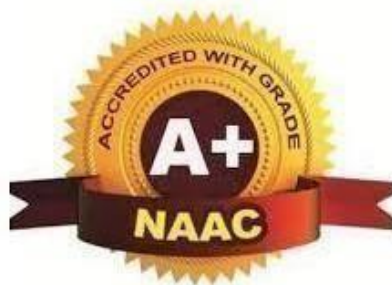




TULSIRAMJI GAIKWAD-PATIL
College of Engineering & Technology

Mohgaon, Wardha Road, Nagpur - 441 108

An Autonomous Institute



DEPARTMENT OF MASTER IN COMPUTER APPLICATION

IV Semester

Teaching Scheme & Syllabus

Considering

**National Education
Policy 2020**

From

Academic Year 2026 – 27

Vision of Institute

To emerge as a learning Center of Excellence in the National Ethos in domains of Science, Technology and Management.

Mission of Institute

M1- To strive for rearing standard and stature of the students by practicing high standards of professional ethics, transparency and accountability.

M2- To provide facilities and services to meet the challenges of Industry and Society

M3- To facilitate socially responsive research, innovation and entrepreneurship

M4- To ascertain holistic development of the students and staff members by inculcating knowledge and profession as work practices.

Vision of the Department

The department of Master in Computer Applications aims to generate groomed, technically competent and skilled intellectual professionals specifically from the rural area to meet the current challenges of the modern computing industry.

Mission of the Department

- To stimulate students to learn effectively and apply the knowledge in the field of Engineering and Technology.
- To undertake industry academic collaboration to enhance competency in graduates.
- To foster innovative ideas amongst students for becoming leaders.
- To create an environment of research culture.
- To impart social and ethical values for inculcating the culture of lifelong learning.

Program Educational Objectives (PEO)

- Providing a strong theoretical and practical background across the computer science discipline with an emphasis on software development.
- To provide technical solutions in the field of information technology to the local society.
- To provide need-based quality training in the field of information technology.
- Empowering the youth in rural communities with computer education.
- To provide students with the tools to become productive, participating global citizens and life-long learners.

Program Outcomes (PO)

- 1. PO1 (Foundation Knowledge):** Apply knowledge of mathematics, programming logic and coding fundamentals for solution architecture and problem solving.
- 2. PO2 (Problem Analysis):** Identify, review, formulate and analyse problems for primarily focussing on customer requirements using critical thinking frameworks.
- 3. PO3 (Development of Solutions):** Design, develop and investigate problems with as an innovative approach for solutions incorporating ESG/SDG goals.
- 4. PO4 (Modern Tool Usage):** Select, adapt and apply modern computational tools such as development of algorithms with an understanding of the limitations including human biases.
- 5. PO5 (Individual and Teamwork):** Function and communicate effectively as an individual or a team leader in diverse and multidisciplinary groups. Use methodologies such as agile.
- 6. PO6 (Project Management and Finance):** Use the principles of project management such as scheduling, work breakdown structure and be conversant with the principles of Finance for profitable project management.
- 7. PO7 (Ethics):** Commit to professional ethics in managing software projects with financial aspects. Learn to use new technologies for cyber security and insulate customers from malware
- 8. PO8 (Life-long learning):** Change management skills and the ability to learn, keep up with contemporary technologies and ways of working.



Tulsiramji Gaikwad-Patil College of Engineering & Technology, Nagpur

(An Autonomous Institution Affiliated to RTM Nagpur University, Nagpur)

SCHEME OF INSTRUCTION & SYLLABI

Programme: Master in Computer Application

Scheme of Instructions: Second Year Master in Computer Application (As Per NEP 2020)

Semester – IV

Sr.	Course Category	CourseCode	Course Title	L	P	Contact Hrs / week	Credits	Exam Scheme				
								CT - 1	CT - 2	TA / CA	ESE	TOTAL
1.	PROJ	MCA32401	Project Work Full Time	-	38	38	19	-	-	300	300	600
2.	PEC	MCA32402-05*	Program Elective-IV	3	-	3	3	15	15	10	60	100
			Total	3	38	41	22	15	15	310	360	700

*Indicates out of the four course codes each student has to select any one PEC from the list provided at the end of structure.

Course Category	PCC	PEC	VSE	Project	CC
Credits	-	3	-	19	
Cumulative Summary	47	12	6	21	2

PROGRESSIVE TOTAL CREDITS: 66 + 22 = 88

				June, 2026	2.00	Applicable for AY 2026-27
Chairperson	Vice Principal / Director Academics	Director - Administration	Principal	Date of Release	Version	



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List of Professional Elective Courses

Course Code	Professional Elective-IV
MCA32402	Systems and Usable Security
MCA32403	Foundations of Virtual Reality
MCA32404	Real-Time Systems
MCA32405	UI/UX Design

				June, 2026	2.00	Applicable for AY 2026-27
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	Tulsiramji Gaikwad-Patil College of Engineering and Technology Wardha Road, Nagpur-441 108 NAAC Accredited (A+ Grade)					
Program: Master in Computer Application						
Semester	Course Code	Name of Course	L	T	P	Credits
IV	MCA32402	SYSTEMS AND USABLE SECURITY	3	-	-	3
Course Contents						
Unit I	Introduction: Computer security concepts, threats, attacks; Malicious Software: Types of Malicious Software (Malware), Vulnerability, Exploits, Social Engineering–SPAM E-mail, Zombie, Bots, Keyloggers, Phishing, Spyware.					
Unit II	Operating System Security: System Security Planning, Application Security, Linux/Unix Security, Windows Security, Virtualization Security.					
Unit III	Web Security: Secure E-mail and S/MIME, Domain Keys Identified Mail, Secure Sockets Layer (SSL) and Transport Layer Security (TLS), HTTPS, IPv4 and IPv6 Security, Public-Key Infrastructure and Federated Identity Management.					
Unit IV	Usable Security: Introduction to Privacy, Trust and Semantic Security, Visualizing Privacy, Web Browser Security and Privacy, Authentication and Text Passwords, Biometrics and Graphical Passwords.					
Unit V	Network Security Concepts, Firewalls and Intrusion Detection Systems (IDS), Intrusion Prevention Systems (IPS), Virtual Private Networks (VPNs), Wireless Network Security, Denial-of-Service (DoS) and Distributed Denial-of-Service (DDoS) Attacks, Cryptography and Digital Signatures, Digital Certificates, Cybersecurity Best Practices and Emerging Trends in Computer Security.					

Text Books	
1	Security and Usability: Designing Secure Systems That People Can Use, Lorrie Faith Cranor and Simson Garfinkel
2	Computer Security: Principles and Practice, William Stallings and Lawrie Brown.
Reference Books	
1.	Introduction to Computer Security, Michael Goodrich and Roberto Tamassia
2.	Usable Security: History, Themes, and Challenges, Simson Garfinkel and Heather Richter Lipford
Useful Links	
1	

Course Outcome

	Course Outcomes	CL	Class Sessions
MCA32402.1	Identify fundamental computer security concepts, threats, attacks, malware, vulnerabilities, exploits, and social engineering techniques.	3	9
MCA32402.2	Apply appropriate security measures to protect operating systems, applications, and virtualized environments against security threats.	3	9
MCA32402.3	Analyze web security mechanisms, including S/MIME, DKIM, SSL/TLS, HTTPS, IP security, Public-Key Infrastructure (PKI), and Federated Identity Management.	4	9
MCA32402.4	Evaluate privacy, trust, browser security, and authentication mechanisms, including text passwords, biometrics, and graphical passwords.	5	9
MCA32402.5	Recommend suitable network security solutions using firewalls, IDS/IPS, VPNs, wireless security, cryptography, digital signatures, and certificates to mitigate cyber threats.	3	9

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Program: Master in Computer Application							
Semester	Course Code	Name of Course	L	T	P	Credits	
IV	MCA32404	Real Time System	3	-	-	3	
Course Contents							
Unit I	Introduction: What is real time, Applications of Real-Time systems, A basic model of Real-time system, Characteristics of Real-time system, Safety and Reliability, Types of Real-time tasks, timing constraints, Modelling timing constraints Real-Time Task Scheduling: Some important concepts, Types of Real-time tasks and their characteristics, Task scheduling, Clock-Driven scheduling, Hybrid schedulers, Event-Driven scheduling, Earliest Deadline First (EDF) scheduling, Rate monotonic algorithm (RMA). Some issues Associated with RMA. Issues in using RMA practical situations.						
Unit II	Handling Resource Sharing and dependencies among Real-time Tasks: Resource sharing among real-time tasks. Priority inversion. Priority Inheritance Protocol (PIP), Highest Locker Protocol (HLP). Priority Ceiling Protocol (PCP). Different types of priority inversions under PCP.Important features of PCP. Some issues in using a resource sharing protocol. Handling task dependencies. Scheduling Real-time tasks in multiprocessor and distributed systems: Multiprocessor task allocation, Dynamic allocation of tasks. Fault tolerant scheduling of tasks. Clock in distributed Real-time systems, Centralized clock synchronization						
Unit III	Commercial Real-time operating systems: Time services, Features of a Real-time operating system, Unix as a Real-time operating system, Unix-based Real-time operating systems, Windows as a Real-time operating system,POSIX-RT, A survey of contemporary Real-time operating systems. Benchmarking real-time systems.						
Unit IV	Real-time Databases: Example applications of Real-time databases. Review of basic database concepts, Real-time databases, Characteristics of temporal data. Concurrency control in real-time databases. Commercial real-time databases. Realtime Communication: Basic concepts, Examples of applications, Real-time communication in a LAN and Real-time communication over packet switched networks.						
Unit V	REAL-TIME MODELING AND CASE STUDIES Petrinets and applications in real-time modeling, Air traffic controller system – Distributed air defense system.						

Text Books	
1	Real-time Systems Theory and Practice by Rajib Mall, Pearson Publication, 2008.
2	Jane W. S. Liu, Real-Time Systems, Pearson Education, 2000.
Reference Books	

1.	C.M. Krishna and K.G. Shin, Real-Time Systems, TMH.
2.	C.M. Krishna, Kang G. Shin, “Real Time Systems”, Tata McGraw - Hil, 2010.
Useful Links	
1	https://nptel.ac.in/courses/106106699

Course Outcome

	Course Outcomes	CL	Class Sessions
MCA32404.1	Apply the fundamental concepts, characteristics, applications, safety, reliability, and timing constraints of real-time systems.	3	9
MCA32404.2	Analyze real-time task scheduling algorithms, including Clock-Driven Scheduling, Earliest Deadline First (EDF), and Rate Monotonic Algorithm (RMA).	4	9
MCA32404.3	Analyze resource-sharing protocols, priority inversion, task dependencies, and fault-tolerant scheduling in real-time systems.	4	9
MCA32404.4	Evaluate real-time operating systems, real-time databases, and communication mechanisms based on their performance and timing requirements.	5	9
MCA32404.5	Apply Petri nets to model real-time systems and analyze case studies such as air traffic control and distributed air defense systems.	3	9



Program: Master in Computer Applications

Semester	Course Code	Name of Course	L	T	P	Credits
IV	MCA32405	UI/UX Design	3	-	-	3

Pre-Requisites: Basic computer operation and internet browsing skills. No prior design or Figma experience is required.

Course Objectives:

1.	To understand the basic concepts of User Interface (UI), User Experience (UX), and Human-Computer Interaction (HCI).
2.	To identify user needs and plan simple application screens and navigation.
3.	To apply basic visual design principles to create clear and user-friendly interfaces.
4.	To create simple wireframes and clickable prototypes using Figma or a similar tool.
5.	To test a design, collect user feedback, and suggest improvements.

Course Contents

Unit I	Introduction to UI/UX Design and HCI: Meaning of UI, UX, and HCI; difference between UI and UX; applications of UI/UX in websites, mobile applications, and software; importance of designing for users; basic principles of good design including simplicity, consistency, and clear feedback; introduction to usability and user satisfaction. Practical Activity: Review one commonly used application or website and note its good design features and two usability problems.
Unit II	Understanding Users and Their Needs: Understanding target users, their needs, and goals; basic research through observation and simple questionnaires; identifying user problems and requirements; introduction to user personas; simple user flows and application navigation. Practical Activity: Create a simple user persona and user flow for a student information portal.
Unit III	Basic UI Principles and Visual Design: Basic colour choices and combinations; fonts, text size, and readability; layout, spacing, alignment, and visual hierarchy; designing buttons, icons, forms, and menus; introduction to responsive design for mobile and desktop; basic accessibility and colour contrast. Practical Activity: Sketch a login page and student dashboard using suitable colours, fonts, and layout.
Unit IV	Figma, Wireframes, and Prototyping: Introduction to Figma and its workspace; using frames, shapes, text, and images; creating simple wireframes; adding colours, fonts, and interface elements; linking screens using buttons and links; creating a clickable prototype for mobile or desktop. Practical Activity: Create a clickable three- or four-screen prototype for a student portal, course registration system, or college event application.
Unit V	Usability Testing and Mini-Project: Introduction to usability testing; preparing simple test tasks and collecting feedback; observing users as they try a prototype; identifying common design problems; improving the design based on feedback; presenting the final mini-project. Practical Activity: Ask classmates to test the prototype, note at least two improvements, update the design, and present it.

Text Books

1.	Don Norman, The Design of Everyday Things: Revised and Expanded Edition, Basic Books.
2.	Jesse James Garrett, The Elements of User Experience: User-Centered Design for the Web and Beyond, 2nd Edition, New Riders.

Reference Books

1.	Steve Krug, Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability, 3rd Edition, New Riders.
2.	Ben Shneiderman, Catherine Plaisant, Maxine Cohen, Steven Jacobs, Niklas Elmqvist, and Nicholas Diakopoulos, Designing the User Interface: Strategies for Effective Human-Computer Interaction, 6th Edition, Pearson.

Useful Links

1.	Figma Help Center - https://help.figma.com/hc/en-us
2.	W3C Web Accessibility Initiative - https://www.w3.org/WAI/fundamentals/
3.	Nielsen Norman Group - 10 Usability Heuristics - https://www.nngroup.com/articles/ten-usability-heuristics/

	Course Outcomes	CL	Class Sessions
MCA32405.1	Explain the basic concepts of UI, UX, and HCI.	2	9
MCA32405.2	Analyse user needs and prepare a simple user persona and user flow.	4	9
MCA32405.3	Apply basic visual design and responsive design principles to create clear interfaces.	3	9
MCA32405.4	Create simple wireframes and clickable prototypes using Figma or a similar tool.	6	9
MCA32405.5	Test a prototype, collect user feedback, and suggest design improvements.	5	9



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Program: Master in Computer Applications

Semester	Course Code	Name of Course	L	T	P	Credits
IV	MCA32403	Foundations of Virtual Reality	3	-	-	3

Pre-Requisites: Basic knowledge of computers. No prior knowledge of Virtual Reality, 3D graphics, or programming is required.

Course Objectives:

1.	To explain the fundamental concepts, types, and working principles of Virtual Reality.
2.	To describe the main hardware and software components of VR systems.
3.	To understand the basic concepts of 3D objects and virtual environments.
4.	To explain user interaction and the basic workflow for creating a VR experience.
5.	To examine the applications, limitations, safety, and ethical considerations of VR.

Course Contents

Unit I	Fundamentals of Virtual Reality: Meaning and definition of Virtual Reality (VR); brief history and evolution of VR; characteristics and types of VR; immersive and non-immersive VR; difference between Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR); concepts of immersion and presence; overview of VR applications.
Unit II	VR Systems, Devices and Human Perception : Basic components of a VR system; Head-Mounted Displays (HMDs) and VR controllers; input and output devices; motion and position tracking; role of audio and haptic feedback; fundamentals of human vision and depth perception; basic concepts of VR rendering and frame rate; latency, user comfort, and motion sickness.
Unit III	3D Objects and Virtual Environments : Difference between 2D and 3D; basic 3D objects, models, and modelling concepts; X, Y, and Z coordinate axes; basic transformations: translation, rotation, and scaling; introduction to virtual scenes and cameras; role of lighting, colours, textures, and materials; use of 3D assets in creating virtual environments.
Unit IV	Interaction and VR Experience Design : User interaction in VR; navigation and movement in virtual environments; object selection and manipulation; controller-based and gesture-based interaction; basic interaction design principles; visual, audio, and haptic feedback; usability, accessibility, and user comfort in VR experience design.
Unit V	Introduction to VR Development and Applications : Overview of VR development tools and platforms, including Unity; basic VR development workflow: setting up a scene, adding 3D objects, configuring interaction, and testing; basic performance requirements of VR applications; applications of VR in education, healthcare, gaming, engineering, training, and tourism; limitations, privacy, safety, and ethical issues; emerging trends and career opportunities in VR.

Text Books

1	Jason Jerald, The VR Book: Human-Centered Design for Virtual Reality, Morgan & Claypool Publishers
2	William R. Sherman and Alan B. Craig, Understanding Virtual Reality: Interface, Application, and Design, Morgan Kaufmann.

Reference Books

1	Steven M. LaValle, Virtual Reality, Cambridge University Press.
2	Introduction to Cyber Security, Chwan-Wu. David Irwin, CRC Press T&F Group.
Useful Links	
1	Unity Learn – Create with VR: https://learn.unity.com/course/create-with-vr
2	Virtual Reality – Steven M. LaValle: https://vr.cs.uiuc.edu/
3	MDN – WebXR Device API: https://developer.mozilla.org/en-US/docs/Web/API/WebXR_Device_API

	Course Outcomes	CL	Class Sessions
MCA32403.1	Apply the fundamentals, characteristics, types, and applications of Virtual Reality (VR), and differentiate VR, AR, and MR.	3	9
MCA32403.2	Illustrate the components, devices, tracking mechanisms, human perception, and performance factors of VR systems.	3	9
MCA32403.3	Apply basic 3D modelling concepts and geometric transformations to create objects and virtual environments.	3	9
MCA32403.4	Analyze basic interaction techniques for navigation, object manipulation, and user feedback in VR environments.	4	9
MCA32403.5	Analyze basic VR applications using development tools such as Unity, considering performance, usability, safety, and ethical issues.	4	9