Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

SEMESTER – VII

Internet Technology
Code: PEC-IT701A
Contacts: 3L

Name of the Course:	**Internet Technology**	
Course Code: PEC-IT701A	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory:3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction to Internet Technology(6L) :** Overview, Network of Networks, Intranet, Extranet and Internet.,World Wide Web:Domain and Sub domain, Address Resolution, DNS, Telnet, FTP, HTTP. Review of TCP/IP:Features, Segment, Three-Way Handshaking, Flow Control, Error Control, Congestion control, IP Datagram, IPv4 and IPv6. IP Subnetting and addressing :Classful and Classless Addressing, Subnetting. NAT, IP masquerading, IP tables,Internet Routing Protocol .Routing -Intra and Inter Domain Routing, Unicast and Multicast Routing, Broadcast. Electronic Mail POP3, SMTP.	6	
2	**HTML, Image Maps ,XML,CGI Scripts(9L):** Introduction, Editors, Elements, Attributes, Heading, Paragraph. Formatting, Link, Head, Table, List, Block, Layout, CSS. Form, Iframe, Colors, Color name, Color value, map, area, attributes of image area. Extensible Markup Language, Introduction, Tree, Syntax, Elements, Attributes, Validation, Viewing. XHTML in brief. Introduction, Environment Variable, GET and POST Methods	9	
3	**Perl, JavaScript,Java applets(10L)** Introduction, Variable, Condition, Loop, Array,	10	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	Implementing data structure, Hash, String, Regular Expression, File handling, I/O handling. ,Basics, Statements, comments, variable, comparison, condition, switch, loop, break. Object – string, array, Boolean, reg-ex. Function, Errors, Validation. Definition of cookies, Create and Store a cookie with example. Container Class, Components, Applet Life Cycle, Update method; Parameter passing applet, Applications.		
4.	**Client-Server programming In Java Threats, Network Security techniques(4L)** Java Socket, Java RMI, Malicious code-viruses, Trojan horses, worms; eavesdropping, spoofing, modification, denial of service attacks. Password and Authentication; VPN, IP Security, security in electronic transaction, Secure Socket Layer (SSL), Secure Shell (SSH), Introduction, Packet filtering, Stateful, Application layer, Proxy	4	
5	**Internet Telephony, Multimedia Applications, Multimedia Applications(5L):** Introduction, VoIP. Multimedia Applications Multimedia over IP: RSVP, RTP, RTCP and RTSP. Streaming media, Codec and Plugins, IPTV. Definition, Meta data, Web Crawler, Indexing, Page rank, overview of SEO.	5	

Text book and Reference books:

1. Web Technology: A Developer's Perspective, N.P. Gopalan and J. Akilandeswari, PHI Learning, Delhi, 2013. (Chapters 1-5,7,8,9).
2. Internetworking Technologies, An Engineering Perspective, Rahul Banerjee, PHI Learning, Delhi, 2011. (Chapters 5,6,12)

Maulana Abul Kalam Azad University of Technology, West Bengal
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Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Quantum Computing
Code: PEC-IT701B
Contacts: 3L

Name of the Course:	**Quantum Computing**	
Course Code: PEC-IT701B	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme	**Examination Scheme**	
Theory:3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance : 5 marks	
Practical: NIL	End Semester Exam :70 Marks	
Credit Points:	3	
Objective:		
1	The course will provide an insight of basic of quantum physics from a computer scientist's perspective, and how it describes reality and understand the philosophical implications of quantum computing	
Pre-Requisite:		
1	Linear Algebra, Theory of Computation	

Unit	Content	Hrs/Unit	Marks/Unit
1	Qubit & Quantum States: The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchyschwarez and triangle Inequalities.	3	
2	Matrices & Operators: Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators,	10	
3.	Commutator Algebra, Heisenberg uncertainty principle, polar decomposition &singular values, Postulates of Quantum Mechanics.	5	
4.	Tensor Products: Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key	5	

3

Maulana Abul Kalam Azad University of Technology, West Bengal
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	Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.		
5.	Quantum Measurement Theory: Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized Measurements, Positive Operator- Valued Measures.	8	
6.	Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming.	6	

Text book and Reference books:

Quantum Computing without Magic by Zdzislaw Meglicki
2. Quantum Computing Explained By DAVID Mc MAHON
3. Quantum Computer Science By Marco Lanzagorta, Jeffrey Uhlmann
4. An Introduction to Quantum Computing Phillip Kaye, Raymond Laflamme, Michele Mosca.

Course Outcomes:

On completion of the course students will be able to
knowledge of Vector spaces, Matrices, Quantum state, Density operator and Quantum

Cloud Computing
Code: PEC-IT701C
Contact: 3L

Name of the Course:	**Cloud Computing**	
Course Code: PEC-IT701C	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical:	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Definition of Cloud Computing and its Basics (Lectures)**. Defining a Cloud, Cloud Types – NIST model, Cloud Cube model, Deployment models (Public , Private, Hybrid and Community Clouds),	9	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	Service Platform as a Service, Software as a Service with examples of services/ service providers, models – Infrastructure as a Service, Cloud Reference model, Characteristics of Cloud Computing – a shift in paradigm Benefits and advantages of Cloud Computing, A brief introduction on Composability, Infrastructure, Platforms, Virtual Appliances, Communication Protocols, Applications, Connecting to the Cloud by Clients, IaaS – Basic concept, Workload, partitioning of virtual private server instances, Pods, aggregations, silos PaaS – Basic concept, tools and development environment with examples SaaS - Basic concept and characteristics, Open SaaS and SOA, examples of SaaS platform Identity as a Service (IDaaS) Compliance as a Service (CaaS)		
2	**Use of Platforms in Cloud Computing** Concepts of Abstraction and Virtualization Virtualization technologies : Types of virtualization (access, application, CPU, storage), Mobility patterns (P2V, V2V, V2P, P2P, D2C, C2C, C2D, D2D) Load Balancing and Virtualization: Basic Concepts, Network resources for load balancing, Advanced load balancing (including Application Delivery Controller and Application Delivery Network), Mention of The Google Cloud as an example of use of load balancing Hypervisors: Virtual machine technology and types, VMware vSphere Machine Imaging (including mention of Open Virtualization Format – OVF) Porting of applications in the Cloud: The simple Cloud API and AppZero Virtual Application appliance,Concepts of Platform as a Service, Definition of services, Distinction between SaaS and PaaS (knowledge of Salesforce.com and Force.com), Application development Use of PaaS Application frameworks, Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and	12	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service., Discussion of Google Applications Portfolio – Indexed search, Dark Web, Aggregation and disintermediation, Productivity applications and service, Adwords, Google Analytics, Google Translate, a brief discussion on Google Toolkit (including introduction of Google APIs in brief), major features of Google App Engine service, Windows Azure platform: Microsoft's approach, architecture, and main elements, overview of Windows Azure AppFabric, Content Delivery Network, SQL Azure, and Windows Live services,		
3	**Cloud Infrastructure**: Cloud Management: An overview of the features of network management systems and a brief introduction of related products from large cloud vendors, Monitoring of an entire cloud computing deployment stack – an overview with mention of some products, Lifecycle management of cloud services (six stages of lifecycle). Concepts of Cloud Security: Cloud security concerns, Security boundary, Security service boundary Overview of security mapping Security of data: Brokered cloud storage access, Storage location and tenancy, encryption, and auditing and compliance Identity management (awareness of Identity protocol standards)	7	
4.	**Concepts of Services and Applications :** Service Oriented Architecture: Basic concepts of message-based transactions, Protocol stack for an SOA architecture, Event-driven SOA, Enterprise Service Bus, Service catalogs, Applications in the Cloud: Concepts of cloud transactions, functionality mapping, Application attributes, Cloud service	8	

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

attributes, System abstraction and Cloud Bursting, Applications and Cloud APIs Cloud-based Storage: Cloud storage definition – Manned and Unmanned Webmail Services: Cloud mail services including Google Gmail, Mail2Web, Windows Live Hotmail, Yahoo mail, concepts of Syndication services		

Text book and Reference books:

1. Cloud Computing Bible by Barrie Sosinsky, Wiley India Pvt. Ltd, 2013
2. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, McGraw Hill Education (India) Private Limited, 2013
3. Cloud computing: A practical approach, Anthony T. Velte, Tata Mcgraw-Hill
4. Cloud Computing, Miller, Pearson
5. Building applications in cloud:Concept, Patterns and Projects, Moyer, Pearson
6. Cloud Computing – Second Edition by Dr. Kumar Saurabh, Wiley India

Machine Learning
Code: PEC-IT701D
Contacts: 3L

Name of the Course:	Machine Learning	
Course Code: PEC IT-701D	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: Nil	End Semester Exam: 70 Marks	
Credit Points:	3	

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

COURSE OBJECTIVE		
☐ To learn the concept of how to learn patterns and concepts from data without being explicitly programmed		
☐ To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.		
☐ Explore supervised and unsupervised learning paradigms of machine learning.		
☐ To explore Deep learning technique and various feature extraction strategies.		
	Hrs/unit	**Marks/unit**
Unit 1: **Supervised Learning (Regression/Classification)** ☐ Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes ☐ Linear models: Linear Regression, Logistic Regression, Generalized Linear Models ☐ Support Vector Machines, Nonlinearity and Kernel Methods ☐ Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	10	
Unit 2: **Unsupervised Learning** ☐ Clustering: K-means/Kernel K-means ☐ Dimensionality Reduction: PCA and kernel PCA ☐ Matrix Factorization and Matrix Completion ☐ Generative Models (mixture models and latent factor models)	7	
Unit 3 Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, Random Forests)	6	
Unit 4 Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning	9	
Unit 5 Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference	9	
Unit 6: Recent trends in various learning techniques of machine learning and classification methods	5	

References:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)

3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007

4. Rajiv Chopra, Machine Learning, Khanna Publishing House, 2018

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Multimedia Technology
Code: PEC-IT702A
Contacts: 3L

Name of the Course:	**Multimedia Technology**	
Course Code: PEC-IT702A	Semester: VII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance : 5 marks	
Practical: Nil	End Semester Exam :70 Marks	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction:** Multimedia today, Impact of Multimedia, Multimedia Systems, Components and Its Applications	2	
2	**Text and Audio, Image and Video(14L)** Text: Types of Text, Ways to Present Text, Aspects of Text Design, Character, Character Set, Codes, Unicode, Encryption; Audio: Basic Sound Concepts, Types of Sound, Digitizing Sound, Computer Representation of Sound (Sampling Rate, Sampling Size, Quantization), Audio Formats, Audio tools, MIDI Image: Formats, Image Color Scheme, Image Enhancement; Video: Analogue and Digital Video, Recording Formats and Standards (JPEG, MPEG, H.261) Transmission of Video Signals, Video Capture, and Computer based Animation.	14	
3.	**Synchronization, Storage models and Access Techniques:**Temporal relationships, synchronization accuracy specification factors, quality of service, Magnetic media, optical media, file systems (traditional, multimedia) Multimedia devices – Output devices, CD-ROM, DVD, Scanner, CCD	8	
4.	**Image and Video Database, Document Architecture and Content Management (17L):** Image representation, segmentation, similarity based retrieval,	17	

9

Maulana Abul Kalam Azad University of Technology, West Bengal
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Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	image retrieval by color, shape and texture; indexing- k-d trees, R-trees, quad trees; Case studies- QBIC, Virage. Video Content, querying, video segmentation, indexing, Content Design and Development, General Design Principles Hypertext: Concept, Open Document Architecture (ODA), Multimedia and Hypermedia Coding Expert Group (MHEG), Standard Generalized Markup Language (SGML), Document Type Definition (DTD), Hypertext Markup Language (HTML) in Web Publishing. Case study of Applications		
5.	**Multimedia Applications(4L):** Interactive television, Video-on-demand, Video Conferencing, Educational Applications, Industrial Applications, Multimedia archives and digital libraries, media editors	4	

Text book and Reference books:

1. Ralf Steinmetz and Klara Nahrstedt , Multimedia: Computing, Communications & Applications , Pearson Ed.
2. V.K. Jain, Multimedia and Animation, Khanna Publishing House, 2019.
3. Nalin K. Sharda , Multimedia Information System , PHI.
4. Fred Halsall , Multimedia Communications , Pearson Ed.
5. Koegel Buford , Multimedia Systems , Pearson Ed.
6. Fred Hoffstetter , Multimedia Literacy , McGraw Hill.
7. Ralf Steinmetz and Klara Nahrstedt , Multimedia Fundamentals: Vol. 1- Media Coding and Content Processing , PHI.
8. J. Jeffcoate , Multimedia in Practice: Technology and Application , PHI.

Neural Networks and Deep Learning
Code: PEC-IT702B
Contacts: 3L

Name of the Course:	**Neural Networks and Deep Learning**	
Course Code: **PEC-IT702B**	Semester: VII	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz : 10 marks	
	Attendance: 5 marks	
Practical:	End Semester Exam: 70 Marks	
Credit Points:	3	

Maulana Abul Kalam Azad University of Technology, West Bengal
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Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction:** Various paradigms of earning problems, Perspectives and Issues in deep learning framework, review of fundamental learning techniques.	3	
2	**Feed forward neural network:** Artificial Neural Network, activation function, multi-layer neural network.cardinality, operations, and properties of fuzzy relations.	6	
3	Training Neural Network: Risk minimization, loss function, backpropagation, regularization, model selection, and optimization.	6	
4.	**Conditional Random Fields:** Linear chain, partition function, Markov network, Belief propagation, Training CRFs, Hidden Markov Model, Entropy.	9	
5	**Deep Learning:** Deep Feed Forward network, regularizations, training deep models, dropouts, Convolutional Neural Network, Recurrent Neural Network, Deep Belief Network.	6	
6	**Deep Learning research:** Object recognition, sparse coding, computer vision, natural language	6	

Text book and Reference books:

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.
3. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
4. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
5. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
6. Rajiv Chopra, Deep Learning, Khanna Publishing House, 2018.

Maulana Abul Kalam Azad University of Technology, WEST BENGAL
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Soft Computing
Code: PEC-IT702C
Contacts: 3L

Name of the Course:	**Soft Computing**	
Course Code: **PEC-IT702C**	Semester: VII	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz : 10 marks	
	Attendance: 5 marks	
Practical:	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Introduction to soft computing; introduction to fuzzy sets and fuzzy logic systems; introduction to biological and artificial neural network; introduction to Genetic Algorithm	8	
2	Fuzzy sets and Fuzzy logic systems: Classical Sets and Fuzzy Sets and Fuzzy relations : Operations on Classical sets, properties of classical sets, Fuzzy set operations, properties of fuzzy sets, cardinality, operations, and properties of fuzzy relations. Membership functions : Features of membership functions, standard forms and boundaries, different fuzzification methods. Fuzzy to Crisp conversions: Lambda Cuts for fuzzy sets, fuzzy Relations, Defuzzification methods. Classical Logic and Fuzzy Logic: Classical predicate logic, Fuzzy Logic, Approximate reasoning and Fuzzy Implication Fuzzy Rule based Systems: Linguistic Hedges, Fuzzy Rule based system – Aggregation of fuzzy Rules, Fuzzy Inference System- Mamdani Fuzzy Models – Sugeno Fuzzy Models. Applications of Fuzzy Logic: How Fuzzy Logic is applied in Home Appliances, General Fuzzy Logic controllers, Basic Medical Diagnostic systems and Weather forecasting	10	

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

		10	
3	Neural Network Introduction to Neural Networks: Advent of Modern Neuroscience, Classical AI and Neural Networks, Biological Neurons and Artificial neural network; model of artificial neuron. Learning Methods : Hebbian, competitive, Boltzman etc., Neural Network models: Perceptron, Adaline and Madaline networks; single layer network; Back-propagation and multi layer networks. Competitive learning networks: Kohonen self organizing networks, Hebbian learning; Hopfield Networks. Neuo-Fuzzy modelling:Applications of Neural Networks: Pattern Recognition and classification		
4.	Genetic Algorithms: Simple GA, crossover and mutation, Multi-objective Genetic Algorithm (MOGA). Applications of Genetic Algorithm: genetic algorithms in search and optimization, GA based clustering Algorithm, Image processing and pattern Recognition	10	
5	**PSO:**Other Soft Computing techniques: Simulated Annealing, Tabu search, Ant colony optimization (ACO), Particle Swarm Optimization (PSO).	4	

Text book and Reference books:

1. Fuzzy logic with engineering applications, Timothy J. Ross, John Wiley and Sons.
2. S. Rajasekaran and G.A.V.Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithms", PHI
3. Principles of Soft Computing , S N Sivanandam, S. Sumathi, John Wiley & Sons
4. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg
5. Neuro-Fuzzy and Soft computing, Jang, Sun, Mizutani, PHI
6. Neural Networks: A Classroom Approach,1/e by Kumar Satish, TMH,

7. Genetic Algorithms in search, Optimization & Machine Learning by David E. Goldberg, Pearson/PHI
8. A beginners approach to Soft Computing, Samir Roy & Udit Chakraborty, Pearson

9.Fuzzy Sets and Fuzzy Logic: Theory and Applications, George J. Klir and Bo Yuan, Prentice Hall
10.Neural Networks: A Comprehensive Foundation (2nd Edition), Simon Haykin, Prentice Hall.

Maulana Abul Kalam Azad University of Technology, WEST BENGAL
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Adhoc –Sensor Network
Code: PEC-IT702D
Contact: 3L

Name of the Course:	**Adhoc –Sensor Network**	
Course Code: **PEC-IT702D**	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: 4 hrs	End Semester Exam: 70 Marks	
Credit Points:	3	
Objective:		
1	provide an overview about sensor networks and emerging technologies	
2	To study about the node and network architecture of sensor nodes and its execution environment.	
3	To understand the concepts of communication, MAC, routing protocols and also study about the naming and addressing in WSN	
4	To learn about topology control and clustering in networks with timing synchronization for localization services with sensor tasking and control. .	
5	To study about sensor node hardware and software platforms and understand the simulation and programming techniques..	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction and Overview [4L]** :Overview of wireless networks, types, infrastructure-based and infrastructure-less, introduction to MANETs (Mobile Ad-hoc Networks), characteristics, reactive and proactive routing protocols with examples, introduction to sensor networks, commonalities and differences with MANETs, constraints and challenges, advantages, applications, enabling technologies for WSNs.	4	
2	**Architectures** Single-node architecture - hardware components, design constraints, energy consumption of sensor nodes , operating systems and execution environments, examples of sensor nodes, sensor network scenarios, types of sources	9	

14

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	and sinks – single hop vs. multi hop networks, multiple sources and sinks – mobility, optimization goals and figures of merit, gateway concepts, design princip		
3	**Communication Protocols [9L]**: Physical layer and transceiver design considerations, MAC protocols for wireless sensor networks, low duty cycle protocols and wakeup concepts - S-MAC , the mediation device protocol, wakeup radio concepts, address and name management, assignment of MAC addresses, routing protocols-classification, gossiping, flooding, energy-efficient routing, unicast protocols, multi-path routing, data-centric routing, data aggregation, SPIN, LEACH, Directed-Diffusion, geographic routing.	9	
4.	**Infrastructure Establishment:** Topology control, flat network topologies, hierarchical networks by clustering, time synchronization, properties, protocols based on sender-receiver and receiver-receiver synchronization, LTS, TPSN, RBS, HRTS, localization and positioning, properties and approaches, single-hop localization, positioning in multi-hop environment, range based localization algorithms – location services, sensor tasking and control		
5	**Sensor Network Platforms and Tools [9L]:**Sensor node hardware, Berkeley motes, programming challenges, node-level software platforms, node-level simulators, state-centric programming, Tiny OS, nesC components, NS2 simulator, TOSSIM.		

Text book and Reference books:
1.   Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005.
2.   Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Information Processing Approach", Elsevier, 2007.
REFERENCES

1.   Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor
Networks- Technology, Protocols, and Applications", John Wiley, 2007.
2.   Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003.
3.   Thomas Haenselmann, "Sensor Networks", available online for free, 2008.

Information Theory and Coding
Code: PEC-IT702E
Contact: 3L

Name of the Course:	**Information Theory and Coding**		
Course Code: **PEC-IT702E**	Semester: VII		
Duration: 6 months	Maximum Marks: 100		
Teaching Scheme	**Examination Scheme**		
Theory: 3 hrs./week	Mid Semester exam: 15		
Tutorial: NIL	Assignment and Quiz: 10 marks		
	Attendance: 5 marks		
Practical:NIL	End Semester Exam: 70 Marks		
Credit Points:	3		
Objective:			
1	To develop an understanding of modern network architectures from a design and performance perspective.		
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).		
3	To provide an opportunity to do network programming		
4	To provide a WLAN measurement ideas.		
Pre-Requisite:			
1			
2			
3			

Unit	Content	Hrs/Unit	Marks/Unit
1	**Source Coding [7L]** Uncertainty and information, average mutual information and entropy, information measures for continuous random variables, source coding theorem, Huffman codes	7	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
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2	**Channel Capacity And Coding [7L]** Channel models, channel capacity, channel coding, information capacity theorem, The Shannon limit	7	
3	**Linear And Block Codes For Error Correction [8L]** Matrix description of linear block codes, equivalent codes, parity check matrix, decoding of a linear block code, perfect codes, Hamming codes	8	
4.	**Cyclic Codes [7L]** Polynomials, division algorithm for polynomials, a method for generating cyclic codes, matrix description of cyclic codes, Golay codes..	7	
5	**BCH Codes [8L]** Primitive elements, minimal polynomials, generator polynomials in terms of minimal polynomials, examples of BCH codes.	8	
6	**Convolutional Codes [8L]** Tree codes, trellis codes, polynomial description of convolutional codes, distance notions for convolutional codes, the generating function, matrix representation of convolutional codes, decoding of convolutional codes, distance and performance bounds for convolutional codes, examples of convolutional codes, Turbo codes, Turbo decoding	8	

Text book and Reference books:
1. Information theory, coding and cryptography - Ranjan Bose; TMH.
2. Information and Coding - N Abramson; McGraw Hill.
3. Introduction to Information Theory - M Mansurpur; McGraw Hill.
4. Information Theory - R B Ash; Prentice Hall.
5. Error Control Coding - Shu Lin and D J Costello Jr; Prentice Hall.

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Cyber Security
Code: PEC-IT702F
Contact: 3L

Name of the Course:	Cyber Security	
Course Code: **PEC-IT702F**	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	
Objective:		
1	To develop an understanding of modern network architectures from a design and performance perspective.	
2	To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).	
3	To provide an opportunity to do network programming	
4	To provide a WLAN measurement ideas.	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction: Introduction to Cyber Security, Importance and challenges in Cyber Security, Cyberspace, Cyber threats, Cyberwarfare, CIA Triad, Cyber Terrorism, Cyber Security of Critical Infrastructure, Cybersecurity - Organizational Implications.	6	
2	Hackers and Cyber Crimes: Types of Hackers, Hackers and Crackers, Cyber-Attacks and Vulnerabilities, Malware threats, Sniffing, Gaining Access, Escalating Privileges, Executing Applications, Hiding Files, Covering Tracks, Worms, Trojans, Viruses, Backdoors.	7	
3	Ethical Hacking and Social Engineering: Ethical Hacking Concepts and Scopes, Threats and Attack Vectors, Information Assurance, Threat Modelling, Enterprise Information Security Architecture, Vulnerability Assessment and Penetration Testing, Types of Social Engineering, Insider Attack, Preventing Insider Threats, Social Engineering Targets and Defence Strategies.	8	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

| 4. | Cyber Forensics and Auditing: Introduction to Cyber Forensics, Computer Equipment and associated storage media, Role of forensics Investigator, Forensics Investigation Process, Collecting Network based Evidence, Writing Computer Forensics Reports, Auditing, Plan an audit against a set of audit criteria, Information Security Management System Management. Introduction to ISO 27001:2013 | 10 | |
| 5 | Cyber Ethics and Laws: Introduction to Cyber Laws, E-Commerce and E-Governance, Certifying Authority and Controller, Offences under IT Act, Computer Offences and its penalty under IT Act 2000, Intellectual Property Rights in Cyberspace. at Network Layer-IPSec. | 5 | |

Text book and Reference books:
1. Cyber security , Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber Laws, Gupta & Gupta, Khanna Publishing House (AICTE Recommended - 2018)
3. Information Security and Cyber Laws, Pankaj Agarwal
4. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A., Enterprise Cybersecurity -How to Build a Successful Cyberdefense Program Against Advanced Threats, A-press
5. Nina Godbole, SumitBelapure, Cyber Security, Willey
6. Hacking the Hacker, Roger Grimes, Wiley
7. Cyber Law By Bare Act, Govt Of india, It Act 2000.

Operation Research
Code: OEC-IT701A
Contact: 3L

Name of the Course:	**Operation Research**	
Course Code: OEC-IT701A	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Theory: 3 hrs./week	Mid Semester exam: 15
Tutorial: NIL	Assignment and Quiz: 10 marks
	Attendance: 5 marks
Practical: NIL	End Semester Exam: 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Basic LPP and Applications; Various Components of LP Problem Formulation. Solution of Linear Programming Problems: Solution of LPP: Using Simultaneous Equations and Graphical Method; Definitions: Feasible Solution, Basic and non-basic Variables, Basic Feasible Solution, Degenerate and Non-degenerate Solution, Convex set and explanation with examples Solution of LPP by Simplex Method; Charnes' Big-M Method; Duality Theory. Transportation Problems and Assignment Problems.	17	
2	Network Analysis:Shortest Path: Floyd Algorithm; Maximal Flow Problem (Ford-Fulkerson); PERT-CPM (Cost Analysis, Crashing, Resource Allocation excluded). Inventory Control:Introduction to EOQ Models of Deterministic and Probabilistic ; Safety Stock; Buffer Stock.	9	
3	Game Theory: Introduction; 2-Person Zero-sum Game; Saddle Point; Mini-Max and Maxi-Min Theorems (statement only) and problems; Games without Saddle Point; Graphical Method; Principle of Dominance	5	
4.	Queuing Theory: Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: (M/M/1): (∞ / FIFO) and (M/M/1: N / FIFO) and problems.	5	

Text book and Reference books:

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Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

1. H. A. Taha, "Operations Research", Pearson
2. P. M. Karak – "Linear Programming and Theory of Games", ABS Publishing House
3. Ghosh and Chakraborty, "Linear Programming and Theory of Games", Central Book Agency
4. Ravindran, Philips and Solberg - "Operations Research", WILEY INDIA

Introduction to Philosophical Thoughts
Code: OEC-IT701B
Contact: 3L

Name of the Course:	Introduction to Philosophical Thoughts	
Course Code: OEC-IT701B	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Nature of Indian Philosophy :** Plurality as well as common concerns. 2. Basic concepts of the Vedic and Upanisadic views : Atman, Jagrata, Svapna, Susupti, Turiya, Brahman, Karma, Rta,Rna,	17	
2	**Carvaka school :** its epistemology, metaphysics and ethics. Mukti	9	
3	**Jainism :** Concepts of sat, dravya, guna, paryaya, jiva, ajiva, anekantavada, syadvada, and nayavada ; pramanas, ahimsa, bondage and liberation.		
4	5. Buddhism : theory of pramanas, theory of dependent origination, the four noble truths; doctrine of momentaryness; theory of no soul. The interpretation of these theories in schools of Buddhism : Vaibhasika, Sautrantrika, Yogacara, Madhyamika.	5	
5	6. Nyaya : theory of Pramanas; the individual self and its liberation ; the idea of God and proofs for His existence.	5	

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Text book and Reference books:

1. M. Hiriyanna : Outlines of Indian Philosophy.
2. C.D.Sharma : A Critical Survey of Indian Philosophy.
3. S.N.Das Gupta : A History of Indian Philosophy Vol – I to V.
4. S.Radhakrishnan : Indian Philosophy Vol – I & II.
5. T.R.V.Murti : Central Philosophy of Buddhism.
6. J.N.Mahanty : Reason and Tradition of Indian Thought.
7. R.D.Ranade : A Constructive Survey of Upanisadic Philosophy.
8. P.T.Raju : Structural Depths of Indian Thought.
9. K.C.Bhattacharya : Studies in Philosophy Vol – 1.
10. Datta and Chatterjee : Introduction of Indian Philosophy

Soft Skills & Interpersonal Communication
Code: OEC-IT701C
Contact: 3L

Name of the Course:	Soft Skills & Interpersonal Communication	
Course Code: OEC-IT701C	Semester: VII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**1. Soft Skills:** An Introduction – Definition and Significance of Soft Skills; Process, Importance and Measurment of Soft Skill Development. **2. Self-Discovery:** Discovering the Self; Setting Goals; Beliefs, Values, Attitude, Virtue. **3. Positivity and Motivation:** Developing Positive Thinking and Attitude; Driving out Negativity; Meaning and Theories of Motivation; Enhancing Motivation Levels.	12	
2	**Interpersonal Communication:** Interpersonal relations; communication models, process and barriers; team communication; developing interpersonal relationships through effective	12	

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	communication; listening skills; essential formal writing skills; corporate communication styles – assertion, persuasion, negotiation. **2. Public Speaking:** Skills, Methods, Strategies and Essential tips for effective public speaking. **3. Group Discussion:** Importance, Planning, Elements, Skills assessed; Effectively disagreeing, Initiating, Summarizing and Attaining the Objective. **4. Non-Verbal Communication:** Importance and Elements; Body Language. **5. Teamwork and Leadership Skills:** Concept of Teams; Building effective teams; Concept of Leadership and honing Leadership skills.		
3	**1. Interview Skills:** Interviewer and Interviewee – in-depth perspectives. Before, During and After the Interview. Tips for Success. **2. Presentation Skills:** Types, Content, Audience Analysis, Essential Tips – Before, During and After, Overcoming Nervousness. 3. Etiquette and Manners – Social and Business. **4. Time Management** – Concept, Essentials, Tips. **5. Personality Development** – Meaning, Nature, Features, Stages, Models; Learning Skills; Adaptability Skills.	12	

Text book and Reference books:

1. Managing Soft Skills for Personality Development – edited by B.N.Ghosh, McGraw Hill India, 2012.
2. English and Soft Skills – S.P.Dhanavel, Orient Blackswan India, 2010.

Project Management and Entrepreneurship
Code: HSMC 701
Contact: 2L+1T

Name of the Course:	Project Management and Entrepreneurship
Course Code: HSMC 701	Semester: VII
Duration: 6 months	Maximum Marks: 100

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Teaching Scheme		Examination Scheme
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: 1hr		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam: 70 Marks
Credit Points:	3	

ENTREPRENEURSHIP

1. Introduction: Meaning and Concept of Entrepreneurship, Innovation and entrepreneurship, Contributions of entrepreneurs to the society, risk-opportunities perspective and mitigation of risks [2L]
2. Entrepreneurship – An Innovation: Challenges of Innovation, Steps of Innovation Management, Idea Management System, Divergent v/s Convergent Thinking, Qualities of a prospective Entrepreneur [2L]
3. Idea Incubation: Factors determining competitive advantage, Market segment, blue ocean strategy, Industry and Competitor Analysis (market structure, market size, growth potential), Demand-supply analysis [4L]
4. Entrepreneurial Motivation: Design Thinking - Driven Innovation, TRIZ (Theory of Inventive Problem Solving), Achievement motivation theory of entrepreneurship – Theory of McClelland, Harvesting Strategies [2L]
5. Information: Government incentives for entrepreneurship, Incubation, acceleration. Funding new ventures – bootstrapping, crowd sourcing, angel investors, Government of India's efforts at promoting entrepreneurship and innovation – SISI, KVIC, DGFT, SIDBI, Defense and Railways [4L]
6. Closing the Window: Sustaining Competitiveness, Maintaining Competitive Advantage, the Changing Role of the Entrepreneur. [2L]
7. Applications and Project Reports Preparation [4L]

8. PROJECT MANAGEMENT : Definitions of Project and Project Management, Issues and Problems in Project Management, Project Life Cycle - Initiation / Conceptualization Phase, Planning Phase, Implementation / Execution Phase, Closure / Termination Phase [4L]

9. Project Feasibility Studies – Pre-Feasibility and Feasibility Studies, Preparation of Detailed Project Report, Technical Appraisal, Economic/Commercial/Financial Appraisal including Capital Budgeting Process, Social Cost Benefit Analysis [2L]

10. Project Planning – Importance of Project Planning, Steps of Project Planning, Project Scope, Work Breakdown Structure (WBS) and Organization Breakdown Structure (OBS), Phased Project Planning [2L]
11. Project Scheduling and Costing – Gantt chart, CPM and PERT Analysis, Identification of the Critical Path and its Significance, Calculation of Floats and Slacks, Crashing, Time Cost Trade-off Analysis, Project Cost Reduction Methods. [6L]

12. Project Monitoring and Control – Role of Project Manager, MIS in Project Monitoring, Project Audit [2L]
13. Case Studies with Hands-on Training on MS-Project [4L]

Text Books and References

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

1. Innovation and Entrepreneurship by Drucker, P.F.; Harper and Row
2. Business, Entrepreneurship and Management: Rao, V.S.P. ;Vikas
3. Entrepreneurship: Roy Rajeev; OUP.
4. Text Book of Project Management: Gopalkrishnan, P. and Ramamoorthy, V.E.; McMillan
5. Project Management for Engineering, Business and Technology: Nicholas, J.M., and Steyn, H.; PHI
6. Project Management: The Managerial Process: Gray, C.F., Larson, E.W. and Desai, G.V.; MGH

**Project
Code: PROJ-IT781
Contact: 12P**

Project work I

The object of Project Work I is to enable the student to take up investigative study in the broad field of Electronics & Communication Engineering, either fully theoretical/practical or involving both theoretical and practical work to be assigned by the Department on an individual basis or two/three students in a group, under the guidance of a Supervisor. This is expected to provide a good initiation for the student(s) in R&D work. The assignment to normally include:

Project Work II & Dissertation

The object of Project Work II & Dissertation is to enable the student to extend further the investigative study taken up under EC P1, either fully theoretical/practical or involving both theoretical and practical work, under the guidance of a Supervisor from the Department alone or jointly with a Supervisor drawn from R&D laboratory/Industry. This is expected to provide a good training for the student(s) in R&D work and technical leadership. The assignment to normally include:

1. In depth study of the topic assigned in the light of the Report prepared under EC P1;
2. Review and finalization of the Approach to the Problem relating to the assigned topic;
3. Preparing an Action Plan for conducting the investigation, including team work;
4. Detailed Analysis/Modelling/Simulation/Design/Problem Solving/Experiment as needed;
5. Final development of product/process, testing, results, conclusions and future directions;
6. Preparing a paper for Conference presentation/Publication in Journals, if possible;
7. Preparing a Dissertation in the standard format for being evaluated by the Department.
8. Final Seminar Presentation before a Departmental Committee.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

SEMESTER – VIII

Signal and Networks
Code: PEC-IT801A
Contact: 3L

Name of the Course:	**Signal and Networks**	
Course Code: PEC-IT801	Semester: VIII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam : 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Objective and overview, signal and system types and classifications, step response, impulse response and convolution integral;	3	
2	**Periodic signal analysis:** Fourier series and properties; Aperiodic signal analysis : Fourier Transform - its properties and sinusoidal steady state analysis of systems;	7	
3	**Elements of electrical network :** dependent and independent sources, active and passive components; classical differential equations for description of transient conditions of Network; Solutions of linear time invariant networks with initial conditions; Unilateral and Bilateral Laplace Transforms and properties; Transient solutions of networks using Laplace Transform; Network functions: poles, zeros, transfer function, Bode plot;	12	
4.	**One and two port network parameters and functions :** Z, Y and ABCD parameters, driving point and transfer impedances and admittances; Network Theorems and Formulation of Network equations: generalized formulation of KCL, KVL, State Variable descriptions; Thevenin, Norton, Maximum Power Transfer, Tellegen and	10	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	Reciprocity Theorems;		
5	**Graph theory:** Tree, Co-tree, fundamental cut-set, fundamental loop analysis of network; Analog filter design: Butterworth, Sallen Key, frequency transformation and scaling;	6	

Text book and Reference books:

1. Signals and Systems by P. Ramesh Babu & R. Ananda Natarajan, Scitech Publications (India) .
2. Signals & Systems by A. V. Oppenheim, A. S. Willsky and S. H. Nawab, Prentice-Hall India .
3. Networks & Systems by D Roy Choudhury.
4. Networks & Systems by Ashfaq Husian.

Cryptography and Network Security
Code: PEC-IT801B
Contact: 3L

Name of the Course:	**Cryptography and Network Security**	
Course Code: PEC-IT801B	Semester: VIII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**
Theory: 3 hrs./week		Mid Semester exam: 15
Tutorial: NIL		Assignment and Quiz: 10 marks
		Attendance: 5 marks
Practical: NIL		End Semester Exam : 70 Marks
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Attacks on Computers & Computer Security - Introduction, Need for Security, Security approaches, Principles of Security, Types of attack	5	
2	Cryptography: Concepts & Techniques- Introduction, Plaintext & Cipher text, Substitution Techniques, Transposition Techniques, Encryption & Decryption, Symmetric & Asymmetric key Cryptography, Key Range & Key Size	7	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

3	Symmetric Key Algorithm - Introduction, Algorithm types & Modes, Overview of Symmetric Key Cryptography, DES(Data Encryption Standard) algorithm, IDEA(International Data Encryption Algorithm) algorithm, RC5(Rivest Cipher 5) algorithm.	8	
4.	Asymmetric Key Algorithm, Digital Signature and RSA - Introduction, Overview of Asymmetric key Cryptography, RSA algorithm, Symmetric & Asymmetric key Cryptography together, Digital Signature, Basic concepts of Message Digest and Hash Function (Algorithms on Message Digest and Hash function not required).	5	
5	Internet Security Protocols, User Authentication - Basic Concepts, SSL protocol, Authentication Basics, Password, Authentication Token, Certificate based Authentication, Biometric Authentication.	6	
6	Electronic Mail Security - Basics of mail security, Pretty Good Privacy, S/MIME.	4	
7	Firewall - Introduction, Types of firewall, Firewall Configurations, DMZ Network	3	

Text book and Reference books:

1. "Cryptography and Network Security", William Stallings, 2nd Edition, Pearson Education Asia
2. "Network Security private communication in a public world", C. Kaufman, R. Perlman and M. Speciner, Pearson
3. Cryptography & Network Security: Atul Kahate, TMH.
4. "Network Security Essentials: Applications and Standards" by William Stallings, Pearson.
5. "Designing Network Security", Merike Kaeo, 2nd Edition, Pearson Books
6. "Building Internet Firewalls", Elizabeth D. Zwicky, Simon Cooper, D. Brent Chapman, 2nd Edition, Oreilly .
7. "Practical Unix & Internet Security", Simson Garfinkel, Gene Spafford, Alan Schwartz, 3rd Edition, Oreilly
8. "Cryptography and Network Security", V.K. Jain, Khanna Publishing House, 2017.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Natural Language Processing
Code: PEC-IT801C
Contacts: 3L

Name of the Course:	**Natural Language Processing**	
Course Code: PEC-IT801C	Semester: VIII	
Duration: 6 months	Maximum Marks:100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance : 5 marks	
Practical:NIL	End Semester Exam :70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Regular Expressions and AutomataRecap)** - Introduction to NLP, Regular Expression, Finite State Automata [2L] **Tokenization -** Word Tokenization, Normalization, Sentence Segmentation, Named Entity Recognition, Multi Word Extraction, Spell Checking – Bayesian Approach, Minimum Edit Distance [5L] **Morphology -** Morphology – Inflectional and Derivational Morphology, Finite State Morphological Parsing, The Lexicon and Morphotactics, Morphological Parsing with Finite State Transducers, Orthographic Rules and Finite State Transducers, Porter Stemmer [4L]	11	
2	**Language Modeling** Introduction to N-grams, Chain Rule, Smoothing – Add-One Smoothing, Witten-Bell Discounting; Backoff, Deleted Interpolation, N-grams for Spelling and Word Prediction, Evaluation of language models. [4L] **Hidden Markov Models and POS Tagging** Markov Chain, Hidden Markov Models, Forward Algorithm, Viterbi Algorithm, Part of Speech Tagging – Rule based and Machine Learning based approaches, Evaluation. [4L]	8	
3	**Text Classification** Text Classification, Naïve Bayes' Text Classification, Evaluation, Sentiment Analysis – Opinion Mining and Emotion Analysis, Resources and Techniques. [4L] **Context Free Grammar** Context Free Grammar and Constituency, Some common CFG phenomena for	9	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	English, Top-Down and Bottom-up parsing, Probabilistic Context Free Grammar, Dependency Parsing [4L]		
4.	**Computational Lexical Semantics** Introduction to Lexical Semantics – Homonymy, Polysemy, Synonymy, Thesaurus – WordNet, Computational Lexical Semantics – Thesaurus based and Distributional Word Similarity [4L] **Information Retrieval** Boolean Retrieval, Term-document incidence, The Inverted Index, Query Optimization, Phrase Queries, Ranked Retrieval – Term Frequency – Inverse Document Frequency based ranking, Zone Indexing, Query term proximity, Cosine ranking, Combining different features for ranking, Search Engine Evaluation, Relevance Feedback [5L]	9	

Text book and Reference books:

1. Speech and Language Processing, Jurafsky and Martin, Pearson Education
2. Foundation of Statistical Natural Language Processing, Manning and Schutze, MIT Press 3. Multilingual Natural Language Processing Applications from Theory to Practice: Bikel, Pearson.

Internet of Things
Code: PEC-IT801D
Contacts: 3L

Course Code	PEC-IT801D
Course Name	**Internet of Things**
Credits	3
Pre-Requisites	Wireless Networks

Total Number of Lectures: 48

COURSE OBJECTIVE
☐ Able to understand the application areas of IOT
☐ Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks
☐ Able to understand building blocks of Internet of Things and characteristics

LECTURE WITH BREAKUP	NO. OF LECTURES

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Unit 1: Environmental Parameters Measurement and Monitoring: Why measurement and monitoring are important, effects of adverse parameters for the living being for IOT	7
Unit 2: Sensors: Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc	8
Unit 3: Important Characteristics of Sensors: Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors	11
Unit 4: Architecture of Smart Sensors: Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel	10
Unit 5: Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor	7
Unit 6: Recent trends in smart sensor for day to day life, evolving sensors and their architecture.	5

COURSE OUTCOMES
On completion of the course the student should be able to
☐ Understand the vision of IoT from a global context.
☐ Determine the Market perspective of IoT.
☐ Use of Devices, Gateways and Data Management in IoT.
☐ Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.
☐ Building state of the art architecture in IoT.

References:
1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, Springer International Publishing
2. Kyung, C.-M., Yasuura, H., Liu, Y., Lin, Y.-L., Smart Sensors and Systems, Springer International Publishing
3. Jeeva Jose, Internet of Things, Khanna Publishing House, 2018.
4. Internet of Things, Arsheep Bahga and Vijay Madisetti

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Remote Sensig and GIS
Code: OEC-IT801E
Contacts: 3L

Name of the Course:	**Remote Sensig and GIS**	
Course Code: PEC-IT801E	Semester:VIII	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz : 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction and Overview of Geographic Information Systems Definition of a GIS, features and functions; why GIS is important; how GIS is applied; GIS as an Information System; GIS and cartography; contributing and allied disciplines; GIS data feeds; historical development of GIS.	3	
2	GIS and Maps, Map Projections and Coordinate Systems Maps and their characteristics (selection, abstraction, scale, etc.); automated cartography versus GIS; map projections; coordinate systems; precision and error.	4	
3	Data Sources, Data Input , Data Quality and Database Concepts Major data feeds to GIS and their characteristics: maps, GPS, images, databases, commercial data; locating and evaluating data; data formats; data quality; metadata. Database concepts and components; flat files; relational database systems; data modeling; views of the database; normalization; databases and GIS.	3	
4.	Spatial Analysis Questions a GIS can answer; GIS analytical functions; vector analysis including topological overlay; raster analysis; statistics; integrated spatial analysis.	3	
5.	Making Maps Parts of a map; map functions in GIS; map design and map elements; choosing a map type; producing a map formats, plotters and media; online and CD-ROM distribution; interactive maps and the Web.	6	
6.	Implementing a GIS Planning a GIS; requirements;	4	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	pilot projects; case studies; data management; personnel and skill sets; costs and benefits; selecting a GIS package; professional GIS packages; desktop GIS; embedded GIS; public domain and lowcost packages.		
1.	Technology & Instruments involved in GIS & Remote Sensing GIS applications; GIS application areas and user segments; creating custom GIS software applications; user interfaces; case studies. Future data; future hardware; future software; Object-oriented concepts and GIS; future issues – data ownership, privacy, education; GIS career options and how to pursue them.	8	
2.	Remote Sensing Remote sensing of environment, E.M. Principle, Thermal infrared remote sensing, Remote sensing of Vegetation, Remote sensing of water, urban landscape	8L	

Text book and Reference books:

1. "Principles of geographical information systems", P. A. Burrough and R. A. Mcdonnel, Oxford. 2. "Remote sensing of the environment" , J. R. Jensen, Pearson References:
2. "Exploring Geographic Information Systems", Nicholas Chrismas, John Wiley & Sons.
3. "Getting Started with Geographic Information Systems",Keith Clarke, PHI.
4. "An Introduction to Geographical Information Systems", Ian Heywood, Sarah Cornelius, and Steve Carver. Addison-Wesley Longman.

Big Data Analytics
Code: OEC-IT801A
Contacts: 3L

Name of the Course:	**Big Data Analytics**	
Course Code: OEC-IT801	Semester:VIII	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz : 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Total Number of Lectures: 48

COURSE OBJECTIVE	
☐ Understand big data for business intelligence. Learn business case studies for big data analytics. Understand nosql big data management. Perform map-reduce analytics using Hadoop and related tools	
LECTURE WITH BREAKUP	**NO. OF LECTUR**
Unit 1: What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data and marketing, fraud and big data, risk and big data, credit risk management, big data and algorithmic trading, big data and healthcare, big data in medicine, advertising and big data, big data technologies, introduction to Hadoop, open source technologies, cloud and big data, mobile business intelligence, Crowd sourcing analytics, inter and trans firewall analytics.	8
Unit 2: Introduction to NoSQL, aggregate data models, aggregates, key-value and document data models, relationships, graph databases, schemaless databases, materialized views, distribution models, sharding, master-slave replication, peer-peer replication, sharding and replication, consistency, relaxing consistency, version stamps, map-reduce, partitioning and combining, composing map-reduce calculations.	8
Unit 3: Data format, analyzing data with Hadoop, scaling out, Hadoop streaming, Hadoop pipes, design of Hadoop distributed file system (HDFS), HDFS concepts, Java interface, data flow, Hadoop I/O, data integrity, compression, serialization, Avro, file-based data structures	9
Unit 4: MapReduce workflows, unit tests with MRUnit, test data and local tests, anatomy of MapReduce job run, classic Map-reduce, YARN, failures in classic Map-reduce and YARN, job scheduling, shuffle and sort, task execution, MapReduce types, input formats, output formats	10
Unit 5:	7
Hbase, data model and implementations, Hbase clients, Hbase examples, praxis.Cassandra, Cassandra data model, Cassandra examples, Cassandra clients, Hadoop integration.	
Unit 6: Pig, Grunt, pig data model, Pig Latin, developing and testing Pig Latin scripts. Hive, data types and file formats, HiveQL data definition, HiveQL data manipulation, HiveQL queries.	6

COURSE OUTCOMES
After completion of course, students would be:

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

- Describe big data and use cases from selected business domains
- Explain NoSQL big data management
- Install, configure, and run Hadoop and HDFS
- Perform map-reduce analytics using Hadoop
- Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics

References:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging
2. V.K. Jain, Big Data and Hadoop, Khanna Publishing House, New Delhi (2017).
3. V.K. Jain, Data Analysis, Khanna Publishing House, New Delhi (2019).
4. Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
5. P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012.
6. Tom White, "Hadoop: The Definitive Guide", Third Edition, O'Reilley, 2012.
7. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
8. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.
9. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
10. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
11. Alan Gates, "Programming Pig", O'Reilley, 2011.

Cyber Law and Ethics
Code: OEC-IT801B
Contacts: 3L

Name of the Course:	Cyber Law and Ethics	
Course Code: OEC-IT801B	Semester:VIII	
Duration:6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory: 3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz : 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction of Cybercrime:** What is cybercrime?, Forgery, Hacking, Software Piracy, Computer Network intrusion[4L]. **Category of Cybercrime:** how criminals plan attacks, passive attack, Active attacks, cyberstalking. [4L]	8	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

2	**Cybercrime Mobile & Wireless devices:** Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cellphones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop [8L]	8	
3	**Tools and Methods used in Cyber crime:** Proxy servers, panword checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: buffer over flow. [8L]	8	
4.	**Phishing & Identity Theft:** Phising methods, ID Theft; Online identity method. [4L] **Cybercrime & Cybersecurity:** Legal aspects, indian laws, IT act, Public key certificate. [4L]	8	

Text book and Reference books:

1. Cyber security by Nina Gobole & Sunit Belapune; Pub: Wiley India.
2. Information Security & Cyber laws, Gupta & Gupta, Khanna Publishing House

Mobile Computing
Code: OEC-IT801C
Contacts: 3L

Name of the Course:	**Mobile Computing**	
Course Code: **OEC-IT801C**	Semester: VIII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory:3 hrs./week	Mid Semester exam: 15	
Tutorial: 3L	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	Introduction to Personal Communications Services (PCS): PCS Architecture, Mobility management, Networks signalling. Global System for Mobile Communication (GSM) system overview: GSM Architecture, Mobility management, Network signalling.	5	
2	General Packet Radio Services (GPRS): GPRS Architecture, GPRS Network Nodes. Mobile Data Communication: WLANs (Wireless LANs) IEEE	5	

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	802.11 standard, Mobile IP.		
3	Wireless Application Protocol (WAP): The Mobile Internet standard, WAP Gateway and Protocols, wireless mark up Languages (WML). Wireless Local Loop(WLL): Introduction to WLL Architecture, wireless Local Loop Technologies.	7	
4.	Third Generation (3G) Mobile Services: Introduction to International Mobile Telecommunications 2000 (IMT 2000) vision, Wideband Code Division Multiple Access (W-CDMA), and CDMA 2000, Quality of services in 3G	7	
5	Global Mobile Satellite Systems; case studies of the IRIDIUM and GLOBALSTAR systems. Wireless Enterprise Networks: Introduction to Virtual Networks, Blue tooth technology, Blue tooth Protocols.	7	
6	Server-side programming in Java, Pervasive web application architecture, Device independent example application	8	

Text book and Reference books:

1. "Pervasive Computing", Burkhardt, Pearson
2. "Mobile Communication", J. Schiller, Pearson
3. "Wireless and Mobile Networks Architectures", Yi-Bing Lin & Imrich Chlamtac, John Wiley & Sons, 2001
4. "Mobile and Personal Communication systems and services", Raj Pandya, Prentice Hall of India, 2001.
5. "Guide to Designing and Implementing wireless LANs", Mark Ciampa, Thomson learning, Vikas Publishing House, 2001.
6. "Wireless Web Development", Ray Rischpater, Springer Publishing,
7. "The Wireless Application Protocol", Sandeep Singhal, Pearson .
8. "Third Generation Mobile Telecommunication systems", by P.Stavronlakis, Springer Publishers.
9. Brijesh Gupta "Mobile Computing", Khanna Publishing House, New Delhi

Bio Informatics
Code: OEC-IT801D
Contacts: 3L

Name of the Course:	**Bio Informatics**	
Course Code: OEC-IT801D	Semester: VIII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme		**Examination Scheme**

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Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Theory:3 hrs./week		Mid Semester exam: 15	
Tutorial: NIL		Assignment and Quiz: 10 marks	
		Attendance: 5 marks	
Practical: NIL		End Semester Exam: 70 Marks	
Credit Points:	3		

Unit	Content	Hrs/Unit	Marks/Unit
1	**INTRODUCTION TO MOLECULAR BIOLOGY** Concepts of Cell, tissue, types of cell, components of cell, organelle. Functions of different organelles. Concepts of DNA: Basic Structure of DNA; Double Helix structure; Watson and crick model. Exons and Introns and Gene Concept. Concepts of RNA : Basic structure, Difference between RNA and DNA. Types of RNA. Concept of Protein: Basic components and structure. Introduction to Central Dogma: Transcription and Tranlation Introduction to Metabolic Pathways.	5	
2	**Sequence Databases** Introduction to Bioinformatics. Recent challenges in Bioinformatics. Protein Sequence Databases, DNA sequence databases. sequence database search programs like BLAST and FASTA. NCBI different modules: GenBank; OMIM, Taxonomy browser, PubMed;	2	
3	**DNA SEQUENCE ANALYSIS** DNA Mapping and Assembly : Size of Human DNA ,Copying DNA: Polymerase Chain Reaction (PCR), Hybridization and Microarrays, Cutting DNA into Fragments, Sequencing Short DNA Molecules, Mapping Long DNA Molecules. DeBruijn Graph. Sequence Alignment: Introduction, local and global alignment, pair wise and multiple alignment, Dynamic Programming Concept. Alignment algorithms: Needleman and Wunsch algorithm, Smith-Waterman.	14	
4.	**Introduction Probabilistic models used in Computational Biology** Probabilistic Models; Hidden Markov Model : Concepts, Architecture, Transition matrix, estimation matrix. Application of HMM in Bioinformatics : Genefinding, profile searches, multiple sequence alignment and regulatory site identification. Bayesian networks Model :Architecture, Principle ,Application in Bioinformatics.	8	
5.	**Biological Data Classification and Clustering** Assigning protein function and predicting splice sites: Decision Tree	6	

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Robotics
Code: OEC-IT801E
Contacts: 3L

Name of the Course:	**Robotics**	
Course Code: OEC-IT801E	Semester: VIII	
Duration: 6 months	Maximum Marks: 100	
Teaching Scheme	**Examination Scheme**	
Theory:3 hrs./week	Mid Semester exam: 15	
Tutorial: NIL	Assignment and Quiz: 10 marks	
	Attendance: 5 marks	
Practical: NIL	End Semester Exam: 70 Marks	
Credit Points:	3	

Unit	Content	Hrs/Unit	Marks/Unit
1	**Introduction :**Introduction -- brief history, types, classification and usage, Science and Technology of robots, Some useful websites, textbooks and research journals.	1	
2	**Elements of robots – links, joints, actuators, and sensors** Position and orientation of a rigid body, Homogeneous transformations, Representation of joints, link representation using D-H parameters, Examples of D-H parameters and link transforms, different kinds of actuators – stepper, DC servo and brushless motors, model of a DC servo motor, Types of transmissions, Purpose of sensors, internal and external sensors, common sensors – encoders, tachometers, strain gauge based force-torque sensors, proximity and distance measuring sensors, and vision.	5	
3	**Kinematics of serial robots** Introduction, Direct and inverse kinematics problems, Examples of kinematics of common serial manipulators, workspace of a serial robot, Inverse kinematics of constrained and redundant robots, Tractrix based approach for fixed and free robots and multi-body systems, simulations and experiments, Solution procedures using theory of elimination, Inverse kinematics solution for the general 6R serial manipulator**.**	4	
4.	**Kinematics of parallel robots** Degrees-of-freedom of parallel mechanisms and manipulators, Active and passive joints, Constraint and loop-closure equations,	5	

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	Direct kinematics problem, Mobility of parallel manipulators, Closed-from and numerical solution, Inverse kinematics of parallel manipulators and mechanisms, Direct kinematics of Gough-Stewart platform.		
5.	**Velocity and static analysis of robot manipulators** Linear and angular velocity of links, Velocity propagation, Manipulator Jacobians for serial and parallel manipulators, Velocity ellipse and ellipsoids, Singularity analysis for serial and parallel manipulators, Loss and gain of degree of freedom, Statics of serial and parallel manipulators, Statics and force transformation matrix of a Gough-Stewart platform, Singularity analysis and statics.	5	
6	**Dynamics of serial and parallel manipulators** Mass and inertia of links, Lagrangian formulation for equations of motion for serial and parallel manipulators, Generation of symbolic equations of motion using a computer, Simulation (direct and inverse) of dynamic equations of motion, Examples of a planar 2R and four-bar mechanism, Recursive dynamics, Commercially available multi-body simulation software (ADAMS) and Computer algebra software Maple.	4	
7	**Motion planning and control** Joint and Cartesian space trajectory planning and generation, Classical control concepts using the example of control of a single link, Independent joint PID control, Control of a multi-link manipulator, Non-linear model based control schemes, Simulation and experimental case studies on serial and parallel manipulators, Control of constrained manipulators, Cartesian control, Force control and hybrid position/force control, Advanced topics in non-linear control of manipulators. 8 Module 8: Modeling and	6	
8	**Modeling and control of flexible robots** Models of flexible links and joints, Kinematic modeling of multi-link flexible robots, Dynamics and control of flexible link manipulators, Numerical simulations results, Experiments with a planar two-link flexible manipulator.	4	
9	**Modeling and analysis of wheeled mobile robots** 3Introduction and some well known wheeled mobile robots (WMR), two and three-wheeled WMR on flat surfaces, Slip and its modeling, WMR on uneven terrain, Design of slip-free motion on uneven terrain,	3	

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

	Kinematics, dynamics and static stability of a three-wheeled WMR's on uneven terrain, Simulations using Matlab and ADAMS.		
10	**Selected advanced topics in robotics** Introduction to chaos, Non-linear dynamics and chaos in robot equations, Simulations of planar 2 DOF manipulators, Analytical criterion for unforced motion. Gough-Stewart platform and its singularities, use of near singularity for fine motion for sensing, design of Gough-Stewart platform based sensors. Over-constrained mechanisms and deployable structures, Algorithm to obtain redundant links and joints, Kinematics and statics of deployable structures with pantographs or scissor-like elements (SLE's).	3	

Text book and Reference books:
1. Robotics Process Automation, Khanna Publishing House
2. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014
3. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

E-Commerce & ERP:
Code: OEC-IT802A
Contacts: 3L

1. Overview, Definitions, Advantages & Disadvantages of E – Commerce, Threats of E – Commerce, Managerial Prospective, Rules & Regulations For Controlling E – Commerce, Cyber Laws. [3 L]
2. Technologies : Relationship Between E – Commerce & Networking, Different Types of Networking Commerce, Internet, Intranet & Extranet, EDI Systems Wireless Application Protocol : Definition, Hand Held Devices, Mobility & Commerce, Mobile Computing, Wireless Web, Web Security, Infrastructure Requirement For E – Commerce . [5 L]
3. Business Models of e – commerce : Model Based On Transaction Type, Model Based On Transaction Party - B2B, B2C, C2B, C2C, E – Governance. [2 L]
4. E – strategy : Overview, Strategic Methods for developing E – commerce. [2 L]
5. Four C's : (Convergence, Collaborative Computing, Content Management & Call Center). Convergence : Technological Advances in Convergence – Types, Convergence and its implications, Convergence & Electronic Commerce. Collaborative Computing : Collaborative product development, contract as per CAD, Simultaneous Collaboration, Security. Content Management : Definition of content, Authoring Tools & Content Management, Content – partnership, repositories, convergence, providers, Web Traffic & Traffic Management ; Content Marketing. Call Center : Definition, Need, Tasks Handled, Mode of Operation, Equipment , Strength & Weaknesses of Call Center, Customer Premises Equipment (CPE). [6 L]

PG

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

7. Supply Chain Management : E – logistics, Supply Chain Portal, Supply Chain Planning Tools (SCP Tools), Supply Chain Execution (SCE), SCE - Framework, Internet's effect on Supply Chain Power. [3 L]

8. E – Payment Mechanism : Payment through card system, E – Cheque, E – Cash, E – Payment Threats & Protections. [1 L]

9. E – Marketing :. Home –shopping, E-Marketing, Tele-marketing [1 L]

10. Electronic Data Interchange (EDI) : Meaning, Benefits, Concepts, Application, EDI Model, Protocols (UN EDI FACT / GTDI, ANSI X – 12), Data Encryption (DES / RSA). [2 L]

11. Risk of E – Commerce : Overview, Security for E – Commerce, Security Standards, Firewall, Cryptography, Key Management, Password Systems, Digital certificates, Digital signatures. [4 L]

12. Enterprise Resource Planning (ERP) : Features, capabilities and Overview of Commercial Software, re-engineering work processes for IT applications, Business Process Redesign, Knowledge engineering and data warehouse . Business Modules: Finance, Manufacturing (Production), Human Resources, Plant Maintenance, Materials Management, QualityManagement, Sales&Distribution ERPPackage, ERP Market: ERP Market Place, SAP AG, PeopleSoft, BAAN, JD Edwards, Oracle Corporation ERP-Present and Future: Enterprise Application Integration (EAI), ERP and E-Commerce, ERP and Internet, Future Directions in ERP [10]

Reference :

1. E-Commerce,M.M. Oka, EPH
2. Kalakotia, Whinston : Frontiers of Electronic Commerce , Pearson Education.
3. Bhaskar Bharat : Electronic Commerce - Technologies & Applications.TMH
4. Loshin Pete, Murphy P.A. : Electronic Commerce , Jaico Publishing Housing.
5. Murthy : E – Commerce , Himalaya Publishing.
6. E – Commerce : Strategy Technologies & Applications, Tata McGraw Hill.
7. Global E-Commerce, J. Christopher & T.H.K. Clerk, University Press
8. Beginning E-Commerce, Reynolds, SPD
9. Krishnamurthy, E-Commerce Mgmt, Vikas

Micro-electronics and VLSI Design
Code: OEC-IT802B
Contact: 3L
Credits: 3
Allotted Hrs: 39L

Introduction to CMOS circuits: MOS Transistors, MOS transistor switches, CMOS Logic, The inverter, Combinational Logic, NAND gate, NOT Gate, Compound Gates, Multiplexers, Memory-Latches and Registers. [6L]

Processing Technology: Silicon Semiconductor Technology- An Overview, wafer processing, oxidation, epitaxy deposition, Ion-implantation and diffusion, The Silicon Gate Process- Basic CMOS Technology, basic n-well CMOS process, p-well CMOS process, Twin tub process, Silicon on insulator, CMOS process enhancement-Interconnect, circuit elements, 3-D CMOS. Layout Design Rule: Layer Representations, CMOS n-well Rules, Design Rule of background scribe line, Layer Assignment, SOI Rule [10L] .

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Power Dissipation: Static dissipation, Dynamic dissipation, short-circuit dissipation, total power dissipation. Programmable Logic, Programmable Logic structure, Programmable interconnect, and Reprogramable Gate Array: Xilinx Programmable Gate Array, Design Methods: Behavioural Synthesis, RTL synthesis [8L]

Placement: placement: Mincut based placement – Iterative improvement placement simulated annealing. Routing: Segmented channel routing – maze routing – routability and routing resources – net delays. [5L]

Verification and Testing: Verification Versus Testing, Verification: logic simulation design validation – timing verification – Testing concepts: failures – mechanisms and faults – fault coverage – ATPG methods – types of tests – FPGAs – programmability failures – design for testability. [5L]

Overview of VHDL [5L]

Text Book:

1."Digital Integrated Circuit", J.M.Rabaey, Chandrasan, Nicolic, Pearson
2. "CMOS Digital Integrated Circuit", S.M.Kang & Y.Leblebici, TMH
3."Modern VLSI Design" Wayne Wolf, Pearson
4."Algorithm for VLSI Design & Automation", N.Sherwani, Kluwer
5."VHDL", Bhaskar, PHI

References:

1. " Digital Integrated Circuits" Demassa & Ciccone, Willey Pub.
2. "Modern VLSI Design: system on silicon" Wayne Wolf; Addison Wesley Longman Publisher
3. "Basic VLSI Design" Douglas A. Pucknell & Kamran Eshranghian; PHI
4. "CMOS Circuit Design, Layout & Simulation", R.J.Baker, H.W.Lee, D.E. Boyee, PHI

Economic Policies in India
Code: OEC-IT802C
Contacts: 3L

Economic Development and its Determinants
Approaches to economic development and its measurement – sustainable development; Role of State, market and other
institutions; Indicators of development – PQLI, Human Development Index (HDI), gender development indices.
Planning in India
Objectives and strategy of planning; Failures and achievements of Plans; Developing grass-root organizations for
development – Panchayats, NGOs and pressure groups.
Demographic Features, Poverty and Inequality

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Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

Broad demographic features of Indian population; rural-urban migration; Urbanization and civic amenities; Poverty and
Inequality.

Resource Base and Infrastructure
Energy; social infrastructure – education and health; Environment; Regional imbalance; Issues and policies in financing
infrastructure development.

The Agricultural Sector
Institutional Structure – land reforms in India; Technological change in agriculture – pricing of agricultural inputs and output;
industry; Agricultural finance policy; Agricultural Marketing and Warehousing; Issues Terms of trade between agriculture
and in food security – policies for sustainable agriculture.

Section – II
Industrial policy; Public Sector enterprises and their performance; Problem of sick units in India; Privatization and
disinvestment debate; Growth and pattern of industrialization; Small-scale sector; Productivity in industrial sector; Exit
policy – issues in labour market reforms; approaches for employment generation.

Public Finances
Fiscal federalism – Centre-State financial relations; Finances of central government; Finances of state governments; Parallel
economy; Problems relating to fiscal policy; Fiscal sector reforms in India.

Money, Banking and Prices
Analysis of price behaviour in India; Financial sector reforms; Interest rate policy; Review of monetary policy of RBI; Money
and capital markets; Working of SEBI in India.

External Sector
Structure and direction of foreign trade; Balance of payments; Issues in export-import policy and FEMA; Exchange rate
policy; Foreign capital and MNCs in India; The progress of trade reforms in India.

Economic Reforms
Rationale of internal and external reforms; Globalization of Indian economy; WTO and its impact on the different sectors of
the economy; Need for and issues in good governance; Issues in competition and safety nets in Indian economy.

BASIC READING LIST

1. Ahluwalia, I. J. and I. M. D Little (Eds.) (1999), India's Economic Reforms and Development (Essays in honour of Manmohan
Singh), Oxford University Press, New Delhi.
2. Bardhan, P. K. (9th Edition) (1999), The Political Economy of Development in India, Oxford University Press, New Delhi.
3. Bawa, R. s. and P. S. Raikhy (Ed.) (1997), Structural Changes in Indian Economy, Guru Nanak Dev University Press,
Amritsar.

Maulana Abul Kalam Azad University of Technology, West Bengal
(Formerly West Bengal University of Technology)
Syllabus for B. Tech in Information Technology
(Applicable from the academic session 2018-2019)

4. Brahmananda, P. R. and V. R. Panchmukhi (Eds.) (2001), Development Experience in the Indian Economy: Inter-State
Perspectives, Book well, Delhi.
5. Chakravarty, S. (1987), Development Planning : The Indian Experience, Oxford University Press, New Delhi.
6. Dantwala, M. L. (1996), Dilemmas of Growth : The Indian Experience, Sage Publications, New Delhi.
7. Datt, R. (Ed.) (2001), Second Generation Economic Reforms in India, Deep & Deep Publications, New Delhi.
8. Government of India, Economic Survey (Annual), Ministry of Finance, New Delhi.
9. Jain, a. K. (1986), Economic Planning in India, Ashish Publishing House, New Delhi.
10. Jalan, B. (1992), The Indian Economy – Problems and Prospects, Viking, New Delhi.

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