# BANGALORE UNIVERSITY

## SCHEME OF STUDY AND EXAMINATIONS

FOR ME DEGREE COURSE IN COMPUTER SCIENCE AND ENGINEERING

### FIRST SEMESTER

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Code</th>
<th>Subject</th>
<th>No. of Hr. / week</th>
<th>Duration of Exams</th>
<th>Sessional Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
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<tbody>
<tr>
<td>1.</td>
<td>2K8CI 11</td>
<td>Computational Combinatorics</td>
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<th>Duration of Exams</th>
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### FOURTH SEMESTER

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### ELECTIVE LIST

Elective I
- 2K8CS 25.1 Internet Security
- 2K8CI 25.2 Machine Learning
- 2K8CS 25.3 Data Engineering

Elective II
- 2K8CI 32.1 Wireless Sensor Networks
- 2K8CI 32.2 Multimedia Computing
- 2K8CI 32.3 Bioinformatics

Any Student of BE (CSE) or BE (ISE) or Equivalent degree

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ME Computer Science and Engineering
I Semester ME (CSE)

2K8CI11 : Computational Combinatorics

Number Theory – Divisibility and Euclidean Algorithms, Primes, Basic Properties of Congruences, Linear Congruences, Chinese Remainder Theorem, Fermat’s Little Theorem, Wilson’s Theorem, Greatest Integer Function, Phi Function, Euler’s Theorem, Moebius Inversion Formula, Lth Multiplication of Arithmetic Functions, Quadratic Residues, Quadratic Reciprocity, Jacobi Symbol.


References:

3. Chartrand Zhang, Introduction to Graph Theory, TMH.

2K8CS 12 : Analysis of Algorithms


Introduction to Parallel Algorithm and Architecture – Approaches to the Design of Parallel Algorithms, Architectural Constraints when Designing Parallel Algorithm, Single Instruction versus Multiple Instructions, The Number and Type of Processors Available, Shared PRAM Example, Searching on a PRAM. Parallel Prefix, Matrix Multiplication – Parallel Prefix Computations on a PRAM, On a Complete Binary Tree, On the Two Dimensional Mesh, Carry Look Ahead Addition and Prefix Computation, Parallel Matrix Vector Product, Matrix Multiplication on PRAM.

Reference:
1. Thomas H Coreman et al., Introduction to Algorithms. (Selected Topics from Chapters 3, 4, 17, 24, 25, 26, 30, 31, 32, 34, 35).
2. Kenneth A Berman, Jerome L Paul, Fundamentals of Sequential and Parallel Algorithms, Thomson Asia Pte. Ltd. (Selected Topics from Chapters 5 and 11)

2K8CI13 : Advanced Computer Architecture


References:
1. Kai Hwang, Advanced Computer Architecture – Parallelism, Scalability, Programmability, McGraw Hill. (Selected Topics from Chapters 1, 2, 4, 5, 6, 7)
2. David E Culler, JP Singh, Anoop Gupta, Parallel Computer Architecture, Morgan Kaufmann. (Selected Topics from Chapter 7)

2K8CI14 : Computer Networks

Packet Switching – Switching and Forwarding, Bridges and LAN Switches, Cell Switching(ATM), Implementation and Performance. Internetworking – Simple Internetworking(IP), Routing, Global Internet, Multicast, Multiprotocol Label Switching (MPLS).


Applications – DNS, Email, WWW, Real Time Transport Protocol, Session Control and Call Control, Overlay Networks. Network Management – Network Monitoring and Control, SNMP.

References:

2K8CS15 : Digital Image Processing


References:
2. Scott E Umbaugh, Computer Vision and Image Processing.
2K8CS16 : Algorithms Lab

Programming Laboratory.
Design and Implementation of Algorithms in C or C++ like Trees (AVL, Red Black
Tree, Huffman Tree), String Matching Algorithms, Graph Algorithms, Number
Theoretical Algorithms, Combinatorial Algorithms.

II Semester ME (CSE)

2K8CI21 : Transaction Processing

Introduction to Network and Distributed OS - Functions of an OS, Design Approaches,
Issues in DOS, Process Synchronisation, Resource Management, Communication
Primitives, Message Passing Model and RPC. Clocks and Distributed Mutual Exclusion
- Introduction, Inherent Limitations of Distributed System, Lamport’s Logical Clocks,
Vector Clocks, Casual Ordering of Messages, Global State, Termination Detection.

A simple solution to Distributed Mutual Exclusion, Non token based Algorithms, Lamport’s
algorithm, The Ricart Agrawala Algorithm, Maekawa’s Algorithm, Token based Algorithms,
Suzuki Kasami’s Broadcast Algorithm, Raymond’s Tree based Algorithm.

Distributed Deadlock Detection - Preliminaries, Deadlock Handling strategies in
Distributed systems, Issues in Deadlock Detection and Resolution, Control
Organizations for Distributed Deadlock Detection, Centralized Deadlock Detection
algorithms, Distributed Deadlock Detection Algorithms, Hierarchical Deadlock
Detection Algorithms.

Classification of Agreement Problems, Solutions to the Byzantine Agreement Problem,
Applications of agreement algorithms. Distributed Scheduling - Issues in Load
Distribution, components of a load distributing algorithm, stability, load distributing
algorithms, performance comparison, selecting a suitable load sharing algorithm,
requirements for load sharing policies.

Fault Tolerance - Atomic actions and committing, commit protocols, non blocking
commit protocols, voting protocols, dynamic voting protocols, The majority based
reassignment protocols.

Resource Security and Protection - Access and flow control : The access matrix model,
implementations of access matrix, safety in the access matrix model, requirement of a
database operating system, database systems, a concurrency control model of a
database systems.

The problem of concurrency control, serializability theory. Concurrency Control
Algorithms - Introduction, Basic Synchronization Primitives, Lock Based algorithms,
timestamp based algorithms, optimistic algorithms, concurrency control algorithms,
data replication.
References:

2K8CS22: Performance Modeling


M/G/1 queueing system, discrete parameter birth death processes, Continuous parameter markov chains – birth and death process, non-birth-death process, markov chains with absorbing states. Network of Queues - Open queueing Networks, Closed Queuing Networks, Nonexponential service time distributions and multiple job types, non product form networks.

References:
1. K S Trivedi, Probability and Statistics with Reliability, Queuing, and Computer Science Applications, PHI.

2K8CI23: Embedded Systems

Introduction to Embedded Systems - An Embedded System, Processor in the System, Other Hardware Units, Software Embedded into a System, exemplary Embedded Systems, Embedded System on Chip (CoC) and in VLSI Circuit.


Programming Models for Event Controlled or Response Time constrained Real Time Programs, Modeling of Multiprocessor Systems. IPC and Synchronization - Multiple Process in an Application, Problem of Sharing Data by Multiple Tasks and Routines, IPC.

References:
1. Rajkamal, Embedded Systems Architecture, Programming and Design, TMH.

2K8CI24 : Object Technology


References:

2K8CSL26 : Project I

Mini project relevant to Database and Web technology / system programming, Examination will be by demonstration and viva voce.
**2K8CI31 : Software Development**


References:

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**2K8CS34 : Project II**

Mini project relevant to Networking Graphics, Computer Vision, Mobile Computing, Multimedia, RTOS, Embedded Systems, Internet Technology, Examination will be by demonstration and viva voce.

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**2K8CS 33 and 2K8CS 41**

Each student should separately carry out the Dissertation work for two semesters (III and IV). The Preliminary work relevant to the dissertation like Literature survey, design and development should be done in III Semester. The completed project should be submitted in the IV semester.

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**2K8CS25.1 : Internet Security**


References:
3. Atul Kahate, Cryptography and Network Security, TMH.

2K8CI25.2: Machine Learning

Introduction, Concept Learning and the General to Specific Ordering, Decision Tree Learning, Introduction to Artificial Neural Networks, Evaluating Hypothesis, Bayesian Learning.

Computational Learning Theory, Instance Based Learning, Genetic Algorithms, Learning Set of Rules, Analytical Learning, Combining Inductive and Analytical Learning, Reinforcement Learning.

References:
2. Alpaydin, Introduction to Machine Learning, PHI.

2K8CS25.3: Data Engineering

Introduction - Data Mining, Kinds of Data, Data Mining Functionalities, Classification of Data Mining Systems, Primitives, Major Issues in Data Mining. Data Preprocessing - Descriptive Data Summarization, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization and Concept Hierarchy Generation.

Data Warehouse and OLAP Technology - Data Warehouse, A Multidimensional Data Model, Data Warehouse Architecture, Data Warehouse Implementation, From Data Warehouse to Data Mining. Mining Frequent Patterns and Associations - Basic Concepts, Efficient and Scalable Frequent Itemset Mining Methods, Mining Various Kinds of Association Rules.
Classification and Prediction - Issues regarding classification and prediction, classification by decision tree induction, Bayesian classification, rule based classification, classification by backpropagation, support vector machines, Lazy Learners, Prediction, Accuracy and Error Measures, Evaluating the Accuracy of a classifier, Ensemble Methods, Model Selection.

Cluster Analysis - Types of Data in Cluster Analysis, A Categorization of Major Clustering Methods, Partitioning Methods, Hierarchical Methods, Density based Methods, Grid based methods, model based clustering methods, Clustering high dimensional data, Constraint based cluster analysis, Outlier analysis.

References:
1. Jiawei Han and Micheline Kamber, Data Mining, Concepts and Techniques, Elsevier, II Edition.
2. David Hand, Heikki Mannila, Padhraic Smyth, Principles of Data Mining, PHI.
3. Margaret H Dunham, Data Mining Introductory and Advanced Topics, Pearson Education.

2K8CI32.1 : Wireless Sensor Networks

Introduction – Applications, Collaborative Processing.


Case study: sensing global phenomena. Sensor Network Databases, Sensor Database Challenges, Querying Probabilistic queries, Query propagation and aggregation, TinyDB query processing, Query processing scheduling and optimization, Data-Centric Storage, Data Indices and Range Queries, orthogonal range searching, Non-orthogonal range searching, Distributed Hierarchical Aggregation, Multi-resolution, Partitioning, Fractional cascading, Locality preserving hashing, Temporal Data, Data aging, Indexing motion data.

References:


2K8CI32.2: Multimedia Computing

Introduction, Media and Data Streams, Audio Technology, Graphics and Images, Video Technology and Computer Based Animation, Data Compression, Optical Storage Media, Content Analysis, Data and File Format Standards, Multimedia Application Design.

References:

2. Prabhat K Andleigh, Kiran Thakrar, Multimedia Systems Design, PHI.

2K8CI32.3: Bioinformatics

Introduction: Bioinformatics – Overview and Definitions, Applications, Major Databases in Bioinformatics, Data Management and Analysis, Molecular Biology and Bioinformatics, Central Dogma of Molecular Biology. Information Search and Data Retrieval - Introduction, Tools for Web Search, Data Retrieval Tools, Data Mining of Biological Databases.


Gene Expression Microarrays: DNA Microarrays, Clustering Gene Expression Profiles, Data Sources and Tools for Microarray Analysis, Applications of Microarray Technology.
Protein Classification and Structure Visualization: Overview of Protein Structure, Visualization, Structure based Protein Classification, Protein Structure Databases, Tools, Protein Structure Alignment.


References:
1. S C Rastogi, N Mdndiratta, P Rastogi, Bioinformatics Methods and Applications, Genomics, Proteomics and Drug Discovery. PHI.