Indian Institute of Technology Jodhpur

Course Booklet

for

M.Tech. (CSE)

and

Dual degree M.Tech. (CSE) + PhD

Programs

offered by the

Department of Computer Science and Engineering

July 2021

Introduction:
Traditionally Computer Science and Engineering (CSE) teaching were focusing on two major areas, i.e., theories and systems (database, computer hardware, and operating systems). With the advent of the era of Cloud Computing, Edge Computing, AI and Big Data, the discipline is being transformed by incorporation of new emerging technologies. It is becoming an instrumental tool in solving major problems faced by modern society such as energy, natural disasters, pollution, and water. Through this newly revamped M.Tech and M.Tech-Ph.D dual degree programs in CSE, IIT Jodhpur is making a conscious effort to divulge from the traditional path and planning to reposition itself to become a leading institute in this new genre of Computer Science education.

Objectives:
This M.Tech and M.Tech-Ph.D dual degree programs in CSE will offer students with deep knowledge of core and applied computer science. Through this programme, a student will learn niche subject areas which are of paramount importance in the modern big data era, such as Computer Systems and Security. This programme is aiming at imparting the necessary breadth and depth to the students for pursuing careers in academics as well as in industry. This programme is aiming at extending undergraduate computing skills with up-to-date and in-depth expertise in specialized areas of Computer Systems and Security.

Expected Graduate Attributes:
After completing this programme, a student will be able to develop an ability to:
1. Understand fundamental concepts and hands-on knowledge of emerging fields in Computer Science.
2. Conceive, Design and Develop state-of-the-art scalable parallel and distributed systems
3. Solve Big data problems through the knowledge of advanced data structures, distributed algorithmic design, analysis, and applications.
4. Design and develop network protocols for Wireless, Sensor, Mobile, and Vehicular networks.
5. Ideate, Implement and Integrate cryptographic, fault tolerant algorithms for large scale distributed systems
6. Understand state-of-the-art hardware platforms for running compute intensive distributed algorithms
7. Ability to understand and apply evolving ethics and privacy laws across various domains and territories.
8. Plan and manage technical projects

Learning Outcome:
1. Understand the fundamentals of algorithmic complexity, advanced computer architecture, advanced network, and security protocols.
2. Apply appropriate design principles, framework and protocols to develop dependable systems.
3. Demonstrate hands-on knowledge of cutting edge simulation, synthesizing, programming tools.
4. Ability to design and develop system architecture for mobile, cloud, fog, and edge computing.
5. Demonstrate hands-on knowledge of virtualization, data center design and management, and software defined networking.
6. Skills to comprehend and communicate effectively.
7. Apply appropriate project and business management principles and tools for real-world problems.

Course Structure for the

M.Tech. (CSE) Program and Dual Degree M.Tech. (CSE)+Ph.D. Program

Cat	Code	Course Title	L-T-P	Cr		Cat	Code	Course Title	L-T-P	Cr
Bridge Course on DSA										
Semester I						**Semester II**				
C	MAL7xx0	Statistical Inference Matrix Theory Constrained Optimization	1-0-0 1-0-0 1-0-0	3		C	CSL7xx0	Software and Data Engineering	3-0-0	3
C	CSL7xx0	Advanced Data Structures and Algorithms	3-0-0	3		C	CSL7xx0	Core Bucket: Security and its Applications, Algorithms for Big Data, Computer Networks: Protocols and Applications	3-0-0	3
C	CSL7xx0	Machine Learning	3-0-0	3		C	CSL7xx0	Computer Architecture	3-0-0	3
PE	xxxxx	Program Elective 1	3-0-0	3		PE	xxxxx	Program Elective 3	3-0-0	3
PE	xxxxx	Program Elective 2	3-0-0	3		OE	xxxxx	Open Elective 1	3-0-0	3
NG		Technical Communication	1-0-0	1		NG	xxxxx	Ethics and Professional Life	1-0-0	1
		Total Credits: 16						Total Credits: 16		

*Maths Fractals: Linear Algebra, Probability and Random Processes, Optimization

Cat	Code	Course Title	L-T-P	Cr		Cat	Code	Course Title	L-T-P	Cr
Semester III						**Semester IV**				
P	CSD7xx0	Major Project – Part 1	0-0-10	5		P	CSD8xx0	Major Project – Part 2	0-0-22	11
PE	xxxxx	Program Elective 4	3-0-0	3		PE	xxxxx	Program Elective 6	3-0-0	3
PE	xxxxx	Program Elective 5	3-0-0	3		NG	xxxxx	Intellectual Property	1-0-0	1
OE	xxxxx	Open Elective - 2	3-0-0	3						
NG	xxxxx	System Engineering and Project Management	1-0-0	1						
		Total Credits: 15						Total Credits: 15		

Credit Distribution					****List of Prescriptive Electives**
1	Program Core	18 credits		1	Linear algebra for data science
2	Program Electives	18 credits		2	Statistics for Data Science
3	Open Electives	6 credits			
4	Project	16 credits			
5	Non-graded	4 credits			
	Total	62 credits			

*The students should have satisfactory performance in the course in order to be eligible for internships and placements opportunities from the institute.

**Depending on the background of students, courses from the prescriptive electives can be recommended for students by the DRC.

Program Electives for M.Tech. (CSE) and Dual Degree M.Tech. (CSE)+Ph.D. Program

Courses offered by Department of Computer Science and Engineering	
5G Mobile Networks Advanced Computer Graphics Advanced Computer Networks Advanced Human Machine Interface Advanced Operating Systems Advanced Biometrics Ad hoc Wireless Networks Artificial Intelligence Advance Artificial Intelligence Algorithms for Big Data Approximation Algorithms Bio-image Computing Blockchain Computer Graphics Computer Vision Computational Optimization Compiler Design Computational Social Choice Theory Computer Network Protocols and Applications Crowd-sourcing and human computing Cryptography Data Visualization Deep Learning Dependable AI Digital Image Analysis Digital System Testing Distributed Database Systems DL-Ops Edge and Fog Computing Environmental Informatics Embedded Systems	Epidemiology GPU Programming Graph-theoretic Algorithms Graph Theory and Applications Hardware Software Co-Design Health Informatics ICT for Development Information Retrieval Introduction to AR and VR Introduction to Wireless Ad hoc Network Machine Learning with Big Data ML-Ops Neuromorphic Computing and Design Autonomous Systems Mobile and Pervasive Computing Natural Language Understanding Parameterized Complexity Randomized Algorithms Social Computing Software Defined Networks Software Testing and Quality Assurance Speech Understanding Sustainable Computing Selected Topics in Computer Science - I/II/III Social Network Analysis Special Topics in Algorithms Stream Analytics Security and its Applications Vehicular Ad-hoc Networks (VANETs) Virtualization and Cloud Computing
Courses offered by Department of Electrical Engineering	
Coding Theory Compressive Sensing Computational Imaging Data Compression Data Communication and Networking Digital Twin Digital Video Processing Digital VLSI Design Embedded System Design Embedded System Design Lab High-level Synthesis	Introduction to Cyber Physical S Introduction to Haptics Introduction to IoT Systems Mathematical Modelling and Simulation Information Theory and Applications Real Time Communications Real time systems Sensors and Measurement Introduction to Smart Grid Speech and Audio Signal Processing Statistical Decision Theory Wireless Communication

Image Sensor Design and Applications	
Courses offered by Department of Mechanical Engineering	
Robotics	
Courses offered by Department of Bioscience and Bioengineering	
Bioinformatics	Computational Biology
Courses offered by Department of Mathematics	
Computational Game Theory Advanced topics in Computational PDE Linear algebra for data science Statistical Techniques Numerical Linear Algebra	Dynamical Systems Stochastic Processes Representation of Finite Groups Statistics for Data Science Unconstrained Optimization
Courses offered by Department of Physics	
Quantum Computing Quantum Information Processing	Quantum Cryptography and Coding
Courses offered by IDRP Digital Humanities	
Analysis of Social Media Networks	Human Factors in Interaction Design
Courses offered by School of Management and Entrepreneurship	
Stochastic Modelling	
Courses offered by Other Departments	
Algorithms in Biology	TeleMedicine