DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COLLEGE OF TECHNOLOGY AND ENGINEERING, UDAIPUR-313001

POST GRADUATE PROGRAMME, 2017-18

Details of P.G. Programme Courses offered for the award M. Tech (CSE) in Computer Science and Engineering

S. No.	Title	Course No.	Cr. Hr.	Semester			
				I	II	III	IV-VI
Core Courses • ***Total 12 credits, two courses in first semester (6 credits) and one course in second and third semester (3 credits each) to be evaluated externally.***							
1.	Distributed Computing	CSE 511	3 (2+1)	3	-	-	-
2.	Mobile Computing	CSE 512	3 (2+1)	3	-	-	-
3.	Multimedia Computing	CSE 521	3 (2+1)	-	3	-	-
4.	Advance Operating Systems	CSE 531	3 (2+1)	-	-	3	-
Major Courses • ***Masters Degree: Total 15 credits, two courses in first and second semester each (6 credits in each semester) and one course in third semester (3 credits).***							
1.	Embedded Systems Design	CSE 513	3 (3+0)	3	-	-	-
2.	Distributed Database Management Systems	CSE 514	3 (2+1)	3	-	-	-
3.	Web Application and Penetration Testing	CSE 515	3 (2+1)	3	-	-	-
4.	Intelligent Systems	CSE 516	3 (3+0)	3	-	-	-
5.	Digital Image Processing	CSE 517	3 (3+0)	3	-	-	-
6.	Interconnection Networks	CSE 522	3 (2+1)	-	3	-	-
7.	Advance Network Security	CSE 523	3 (2+1)	-	3	-	-
8.	Cyber and Digital Forensics	CSE 524	3 (2+1)	-	3	-	-
9.	Data Storage Technology	CSE 525	3 (3+0)	-	3	-	-
10.	Software Testing	CSE 526	3 (3+0)	-	3	-	-
11.	Soft Computing	CSE 527	3 (2+1)	-	3	-	-
12.	Internet of Things	CSE 532	3 (2+1)	-	-	3	-
13.	Data Mining Technology	CSE 533	3 (2+1)	-	-	3	-
14.	Machine Learning	CSE 534	3 (3+0)	-	-	3	-
15.	Watermarking and Steganalysis	CSE 535	3 (2+1)	-	-	3	-
Minor & Supporting Courses • ***Masters Degree: Total 9 credits, one course in first, second and third semester each (3 credits in each semester)..***							
1.	Optimization Techniques	BS 514	3 (3+0)	3	-	-	-
2.	Higher Mathematics	BS 515	3 (3+0)	3	-	-	-
3.	Information Processing and Coding Techniques	ECE 515	3 (3+0)	3	-	-	-
4.	ANN and Fuzzy Logic	EPE 514	3 (2 +1)	3	-	-	-
5.	Methods of Numerical Analysis	BS 521	3 (3+0)	-	3	-	-
6.	Telecommunication Switching & Networks	ECE 522	3 (2+1)	-	3	-	-
7.	Advance VLSI Design	ECE 524	3 (2+1)	-	3	-	-
Others							
	Compulsory Courses; {(0+1) or (1+0)} Non Credit (NC); PGS Series	- PGS501/502 /..	1	NC	NC	-	-
	Seminar	CSE 536	1	-	-	1	-
	Comprehensive	CSE 537	NC	-	-	NC	-
	Research (Thesis). Thesis minimum duration 2 semesters	CSE 538	20				20
	Total Credits to be offered (for masters program)		57	15	12	10	20

Course Summary

MASTERS PROGRAMME

Courses	No. of Courses					Credit Hours
	Semester					
	I	**II**	**III**	**IV**	**Total**	
Core	2	1	1	-	4	12
Optional (Major)	2	2	1	-	5	15
Supporting &Minor	1	1	1	-	3	9
Seminar	-	-	1	-	1	1
Comprehensive	-	-	-	1	1	Non Credit (graded as satisfactory/ non satisfactory)
Research (Thesis)	-	-	-	1	1	20* (graded as satisfactory/ non satisfactory)
Compulsory Courses (PGS series)	1	1	-	-	2	Non Credit
Total	**6**	**5**	**4**	**2**	**17**	**57**

*Research (Thesis) credit load is not counted in calculation of final OGPA.

DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

COLLEGE OF TECHNOLOGY AND ENGINEERING, UDAIPUR-313001

POST GRADUATE PROGRAMME, 2017-18

Details of P.G. Programme Courses offered for the award Ph.D. (CSE) in Computer Science and Engineering

S. No.	Title	Course No.	Cr. Hr.	Semester			
				I	II	III	IV-VI
Core Courses • ***Ph.D. Degree: Total 6 credits (3 credits in each semester) one course in first semester and one course in second semester to be evaluated externally.***							
1.	Big Data Technology	CSE 611	3 (2+1)	3	-	-	-
2.	Advance Computer Architectures and Distributed Processing	CSE 621	3 (2+1)	-	3	-	-
Major Courses • ***Ph.D. Degree: Total 12 credits (6 credits in each semester) two courses in first and second semester each.***							
1.	Embedded Systems Design	CSE 513	3 (3+0)	3	-	-	-
2.	Distributed Database Management Systems	CSE 514	3 (2+1)	3	-	-	-
3.	Web Application and Penetration Testing	CSE 515	3 (2+1)	3	-	-	-
4.	Intelligent Systems	CSE 516	3 (3+0)	3	-	-	-
5.	Digital Image Processing	CSE 517	3 (3+0)	3	-	-	-
6.	Real Time Computing	CSE 612	3 (3+0)	3	-	-	-
7.	Grid Computing	CSE 613	3 (3+0)	3	-	-	-
8.	Advance Algorithms and Applications	CSE 614	3 (2+1)	3	-	-	-
9.	Graphics and Visualization	CSE 615	3 (3+0)	3	-	-	-
10.	Interconnection Networks	CSE 522	3 (2+1)	-	3	-	-
11.	Advance Network Security	CSE 523	3 (2+1)	-	3	-	-
12.	Cyber and Digital Forensics	CSE 524	3 (2+1)	-	3	-	-
13.	Data Storage Technology	CSE 525	3 (3+0)	-	3	-	-
14.	Software Testing	CSE 526	3 (3+0)	-	3	-	-
15.	Soft Computing	CSE 527	3 (2+1)	-	3	-	-
16.	Unix Operating System Design	CSE 622	3 (2+1)	-	3	-	-
17.	Modeling and Simulation	CSE 623	3 (3+0)	-	3	-	-
18.	Cloud Computing	CSE 624	3 (3+0)	-	3	-	-
19.	Web Engineering	CSE 625	3 (2+1)	-	3	-	-
20.	Video Communications	CSE 626	3 (2+1)	-	3		
21.	Internet of Things	CSE 532	3 (2+1)	-	-	3	-
22.	Data Mining Technology	CSE 533	3 (2+1)	-	-	3	-
23.	Machine Learning	CSE 534	3 (3+0)	-	-	3	-
24.	Watermarking and Steganalysis	CSE 535	3 (2+1)	-	-	3	-
Supporting Courses • ***Ph.D. Degree: Total 9 credits, two courses in first semester (6 credits) and one course in second semesters (3 credits).***							
1.	Optimization Techniques	BS 514	3 (3+0)	3	-	-	-
2.	Higher Mathematics	BS 515	3 (3+0)	3	-	-	-
3	ANN and Fuzzy Logic	EPE 514	3 (2 +1)	3	-	-	-
3.	Information Processing and Coding Techniques	ECE 515	3 (3+0)	3	-	-	-
4.	Numerical analysis of Differential Equations	BS 611	3 (3+0)	3	-	-	-
5.	Methods of Numerical Analysis	BS 521	3 (3+0)	-	3	-	-
6.	Telecommunication Switching & Networks	ECE 522	3 (2+1)	-	3	-	-
7.	Advance VLSI Design	ECE 524	3 (2+1)	-	3	-	-
8.	Advanced Mathematics for Computing	BS 621	3 (3+0)	-	3	-	-
Others							
	Compulsory Courses+; {(0+1) or (1+0)} Non Credit (NC); PGS Series	PGS501/ 502/...	1	NC	NC	-	-
	Seminar	CSE 691/692	1 (0+1)	1	1	-	-
	Preliminary	CSE 632	NC	-	-	NC	-

	Research (Thesis). Thesis minimum duration 4 semester	CSE 633	45	-	-		45
	Total credits to be offered		74	16	13		45

Note:

- **A Ph.D. student must take two 600 series core courses. A student may choose optional/minor & supporting courses of 500 series courses if not studied during Masters Programme as per ICAR guidelines.**
- **Exempted for those who have cleared these in Master"s Programme (permission to be sought from the Dean, CTAE).**

PH.D. PROGRAMME

Courses	**No. of Courses Semester**							**Credit Hours**
	I	**II**	**III**	**IV**	**V**	**VI**	**Total**	
Core	1	1	-	-	-	-	2	6
Major(optional)	2	2	-	-	-	-	4	12
Supporting & Minor	2	1	-	-	-	-	3	9
Seminar	1	1	-	-	-	-	2	2
Preliminary	-	-	1	-	-	-	1	Non Credit (graded as satisfactory/ non satisfactory)
Research (Thesis)*	-	-	-	-	-	1	1	45
Compulsory Courses** (PGS series)	1	1	-	-	-	-	2	Non Credit
Total	**7**	**6**	**1**			**1**	**15**	**74**
***Research (Thesis) credit load is not counted in calculation of final OGPA.** ****Exempted for those who have cleared these in Master"s Programme**								

CSE 511 DISTRIBUTED COMPUTING

	L	T	P
Credits	2	0	1
Hours	2	0	2

Distributed computing system characterization, challenges & examples, interprocess communication, external data representation, marshalling, client server communications, IPC in UNIX.

Communication between distributed objects, distributed object model, design issues of RMI, distributed garbage collection, Sun RPC and Java RMI.

Name services and Domain name system, directory & discovery services, time & global states, synchronizing physical clock, logical time and logical clocks.

Transactions, nested transactions, locks, optimistic concurrency control, time stamp ordering, distributed transactions, flat and nested distributed transactions, atomic commit protocols in distributed transactions, concurrency control in distributed transactions, distributed deadlocks, transaction recovery.

Practicals: Based on theory.

Text/References:

1. George Coulouris, Jean Dollimore and Tim Kindberg. Distributed Systems, Concepts and Design, Addission Wesley.
2. A.S. Tanenbaum and M.S. Steen. Distributed System: Principles and Paradigms, Pearson Education.

CSE 512 MOBILE COMPUTING

	L	T	P
Credits	2	0	1
Hours	2	0	2

Fundamentals of cellular communications: Cell geometry, Frequency reuses, Co-channel interference and reduction, Adjacent channel interference, Cell splitting, sectoring and micro-cell.
Multiple access technique: Narrowband systems- FDD, TDD; Wideband systems- FDMA, TDMA, Spread Spectrum and CDMA, OFDM, CSMA, CSMA/CA, Error control schemes; Mobility management: Mobility models, Mobile registration, Paging, Handoff, Location management, HLR-VLR scheme, Hierarchical scheme, Predictive location management schemes.
GSM systems: Architecture, GSM evolution for data, 3G/4G wireless systems.
Wireless LAN: IEEE 802.11 standards, Architectures and services, HIPERLAN, WiFi, and WiMAX; Mobile network and transport layers: Mobile IP, DHCP, Mobile ad hoc routing protocols, Multicast routing, TCP over wireless networks, Mobile TCP, Retransmission, Timeout and Transaction, TCP over 2.5G/3G networks.
Application layer: WAP model, Mobile location based services, WAP protocols, WML; Security in wireless systems.

Practicals: Based on theory.

Text/References:

1. William C.Y. Lee, Wireless and cellular communications, Tata Mc-Graw Hill.
2. John Schiller. Mobile Communications, Pearson Education.
3. William Stallings. Wireless Communications & Networks, Pearson Education.
4. T.S. Rappaport. Wireless Communications, Principles & Practices.

5. Ashoke K. Talukder, Mobile Computing, Tata Mc-Graw Hill..

CSE 513 EMBEDDED SYSTEMS DESIGN

	L	T	P
Credits	3	0	0
Hours	3	0	0

Design challenges, processor, technology, IC technology, design technology. Custom single purpose processor: Custom single purpose processor design, operation, programmer view, development environment, application specific instruction set processor, selecting a microprocessor.

Standard single purpose processor peripherals, timers counters, watchdog timers, UART, pulse with modulator, LCD controller, keypad controller, APC, real time clocks. Memory: memory write ability and storage performance. Common memory types, composing memories, memory hierarchy and cache, advanced RAM: DRAM, FPMDRAM, EDO DRAM, SDRAM, RDRAM, memory management unit.

Interfacing: arbitration, multi-level bus architectures, serial protocols: 12C bus, CAN bus, fire wire bus, USAB, parallel protocols: PCI and ARM bus, wireless protocols: 1rdA, Bluetooth, IEEE 802.11.

Control systems: open loop and closed loop systems, general control systems and PID controllers, fuzzy control, practical issues related to computer based control, benefits of computer based control implementations.

Text/References:

1. Frank Vohid and Tomy Givargi. Embedded System Design: A Unified Hardware/software Introduction, wiley.

2. Raj Kamal. Embedded System: Architecture, Programming and Design, Tata McGraw-Hill Publication.

CSE 514 DISTRIBUTED DATABASE MANAGEMENT SYSTEMS

	L	T	P
Credits	2	0	1
Hours	2	0	2

Concepts and design of distributed database systems, data fragmentation, replication, and allocation techniques for DDBMS, methods for designing and implementing DDBMS, designing a distributed relational database, architectures for DDBMS cluster, federated, parallel databases and client server architecture.

Advanced concepts in DDBMS: overview of distributed management, atomicity, consistency, isolation, durability, two phase locks, time stamp ordering, optimistic concurrency control, concurrency and recovery in DDBMS, distributed deadlock management, transaction recovery and replication servers, distributed query processing and optimization. Current trends and developments related to distributed database applications technologies.

Introduction to related database technologies: parallel databases, mobile database and web databases.

Practicals: Based on theory.

Text/References:

1. M. Tomer Ozsu and P. Valduriez. Principles of Distributed Database Systems, Pearson Education.

2. S. Ceri and G. Pelagapati. Distributed Database, Principles and Systems, McGraw Hill Publication.

CSE 515 WEB APPLICATION AND PENETRATION TESTING

	L	T	P
Credits	2	0	1

	L	T	P
Hours	2	0	2

Web Fundamentals – HTML, HTTP, Client-side scripting, Server-side scripting; Web server architecture - Windows & Linux, IIS and LAMP servers, Network topologies and DMZ

Web applications: Introduction to web applications, Web application hacking, Overview of browsers, extensions, and platforms

Attacks, detection evasion techniques, and countermeasures for the most popular web platforms, including IIS, Apache, PHP, and ASP.NETAttacks and countermeasures for common web authentication mechanisms, including password-based, multifactor (e.g., CAPTCHA), and online authentication services like Windows Live ID.

Advanced session analysis, hijacking, and fixation techniques, cross-site scripting, SQL injection, classic categories of malicious input, Overlong input (like buffer overflows), canonicalization attacks (like the infamous dot-dot-slash), and meta characters (including angle brackets, quotes, single quote, double dashes, percent, asterisk, underscore, newline, ampersand, pipe, and semicolon), beginner-to advanced SQL injection tools and techniques, stealth-encoding techniques and input validation output-encoding countermeasures.

Web services vulnerabilities discovery and exploited through techniques including WSDL disclosure, input injection, external entity injection, and XPath injection. Web application management attacks against remote server management, web content management/authoring, admin misconfigurations, and developer-driven mistakes. Web browser exploits

Practical: Based on theory

Text/References:

1. Hacking Exposed Web Applications, 3rd edition, Joel Scambray, Vincent Liu, Caleb Sima, TMH
2. The Web Application Hacker's Handbook Discovering and Exploiting Security Flaws By Dafydd Stuttard, Marcus Pinto, wiley India
3. Web Security, Privacy & Commerce : Simson Garfinkel, Gene Spafford, SPD O'reilly.
4. Rich Bowen, Ken Coar, Apache Cookbook, O'Reilly

CSE 516 INTELLIGENT SYSTEMS

	L	T	P
Credits	3	0	0
Hours	3	0	0

Artificial intelligence, intelligent agents, solving problems by searching, informed search methods, game playing.

Neural networks, basic neural computational models learning: supervised versus unsupervised, knowledge based neural networks, mathematical modeling.

Expert Systems: knowledge acquisition and representation, inference engines, reasoning under uncertainty, hybrid expert systems, fuzzy logic and neural networks.

Text/References:

1. Stuart Russell and Peter Norvig. Artificial Intelligence: A Modern Approach, Pearson Education Asia.
2. Li Min Fu. Neural Networks in Computer Intelligence, TMH.
3. B. Kosko. Neural Networks and Fuzzy Systems: A Dynamical systems approach to machine intelligence, PHI.

CSE 517 DIGITAL IMAGE PROCESSING

	L	T	P
Credits	3	0	0
Hours	3	0	0

Origins of digital image processing, application area, components of an image processing system. Elements of visual perception, light and the electromagnetic spectrum, image sensing and acquisition, image sampling and quantization, relationships between pixels.

Image enhancement in the spatial domain: background, gray level transformations, histogram processing, enhancement using arithmetic/logic operations, spatial filtering, smoothing spatial filters, sharpening spatial filters, combining spatial enhancement methods.

Image enhancement in the frequency: introduction to the Fourier transform and the frequency domain, smoothing frequency-domain filters, sharpening frequency domain filters, homomorphic filtering, implementation.

Image restoration: model of the image degradation/restoration process, noise models, restoration in the presence of noise only–spatial filtering, periodic noise reduction by frequency domain filtering, linear, position-invariant degradations, estimating the degradation function, inverse filtering, minimum mean square error (wiener) filtering, constrained least squares filtering. Geometric mean filter, geometric transformations.

Color image processing: color fundamentals, and models, color image processing, transformations, smoothing and sharpening, color segmentation. Wavelets and multiresolution processing: multiresolution expansions, wavelet transforms in one dimension, fast wavelet transform, wavelet transforms in two dimensions.

Image compression: image compression models, error-free compression, lossy compression, image compression standards.

Text/Reference:

1. Rafael C. Gonzalez and Richard E. Woods. Digital Image Processing, Pearson Education.

2. Gonzalez R and Wood R. E. Digital Image Processing, Prentice Hall of India.

BS 514 OPTIMIZATION TECHNIQUES

	L	T	P
Credits	3	0	0
Hours	3	0	0

Introduction: historical development, application to engineering problems, statement of optimization, classification of optimization, examples of optimization problems. Optimization: calculus based methods, lagrange multiplier.

Non-linear programming: unconstrained optimization techniques, constrained optimization, direct and indirect methods, kuhn-tucker conditions.

Linear programming: graphical method, simplex method, revised simplex method, big-M method, 2-phase method, unbounded LPs, degeneracy and convergence, duality in linear programming, sensitivity analysis, dual simplex method.

Transportation problem: north-west corner rule, row-minimum method, Vogel's approximation. Dynamic programming: multistage decision process, principles of optimality, computational procedures in dynamic programming.

Text/References:

1. S. S. Rao. Engineering optimization: Theory and practice, New Age International (P) Ltd, New Delhi.

2. H. Taha. Operation research: An introduction, Prentice Hall, India.

BS 515 HIGHER MATHEMATICS

	L	T	P
Credits	3	0	0
Hours	3	0	0

Complex variables: analytic functions, cauchy-riemann equations, harmonic functions, construction ofanalytic functions. Conformal mapping: elementary transformations, bilinear mapping. Complex integration: cauchy's integral theorem, cauchy's integral formula and derivatives of an analytic function. Taylor's and laurent's series. Classifications of singularities, residue of functions, cauchy's residue theorem; evaluation of real integrals by means of calculus of residue.

Special functions: error function, fresnel integrals, sine and cosine integrals. Bessel function, bessel's differential equation, recurrence relations, orthogonal property and generating function. Legendre polynomials, legendre differential equation, rodringue's formula, recurrence relations, orthogonal property and generating function.

Text/References:

1. G.N. Purohit and S.P. Goyal. Complex Analysis, Jaipur Publishing House, Jaipur.
2. B.S. Tyagi. Functions of Complex Variables, Kedarnath Ramnath, Meerut.
3. J.L. Bansal and H.S. Dhami. Differential Equations (Vols.-II), Jaipur Publishing House, Jaipur.
4. R.K. Jain and S.R.K. Iyengar. Advanced Engineering Mathematics, Narosa Publishing House, New Delhi.

ECE 515 INFORMATION PROCESSING AND CODING TECHNIQUES

	L	T	P
Credits	3	0	0
Hours	3	0	0

Shannon's fundamental coding theorems, differential entropy & mutual information for discrete & continuous ensembles, source coding, rate distortion theory.

Introduction to algebra: groups, fields, binary field arithmetic, basic properties of galois field GF (2m) and vector spaces.

Channel coding & decoding: run length limited codes, LBC, cyclic code, BCH code, convolutional code, trellis coded modulation, reed-solomon code.

Text/References:

1. F.M Reza. Information Theory: McGraw Hill.
2. K.Sam Shanmugam. Digital and Analog Communication Systems, John Wiley.
3. Singh & Sapre. Communication Systems: Analog and Digital, TMH.
4. B. Sklar. Digital Communication, Pearson Education Asia.

EPE 514 ANN and Fuzzy Logic

	L	T	P
Credits	2	0	1
Hours	2	0	2

Course outcome: At the end of the course, the student will able to

CO1	Ability to contrive optimum NN architecture for specific engineering problem.
CO2	Compentency in applying NN technology in control problems.
CO3	Skill in framing fuzzy rules & employing fuzzy technique in solving engineering problems.
CO4	Dexterity in contriving neuro –fuzzy based solutions

Neural Network: Introduction-biological neurons and their artificial models-learning, adaptation and neural network's learning rules types of neural networks-single layer, multiplayer-feed forward, feedback networks; back propagation learning and training-Hopfield network.

Neural Networks in Control:Neural network for non-linear systems-schemes of neuro controlsystem identification forward model and inverse model-indirect learning neural network control applications-case studies

Neural Network in Control: Structure of fuzzy logic controller-fuzzification models-data baserule base-inference engine defuzzification module. Non-linear fuzzy control-PID like FLC-Sliding mode FLC - Surgeno FLC-adaptive fuzzy control-fuzzy control applications-case studies. Analysis of Neural Networks:Analysis of Neural Network for liner and non-liner systems. Analysis of neuro -fuzzy systems. Application of neural networks

Fuzzy Logic:Fuzzy sets-fuzzy operation-fuzzy arithmetic-fuzzy relations-fuzzy relational equationsfuzzy measure-fuzzy functions-approximate reasoning-fuzzy propositions-fuzzy quantifiers-if-then rules. Adaptive Fuzzy control: Introduction, design & performance evaluation, performance monitor, main approaches to design. FKBC design parameters: Structure of FKBC fuzzification and defuzzification module, rule based choice of variable and contents of rules, derivation of rule data based, choice of membership function and scaling factors

Practicals: Based on theory

Text/References:

1. Introduction of artificial neural systems - J.M.ZURADA, Jaico publication House 1997
2. Neural networks: comprehensive foundation - S.IIAYKIN McMillian College Publishing company inc. 1994
3. Neuro control and its application - S.OMATU, M.KHALID, R.YUSOF. Spring Verlag London Ltd. 1996.
4. An introduction to fuzzy control - D.DRIANKOV, H. HELLENDOORN and M REINFRANK Narosa Publication House, 2nd reprint 1997.
5. Neural Network Design, - Hagan, Demuth Deak Thomson Learning.
6. Neuro-fuzzy and soft computing, PHI publication.
7. Fuzzy logic : Intelligence control and Information, - John Yen Pearson publication.

CSE 521 MULTIMEDIA COMPUTING

	L	T	P
Credits	2	0	1
Hours	2	0	2

Multimedia authoring and data representation: component of multimedia, multimedia software tools, multimedia authoring and tools. Graphic and Image data representations: graphic and image data types, popular file format. Colour models in images and video.

Video and audio: types of video signals, analog video, digital video, digitization of sound, musical instrument digital interface (MIDI), quantization and transmission of audio.

Multimedia data compression: lossless and lossy compression algorithms, image compression standards, video compression techniques, MPEG video coding-I (MPEG-1 and MPEG-2), MPEG video coding (MPEG-4 and MPEG-7 and beyond), audio compression techniques. MPEG audio compression.

Multimedia communication: computer and multimedia networks, multiplexing techniques, quality of multimedia data transmission, Multimedia over IP, transport of MPEG-4 video, video-on-demand, multimedia over wired and wireless network. Multimedia applications: media preparation, media composition, media integration, media communication, media entertainment.

Practicals: Based on theory.

Text/References:

1. Ralf Steinmetz and Klara Nahrstedt. Multimedia Computing, Communication and applications, Pearson Education.
2. Ze-Nian Li and Mark S. Drew. Fundamentals of Multimedia, Pearson Education.
3. Fred Halsall. Multimedia Communications, Pearson Education.

CSE 522 INTERCONNECTION NETWORKS

	L	T	P
Credits	2	0	1
Hours	2	0	2

Shared medium networks, direct networks, indirect networks, multiple backplane buses, hierarchical networks, and cluster based networks.

Message switching layer: circuit switching, packet switching, virtual cut-through switching, wormhole switching, mad postman switching, virtual channels.

Deadlock, livelock, and starvation: a theory of deadlock avoidance: network & router model, deadlock avoidance in SAF & VCT switching, deadlock avoidance in wormhole switching, channel classes, central queues, deflection routing, injection limitations, deadlock avoidance in switch based networks, deadlock prevention in circuit switching and PCS, deadlock recovery: deadlock probability, detection of potential deadlocks, progressive and regressive recovery techniques, livelock avoidance.

Routing algorithms: deterministic routing algorithms, partially adaptive routing algorithm: planar adaptive and turn model, fully adaptive algorithms: algorithms based on structured buffer pools, algorithms derived from SAF algorithms, virtual networks, deterministic and adaptive sub networks, maximally adaptive routing algorithms: algorithms with minimum buffer requirement, true fully adaptive routing algorithms, nonminimal routing algorithms, backtracking protocols, routing in switch based networks with irregular topologies, resource allocation policies: selection function, policies for arbitration & resource allocation.

Practicals: Based on theory.

Text/References:

1. Jose Duato, Sudhakar Yalamanchili and Lionel M. Ni. Interconnection Networks an Engineering Approach, Morgan Kaufmann.

CSE 523 ADVANCE NETWORK SECURITY

	L	T	P
Credits	2	0	1
Hours	2	0	2

Principle of security, types of attacks, cryptography techniques: plain text and cipher text, substitution techniques, transposition techniques, encryption & decryption, symmetric & asymmetric cryptography, steganography, key range and key size, possible types of attacks.

Computer based symmetric key cryptography algorithms: symmetric key cryptography, DES, IDEA, blowfish, advance encryption standards, computer-based asymmetric key cryptographic algorithms: RSA algorithms, digital signature, MD5, discrete logarithm algorithms.

Public key infrastructure (PKI): digital certificates, private key management, authentication password, authentication tokens, certificate based authentication, biometric authentication, kerberos, single sign on (SSO).

Internet security Protocols: secure socket layer, secure hyper text transfer protocol, time stamping protocol, secure electronic transaction, electronic money, E-Mail security, wireless application protocol (WAP) security, network security: IP security, firewalls, virtual private networks, denial of service attack, IP spoofing attacks, cross site scripting vulnerability, contract signing, secret splitting, virtual elections. Intrusion detection, models, architecture, NIDS, HIDS, network security, network security attacks, applications of cryptography in network security, encryption at different OSI-layers, code based vulnerabilities, policy deployment in network, study of emerging intrusion detection and prevention techniques.

Practicals: Based on theory.

Text/References:

1. Atul Kahate. Cryptography and Network Security, Tata McGraw-Hill Publishing Company Ltd.
2. William Stallings. Cryptography and Network Security, Pearson Asia.

Bishop and Matt. Introduction to Computer Security**,** Addison-Wesley, Pearson Education, Inc.

CSE 524 Cyber and Digital Forensics

	L	T	P
Credits	2	0	1
Hours	2	0	2

Understanding computer forensics, preparing computer for investigation, procedure for corporate high-Tech Investigations, understanding data recovery workstations and software, gathering evidence, understanding bit-stream copies, acquiring an image of evidence media, acquiring a USB drive, analyzing digital evidence, introduction to India IT Act.

Data Acquisition: storage formats for digital evidence, using best acquisition method, image acquisition, window, linux acquisition and validation tools & methods, RAID data acquisition, remote network acquisition tools; Crime processing: identifying digital evidence, evidence collection-rules and procedures, securing crime scene and seizing digital evidence, storing digital evidence, obtaining digital hash; understanding DOS & window OS with perspective of digital forensics: boot

sequence, disk partition, master boot record, FAT, NTFS, Disk encryption, window registry, startup tasks, virtual machine; understanding linux with perspective of digital forensics: inodes, boot process, GRUB, linux drive & partition schemes, linux disk structure; Disk structures: CD, SCSI, IDE & SATA

Computer forensics analysis and validation: identifying and validation data to be collected, data hiding techniques, remote acquisitions; Recovering Graphics files: bitmap, raster image, vector graphics, meta file, graphic file formats, digital camera file format, lossless and lossy compression; Locating and recovering graphics files: identifying graphics file fragments, repairing damaged headers, searching and recovering data from unallocated space, rebuilding file headers, reconstructing file fragments; identifying unknown file formats: analyzing graphics file headers, tools of viewing images, understanding steganography in graphics in graphics file, using steganalysis.

Virtual machines, network forensics and live acquisitions, network logs, linux network tools, packet sniffers, honeynet, E-mail investigations: examining and tracing e-mail messages, headers, files and logs, understanding e-mail servers, e-mail forensics tools; cell phone and mobile device forensics: basics of mobile phone, mobile devices and PDAs, mobile data acquisition procedures, tools and equipments, report writing for digital forensics investigations.

Practical: Based on theory

Text/References:

3. Bill Nelson, Amelia Phillips and Christopher Steuart, "Computer Forensics and Investigations", Third edition, Cengage Learning, New Delhi, 2009.
4. Kevin Mandia, Chris Prosise, Matt Pepe, "Incident Response and Computer Forensics ", Tata McGraw – Hill, New Delhi, 2006.
5. Robert M Slade," Software Forensics", Tata McGraw - Hill, New Delhi, 2005..

CSE 525 DATA STORAGE TECHNOLOGY

	L	T	P
Credits	3	0	0
Hours	3	0	0

Storage devices & I/O subsystems: traditional backup devices, disk arrays, disk physical structure-components, properties, performance, and specifications. Tape drives, JBODs, RAIDs, hot spares, storage I/O & storage system connectivity protocols.

Introduction to networked storage: discussion of direct attached storage (DAS), storage area networks (SAN), network attached storage (NAS) and content addressable storage (CAS). Basic architecture, connectivity and management principles.

Information availability: business continuity and disaster recovery basics, local business continuity techniques, Remote business continuity techniques, disaster recovery principles & techniques.

Storage area networks (SAN): SAN components & building blocks, SAN software, data access over SAN. Fiber channel basics, protocols & connectivity. SAN topologies, elements of SAN design, scalability, availability, performance, security, capacity, and manageability issues. Studies and critiques of existing SAN design scenarios (partial mesh, full mesh, core/edge, & tiered designs).

Text/References:

1. Marc Farley Osborne. Building Storage Networks, Tata McGraw Hill.
2. Robert Spalding. Storage Networks: The Complete Reference, Tata McGraw Hill.
3. Gupta Meena. Storage Area Network Fundamentals, Pearson Ed.

CSE 526 SOFTWARE TESTING

	L	T	P
Credits	3	0	0
Hours	3	0	0

Testing concepts, issues and planning: purpose, activities, processes and context questions about testing, functional vs structural testing: coverage based vs usage based testing, test planning and preparation: goals, strategies, and techniques, testing models and test cases. Test suite preparation and management, preparation of test procedure, test execution, result checking, and measurement.

Coverage based and boundary testing techniques: checklist-based testing and its limitations, testing for partition coverage, partition: concepts and definitions, testing decisions and predicates for partition coverage, usage-based statistical testing, a case study, input domain partitioning and testing, input domain testing for partition and boundary problems, simple domain analysis and the extreme point combination strategy.

Control flow, data dependency, and integration testing: basic control flow testing, model construction path selection & sensitization, loop testing, CFT Usage, different types of loops and corresponding CFGs, loop testing: difficulties and a heuristic strategy, CFT usage and other issues, data dependency and data flow testing: basic concepts: operations on data and data dependencies, DFT and DDG elements and characteristics .

Testing techniques: adaptation, specialization and integration: testing sub-phases and applicable testing techniques, specialized test tasks and techniques. basic concepts and generic approaches, root cause analysis for defect prevention other techniques for defect prevention, analysis and modeling for defect prevention, software tools to block defect injection.

Software inspection and formal verification: basic concepts and generic process, fagan inspection, other inspections and related activities, code reading, other formal reviews and static analyses, defect detection techniques, tool / process support, and effectiveness.

Text/References:

1. Jeff Tian. Software Quality Engineering Testing, Quality Assurance, and Quantifiable Improvement, John Wiley and Sons Inc., and IEEE Computer Society Press.
2. Edwar Dkit. Software testing in the Real World, Pearson Education.
3. William E Perry. Effective Methods for Software Testing, John Wiley and Sons.
4. Stephan H. Kan. Metrics and Models in Software Quality Engineering, Pearson Education.

CSE 527 SOFT COMPUTING

	L	T	P
Credits	2	0	1
Hours	2	0	2

Essentials of artificial neural networks & applications, characteristics of ANNs Biological Prototype, Perceptron, Multilayer NN. Learning methods, back propagation, counter propagation, ART, BAM, associative memories.

Fuzzy logic, fuzzy sets, fuzzy model, fuzzy rule generation, fuzzy inference system, defuzzification. Neuro fuzzy systems, architecture and application of a neuro fuzzy system and its applications.

Genetic algorithm: problem solving using GA, applications of GA & GP, hybrid systems

Practicals: Based on theory.

Text /References:

1. Jang. Neuro Fuzzy and Soft Computing, Pearson Education.
2. Kecman. Learning and Soft Computing, Pearson Education.
3. Klir and Yuan. Fuzzy Sets and Fuzzy Logic, PHI.
4. Fu. Neural Network in computer Intelligence, TMH.
5. Bart Kosko. Neural Networks and Fuzzy Systems, PHI.
6. Melaine Mitchell. An Introduction to Genetic Algorithm, PHI Course.

BS 521 METHODS OF NUMERICAL ANALYSIS

	L	T	P
Credits	3	0	0
Hours	3	0	0

Solution of system of linear equations: gaussian elimination method, gauss-jordan method, gauss-seidel method, matrix inversion method. Matrix eigenvalue problem: power method and inverse power method.

Numerical solution ordinary differential equations: taylor's series method, picard's method, euler's and euler's modified method, runge-kutta methods.

Solution of algebraic and transcendental equations: bisection method, false position method, newton raphson method.

Interpolation: forward, backward and central difference operators, shifting and averaging operator, relation between difference operators. Forward and backward interpolation formulae, lagrange's interpolation formula for unequal intervals.

Solution of difference equations: linear difference equations, different forms of particular solutions.

Text /References:

1. Babu Ram. Numerical Methods, Pearson Education India.
2. Santosh K. Gupta. Numerical Methods for Engineers, New Age International Publishes, New Delhi.
3. Dileep S. Chouha, Paresh Vyas and Vimlesh Soni. Studies in Numerical Analysis, Jaipur Publishing House, Jaipur.
4. M.K. Jain, S.R.K. Iyengar and R.K. Jain. Numerical Methods for Scientific and Engineering computation, New Age International (P) Ltd, New Delhi.

ECE 522 TELECOMMUNICATION SWITCHING & NETWORKS

	L	T	P
Credits	2	0	1
Hours	2	0	2

Principles of circuit switching & signaling schemes, space time & space time division switching, single stage & multi stage switching network. Traffic engineering and teletraffic theory. Markov processes representing traffic, calculation of blocking probability.

Modeling and analysis of important media access control protocols: ALOHA, slotted ALOHA, CSMA, CSMA/CD.

LAN: ethernet, token ring, FDDI.B-ISDN architecture, B-ISDN protocols, ATM traffic & congestion control, signaling, routing and addressing, internetworking: switches, bridges, routers,gateways. ATM switching.

Practicals: Based on theory.

Text /References:

1. Vishwanathan. Telecom Switching, PHI
2. Flood F.E. Telecommunication Networks, Pearson Publications.

ECE 524 ADVANCE VLSI DESIGN

	L	T	P
Credits	2	0	1
Hours	2	0	2

Introduction to VLSI design – motiviation for IC design, IC design process, design abstraction levels, CAD tools, elements of system specification and design.

Combinational logic design, logic minimization, synchronous sequential logic design. Finite state machines, Mealy and Moore models, designing with programmable logic devices ROM, PLA, PAL, PLD.

A synchronous sequential logic- analysis procedure, state minimization, state assignment, static and dynamic hazards.

Introduction to VHDL – basic concepts in VHDL, language features, types of VHDL description – structural, data flow and behavioral descriptions of hardware, combinational and sequential design examples using VHDL. Features and internal structure of CPLDs, FPGAs, designing with CPLDs and FPGAs.

Introduction to IC floor planning and testing, design for testability, combinational logic testing, sequential logic testing, ATPG, boundary scan, built in self test. Design examples and case studies.

Practicals: Based on theory.

Text /References:

1. Zainalabedin Navabi. VHDL: Analysis and Modeling of digital Systems, Mc Graw Hill.
2. Bhaskar. VHDL Prniter, PHI.
3. Donald D. Givone. Digital Principles and Design, Tata McGraw Hill.
4. M.M. Mano. Digital Design, Pearson Education.
5. John.F.Wekerly. Digital Design: Principles and Practice, Pearson Education.
6. Wayne Wolf. Modern VLSI design, Pearson Education.
7. Daniel D. Gajski, Frank Vahid, Sanjiv Narayan and Jie Gong. Specification and Design of Embedded Systems, Prentice Hall.

CSE 531 ADVANCE OPERATING SYSTEMS

	L	T	P
Credits	2	0	1
Hours	2	0	2

Operating system introduction and structure, processes, threads, interprocess communication. cpu scheduling**:** Scheduling algorithm, multiprocess and realtime process scheduling, algorithm evaluation. Process synchronizations: semaphores, critical regions and monitors.

Distributed OS: architecture of distributed Systems, issues in DOS, client-server computing, message-passing, remote procedure call (RPC), limitations of DS, absence of shared memory and global clock, lamport's Logical clocks, vector clocks, causal ordering of messages.

Distributed mutual exclusion and deadlock: mutual exclusion algorithms, token-based and non-token-based algorithms, deadlock models and algorithms, deadlock detection and prevention.

Distributed file systems and shared memory: architecture of distributed file systems, design issues, replication algorithms, cache coherence.

Distributed scheduling: motivation and issues, load distribution, balancing and sharing algorithms, load distribution algorithms, load scheduler, task migration.

Failure recovery and fault tolerance: introduction and basic concepts, classification of failures, backward and forward recovery, check pointing and recovery, issues in fault tolerance, commit and voting protocols.

Real-time OS: characteristics of real time OS, hard versus soft real-time systems, real-time communications, real-time scheduling, case study: windows CE, palm OS.

Practicals: Based on theory.

Text/References:

1. M. Singhal & N.G. Shivaratri. Advanced Concepts in Operating Systems, TMH.

2. A. S. Tanenbaum. Modern Operating System, PHI.
3. W. Stallings. Operating Systems, PHI.

CSE 532 INTERNET OF THINGS

	L	T	P
Credits	2	0	1
Hours	2	0	2

Introduction to Internet of Things –Definition and Characteristics of IoT, Physical Design of IoT – IoT Protocols, IoT communication models, Iot Communication APIs IoT enabaled Technologies – Wireless Sensor Networks, Cloud Computing, Big data analytics, Communication protocols, Embedded Systems, IoT Levels and Templates Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle

IoT and M2M – Software defined networks, network function virtualization, difference between SDN and NFV for IoT Basics of IoT System Management with NETCOZF, YANG- NETCONF, YANG, SNMP NETOPEER

Introduction to Python - Language features of Python, Data types, data structures, Control of flow, functions, modules, packaging, file handling, data/time operations, classes, Exception handling Python packages - JSON, XML, HTTPLib, URLLib, SMTPLib

IoT Physical Devices and Endpoints - Introduction to Raspberry PI-Interfaces (serial, SPI, I2C) Programming – Python program with Raspberry PI with focus of interfacing external gadgets, controlling output, reading input from pins.

IoT Physical Servers and Cloud Offerings – Introduction to Cloud Storage models and communication APIs Webserver – Web server for IoT, Cloud for IoT, Python web application framework Designing a RESTful web API

Text/References:

1. Internet of Things - A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015, ISBN: 9788173719547.

2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014, ISBN: 9789350239759.

CSE 533 DATA MINING TECHNOLOGY

	L	T	P
Credits	2	0	1
Hours	2	0	2

Data warehousing, OLAP and data mining, classification of data mining techniques, discovery and analysis of patterns, trends and deviations. data ware housing schema: star schema, snowflake schema, and fact constellation schema, data warehouse architecture, data marts, OLAP operations in the multidimensional data model, types of OLAP servers.

Data preprocessing: data cleaning, data integration and transformation, data Reduction. Data mining architecture, knowledge discovery in databases.

Data mining models: classification and prediction, parametric and non-parametric approaches. Classification based on association rules and decision tree models. Advanced classification based on neural networks, genetic algorithms, and fuzzy systems.

Cluster analysis: hierarchical models, model based clustering methods, outlier analysis.

Practicals: Based on theory.

Text/References:

1. Inmon W.H. Building the Data Warehouse, John Wiley & Sons Inc.

2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, San Francisco: Morgan Kaufmann Publishers, An Imprint of Elsevier.

CSE 534 MACHINE LEARNING

	L	T	P
Credits	3	0	0
Hours	3	0	0

The concept learning task, general-to-specific ordering of hypotheses, version spaces, inductive bias, decision tree learning. Rule Learning: propositional and first-order, over-fitting, cross-validation.

Experimental evaluation of learning algorithms instance-based learning: k-nearest neighbor algorithm, radial basis functions. case-based learning, computational learning theory: probably approximately correct (PAC) learning. sample complexity, computational complexity of training. Vapnik-chervonenkis dimension.

Minimum description length principle, bayesian networks, inference in bayesian networks.
Bayes net structure learning unlabelled data: em, preventing overfitting, cotraining gaussian mixture models, k-means and hierarchical clustering, clustering and unsupervised learning, hidden markov models, reinforcement learning. support vector machines ensemble learning: boosting, bagging.

Text/References:

1. Tom. M. Mitcheli. Machine Learning, McGraw-Hill Publishing Company Ltd.
2. Ethem ALPAYDIN**.** Introduction to Machine Learning**,** The MIT Press.

CSE 535 DIGITAL WATERMARKING AND STEGANALYSIS

	L	T	P
Credits	2	0	1
Hours	2	0	2

Digital watermarking, digital steganography, differences between watermarking and steganography**.** watermarking applications, techniques, models, detection techniques, visible and invisible watermarks. Robust watermarking and watermark security attacks.

Spatial-domain watermarking, substitution watermarking in the spatial domain, additive watermarking in the spatial domain, frequency-domain watermarking, substitution watermarking in the frequency domain, multiplicative watermarking in the frequency domain, watermarking based on vector quantization, the rounding error problem, the fragile watermark, the block-based fragile watermark, weaknesses of the block-based fragile watermark, the hierarchical block-based fragile watermark, the robust watermark, the redundant embedding approach, the spread spectrum approach.

Types of steganography, technical steganography, linguistic steganography, digital steganography, applications of steganography, cover communication, one-time pad communication, embedding security and imperceptibility. Steganography techniques: least bit, DCT, spread spectrum. Audio seganography.

Practicals: Based on theory.

Text/References:

1. Ingemar Cox, Matthew Miller, Jeffrey Bloom, and Jessica Fridrich. Digital Watermarking and Steganography, (The Morgan Kaufmann Series in Multimedia Information and Systems).
2. Frank Y. Shih. Digital Watermarking and Steganography: Fundamentals and Techniques, CRC Press.

CSE 611 BIG DATA TECHNOLOGY

L	T	P

Credits	2	0	1
Hours	2	0	2

INTRODUCTION TO BIG DATA : Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

INTRODUCTION HADOOP: Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

HADOOP ARCHITECTURE: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

HADOOP ECOSYSTEM AND YARN: Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New Features- NameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

HIVE AND HIVEQL, HBASE: Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase concepts- Advanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

Practicals: Based on theory.

Text/References:

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
2. Chris Eaton, Dirk deroos et al. , "Understanding Big data ", McGraw Hill, 2012.
3. Tom White, "HADOOP: The definitive Guide" , O Reilly 2012.

CSE 612 REAL TIME COMPUTING

	L	T	P
Credits	3	0	0
Hours	3	0	0

Structure of a real-time system, characterization of real-time systems and tasks, performance measures. task assignment and scheduling: uniprocessor scheduling algorithms, task assignment, mode changes, fault tolerant scheduling.

Real-time communication: network topologies and architecture issues, protocols, contention-based, token-based, polled bus, fault tolerant routing.

Real-time databases: transaction priorities and aborts, concurrency control issues, scheduling algorithms, two-phase approach to improve predictability.

Programming languages and tools: hierarchical decomposition, run-time error handling, overloading, timing specification, recent trends and developments.

Text/References:

1. C.M. Krishna and K.G. Shin. Real-Time Systems, McGraw Hill.
2. Jane W.S.Liu. Real Time Systems, Pearson Edition.

CSE 613 GRID COMPUTING

	L	T	P
Credits	3	0	0
Hours	3	0	0

Grid computing and its benefits, virtual organizations, grid architecture and its relationship to other distributed technologies, grid application areas, OGSA, OGSI, semantic grids.

Building blocks for grid systems: XML, SOAP, UDDI, service oriented architecture, web services, web services architecture, WSRF, relationship between grid and web services, grid and web services invocation.

Data Management: data management in GT4, data movement: Grid FTP, RFT, data replication: RLS, Higher level data services.

Resource management and scheduling: resource management concepts, generalized resource management framework, grid resource management systems, scheduling in grids, qos, introduction to gram.

Security: security issues in grids, authentication issues, trust and privacy related issues, authorization issues, grid security frameworks, standards, web services security specifications.
Monitoring and discovery services**:** index services, resource discovery, UDDI, introduction to MDS in GT4.

Text/References:

1. Joshy Joseph and Craig Fellenstein. Grid Computing, Pearson Education.
2. Bart Jacob, Michael Brown, Kentaro Fukul and Nihar Trivedi. Introduction to Grid Computing, IBM Red Books.
3. Ian Foster and Carl Kesselman. The grid 2: Blueprint for a New Computing Infrastructure, Morgan Kaufman.

CSE 614 ADVANCED ALGORITHMS AND APPLICATIONS

	L	T	P
Credits	2	0	1
Hours	2	0	2

Dynamic programming: rod cutting, matrix chain multiplication, optimal binary search trees. Greedy algorithm: activity selection problem, elements of greedy strategy, huffman codes.

Linear programming, polynomials and the fft: representation of polynomials, DFT and FFT. String matching: native string matching algorithm, string matching with finite automata.

Number theoretic algorithms: number theoretic notions, greatest common divisor, modular arithmetic, chinese remainder theorem, modular linear equation, RSA public key cryptosystem.

Computational geometry: line segment properties, finding the convex hull, finding the closest pair of points. NP-completeness: polynomial time, polynomial time verification, np completeness and reducibility. Approximation algorithm: the vertex cover problem, travelling salesman problem, set covering problem, subset sum problem.

Practicals: Based on theory.

Text/References:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein**.** Introduction to Algorithms, PHI.
2. Alfred V Aho and John E Hopcroft. Design & Analysis of Computer Algorithms, Pearson Education India.
3. Dexter Kozen. The Design and Analysis of Algorithms, By Springer.

CSE 615 GRAPHICS & VISUALIZATION

	L	T	P
Credits	3	0	0
Hours	3	0	0

Concept of 3-D, representation of 3-D object, 3-D transformation, translation, rotation, reflection, scaling. Parallel perspective, isometric projections. 3-D clipping sutherland and cohen algorithm. Hidden lines and surface removal techniques.

Picture analysis, modeling: 2D, 3D geometric modeling and transformations, projections, clipping, curves and fractals. Illumination models and rendering: light, ambient light, diffuse reflection, specular reflection, shading algorithms, color models, ray tracing, texture mapping.

Scientific visualization: methods of scientific exploration, data aspects and transformations, time-tested principles for good visual plots, tone mapping, matters of perception, visualizing multidimensional data, scalar data visualization, vector data visualization. Graphics user interfaces, image manipulation and storage, advanced modeling techniques.

Text/References:

1. Peter Shirley, Ashikhmin Gleicher et. al., Fundamentals of Computer Graphics, A. K.Peters Ltd.
2. Hearn and Baker. Computer Graphics, PHI.
3. Van Dan Feiner, Hughes and Foley. Computer Graphics: Principles and Practice, PHI.

BS 611 NUMERICAL ANALYSIS OF DIFFERENTIAL EQUATIONS

	L	T	P
Credits	3	0	0
Hours	3	0	0

Numerical solution of ordinary differential equations: single step methods: taylor's series method, picard's method, euler's and euler's modified method, runge-kutta methods. Multi-step methods: milne's method, adams-moulton method, adams-bashforth method. System of simultaneous and higher order differential equations. Convergence and stability analysis.

Partial differential equations: classification of linear second order equations, finite difference methods for the solution of two-point boundary-value problems and eigenvalue problems. Elliptic, parabolic and hyperbolic partial differential equations.

Text/References:

1. Babu Ram. Numerical Methods, Pearson Education India.
2. Santosh K. Gupta. Numerical Methods for Engineers, New Age International Publishes, New Delhi.
3. Dileep S. Chouha, Paresh Vyas and Vimlesh Soni. Studies in Numerical Analysis, Jaipur Publishing House, Jaipur.
4. M.K. Jain, S.R.K. Iyengar and R.K. Jain. Numerical Methods for Scientific and Engineering computation, New Age International (P) Ltd, New Delhi.

CSE621 ADVANCE COMPUTER ARCHITECTURES AND DISTRIBUTED PROCESSING

	L	T	P
Credits	2	0	1
Hours	2	0	2

Architectural classification schemes for parallel computers, instruction and data multiplicity, serial verses parallel computers, parallelism verses pipelining, memory hierarchy.

General pipelines and reservation tables, interleaved memory organization, instruction pre-fetch and branch–handling, data buffering and business structures, internal forwarding and register tagging, hazard detection and resolution, job sequencing and collision prevention, dynamic pipelines and re configurability.

SIMD computer organization, masking and data routing mechanism inter PE communication, introduction to associative array processing. Multiprocessor architecture: loosely coupled & tightly coupled multiprocessor, processor characteristics for

multiprocessing, interconnection networks, cache coherence protocols, scalable multiprocessors, clusters and network of workstations.

Distributed objects and remote method invocation, communication between distributed objects, distributed object model, design issues of RMI, remote procedure call, SUN RPC and JAVA RMI.

Practicals: Based on theory.

Text/References:

1. Hwang and Briggs. Computer Architecture and Parallel Processing, Mcgraw-Hill.
2. Kai Hwang. Advanced Computer Architecture, McGraw-Hill.
3. Rajaraman. Parallel Computers Architecture and Programming.
4. D. E. Culler and J. P. Singh. Parallel Computer Architecture.
5. George Coulouris, Jean Dolimore and Tim Kindberg. Distributed Systems Concepts and Design, Addission Wesley.

CSE 622 UNIX OPERATING SYSTEM DESIGN

	L	T	P
Credits	2	0	1
Hours	2	0	2

Operating system services, architecture of the UNIX operating system, system concept, kernel data structure, system administration.

Buffer header, structure of the buffer pool, scenarios for retrieval of a buffer, reading & writing disk blocks, advantages & disadvantages of the buffer cache, Internal representation of files : inodes, structure of a regular file, directories, conversion of a path name to an inode, super block, inode assignment to a new file, allocation of a disk blocks, other file types.

Process creation, signals, process termination, awaiting process termination invoking other programs, the user ID of a process, changing the size of a process.

Process scheduling & time: process scheduling, system calls for time clock, memory management: swapping, demand paging, a hybrid system with swapping and demand paging.

Practicals: Based on theory.

Text/References:

1. Maurice J. bach. The Design of the Unix Operating System, Pearson Education.
2. Jerry Peek, Grace Todino and John Strang. Learning the Unix Operating System, A Concise Guide for the New User, O'Reilly Media.

CSE623 MODELLING AND SIMULATION

	L	T	P
Credits	3	0	0
Hours	3	0	0

Importance of simulation and modelling, discrete-event simulation, time advance mechanisms, components and organization of discrete-event simulation, continuous simulation, random number generation methods.

Queuing models: single server queuing system, arrival and departure time and routine, event graphs of queuing model, determining the events and variables.

Distribution functions: stochastic activities, discrete probability functions, cumulative distribution function, continuous probability functions. Generation of random numbers following binomial distribution, poisson distribution, continuous distribution, normal distribution, exponential distribution, uniform distribution.

Programming: branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.

Text/References:

1. Averill M.Law and W. david Kelton. Simulation Modeling and Analysis, Tata McGraw-Hill Publication.
2. Geoffery Gordon. System Simulation, Prentice-Hall of India.
3. D.S.Hira. System Simulation, S.Chand Publications.

CSE 624 CLOUD COMPUTING

	L	T	P
Credits	3	0	0
Hours	3	0	0

History of cloud computing, cloud architecture and storage, advantages and disadvantages of cloud computing.

Developing cloud services: web-based application, pros and cons of cloud service development, types of cloud service development, software as a service, platform as a service, web services, on-demand computing, discovering cloud services development services and tools.

Centralizing email communications, collaborating on schedules, collaborating on to-do lists, collaborating contact lists, cloud computing for the community, collaborating on group projects and events, cloud computing for the corporation.

Using cloud services: collaborating on calendars, schedules and task management, exploring online scheduling applications, exploring online planning and task management, collaborating on event management, collaborating on contact management, collaborating on project management, collaborating on word processing, collaborating on databases, storing and sharing files.

Text/References:

1. Michael Miller. Cloud Computing: Web-Based Applications that change the way you work and collaborate online, Pearson Education, India.
2. Anthony T.Velte, Toby J.Velte and Robert Elsenpeter. Cloud Computing–A Practical Approach, Tata McGraw Hill Education Pvt. Ltd.
3. Haley Beard. Cloud Computing Best Practices for managing and measuring processes for on demand computing, applications and data center in the cloud with slas, Emereo Pty1.

CSE 625 WEB ENGINEERING

	L	T	P
Credits	2	0	1
Hours	2	0	2

Web applications versus conventional software, web hypermedia, web software, or web application, web development vs. software development, the need for an engineering approach, empirical assessment.

Web effort estimation: effort estimation techniques, expert opinion, algorithmic techniques, artificial intelligence techniques, measuring effort prediction power and accuracy, measuring predictive power, measuring predictive accuracy, data validation, variables and model selection, extraction of effort equation, model validation.

Web quality: different perspectives of quality, standard and quality, quality versus quality in use, quality and user standpoints, evaluating web quality using webqem, quality requirements, measurement and evaluation.

Web application testing: challenges and perspectives, testing the functional and non-functional requirements model, unit integration and system testing of a web application. Strategies: white box strategies, bloc box strategies, grey box testing strategies, user session based testing, tools for web application testing, a practical example of web application testing.

Practicals: Based on theory.

Text/References

1. Roger S.Pressman. Web Engineering, Tata Mcgraw Hill Publication.
2. Achyut S Godbole and Atul Kahate. Web Technologies, Tata McGraw Hill.
3. Gopalan N P and Akilandeswari. Web Technology: A Developers Perspective, PHI.
4. Neil Gray. Web server Programming, Wiley.
5. Chris Bates. Web Programming: Building Internet applications, Wiley.

CSE 626 VIDEO COMMUNICATIONS

	L	T	P
Credits	2	0	1
Hours	2	0	2

Video formation, perception, and representation video hierarchy, video encoding, DCT-based video encoding, inter-frame coding: motion estimation and compensation, scalable video encoding, temporal scalability, spatial scalability.
Internet protocol QoS: QoS fundamentals, IPv4 ToS octet, integrated service (IntServ), differentiate services (DiffServ), traffic management capabilities, and quality assessment.

Digital video compression: MPEG Frames, Group of Pictures (GOP), MPEG Video Coding Standards. Statistics of Video Traces: Compressed Video Quality Evaluation.

Video transmission over wired network, differentiated service model and wireless network. RTP (realtime transport protocol), video servers, video adaptation and transcoding. quality evaluation over wired and wireless network. Scheduling and queuing management system.

Marker scheme: legacy packet markers, marking schemes based on token bucket, single rate three color marker (srTCM) scheme, two rate three color marker (trTCM) scheme.
Compare QoS parameters of video using marker scheme. Other improved marker scheme for video communications.

Text/References:

1. K.R. Rao, Z.S. Bojkovic, and D.A. Milovanovic. Multimedia Communication Systems: Techniques, Standards and Networks, Prentice Hall.

BS 621 ADVANCED MATHEMATICS FOR COMPUTING

	L	T	P
Credits	3	0	0
Hours	3	0	0

Matrix computations: solutions of non-homogenous system of linear equations: direct methods: matrix inversion method, gaussian elimination method, gauss-jordan method, LU decomposition method. Iterative methods: jacobi method, gauss-seidel method, the relaxation method. matrix eigenvalue problem: power method, jacobi method, given's method.

Curve fitting and approximation theory: least square principle for linear and non-linear data. Least square approximation using orthogonal polynomial. Chebyshev approximation, chebyshev polynomial, chebyshev expansions.

Fast Fourier Transform: Discrete Fourier transform, Fast Fourier transform.

Text/References:

1. A.K. Gupta and S.K. Sarkar. Mathematics for Computing, Wheeler Publishing, New Delhi.
2. Babu Ram. Numerical Methods, Pearson Education India.
3. Santosh K. Gupta. Numerical Methods for Engineers, New Age International Publishes, New Delhi.
4. Dileep S. Chouha, Paresh Vyas and Vimlesh Soni. Studies in Numerical Analysis, Jaipur Publishing House, Jaipur.