



CENTRE FOR ADVANCED STUDIES
Dr. APJ Abdul Kalam Technical University, Lucknow

M.TECH - COMPUTER SCIENCE AND ENGINEERING (CSE)
with choice based specialization in

Cyber Security (CyS)
&
Information and Communication Technologies (ICT)
&
Machine Learning (ML)

Program Structure
Effective from academic session 2021-22

Centre for Advanced Studies (Dr. A.P.J. Abdul Kalam Technical University, Lucknow, U.P.) is starting with Master of Technology in Computer Science & Engineering with choice based specialization in Cyber Security, ICT and Machine Learning from the academic session 2021-22. The curriculum has been developed considering the present and future needs of industry and higher education. The Centre will facilitate both industry ready and research based ambience to students with world class e-library, renowned faculty members to achieve academic excellence and other services.

This is a specialized program aimed to provide the student with in-depth knowledge of domains not only in the field of Computer Science and Engineering but also in the specialized area of their choice. The course structure will help students to develop knowledge and skill in the following proportionate:

90% Technical /Research	<ul style="list-style-type: none"> ○ Information Processing Platform, OS Security, Networking in a global Distributed Environment, Security Techniques, technical experience in industrial design, risk analysis, physical and data security and auditing techniques, VLSI design and communication , Pattern Recognition and Machine Learning , IoT and data science. ○ Excellent Visionary Skill that focus on scalability, cost effectiveness and implementation ease.
10% Business Process & Managerial Practices	<ul style="list-style-type: none"> ○ Know the Business Dynamics, Business Processes and good planning , ability to work with all management level and resolve issues, Business Need with Security Requirement. ○ Consulting Skill, Communication Skill, Legal Understanding.

M.Tech in Computer Science & Engineering with Specialization in Cyber Security aims at providing a strong background for students to get specialized knowledge to design solutions and management policy to build up secure and reliable systems in the modern era of distributed computing. The course covers a Common Body of Knowledge (CBK) about the major 10 security domains for information security professionals :

- Cryptography
- Security Architecture and Design
- Operations Security
- Access Control
- Telecommunications and Network Security
- Information Security Governance and Risk Management
- Software Development Security
- Business Continuity and Disaster Recovery Planning
- Legal, Regulations, Investigations and Compliance

M.Tech in Computer Science & Engineering with Specialization in ICT program aims to provide exposure to students to learn the cutting edge of technology, research and development for solving real-world problems in bridging gap in urban and rural developments. The course enable students in broadening their knowledge of ICT disciplines, major area include:

- Machine Intelligence and Analytics
- Parallel & Distributed Computing

- Signal and Image Processing
- Communication Systems
- VLSI and embedded system
- Intelligent Systems and Security

M.Tech in Computer Science & Engineering with Specialization in ML program, One of the popular applications of AI is Machine Learning (ML), in which computers, software, and devices perform via cognition (very similar to human brain). Machine learning applications are used everywhere everyday. In this specialisation, the students will learn about the cutting edge technology and apply the taught concepts to create machine learning applications. The courses taught in this specialisation include:

- Foundation of Machine Learning
- Neural Networks and Evolutionary Algorithms
- Reinforcement Learning
- Deep Learning
- Machine Learning Applications
- Topological Data Analysis

Program Structure : M.Tech course is a full time two year program and classes will be held on all working days. The Program Structure has been designed such that the students shall study core subjects of Computer Science and Engineering as well as the courses for specialization.

In Semester 1, students shall study Advanced Core courses of Computer Science & Engineering while in the next two semesters students shall study in depth subject of Specialization with its core and elective subjects. Semester IV is Thesis/ Dissertation.

Every core course consists of lecture (L) hours, tutorial (T) hours and practical (P) hours. Elective courses consist of Lecture (L) hours only. The credit (C) for a course is dependent on the number of hours of instruction per week in that course, as given below:

- (1) 1h/week of Lecture (L) = 1 credit
- (2) 2h/week of Practical (P) = 1 credit
- (3) 1h/week of Tutorial(T) = no credit
- (4) Credit (C) for a Theory course = No. of hours of lectures per week + No. of hours of tutorials per week = L + T
- (5) Credit (C) for a Lab course = $\frac{1}{2}$ * No. of hours of lab per week = P

Course Code Abbreviation :

- MCSC – Core Course Common to CyS , ICT and ML
- MCSE – Elective Course Common to CyS / ICT / ML
- MCySC- Core Course for Cyber Security
- MICTC- Core Course for ICT
- MMLC- Core Course for ML
- MMLE- Elective Course for ML
- MCySE- Elective Course for Cyber Security
- MICTE- Elective Course for ICT

Course Credit Distribution

CATEGORY	PROGRAM CORE FOR CSE	SPECIALIZATION CORE COURSE	SPECIALIZATION ELECTIVES COURSE	PROJECT	NON TEACHING COURSE	TOTAL CREDIT
CREDITS	25	10	9	18	2	64
Semester 1						
1	Core Course	(4 credit * 3 course) + (3 credit * 2 course) + (1 credit * 1 course) = 19			TOTAL COURSE = 6 TOTAL SEM CREDIT = 19	
Semester 2						
2	Core Courses	(4 credit * 1 course) + (1 credit * 1 course) = 5			TOTAL COURSE = 6 TOTAL SEM CREDIT = 18	
2	Core Course (specialization)	3 credit *1 course=3 4 credit *1 course = 4	3+4=7			
2	Elective Course (specialization)	3 credit * 2 course = 6				

Semester 3			
3	Core Courses	3 credit * 1 course = 3	TOTAL COURSE = 3 + 1 Thesis TOTAL SEM CREDIT = 13
3	Core Course (specialization)	3 credit * 1 course = 3	
3	Elective course (specialization)	3 credit * 1 course = 3	
3	Thesis/Dissertation- I	4 credit	
Semester 4			
4	Thesis / Dissertation-II	14 credit	TOTAL COURSE = 1 MAJOR PROJECT TOTAL SEM CREDIT = 14
TOTAL PROGRAM CREDIT			64

Semester I

Core Subject common to all branches:

S. No.	Course Code	Subject	Credit			
			L	T	P	Total
1.	MCSC-105	Discrete Mathematics and Graph Theory	3	0	0	3
2.	MCSC-103	Advanced Computer Networks and Communication	3	0	2	4
3.	MCSC-104	Foundation of Machine Learning	3	0	2	4
4.	MCSC-102	Probability & Statistics	3	0	0	3
5.	MCSC-101	Analysis and Design of Algorithms	3	0	2	4
6.	MCSC-106	Independent Study and Research - I	0	0	2	1

Total Semester credit: 19

Semester II

S. No.	Course Code	Subject	Credit			
			L	T	P	Total
CORE COURSES - COMPULSARY (Common for All Branches)						
1.	MCSC-201	The Internet of things	3	0	2	4
2.	MCSC-202	Independent Study and Research - II	0	0	2	1
CYBER SECURITY CORE COURSES - COMPULSARY						
3.	MCySC-202	Fundamentals of Information Security & Practices	3	0	0	3
4.	MCySC-201	Cryptography	3	0	2	4
ICT CORE COURSES - COMPULSARY						
5.	MICTC-201	Mathematical Foundations for Computing in ICT	3	0	0	3
6.	MICTC-202	Embedded System	3	0	2	4
ML CORE COURSES - COMPULSARY						
7.	MMLC-201	Neural Networks and Evolutionary Algorithms	3	0	0	3
8.	MMLC-202	Pattern Recognition	3	0	2	4
CYBER SECURITY ELECTIVE COURSES - ANY TWO						
9.	MCSE-201	Introduction to Formal Methods and Verification of Large Systems	3	0	0	3
10.	MCySE-204	Ethical Hacking	3	0	0	3

11.	MCySE-201	Security Standards & Project Management	3	0	0	3
12.	MCySE-202	System Security	3	0	0	3
13.	MCySE-203	Identity and Access Management & Trusted Computing	3	0	0	3
ICT ELECTIVE COURSES - ANY TWO						
14.	MCSE-201	Introduction to Formal Methods and Verification of Large Systems	3	0	0	3
15.	MICTE-202	Speech Communication and Biomedical Signal Processing	3	0	0	3
16.	MCSE-202	Data Science	3	0	0	3
17.	MICTE-201	Information theory and coding	3	0	0	3
18.	MCSE-203	Computer Vision	3	0	0	3
ML ELECTIVE COURSES - ANY TWO						
19.	MMLE-201	Big Data Analytics	3	0	0	3
20.	MMLE-202	Optimization Techniques	3	0	0	3
21.	MCSE-202	Data Science	3	0	0	3
22.	MMLE-203	Probabilistic Graphical Model	3	0	0	3
23.	MCSE-203	Computer Vision	3	0	0	3

Total credits: 18

Semester III

S. No.	Course Code	Subject	Credit			
			L	T	P	Total
CORE COURSES - COMPULSARY (Common for All Branches)						
1.	MCSC -301	Research Methodology	3	0	0	3
2.	MCSC-302	Thesis / Dissertation –I	0	0	8	4
CYBER SECURITY CORE COURSES - COMPULSARY						
3.	MCySC-301	Digital and Cyber Forensics	3	0	0	3
ICT CORE COURSES - COMPULSARY						
4.	MICTC-301	Multimedia Signal Processing	3	0	0	3
ML CORE COURSES - COMPULSARY						
5.	MMLC-301	Deep Learning (Pre Req: Neural Networks and Evolutionary Algorithms)	3	0	0	3
CYBER SECURITY ELECTIVE COURSES - ANY ONE						
6.	MCSE-301	Cloud Computing	3	0	0	3
7.	MCySE-301	Network Protocol Security	3	0	0	3

		<i>(Pre Req: System Security)</i>				
8.	MCSE-302	Wireless Sensor Network	3	0	0	3
9.	MCSE 304	Media Security	3	0	0	3
10.	MCSE-303	Intelligent System and Green Computing	3	0	0	3
ICT ELECTIVE COURSES - ANY ONE						
11.	MCSE-302	Wireless Sensor Network	3	0	0	3
12.	MICTE301	Secure Coding <i>(Pre Req: Information theory and coding)</i>	3	0	0	3
13.	MCSE-301	Cloud Computing	3	0	0	3
14.	MCSE 304	Media Security	3	0	0	3
15.	MCSE-303	Intelligent System and Green Computing	3	0	0	3
ML ELECTIVE COURSES - ANY ONE						
16.	MMLE-301	Advanced Kernel Methods	3	0	0	3
17.	MMLE-302	Reinforcement Learning	3	0	0	3
18.	MCSE-301	Cloud Computing	3	0	0	3
19.	MMLE-303	Machine Learning Applications	3	0	0	3
20.	MMLE-304	Topological Data Analysis	3	0	0	3

Total credits: 13

Semester IV

S. No.	Course Code	Subject	Credits			
			L	T	P	Total
CORE COURSE – COMPULSORY						
1.	MCSC-401	Thesis / Dissertation-II	-	-	28	14
Total credits: 14						