VISION AND MISSION

VISION OF THE DEPARTMENT
The Department of Computer Science and Engineering strives to create computing professionals, researchers, and entrepreneurs, with high technical knowledge, communication skills, values and ethics. It collaborates with academia, industry and community to set high standards in academic excellence and in fulfilling societal responsibilities.

MISSION OF THE DEPARTMENT
The mission of the Department of Computer Science and Engineering is to

- Provide motivated faculty and state of the art facilities for education and research, both in foundational aspects and of relevance to emerging computing trends.
- Develop knowledgeable, industry-ready students with pertinent competencies.
- Inculcate responsibility through sharing of knowledge and innovative computing solutions that benefit the society-at-large.
- Engage in collaborative research with academia and industry for seamless transfer of knowledge resulting in patentable solutions.
- Generate adequate resources for research activities from sponsored projects and consultancy.
PROGRAM EDUCATIONAL OBJECTIVES:
1. Prepare students to review and understand concepts in Computer Science and Engineering and optimization techniques.
2. Empower students to critically analyze current trends and learn future issues from a system perspective at multiple levels of detail and abstraction.
3. Enable students to apply theory and practice for problem solving based on case studies.
4. Enable students to pursue lifelong multidisciplinary learning as professional engineers and scientists to effectively communicate technical information, function effectively on teams, and apply computer science & engineering and optimization techniques within a global, societal, and environmental context by following ethical practices.
5. Prepare students to critically analyze existing literature, identify the gaps in the existing literature and propose innovative and research oriented solutions.

PROGRAM OUTCOMES:
Students will be able to:
1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex computer science problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and computer science related tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
5. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
6. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme educational objective and the outcomes is given in the following table:

<table>
<thead>
<tr>
<th>PROGRAMME EDUCATIONAL OBJECTIVES</th>
<th>PROGRAMME OUTCOMES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PO1</td>
</tr>
<tr>
<td>1.</td>
<td>3</td>
</tr>
<tr>
<td>2.</td>
<td>2</td>
</tr>
<tr>
<td>3.</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>1</td>
</tr>
</tbody>
</table>
### SEMESTER I

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>1.</td>
<td>MA3154</td>
<td>Advanced Mathematics for Scientific Computing</td>
<td>FC</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2.</td>
<td>RM3151</td>
<td>Research Methodology and IPR</td>
<td>RMC</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3.</td>
<td>CP3151</td>
<td>Data Structures and Algorithms</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4.</td>
<td>CP3153</td>
<td>Multi Core Architectures</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5.</td>
<td>CP3154</td>
<td>Networking Technologies</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6.</td>
<td>OR3101</td>
<td>Linear Programming and Applications</td>
<td>PCC</td>
<td>3</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

#### PRACTICALS

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>CODE NO.</th>
<th>COURSE TITLE</th>
<th>CATEGORY</th>
<th>PERIODS PER WEEK</th>
<th>TOTAL CONTACT PERIODS</th>
<th>CREDITS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>L</td>
<td>T</td>
<td>P</td>
</tr>
<tr>
<td>7.</td>
<td>CP3161</td>
<td>Data Structures and Algorithms Laboratory</td>
<td>PCC</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
</tbody>
</table>

**TOTAL** 18 1 9 28 23.5
UNIT I  LINEAR PROGRAMMING  12
Formulation – Graphical solution – Simplex method – Two phase method -Transportation and Assignment Problems

UNIT II  SIMULATION  12
Discrete Event Simulation – Monte – Carlo Simulation – Stochastic Simulation – Applications to real time problems.

UNIT III  ESTIMATION THEORY  12

UNIT IV  TESTING OF HYPOTHESIS  12

UNIT V  MULTIVARIATE ANALYSIS  12

TOTAL: 60 PERIODS

OUTCOMES:
At the end of the course, students will be able to
CO1 Formulate and find optimal solution in the real life optimizing/allocation/assignment problems involving conditions and resource constraints.
CO2 Simulate appropriate application/distribution problems.
CO3 Obtain the value of the point estimators using the method of moments and method of maximum likelihood.
CO4 Apply the concept of various test statistics used in hypothesis testing for mean and variances of large and small samples.
CO5 Get exposure to the principal component analysis of random vectors and matrices.

REFERENCES:
CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>AVG</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

RM3151 RESEARCH METHODOLOGY AND IPR L T P C 2 1 0 3

UNIT I RESEARCH PROBLEM FORMULATION 9
Objectives of research, types of research, research process, approaches to research; conducting literature review- information sources, information retrieval, tools for identifying literature, Indexing and abstracting services, Citation indexes, summarizing the review, critical review, identifying research gap, conceptualizing and hypothesizing the research gap

UNIT II RESEARCH DESIGN AND DATA COLLECTION 9
Statistical design of experiments- types and principles; data types & classification; data collection - methods and tools

UNIT III DATA ANALYSIS, INTERPRETATION AND REPORTING 9
Sampling, sampling error, measures of central tendency and variation.; test of hypothesis- concepts; data presentation- types of tables and illustrations; guidelines for writing the abstract, introduction, methodology, results and discussion, conclusion sections of a manuscript; guidelines for writing a thesis, research proposal; References – Styles and methods, Citation and listing system of documents; plagiarism, ethical considerations in research

UNIT IV INTELLECTUAL PROPERTY RIGHTS 9
Concept of IPR, types of IPR – Patent, Designs, Trademarks and Trade secrets, Geographical indications, Copy rights, applicability of these IPR; IPR & biodiversity; IPR development process, role of WIPO and WTO in IPR establishments, common rules of IPR practices, types and features of IPR agreement, functions of UNESCO in IPR maintenance.

UNIT V PATENTS 9
Patents – objectives and benefits of patent, concept, features of patent, inventive steps, specifications, types of patent application; patenting process - patent filling, examination of patent, grant of patent, revocation; equitable assignments; Licenses, licensing of patents; patent agents, registration of patent agents.

REFERENCES:
2. Soumitro Banerjee, “Research methodology for natural sciences”, IISc Press, Kolkata, 2022,

TOTAL: 45 PERIODS


CP3151 DATA STRUCTURES AND ALGORITHMS

UNIT I BASIC STRUCTURES AND ALGORITHM 9
Stack - Queue - Linked List Implementation - Min/Max heap – Algorithm Analysis- Asymptotic Analysis- Solving Recurrence Relation – Amortized Analysis

UNIT II BALANCED TREE STRUCTURES 9

UNIT III MELDABLE HEAP STRUCTURES 9

UNIT IV NP COMPLETENESS 9
NP Classes- Polynomial Time Verification – Theory of Reducibility - NP Completeness Proof for Vertex Cover & Hamiltonian Cycle

UNIT V APPROXIMATION ALGORITHMS 9
Approximation Algorithms: Vertex Cover & Euclidean Travelling Salesperson Problem- Randomized Algorithms: Closest Pair Problem & Minimum Spanning Trees

TOTAL: 45 PERIODS

REFERENCES

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Understand, design and implement balanced search structures
CO2: Analyse algorithms for time complexity
CO3: Understand and implement different meldable priority queues
CO4: Appreciate Approximation and randomized algorithm design
CO5: Apply various data structures for solving problems
CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

UNIT I  FUNDAMENTALS OF COMPUTER DESIGN AND ILP  9

UNIT II  MEMORY HIERARCHY DESIGN  9

UNIT III  MULTIPROCESSOR ISSUES  9

UNIT IV  EXPLOITING DIFFERENT TYPES OF PARALLELISM  9

UNIT V  DOMAIN SPECIFIC ARCHITECTURES  9
Introduction to Domain Specific Architectures - Guidelines for DSAs. Case Studies - Example Domain: Deep Neural Networks - Google's Tensor Processing Unit - Microsoft Catapult - Intel Crest - Pixel Visual Core. CPUs Versus GPUs Versus DSAs.

TOTAL: 45 PERIODS

REFERENCES

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Discuss and evaluate the performance of computer systems
CO2: Discuss and point out the various ways of exploiting ILP
CO3: Point out the various optimizations that can be performed to improve the memory hierarchy design
CO4: Discuss the issues related to multiprocessing and suggest solutions
CO5: Point out the salient features of different multicore architectures and how they exploit different types of parallelism
CO6: Point out the salient features of different example domain specific architectures

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO5</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO6</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

CP3154 NETWORKING TECHNOLOGIES

UNIT I NETWORK ARCHITECTURE AND QoS

UNIT II CELLULAR NETWORKS

UNIT III WIRELESS NETWORKS

UNIT IV 4G NETWORKS
UNIT V 5G NETWORKS


SUGGESTED LIST OF EXPERIMENTS:

1. Configure networks using:
   a. Distance Vector Routing protocol
   b. Link State Vector Routing protocol
2. Implement the congestion control using Leaky bucket algorithm.
3. Installation of NS3.
4. Implementation Point to Point network using duplex links between the nodes. Analyze the packet transfer by varying the queue size and bandwidth. (using simulator)
5. Implement the dynamic routing protocol by varying the CBR traffic for each node and use a flow monitor( ) to monitor losses at nodes. (using simulator)
6. Create a wireless mobile ad-hoc network environment and implement the OLSR routing protocol. (using simulator)
7. Implement CDMA by assigning orthogonal code sequence for 5 stations, generate the CDMA code sequence and communicate between the stations using the generated code.
8. Create a GSM environment and implement inter and intra handover mechanisms. (using simulator)
10. Write python script to create topology in Mininet and configure OpenFlow switches with POX controller to communicate between nodes.

TOTAL: 90 PERIODS

REFERENCES
COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Identify the different features of integrated and differentiated services.
CO2: Demonstrate various protocols of wireless networks.
CO3: Analyze the use of next generation networks.
CO4: Design protocols for cellular networks.
CO5: Explore 5G networks and applications.

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>-</td>
<td>2</td>
</tr>
</tbody>
</table>

OR3101 LINEAR PROGRAMMING AND APPLICATIONS L T P C
3 0 2 4

UNIT I BASIC STRUCTURES AND ALGORITHM 9

UNIT II ADVANCED LINEAR PROGRAMMING 9

UNIT III MELDABLE HEAP STRUCTURES 9
Sensitivity Analysis or Post Optimality Analysis – Changes in the Right-handside– Objective function – Changes affecting feasibility – Changes affecting optimality.

UNIT IV INTEGER PROGRAMMING 9

UNIT V CASE STUDIES AND TOOLS 9
Case Studies – Production Planning– Manpower planning– Solving LP problems using TORA / LINDO / LINGO / LP Solver using R

LIST OF EXPERIMENTS:
1. Solving simplex maximization problems using R programming.
2. Solving simplex minimization problems using R programming.
3. Solving mixed constraints problems – Big M & Two phase method using TORA.
4. Solving transportation problems using R.
5. Solving assignment problems using R.
6. Solving optimization problems using LINGO.
7. Studying Primal-Dual relationships in LP using TORA.
8. Solving LP problems using dual simplex method using TORA.
9. Sensitivity & post optimality analysis using LINGO.

TOTAL: 45+30=75 PERIODS

REFERENCES

COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Mathematically formulate and solve minimization/maximization problems.
CO2: Solve transportation and assignment problems.
CO3: Analyse sensitivity, post optimality, changes affecting feasibility and optimality.
CO4: Model and solve integer programming problems like travelling salesman problems.
CO5: Solve linear programming problems using software tools.

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>CO2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO3</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO4</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

CP3161 DATA STRUCTURES AND ALGORITHMS LABORATORY L T P C 0 0 4 2

LIST OF EXPERIMENTS:
1. Linked list implementation of Stack and Queue ADTs
2. Binary Search tree
3. Min/Max Heap
4. AVL tree
5. Red- Black tree
6. Splay Tree
7. Leftist Heap
8. Binomial Heap
COURSE OUTCOMES:
Upon completion of the course, the students will be able to
CO1: Apply suitable data structures in problem solving.
CO2: Select suitable search structures for an application
CO3: Understand priority queue implementations
CO4: Differentiate between approximation and Randomized algorithms
CO5: Understand NP complete problem solutions

CO-PO Mapping

<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO2</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO3</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO4</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>CO5</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>