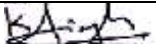
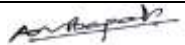
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BE SoE and Syllabus 2014

Computer Technology

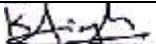
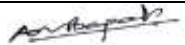
8th Semester

CT1426	Project Phase-II			L=0	T=0	P=0	Credits=8
Evaluation Scheme	Continuous Evaluation	TA	ESE	Total	ESE Duration		
		60	40	100			

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
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**8th Semester**

CT1427	Extra / Co –curricular/ Competitive Examination	L=0	T=0	P=0	Credits=2
Evaluation Scheme	Continuous Evaluation	TA	ESE	Total	ESE Duration
			100	100	

Chairperson		Version	1.01	Applicable for AY 2017-18 Onwards
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