ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

M.Sc. COMPUTER SCIENCE

3rd Semester

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M.Sc. Computer Science 3rd Semester

Semester III / M.Sc. Computer Science: Course Structure

Sl. No.	Sub-Code	Subject	Hours per Week			Credits
			L	T	P	C
Theory						
1	MCS182301	Computer Graphics & Multimedia	3	1	0	4
2	MCS182302	Design and Analysis of Algorithm	3	1	0	4
3	MCS182303	Web Programming Technologies	3	1	0	4
4	MCS18230E1*	Elective – I	3	1	0	4
5	MCS182315	Seminar and Viva	0	0	0	2
Total			12	4	0	**18**
Total Contact Hours per week : 16						
Total Credit: 18						

Elective-I Subjects		
Sl. No.	**Subject Code**	**Subject**
1	MCS18230E11	Digital Signal Processing
2	MCS18230E12	Ethical Hacking
3	MCS18230E13	Operations Research & Queueing Theory
4	MCS18230E14	Embedded Systems
5	MCS18230E15	Network Security
6	MCS18230E1*	Any other subject offered from time to time with the approval of the university

Detailed Syllabus

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182301	**Computer Graphics & Multimedia**	**3-1-0**	**4**

Module 1: Basics of Computer Graphics

Introduction, Definition of Computer Graphics, Types of Computer Graphics, Area of Computer Graphics, Classification of Applications, Programming Language, Graphics and Operating Software, Graphic System Configuration.

Module 2: Graphics Systems

Introduction, Cathode Ray Tube (CRT) Basics, Refresh Display, Direct View Storage Tube (DVST), Raster Display, Input and Output Devices, Computer Graphics Software, Graphical User Interface.

Module 3: Output Primitives

Introduction, Representing Image, Straight Line, Line Drawing Algorithms, Differential Digital Analyser (DDA) Algorithm, Bresenham's Line Algorithm, Circle-Generating Algorithm, Midpoint Circle Algorithm, Ellipse-Generating Algorithm, Midpoint Ellipse Algorithm, Polygon Filling Algorithm, Character /Text Generation, Aliasing and Ant-aliasing.

Module 4: Two – Dimensional Transformations

Introduction, Representation of Points, Matrix Algebra and Transformation, Transformation of Points and Line, Translation and Homogenous Coordinates, Rotation about an origin and an arbitrary Point, Scaling, Shearing, Reflection about an arbitrary Line.

Module 5: Windowing and Clipping

Introduction, Viewing Transformation, Clipping, Point and Line Clipping, Cohen – Sutherland Line Clipping Algorithm, Parametric Liang – Braksy2D Line Clipping Algorithm, Polygon Clipping, Sutherland – Hodgman Algorithm, Curve and Text Clipping.

Module 6: Three Dimensional Graphics

Introduction, Need for 3-Dimensional Imaging, Techniques for 3-Dimesional displaying, Parallel Projections, Perspective projection, Intensity cues, Stereoscope effect, Kinetic depth effect, Shading.

Module 7: Solid Area Scan Conversion and Three Dimensional Transformations

Solid Area Scan Conversion, Scan Conversion of Polygons, Algorithm Singularity, 3D transformation, Translations, Scaling, Rotation, Viewing Transformation, The Perspective Transformation, Three Dimensional Clipping, Perspective view of Cube.

Module 8: Curve and Surfaces

Introduction, Shape description requirements, Parametric Functions, Bezier Methods, Bezier Curves, Bezier Surfaces, B-Spline Methods.

Module 9: Solid Area Scan Conversion and Three Dimensional Transformations

Solid Area Scan Conversion, Scan Conversion of Polygons, Algorithm Singularity, 3D transformation, Translations, Scaling, Rotation, Viewing Transformation, The Perspective Transformation, Three Dimensional Clipping, Perspective view of Cube.

Module 10: Hidden Surface Removal

Introduction, Need for Hidden Surface Removal, The Depth - Buffer Algorithm, Properties that help in reducing efforts, Scan Line Coherence Algorithm, Span - Coherence algorithm, Area-Coherence Algorithms, Warnock's Algorithm, Priority Algorithms.

Module 11: Colour and Illumination Models

Introduction, Colours, Illumination Model and Light Sources, Shadow, Reflectivity and Refractivity, Surface Texturing, Polygon Shading Methods, Fractals.

Module 12: Animation and Multimedia

Introduction Animation, Types of Animation, Computer Animation Software, Introduction to Multimedia, Concept of Hypertext and Hypermedia, Multimedia Applications, Basics of Animation, Music and Sounds, Audio Basic Concepts, Digital And Analog Basic Concepts, MIDI Hardware, MIDI messages, MIDI Files, Video Basic Concepts, Analog and Digital Video, Imaging and Graphics, Image Formats, Graphic Formats, File Format, Image Quality and Graphic Systems, Compression, Image Compression, Sound Compression, Video Compression.

Recommended Books:

Text Books:

1. Computer Graphics: Hearn ID and Baker. P.M., PHI
2. Principles of Interactive Computer Graphics: Newman W. Sproule, R.F. Mcgraw Hill
3. Multimedia Systems: John F. Koegel Buford

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182302	Design and Analysis of Algorithm	3-1-0	4

Module 1: Introduction:
Introduction to algorithms, analysis, asymptotic notation, mathematical induction.

Module 2: Recurrences:
The substitution, recursion-tree and the master theorem.

Module 3: Randomized algorithms:
Indicator random variables, probabilistic analysis and uses of random variables.

Module 4: Data structures:
Priority queues, binary heaps, binomial and Fibonacci heaps, binary search trees, Cost Amortization

Module 5: Design and Analysis Techniques:
Divide and Conquer, merge sort, finding closest pair of points.

Module 6: Greedy Algorithms:
Coin charging, Kruskal's, Prim and Dijkstra's algorithm, Knapsack problem

Module 7: Dynamic Programming:
Coin charging problem, matrix multiplication, longest common subsequence, Floyd and Warshall algorithm.

Module 8: Graph Algorithms:
Topological sort, minimum spanning trees, shortest paths, maximum-flow – Flow networks, Ford-Fulkerson method, Maximum bipartite matching.

Module 9: Problem classes:
P, NP, NP-Complete, Easy vs Hard, Polynomial time, non-deterministic algorithms, reducibility.

Module 10: Approximation Algorithms:
Traveling salesman problem, Parallel and Distributed algorithms.

Recommended Books:

1. Introduction to algorithms ----------Cormen
2. Algorithms ---------- Johnsonbaugh & Schaefer
3. Fundamentals of Computer algorithms ----Horowitz's Sahni
4. Data structure and algorithm analysis in C & C++ ----Mark Allen

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182303	**Web Programming Technologies**	**3-1-0**	**4**

Module 1:

Concept of WWW and internet, e-mail, Hypermedia, Web Browsers: Browser architecture, IP Address, DNS, search engines.

Module 2:

Web page designing using HTML, Use of Cascading Style Sheet, JavaScript, VB Script, jQuery, SGML - structures, elements, DHTML with DTD concept, Content models, Extensible Markup Language (XML), XSL, Activex, Plugins.

Module 3:

Web server: Architecture and functionality, configuration of Apache and IIS, Client-Server Architecture, middleware, Thin Client, Fat Clients ,Fat Servers, Client pull, server push.

Module 4:

TCP/IP, HTTP, SMTP, MIME, telnet, ftp; Server-side scripting: overview of CGI, ASP, and JSP, PHP; Web database connectivity- ODBC, JDBC; Web services and Related Technologies- AJAX,.NET.

Module 5:

Object based models-COM DCOM, CORBA, IIOP, EJB;Web Security: Firewalls, Tunnels, SSI, Digital Signature.

Recommended Readings:

1. Web Technologies by Achyut S Godbole and Atul Kahate
2. Web Technology by Deital & Deital
3. ASP.net Using VB.net by Cornes, Goode, Sussman, Krishnamoorthy, Miller.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS18230E11	**Digital Signal Processing**	**3-1-0**	**4**

Module 1:

Introduction, Overview of digital signal processing

Review of Discrete – Time linear system, Sequences, arbitrary sequences, linear time invariant system, causality, stability. Difference equation, relation between continuous and discrete system, Classifications of sequence, recursive and non-recursive system

Review of: Mathematical operations on sequences: Convolution, graphical and analytical techniques, overlap and add methods, matrix method, some examples and solutions of LTI systems, MATLAB examples.

Module 2:

Z-transform: Definition, relation between Z transform and Fourier transform of a sequence, properties of Z transform, mapping between S-plane and Z-plane. Module circle, convergence and ROC, Inverse Z-transform, solution of difference equation using the one sided Z-transform MATLAB examples.

Module 3:

Discrete Fourier transform: Definition, inverse discrete Fourier transform (IDFT) Twiddle factor, linear transformation, basic properties, circular convolution, multiplication of DFT, linear filtering using DFT, filtering of long data sequences, overlap add and save method. Computation of DFT, Fast Fourier transform (FFT), FFT algorithm, Radix 2 algorithm. Decimation-in-time and decimation-in- frequency algorithm, signal flow graph, butterflies, Chirp z-transform algorithm, MATLAB examples

Module 4:

Digital filter realization: Principle of digital filter realization, structures of All-zero filters. Design of FIR (Finite impulse response) filters, linear phase, windows-rectangular, Berlitt, Hanning, Hamming and Blackman. Design of infinite impulse response filters (IIR) from analog filters. Bilinear transformation, Butterworth, Chebyshev, Elliptic filters. Optimisation method of IIR filters. Some example of practical filter design. Computer aided filter design, MATLAB examples

Recommended Books:

Text Books:

1. Ifeachor, Digital Signal Processing, Pearson, 2nd Edition, 2002.
2. R. G. Lyons, Understanding Digital Signal Processing, Prentice Hall, 2010
3. L.R. Rabiner & B.Gold, Theory and Application of Digital Signal Processing, PHI, 2009.

4. J.G. Proakis & D.G. Manolakis, Digital Signal Processing, Principles, Algorithms and Applications, PHI , 2008.
5. S. Salivahanan et al., Digital Signal Processing, TMH

Reference Books:

1. Chen, Digital Signal Processing, OUP
2. Meyer-Basse U, Digital Signal Processing with FPGA, Spriger India, 2007.
3. Ingle, Digital Signal Processing using MATLAB, Vikas Publishing House, 2001.
4. Babu R, Digital Signal Processing, Scitech Publications, 2010.
5. S. K. Mitra, Digital Signal Processing - A Computer based approach, TMH, 2006.
6. Xavier, Digital Signal Processing, S. Chand, 2003
7. Pradhan, Digital Signal Processing Applications, Jaico

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS18230E12	**Ethical Hacking**	**3-1-0**	**4**

Introduction to Hacking, Ethical hacking and penetration testing.

Being a Hacker – Introduction, Resources – books, magazines, newspapers, zines and blogs, forums and mailing lists, newsgroups, websites, chat, P2P.

Internet legalities and ETHICS – Introduction, Foreign crimes vs local rights, crime related to the TIC's, COMINT, ECHELON, CARNIVORE, Ethical Hacking, most common internet frauds.

Basic Commands in LINUX and WINDOWS:

Introduction and objectives, Commands and tools (Windows), Commands and tools (LINUX), Basic commands equivalances for Windows/Linux, Exercises in Windows and Linux. Backdoor Overview**: Backdoor Process and Functions, Backdoor Gaining Access, Backdoor Maitaining Access, Command Prompt Backdoor.**

Ports and Protocols: Introduction, Basic concepts of networks- devices and topologies, TCP/IP model-Layers, Protocols, IP Addresses, PORTS, Encapsulation, Exercises.

Services and Connections: Introduction, Services – HTTP and WEB, Email-POP and SMTP, IRC, FTP, Telnet and SSH, DNS, DHCP. Connections – ISPS, Plain OLD telephone Service, DSL, cable Modems.

System Identification – Identifying a server, identifying the IP address of a domain, identifying services – ping and traceroute, banner grabbing, system fingerprinting.

Malware – Introduction, Viruses – Boot sector viruses, executable file virus, terminate and stay resident virus, Polymorphic virus, macro virus. WORMS – Introduction, description, Trojans and spyware, Rootkits and Backdoors, Logicbombs and timebombs, Countermeasures – Introduction, Antivirus, NIDS, HIDS, Firewalls, SandBoxes. Good safety Advice.

Attack Analysis – Introduction, Netstat, Firewall, Packet sniffers, Honeyspots and honeynets.

Digital Forensic – Introduction, Forection Principles – Avoid contamination, Act methodically, Chain of evidence. Stand alone Forensic – Hard drivre and storage media basics, Encrypton, Decrypton and file formats. Needle in a Haystack, NETWORK Forensics – Firewall Logs, Mail Headers.

Email Security – Introduction, Working principle, Email accounts, POP and SMTP, WEB Mail, security at Receiving – S pam, Phising and fraud, HTML Email, Attachment security, Forged headers, Security at Sending – Digital certificates, Digital signature, Encryption, Decryption. Connection security, Introduction To Cryptography, **Basic Concepts On Cryptography,** Hash Function and Oracle Method, Pros and Cons Of Cryptography.

NMAP, ZENMAP, Mass mailer Attack, MITM Attack, **ARP Poisoning, DNS Spoofing vs**

DNS Poisoning, DNS Spoofing, Advanced Concepts on DNS Spoofing, DHCP Spoofing, Port Stealing.

Introduction To ICMP redirection, ICMP redirection Visual Chart, IMPC redirection Process and Functions, Killing a Network, DDoSing Unauthorised Network, Driftnet, Introducing EvilGrade.

Web security and privacy – Fundamentals of web security, Web vulnerabilities, proxy methods for web application manipulation, Firewall, Intrusion detection system, Methods of verification – OSSTMM.

Passwords – Introduction To Password Cracking, password history, types of passwords, Password Cracking Strategy, windows Password Cracking Overview, Nuts And Bolts Of Windows Password Cracking Strategy, Introduction To Linux Hash Cracking, Linux Hash Cracking Strategy, password encrypton, password cracking.

Introduction To SQL injection, SQL Injection To Google Dorks

Reference Books:

1. Nikhalesh Singh Bhadoria,"First Step to Ethical Hacking",Rigi Publication
2. Sai Satish, "Hacking Secrets- A Practical Guide to learn Hacking",Indian Servers

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS18230E13	**Operations Research and Queueing Theory**	**3-1-0**	**4**

Module 1: Basics of Operations Research
Development of Operation Research , Definition of Operation Research , Scope/ Applications of Operation Research , Limitations of Operations Research.

Module 2: Linear Programming Problem (LPP)
Introduction , Mathematical Formulation of Linear Programming Problem , Statements of Basic Theorems and Properties , Graphical Solutions to a Linear Programming Problem , Simpkex Method , The Big-M Method Two Phase simplex Method .

Module 3: Advanced Topics in Linear programming
Dual Theory , Dual simplex Method , Revised simplex Method , Integer Programming Problem (IPP) : Introduction , Formulation of IPP , Gromory's cutting plane Method , Branch and Bound Technique ,Limitations of Linear programming problem .

Module 4: Transportation Problem
Introduction , Mathematical Formulation , Method of finding initial basic feasible solution , MODI Method , Degeneracy of Transportation Problem , Unbalanced Transportation Problems , Maximisation in Transportation Problem .

Module 5: Assignment Problem
Introduction and formulation , Method for solving an Assignment problem (Hungarian Assignment Algorithm) , Travelling Salesman Problem .

Module 6: Game Theory
Introduction to Games , Two-person Zero –sum Game: Games with Saddle point , Games without Saddle point: Mixed Strategies , Matrix Method , Graphical Method (for $2 \times n$ or for $m \times 2$ $Games$) , Solution of $m \times n$ size games , n −person zero sum game .

Module 7: Queuing Models
Characteristics of Queuing Models , Transient and Steady states , Role of exponential Distribution , Kendall's Notation for representing Queuing Models , Classification of queuing Models , Model I : (M/M/1): $(\infty: FIFI)$, Model II : (M/M/s): $(\infty: FIFI)$,Model III : (M/M/ 1) : (N/FIFO) , Model IV : (M/M/s): $(N: FIFI)$.

Recommended Books:

Text Books:

1. J . K . Sharma , Operation Research – Theory and Application , MacMillan India Ltd.
2. G . Hadley ; Linear Programming , Narosa Publishing House , New delhi .
3. Bronson , Richard , Operational Research , McGraw Hill .

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS18230E14	**Embedded Systems**	**3-1-0**	**4**

Module 1: Introduction to Embedded Systems:
Overview of embedded systems, features, requirements and applications of embedded systems, recent trends in the embedded system design, common architectures for the ES design, embedded software design issues, interfacing and communication Links, introduction to development and testing tools.

Module 2: Embedded System Architecture:
Basics of 8 – bit RISC microcontroller (PIC), block diagram, addressing modes, instruction set, timers, counters, stack operation, programming using PIC controller, basics of 32 – bit microprocessor (ARM), processor and memory organization, data operations, flow of control, pipelining in ARM, ARM bus (AMBA).

Module 3: Embedded Software:
Programming in embedded environment, Programming for microcontrollers such as Intel 8051 and PIC, overview of Java 2 micro edition (J2ME), concept of a MIDLET, applications of J2ME in mobile communication.

Module 4: Applications of Embedded Systems:
Industrial and control applications, networking and telecom applications, DSP and multimedia applications, applications in the area of consumer appliances, concept of smart home.

Recommended Books:

Text Books:

1. Daniel W. Lewis, Fundamentals of Embedded Software, where C and assembly meet, Pearson Education 2001.
2. John B. Peatman, Design with PIC Microcontrollers, Pearson Education, 1997.
3. Robert B. Reese, Microprocessors: From assembly language to C using PIC18Fxx2, Shroff Publishers and Distributors Pvt Ltd. 2005.
4. Wayne Wolf, Computers as Components: Principles of Embedded Computing System Design, Elsevier Publication 2000.
5. Michael Juntao Yuan, Enterprise, J2ME – Developing Mobile Java Applications, Pearson Education, 2003.
6. Andrew N. Sloss, Dominic Symes, Chris Wright, ARM System Developer's Guide – Designing and Optimizing System Software, Elsevier Publications, 2007.
7. A. Silberschatz, P.B.Galvin and G. Gagne, Operating System Concepts (6th ed.), John Wiley & Sons, Inc., 2001
8. K.V.K.K.Prasad, Embedded/Real Time Systems: Concepts, Design and Programming,Dreamtech Press, New Delhi, India, 2003.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS18230E15	**Network Security**	**3-1-0**	**4**

Module 1: Overview and Classical Encryption Techniques

Overview: Services, mechanisms and attacks; Security architecture – security services, authentication, data confidentially, data integrity, non-repudiation, availability; Security Mechanisms-attacks; Security network model.

Classical Encryption techniques: Symmetric cipher model, Cryptography, Cryptanalysis; Substitution techniques – Caesar Cipher, Mono alphabetic Cipher, Playfair Cipher, Transposition technique.

Module 2: Data Encryption and Symmetric Ciphers

Data Encryption: Simplified DES, DES; Differential & Linear Cryptanalysis; Block Cipher - Stream and Block Ciphers, Feistel Cipher.

Symmetric Ciphers - Double DES, Triple DES, Blowfish; Confidentiality – Placement of functions, Key distribution.

Module 3: Public Key Encryption and Hash Functions

Public Key Encryption: Public Key Cryptosystems, Applications, Requirements, Cryptanalysis; RSA Algorithm; Public Key Distribution; Deffie-Hellman Key Exchange.

Hash Functions: Authentication Requirements, Message authentication codes; Hash functions – Requirements, Simple hash functions, Birthday attack, Block chaining, Brute Force attack, Cryptanalysis.

Module 4: Digital Signatures and Network Security Applications

Digital Signatures: Requirements, Direct and Arbitrated Digital Signatures; Mutual Authentication, One-way Authentication; DSS, Network Security Applications: Kerberos-Versions 4 and 5; PGP – Operation, Cryptographic Keys; S/MIME; IP Security – IPSec, IPSec Services, Security Associations, Transport and Tunnel Modes, Authentication Header, Security Payload Encapsulation, SSL Architecture; SET; Intrusion Detection – Audit records, Anomaly Detection; Base Rate Fallacy, Distributed intrusion detection, Honeypots; Password Management; Firewalls – Characteristics

Recommended Books:

Text Books:

1. Stallings, W**.,** Cryptography and Network Security: Principles and Practice, Latest Edition, New Delhi: Prentice-Hall India, 2006.
2. Cheswick, W.; S. Bellovin, Firewalls and Internet Security. Repelling the Wiley Hacker, (Second Edition), New Delhi: Addison-Wesley, 1998.

Course Code	Course Title	Hours per week L-T-P	Credit C
MCS182315	**Seminar and Viva**	**0-0-0**	**2**

Seminar and Viva

For this course, each student is required to

i. Select appropriate field of study under the supervision of a faculty of the department.

ii. Present a seminar in the beginning after the selection of the topic in presence of the expert committee (internal).

iii. Deliver a final seminar at the end of the semester course work in presence of the departmental committee and one external examiner as appointed by University.

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