M.Tech COURSE

Title of the Course :

The Course shall be termed as Master of Technology (M.Tech) Course in Computer Science and Engineering of the University of Calcutta under the Faculty Council for Post Graduate studies of Engineering and Technology.

Minimum Qualifications for Admission:

B.Tech. / B.E. in Computer Science / Computer Science & Engineering / Information Technology (C.U.) / Computer Science & Technology, MCA (with B.Sc. (Honours) in Physics / Mathematics / Statistics / Computer Science / Electronic Science) or M.Sc. in Computer and Information Science (with B.Sc. (Honours) in Computer Science from University of Calcutta) or equivalent degree in Computer Science from other University.

Duration :

Duration of the course will be of 2 academic years consisting of 4 semesters, each of six months duration. At the end of each semester an examination of the courses covered in the semester will be held. This examination will be referred to as M.Tech. Examination of that semester.

Course Work :

The course work that each student will have to complete in each semester is as follows. Each course will be covered in approximately 40 lecture hours.

Curriculum :

Semester – I

Course No.	Course Name	Periods/week	Marks
CSE101	**Algorithms and Algorithmic Complexity**	**3**	**100**
CSE102	**Cryptography and Network Security**	**3**	**100**
CSE103	**Advanced Database Management Systems**	**3**	**100**
CSE104	**Elective – I ***	**3**	**100**
CSE105 (P)	**Systems Design Lab. - I**	**-**	**100**

*** Elective-I : (Any one)**

1. **Distributed Systems**
2. **Bioinformatics**
3. **Soft Computing**
4. **Multimedia System**

Semester – II

Course No.	Course Name	Periods/week	Marks
CSE201	VLSI Design	3	100
CSE202	Gr. A – Image processing	2	50
	Gr. B – Embedded Systems	2	50
CSE203	Mobile and Wireless Computing	3	100
CSE204	Elective – II *	3	100
CSE205 (P)	Systems Design Lab. – II	-	100

*** Elective-II : (Any one)**

1. **Real-time Systems**
2. **Advanced Software Engineering**
3. **Cluster and Grid Computing**
4. **Natural Language Processing**

Semester – III

Course Name	Marks
Project - I #	200
Seminar *	100
General Viva-Voce	100

*** Seminar: Each student will be allotted a topic of seminar at the beginning of the current semester. The student will have to submit a written presentation and give a seminar on that topic on a date and time to be announced subsequently.**

 # Project - I : Each student will have to undertake a project work under a supervisor. The work will have to be carried out during the 3rd semester of study. The student will have to submit a typewritten or printed report on the work done by him / her according to a schedule to be announced by the department. The project-report should be duly approved by the supervisor concerned and should embody results of research / development work carried out by the student. A project work is to be carried out within department under the guidance of the thesis supervisor who must be a faculty member of the department.

Semester – IV

Course Name	Marks
Project - II ##	**400**

Project - II : Each student will have to undertake a project work under a supervisor. The work will have to be carried out during the 4th semester of study. The student will have to submit typewritten or printed report on the work done by him / her according to a schedule to be announced by the department. The project-report should be duly approved by the supervisor concerned and should embody results of research / development work carried out by the student. A project work may be carried out within department or in any other academic / research / industrial / commercial organization under the guidance of the thesis supervisor who must be a faculty member of the department or under a joint supervision including at least one such faculty member.

- Requirement for the M.Tech. Degree :
- To qualify for M.Tech. degree in Computer Science & Engineering a student will have to complete the total requirement as follows :

Total Marks

In first semester, a course work consisting of 4-courses each of 100 marks together with a practical paper of 100-marks.	**400 (Theory)** **100 (Practical)**
In second semester a course work consisting of In second semester a course work consisting of practical paper of 100 marks	**400 (Theory)** **100 (Practical)**
In third semester a project work of 200-marks, a seminar of 100 marks, and a general viva-voce of 100 marks.	**200 (Project)** **100 (Seminar)** **100 (General Viva-voce)**
In fourth semester a project work of 400 marks	**400 (Project)**
Grand Total (for M.Tech. Course)	**1800 Marks**

Examination :

An examination will be held at the end of each semester.

Course Work	**For each theoretical paper there will be a theoretical examination of 4-hour duration at the end of the semester.**
Seminar	**At the end of 3rd semester each student will have to deliver a seminar lecture on the topic assigned to him / her. Assessment will be made by a set of examiners which should consist of at least two faculty members.**
Project - I	**At the end of the third semester, assessment of the project work of each student will be made by the board of examiners including supervisors on the basis of a viva-voce examination and the report submitted by the student.**
General Viva-Voce	**At the end of 3rd semester, all the students will have to appear at a general viva-voce test to be conducted by a board of examiners consisting of the faculty members of the department and external examiners.**
Project - II	**At the end of 4th semester, the thesis work of all students will be assessed by a board of examiners consisting of supervisors and external examiners.**
Practical Paper	**Assessment of performance in the practical papers will be made as follows – 50% marks will be set apart for the sessional work and laboratory report and the rest 50% marks will be for viva voce test / examinations which will be conducted by a board of examiners appointed from the faculty members of the department.**

Minimum Requirements for the M.Tech. Degree :

To pass an examination a student will have to earn at least the following marks :

For each theoretical course work	**50**
For Seminar	**50**
For Project - I (3rd Semester)	**50**
For each Practical paper	**50**
For General viva-voce	**50**
For Project – II (4th Semester)	**50**

The 2nd, 3rd and 4th Semester will begin immediately after the completion of the respective previous Semester examination.

Attendance :

In order to be eligible for appearing at a Semester examination a candidate shall have to pursue a regular course of studies in the subject and attend at least 65% of the theoretical and practical classes separately during the academic session. Candidates who fail in any paper and appear for the same at subsequent chances need not attend classes.

Additional Chances:

- A student failing in a course work or seminar or project will have a chance to reappear at an examination for that course / seminar / project of the next corresponding semester examination. Marks in course / seminar / project in which he / she have passed will be considered at the time of computation of his / her final result and it is not necessary to reappear at the other examinations. For reappearing at a course examination it will not be necessary to attend lectures.
- A student failing or absent in more than two paper in a semester, will be declared to have failed in that semester. He / She will have to appear afresh from that particular semester in the next academic session.
- A student failing in project work will have to complete a new project work. Examination will be held as per rules.
- To complete a course / seminar / project work a student will have at most two consecutive chances in next two corresponding examinations after the first examination in which he / she was registered or was eligible to appear as a regular student.

Award of Degree

1. A student will complete the minimum requirements in both the parts will be declared to have passed the M.Tech. examination in Computer Science & Engineering of the University of Calcutta.
2. A student who will earn in aggregate 50% or above but less than 66% of the grand total will be declared to have passed M.Tech. examination with second class and a student who will earn in aggregate 66% and above of the grand total will be declared to have passed M.Tech. examination with first class.

3. The student passing the examination as in (i) and (ii) above will be awarded degree of Master of Technology (M.Tech.) in Computer Science & Engineering, University of Calcutta and be placed in First / Second Class (as the case may be) as per rules of University of Calcutta, the University would publish a list of successful candidates in order of merit.

Detailed Syllabus

CSE101 : Algorithms and Algorithmic Complexity

- Fundamentals of Mathematics: Linear Algebra, Combinatorics, Boolean Functions, Number Theory.
- Fundamentals of Algorithms: Classification of Problems, Complexity, Asymptotic Notations.
- Recurrences: Master Theorem
- Probabilistic Analysis: Sort, Search, Random Binary Search trees, Red-black trees, Priority Queues, Bipartite Matching, Common Subsequence Problem, Flow Networks, Ford-Fulkerson Method, Fast Fourier Transforms, Knuth-Morris-Pratt Algorithm, Convex Hull, Point Location.
- Combinatorial Algorithms: Generating Permutations, Generating Partitions.

- Approximation Algorithms: Concept, Design, Applications. In approximability. Number -Theoretic Algorithms. Randomized Algorithms, Primality Testing, Constrained and Unconstrained Optimization, Evolutionary Algorithms.

Books / References :

1. Introduction to Algorithms - T. H. Cormen, et. al. (PHI, 1990)
2. Algorithms for Hard Problems - J. Hromkovic (Springer)

3. Analysis of Algoriyhms & Data Structures - L. Banachowski, et. al. (Addison Wesley)

CSE102 : Cryptography and Network Security

- Principles of Security, Basic Cryptographic techniques, Classification of attacks, Virus, Worm, Trojan Horse, Spam etc.
- Symmetric Key Cryptography : Algorithm types and modes, Cryptographic Algorithms
- Asymmetric Key Cryptographic Algorithms, Digital Signature
- Digital Envelope, Message Authentication Code, Message Digest
- Public-Key Infrastructure (PKI)
- Authentication: Classifications, Mutual authentication Algorithms, Kerberos
- Security in layers and domains: IPsec, Secure Socket Layer (SSL), E-mail Security

- Electronic transactions

Books / References :

1. Cryptography and Network Security : Atul Kahate , TMH
2. Cryptography and Network Security : Principles & Practices : William Stallings, 4th Edition Pearson & Printice Hall

3. Network Security : Kaufman , Perlman, Speciner, Pearson Education

CSE103 : Advanced Database Management Systems

- Distributed Database: Distributed database architecture, levels of distribution transparency, DDB design, Translation of global queries, Query optimization for DDB, Concurrency control for DDB
- Object Oriented Database: OO paradigm, OO data models: Object identifiers, Relationship and Integrity, ER Diagramming model for OO relationships, Object relational data models
- Data Warehousing: Components, Building a data warehouse, Data extraction, cleanup and transformation, OLAP

- Future Trends in data models: Semantic data models, DM for loosely structured data items, Multimedia database.

Books / References :

1. Alex Berson, Stephen J Smith; "Data Warehousing, Data Mining, and OLAP"; Tata McGraw-Hill Publishing Company Limited, 1997, ISBN 0-07-058741-8

2. S Ceri, G Pelagatti; ""Distributed Databases: Principles and Systems"; Tata McGraw-Hill Publishing Company Limited, ISBN 0-07-066215-0
3. M Tamer Ozsu, P Valduriez; "Principles of Distributed Database Systems"; Pearson Education Pvt. Ltd., 2005, ISBN 81-7808-375-2.
4. J. L. Harrington; "Object Oriented Database Design Clearly Explained"; Morgan Kaufmann Publishers, 2001, ISBN 0-12-326428-6.

5. A K Majumder, P Bhattacharya; "Database Management Systems"; Tata McGraw-Hill Publishing Company Limited, 2004, ISBN 0-07-462239-0
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CSE104(a) : Distributed Systems

- Introduction: definition, characteristics and challenges of distributed systems, Architectural models (client-server).
- Time: Physical and logical time, Event ordering, Clock Synchronization, Message delivery ordering.
- Inter-process communication (sockets, UDP/TCP), Overview of middleware, Web services, RPC.
- Operating system support - Mutual exclusion, termination detection, deadlock, process migration, replication management, threads, multi-threaded client/server.
- Distributed file service (design options, file sharing, access control).
- Distributed transactions (flat/nested, one/two phase commit).
- Security - main threats and techniques for ensuring security (secure channels, firewalls).
- Fault-tolerance and availability (passive/active replication, gossip architectures).

- Applications. Pervasive computing environments: active office, home and city, Events, composite events, mobility and location-tracking, Electronic health, police and transport services.

CSE104(b) : Bioinformatics

- Basic Biology: What is life? The unity and the diversity of living things. Prokaryotes and Eukaryotes, Yeast and People, Evolutionary time and relatedness, Living parts: Tissues, cells, compartments and organelles, Central dogma of molecular biology, Concept of DNA, RNA, Protein and metabolic pathway. What is Bioinformatics? Recent challenges in Bioinformatics.
- Biological databases: Their needs and challenges. Example of different biological databases – sequence, structure, function, micro-array, pathway, etc.
- Sequence Analysis: Theory and Tools: -Pairwise alignment – Different local and global search alignment, Heuristic searches (like BLAST) applicable to search against database, Multiple alignment algorithms, Whole genome comparison.
- Walk through the genome: Prediction of regulatory motifs, Operon, Gene, splices site, etc.
- Markov models: Hidden Markov models – The evaluation, decoding and estimation problem and the algorithms. Application in sequence analysis.
- Molecular phylogeny: maximum Parsimony, distance Matrix and maximum likelihood methods. Concepts of adaptive evolution.

- Application of graph theory in Biology: Biochemical Pathway, Protein-protein interaction network, Regulatory network and their analysis.

Books / References :

1. Bioinformatics: David Mount

2. Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic acids, R. Durbin, S.R. Eddy, A. Krogh and G. Mitchison.

CSE104(c) : Soft Computing

- Soft Computing: Introduction, requirement, different tools and techniques, usefulness and applications.
- Fuzzy sets and Fuzzy logic: Introduction, Fuzzy sets versus crisp sets, operations on fuzzy sets, Extension principle, Fuzzy relations and relation equations, Fuzzy numbers, Linguistic variables, Fuzzy logic, Linguistic hedges, Applications, fuzzy controllers, fuzzy pattern recognition, fuzzy image processing, fuzzy database.
- Artificial Neural Network: Introduction, basic models, Hebb's learning, Adaline, Perceptron, Multilayer feed forward network, Back propagation, Different issues regarding convergence of Multilayer Perceptron, Competitive learning, Self-Organizing Feature Maps, Adaptive Resonance Theory, Associative Memories, Applications.
- Evolutionary and Stochastic techniques: Genetic Algorithm (GA), different operators of GA, analysis of selection operations, Hypothesis of building blocks, Schema theorem and convergence of Genetic Algorithm, Simulated annealing and Stochastic models, Boltzmann Machine, Applications.

- Rough Set: Introduction, Imprecise Categories Approximations and Rough Sets, Reduction of Knowledge, Decision Tables, and Applications.

- Hybrid Systems: Neural-Network-Based Fuzzy Systems, Fuzzy Logic-Based Neural Networks, Genetic Algorithm for Neural Network Design and Learning, Fuzzy Logic and Genetic Algorithm for Optimization, Applications.

Books / References :

1. Neural Fuzzy Systems, Chin-Teng Lin & C. S. George Lee, Prentice Hall PTR.
2. Fuzzy Sets and Fuzzy Logic, Klir & Yuan, PHI, 1997.
3. Neural Networks, S. Haykin, Pearson Education, 2ed, 2001.
4. Genetic Algorithms in Search and Optimization, and Machine Learning, D. E. Goldberg, Addison-Wesley, 1989.
5. Neural Networks, Fuzzy logic, and Genetic Algorithms, S. Rajasekaran & G. A. V. Pai, PHI.
6. Neuro-Fuzzy and Soft Computing, Jang, Sun, & Mizutani, PHI.
7. Learning and Soft Computing, V. Kecman, MIT Press, 2001.
8. Rough Sets, Z. Pawlak, Kluwer Academic Publisher, 1991.

9. Intelligent Hybrid Systems, D. Ruan, Kluwer Academic Publisher, 1997.

CSE104(d) : Multimedia Systems

Books / References :

CSE 105 (P) Systems Design Lab. - I :

a)Hardware-oriented Application Lab
b)Software-oriented Application Lab.

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