REVA UNIVERSITY
Bengaluru, India

School of Computer Science & Engineering

M. Tech. in Computer Science and Engineering [FULL TIME]

Handbook 2021-23

Rukmini Knowledge Park
Kattigenahalli, Yelahanka, Bengaluru – 560064
www.reva.edu.in

REVA UNIVERSITY
Bengaluru, India

School of Computer Science and Engineering

HANDBOOK

M. Tech. in Computer Science and Engineering

2021-23

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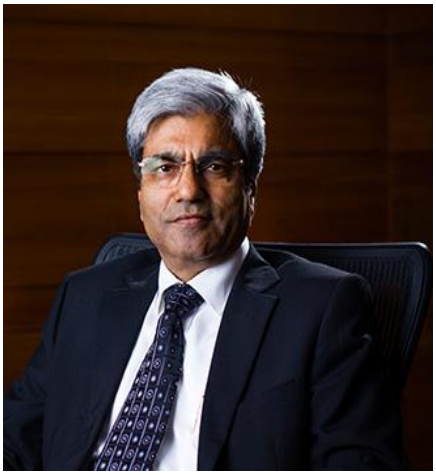
Kattigenahalli, Yelahanka, Bangalore - 560 064
Phone No: +91-9021190211/080-46966966

Rukmini Educational
Charitable Trust

www.reva.edu.in

Chancellor's Message



"Education is the most powerful weapon which you can use to change the world."

- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when 'intellectual gratification' has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge.

It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of 'Knowledge is power', we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible.

India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.

For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centered and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said 'A University should be a place of light, of liberty and of learning'. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

Dr. P. ShyamaRaju
The Founder and Hon'ble Chancellor, REVA University

Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards inter-disciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.A strong believer and practitioner of the dictum "Knowledge is Power", REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this 'temple of learning' has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of RevaUniversity.At REVA University, research, consultancy, and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries.

The outcome of the research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of "Technology Incubation Centers" in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating "GLOBAL PROFESSIONALS".

Welcome to the portals of REVA University!

Dr. M Dhanamjaya
Vice-Chancellor, REVA University

Director's –Message

I congratulate and welcome all the students to the esteemed School of Computer Science and Engineering. You are in the right campus to become a computer technocrat. The rising needs of automation in Industry 4.0 and improvising living standards have enabled rapid development of computer software and hardware technologies. Thus providing scope and opportunity to generate more human resources in the areas of compute rscience. The B.Tech and M.Techprogram curriculum and Ph.D areas in the school are designed to cater to the requirements of industry and society. The curriculum is designed meticulously in association with persons from industries (TCS, CISCO, AMD, MPHASIS, etc.), academia and research organizations (IISc, IIIT, Florida University, Missouri S & T University, etc).This handbook presents the M. Tech in Computer Science and Engineering program curriculum. The program is of 2 years duration and split into 4 semesters. The courses are classified into foundation core, hard core, and soft core courses. Hard core courses represent fundamentals study requirements of CSE. Soft courses provide flexibility to students to choose the options among several courses as per the specialization, such as, AI, Data Science, and Systems. Theoretical foundations of engineering, science, and computer science are taught in first two Semesters. Later, advanced courses and recent technologies are introduced in subsequent semesters for pursuing specialization.

The important features of the M.TechCSE are as follows: 1) Choice based course selection and teacher selection, 2) Studies in emerging areas like Machine Learning, Artificial Intelligence, Data Analytics, Cloud Computing, Python/R Programming, Genetic Engineering, NLP, Swarm Intelligence, IOT and Cybersecurity, 3) Short and long duration Internships 4) Opportunity to pursue MOOC course as per the interest in foundation and soft core courses, 5) Attain global and skill certification as per the area of specialization, 6) Self-learning components, 7) Experiential, practice, practical, hackathons, and project based learning, 8) Mini projects and major projects with research orientation and publication, 9) Soft skills training and 10) Platform for exhibiting skills in cultural, sports and technical activities through clubs and societies.

The curriculum caters to and has relevance to local, national, regional, and local developmental needs. Maximum number of courses are interpreted with cross cutting issues relevant to professional ethics generic human values environmental and sustainability.

The school has well qualified faculty members in the various areas of Computer Science and Engineering including cloudcomputing, security, IOT, AI, ML and DL, software engineering, computer networks, cognitive computing, etc. State of art laboratories is available for the purpose of academics and research.

Dr. Ashwin kumar U M
Director, School of CSE

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RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. RukminiShyamaRaju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini ShyamaRaju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. Rukmini Educational Charitable Trust (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. ShyamaRaju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. ShyamaRaju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond road park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 13,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer centre, the well planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

REVA consistently ranked as one of the top universities in various categories because of the diverse community of international students and its teaching excellence in both theoretical and technical education in the fields of Engineering, Management, Law, Science, Commerce, Arts, Performing Arts, and Research Studies. REVA offers 28 Undergraduate Programmes, 22 Full-time and 2 Part-time Postgraduate Programmes, 18 Ph. D Programmes, and other Certificate/ Diploma/Postgraduate Diploma Programmes in various disciplines.

The curriculum of each programme is designed with a keen eye for detail by giving emphasis on hands-on training, industry relevance, social significance, and practical applications. The University offers world-class facilities and education that meets global standards.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business

sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nana Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor& Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under PradhanMantriKaushalVikasYojana. The Centre conducts several add-on

courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, 2.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists, and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

REVA organises various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions, and variety of cultural events. Another important event is Shubha Vidaaya, Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and

are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognised by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga class'severyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

REVA University

Vision

''REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards".

Mission

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

Objectives

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner.

ABOUT THE SCHOOL OF COMPUTER SCIENCE AND ENGINEERING

The School has a rich blend of experienced and committed faculty who are well qualified in various aspects of Computer Science and Engineering apart from the numerous state-of-the-art digital classrooms and laboratories having modern computing equipment. The School offers B Tech in Computer Science and Engineering and M. Tech in Computer Science and Engineering (Both Full time and Part time). In addition, the school has a unique academic collaboration with the University of Alabama in Huntsville to jointly offer an MS program in Computer Science. In addition, the school has a research center in which students can conduct cutting edge research leading to a PhD degree.

Curricula of both undergraduate and postgraduate programs have been designed through a collaboration of academic and industry experts in order to bridge the growing gap between industry and academia. This makes the program highly practical-oriented, and thus industry-resilient. The B Tech program aims to create quality human resources to play leading roles in the contemporary, competitive industrial and corporate world. The masters' degrees focus on quality research and design in the core and application areas of computing to foster a sustainable world and to enhance the global quality of life by adopting enhanced design techniques and applications. This thought is reflected in the various courses offered in the masters' programs.

Vision

School of Computer Science and Engineering aspires to become an Innovative Technological Education and Research hub in developing excellent human resources through education of global standards that will inculcate technical competence, leadership qualities, ethical, moral values, research and innovative skills, social responsibility and entrepreneurship abilities.

Mission

- To create state of the art- Computing labs infrastructure and research facilities in Computer Science and Engineering.
- To provide student-centric learning environment in Computer Science and Engineering through innovative pedagogy and education reforms.
- To encourage research, innovation and entrepreneurship in Computer Science and Engineering through industry/academia collaborations and extension activities
- Organize programs through club activities for knowledge enhancement in thrust areas of Computer Science and Engineering.

- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism, moral and ethical values.

Quality Policy

The School of Computer Science and Engineering is committed to excellence through following policies.

1. Impart quality education by providing state of art curriculum, experimental learning, and state of the art labs.
2. Enhance skill set of faculty members through faculty development programmes and interaction with academia and industries.
3. Inculcate the competency in software/hardware design and programming through co-curricular activities like Hackathon, Project exihibition, Internship and Enterpreneuship Programme.
4. Provide soft skill and skill development training for personality development and better placement.
5. Promote innovation and research culture among students and support faculty members for better research and development activity.

MEMBERS OF BOARD OF STUDIES

Sl.NO	Name, Designation and Affiliation	Status	Correspondence Address
1.	**Dr Sunil Kumar S Manvi** Professor and Director School of CSE and CIT, REVA University	Chair Person	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
2.	**Dr Mallikarjuna Shastry P** M Professor, School of CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
3.	**Dr KiranKumari Patil**, Professor, School of CSE, Director UIIC, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
4.	**Dr Mallikarjuna M. Kodabagi**, Assistant Director, School of CSE, REVA University	, Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
5.	**Dr. Ashwin Kumar U M**, Professor and Assistant Director, School of CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
6.	**Dr. Gopal Krishna Shyam** Professor, School of CSE, REVA University	Member (Internal)	Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru, Karnataka 560064
7.	**Mr. Chetan Shivakumar,** CEO & Cofounder, Aikaan Labs Pvt Ltd, Bengaluru	Member	CEO & Cofounder, Aikaan Labs Pvt Ltd, Bengaluru
8.	**Mr. Muralidhar Jahagirdhar**, Practice Head Engineering, ATMECS Technology Pvt Ltd, Hyderabad	Member	Practice Head Engineering, ATMECS Technology Pvt Ltd, Hyderabad
9.	**Mr. Ravikant Soni**, Technical Manager, Solution Architect, Standard Chartered bank, Bengaluru.	Member	Technical Manager, Solution Architect, Standard Chartered bank, Bengaluru.
10.	**Dr Sanjay**, HoD Dept. of ISE, NITTE Meenakshi Institute of Technology, Bengaluru	Member	HoD Dept. of ISE, NITTE Meenakshi Institute of Technology, Bengaluru
11.	**Dr Raghavendra Kulkarni**, Director of Academics, M. S. Ramaiah University of Applied Sciences, Bengaluru	Member	Director of Academics, Ramaiah University of Applied Sciences, Bengaluru

Program Overview

M Tech in Computer Science and Engineering

Computer Science and Engineering (CSE) encompasses a variety of topics that relates to computation, like development of algorithms, analysis of algorithms, programming languages, and software design and computer Computer Science was taught as part of mathematics or engineering departments and in the last hardware. ComputerScience and engineeringhas roots in electrical engineering, mathematics, and linguistics. In the past 3 decades it has emerged as a separate engineering field. In the present information era (Knowledge era) computer science and engineering will see an exponential growth as the future machines work on artificial intelligence.

The oldest known complex computing device, called the Antikythera mechanism, dates back to 87 B.C., to calculate astronomical positions and help Greeks navigate through the seas. Computing took another leap in 1843, when English mathematician Ada Lovelace wrote the first computer algorithm, in collaboration with Charles Babbage, who devised a theory of the first programmable computer. But the modern computing- machine era began with Alan Turing's conception of the Turing Machine, and three Bell Labs scientists invention of the transistor, which made modern-style computing possible, and landed them the 1956 Nobel Prizein Physics. Fordecades, computing technology was exclusive to the government and the military; later, academic institutions came online, and Steve Wozniak built the circuit board for Apple-1, making home computing practicable. On the connectivity side, Tim Berners-Lee created the World Wide Web, and Marc Andreessen built a browser, and that's how we came to live in a world where our glasses can tell us what we're looking at. With wearable computers, embeddable chips, smart appliances, and other advances in progress and on the horizon, the journey towards building smarter, faster and more capable computers is clearly justbeginning.

Computers have become ubiquitous part of modern life and new applications are introduced everyday. The use of computer technologies is also commonplace in all types of organizations, in academia, research, industry, government, private and business organizations. As computers become even more pervasive, the potential for computer-related careers will continue to grow and the career paths in computer-related fields will become more diverse. Since 2001, global information and communication technologies (ICTs) have

become more powerful, more accessible, and more widespread. They are now pivotal in enhancing competitiveness, enabling development, and bringing progress to all level society.

The career opportunities for computer science and engineering graduates are plenty and growing. Programming and software development, information systems operation and management, telecommunications and networking, computer science research, web and Internet, graphics and multimedia, training and support and compute rindustry specialists are some of the opportunities the graduates find.

The School of Computer Science and Engineering at REVA University offers M. Tech Computer Science and Engineering programme to create motivated, innovative, creative thinking graduates to fill ICT positions across sectors who can conceptualize, design, analyse, and develop ICT applications to meet the modern-day requirements.

The MTech., in Computer Science and Engineering curriculum developed by the faculty at the School of Computer Science and Engineering, is outcome based and it comprises required theoretical concepts and practical skills in the domain. By undergoing this programme, students develop critical, innovative, creative thinking and problemsolving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in interdisciplinary topics and attitudinal skills to enhance their scope. The above-mentioned features of the programme, advanced teaching and learning resources, and experience of the faculty members with their strong connections with ICT sector makes this programme unique.

REVA UNIVERSITY
Bengaluru, India

School of Computer Science and Engineering

Program Educational Objectives (PEO's)

After few years of graduation, the graduates of M. Tech. (Computer Science and Engineering) will:

PEO-1: Have successful professional careers in industry, government, academia and military as innovative engineers.

PEO-2: Successfully solve engineering problems associated with the lifecycle of Computer Science and Engineering either leading a team or as a team member.

PEO-3: Continue to learn and advance their careers through activities such as research and development, acquiring doctoral degree, participation in national level research programme, teaching and research at university level etc.

PEO-4: Be active members ready to serve the society locally and internationally, may take up entrepreneurship for the growth of economy, to generate employment and adopt the philosophy of lifelong learning to be aligned with economic and technological development.

Program Outcomes (POs)

On successful completion of the program, the graduates of M. Tech. (Computer Science and Engineering) program will be able to:

PO-1: Demonstrate in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyze and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.

PO-2: Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

PO-3: Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO-4: Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.

PO-5: Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of the limitations.

PO-6: Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO-7: Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economical and financial factors.

PO-8: Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO-9: Recognize the need for and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO-10: Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO-11: Observe and examine critically the outcomes of one's actions and make corrective measures subsequently and learn from mistakes without depending on external feedback (SELF learning).

Programme Specific Outcomes (PSO's)

On successful completion of the program, the graduates of M Tech. (Computer Science and Engineering) program will be able to:

PSO-1: Isolate and solve complex problems in the domains of **Computer Science and Engineering** using latest hardware and software tools and technologies, along with analytical and managerial skills to arrive at cost effective and optimum solutions either independently or as a team.

PSO-2: Implant the capacity to apply the concepts of wireless communications, advanced computer networks, network security, IoT and cyber physical systems, etc. in the design, development and implementation of application-oriented engineering systems.

PSO-3: Review scholarly work by referring journals, define a new problem, design, model, analyze and evaluate the solution and report as a dissertation in the area of Computer Science and Engineering.

REVA University Academic Regulations

M Tech., Degree Programs

(Applicable for the programs offered from 2020-21 Batch)

Regulations - MTech., Degree Program
Academic Year 2020-21 Batch

1. Title and Commencement:

1.1 These Regulations shall be called **"REVA University Academic Regulations – M Tech., Degree Program 2020-21 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management**

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

2. The Programs:

These regulations cover the following M Tech., Degree programs of REVA University offered during 2020-21

M Tech (Full Time) in:
Artificial Intelligence
Computer Science and Engineering
Computer Aided Structural Engineering
Construction Technology & Management
Digital Communication and Networking
Machine Design
Power Energy & Systems
Transportation Engineering and Management
VLSI and Embedded Systems

Also
M Tech (Part Time) in:
Computer Science and Engineering
VLSI and Embedded Systems

3. Duration and Medium of Instructions:

3.1 **Duration:** The duration of the M Tech degree program shall be **TWO years** comprising of **FOUR** Semesters. A candidate can avail a maximum of 8 semesters - 4 years as per double duration norm, in one stretch to complete M Tech degree. The duration for part time students is **THREE years** and a maximum of 6 years they are required to complete the program.

3.2 The medium of instruction shall be English.

4. Definitions:

4.1 Course: "Course" means a subject, either theory or practical or both, listed under a programme; Example: "Finite Element Method of Analysis" in M Tech Civil Engineering program, "Advanced Theory of Vibration" in M Tech., Mechanical program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely:

L	**Lecture**
T	**Tutorial**
P	**Practice**

Where:

L stands for **Lecture** session consisting of classroom instruction.

T stands for **Tutorial** session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

P stands for **Practice** session and it consists of Hands on Experience / Laboratory Experiments / Field Studies / Case Studies / Project Based Learning or Course end Project/Self Study/ Online courses from listed portals that equip students to acquire the much required skill component.

4.2 Classification of Courses

Courses offered are classified as: Core Courses, Open Elective Courses, Project work/Dissertation

4.2.1 **Core Course:** A course which should compulsorily be studied by a candidate choosing a particular program of study

4.2.2 **Foundation Course:** The foundation Course is a mandatory course which should be completed successfully as a part of graduate degree program irrespective of the program of study

4.2.3 **Hard Core Course (HC) simply core course:** The **Hard Core Course** is a Core Course in the main branch of study and related branch(es) of study, if any, that the candidates have to complete compulsorily

4.2.4 **Soft Core Course (SC) (also known as Professional Elective Course)**

A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study

4.2.5 **Open Elective Course (OE):**

An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an **Open Elective Course**

4.2.6 **Project Work / Dissertation:**

Project work / Dissertation work is a special course involving application of knowledge in solving / analysing /exploring a real life situation / difficult problems to solve a multivariable or complex engineering problems.

5. Eligibility for Admission:

5.1. The eligibility criteria for admission to M Tech Program (Full Time) of 2 years (4 Semesters) and (Part Time) of 3 years (6 Semesters) are given below:

Sl. No.	Program	Duration	Eligibility
1	Masters of Technology (M Tech) in Artificial Intelligence	4 Semesters (2 years)	B E / B.Tech. in CSE / ISE / TE / MCA / M. Sc. in Computer Science or Mathematics or Information Science or Information Technology with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.
2	M Tech in Computer Science and Engineering	**Full Time** – 4 Semesters (2 years) **Part Time** – 5 Semesters (3 years)	B E / B.Tech. in ECE / IT / EEE / CSE / ISE / TE / MCA / M.Sc. in Computer Science or Mathematics or Information Science or Information Technology with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.
3	M Tech in Computer Aided Structural Engineering Construction Technology & Management Transportation Engineering and Management	6 Semesters (2 years)	BE/ B.Tech. in Civil Engineering with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.
4	M Tech in Power Energy & Systems	4 Semesters (2 years)	BE/ B.Tech. in EE/ EEE/ ECE/ CSE/ MS / M.Sc. in Mathematics/Physics/Electronics / Information Technology or Information Science with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.
5	M Tech in Digital Communication and Networking Machine Design	4 Semesters (2 years)	B E / B.Tech. in ECE /TE / EEE / CSE / ISE / Instrumentation Technology / Medical Electronics/M Sc in Electronics with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University/Institution or AMIE or any other qualification recognized as equivalent there to.
6	M Tech in VLSI and Embedded Systems	**Full Time** – 4 Semesters (2 years) **Part Time** – 6 Semesters (3 years)	B E / B.Tech. in ECE /TE / EEE / CSE / ISE / Instrumentation Technology / Medical Electronics/M Sc in Electronics with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University/Institution or AMIE or any other qualification recognized as equivalent there to.

7	M Tech in Machine Design	4 Semesters (2 years)	BE / B.Tech. in Mechanical/Aeronautical / Automobile / Industrial Production Engineering with a minimum of 50% (45% in case of candidate belonging to SC/ST category) marks in aggregate, of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.

5.2 Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, such as AICTE, UGC from time to time.

6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning and the remaining 4 weeks for final examination, evaluation and announcement of results

6.3 The credit hours defined as below

In terms of credits, every one hour session of L amounts to 1 credit per Semester and a minimum of two hour session of T or P amounts to 1 credit per Semester or a three hour session of T / P amounts to 2 credits over a period of one Semester of 16 weeks for teaching-learning process.

1 credit = 13 credit hours spread over 16 weeks or spread over the semester

The total duration of a semester is 20 weeks inclusive of semester-end examination.

The following table describes credit pattern

Table -2: Credit Pattern					
Lectures (L)	**Tutorials (T)**	**Practice (P)**	**Credits (L:T:P)**	**Total Credits**	**Total Contact Hours**
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6
4	0	0	4:0:0	4	4
2	0	0	2:0:0	2	2

a. The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course

7. Different C**ourses of Study**:

Different C**ourses of Study** are labeled as follows:

a. Core Course (CC)
b. Foundation Course (FC)
c. Hard Core Course (HC)
d. Soft Core Course (SC)
e. Open Elective Course (OE)
f. Minor Project
g. Major Project / Dissertation:

The credits for minor projects, major project/Dissertation will be decided by the respective Schools.

8. Credit and Credit Distributions:

8.1 A candidate has to earn 72 credits for successful completion of M Tech degree with a distribution of credits for different courses as prescribed by the University.

8.2 A candidate can enroll for a maximum of 24 credits per Semester. However s/he may not successfully earn a maximum of 24 credits per semester. This maximum of 24 credits does not include the credits of courses carried forward by a candidate.

8.3 Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to IV semester and complete successfully 72 credits in 4 successive semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full time students and for hostel facilities.

9. Assessment and Evaluation

9.1 The assessment and evaluation process happens in a continuous mode. However, for reporting purpose, a Semester is divided into 3 components as IA1, IA2 and SEE. The performance of a candidate in a course will be assessed for a maximum of 100 marks as explained below.

(i) Component IA1:

The first Component (IA1), of assessment is for 25 marks. This will be based on test, assignment / seminar. During the first half of the semester (i.e. by 8th week), the first 50% of the syllabus (Unit 1&2) will be completed. This shall be consolidated during the first three days of 8th week of the semester. A review test based on IA1 will be conducted and completed in the beginning of the 9th week. In case of courses where test cannot be conducted, the form of assessment will be decided by the concerned school and such formalities of assessment will be completed in the beginning of the 9th week. The academic sessions will continue for IA2 immediately after completion of process of IA1.

The finer split - up for the award of marks in IA1 is as follows:

Assignment & Seminars…….. 10 marks for the first 20% of the syllabus
Test (Mid-Term) ……..15 marks for the first 30% of the syllabus
Total …… ……..25 marks

(ii) Component IA2:

The second component (IA2), of assessment is for 25 marks. This will be based on test, assignment /seminar. The continuous assessment and scores of second half of the semester (9th to 16th week) will be consolidated during 16th week of the semester. During the second half of the semester the remaining

units in the course will be completed. A review test based on IA2 will be conducted and completed during 16th week of the semester. In case of courses where test cannot be conducted, the form of assessment will be decided by the concerned school and such formalities of assessment will be completed during 16th week.

The 17th week will be for revision of syllabus and preparation for the semester – end examination.

The finer split - up for the award of marks in IA2 is as follows:

Assignment/Seminar…….....10 marks for the second 20% of the syllabus

Review Test (Mid-Term) ……..15 marks for the second 30% of the syllabus

Total ……..25 marks

(iii) Component SEE:

The Semester End Examination of 3 hours duration for each course shall be conducted during the 18th & 19th week. **This forms the third / final component of assessment (SEE) and the maximum marks for the final component will be 50.**

9.2 The schedule of continuous assessment and examinations are summarized in the following Table below.

Component	Period	Syllabus	Weightage	Activity
IA1	1st Week to 8th Week	First 50% (two units)		Instructional process and Continuous Assessment
	Last 3 days of 8th Week		25%	Consolidation of IA1
IA2	9th week to 16th week	Second 50% (remaining two units)		Instructional process and Continuous Assessment
	Last 3 days of 16th week		25%	Consolidation of IA2
SEE	17th and 18th week			Revision and preparation for Semester end examination
	19th week to 20th week	Entire syllabus	50%	Conduct of semester end examination and Evaluation concurrently
	21st week			Notification of Final Grades
***Evaluation shall begin very first day after completion of the conduct of examination of the first course and both examination and evaluation shall continue concurrently. The examination results / final grades be announced latest by 21st week**				

Note: 1. Practical examination wherever applicable shall be conducted before conducting of IA2

examination. The calendar of practical examination shall be decided by the respective school.

2. Finally**, awarding the Grades** be announced latest by 5 days after completion of the examination.

9.3 The Assessment of MOOC and Online Courses shall be decided by the concerned School Board of Studies (BOS).

9.3.1 **For > 3 credit courses**

I	IA-I	25 marks
Ii	IA-2	25 marks
Iii	Semester end examination by the concern school board (demo, test, viva voice etc)	50 marks
	Total	**100 marks**

9.3.2 **For 1 & 2 credit courses**

I	IA-I	15 marks
Ii	IA-2	15 marks
Iii	Semester end examination by the concern school board (demo, test, viva voice etc)	20 marks
	Total	**50 marks**

9.3.3 The 50 marks meant for Internal Assessment (IA) of the performance in carrying out practical shall further be allocated as under:

I	Conduction of regular practical / experiments throughout the semester	20 marks
Ii	Maintenance of lab records / Activities /Models / charts etc	10 marks
Iii	Performance of mid-term test (to be conducted while conducting second test for theory courses); the performance assessments of the mid-term test includes performance in the conduction of experiment and write up about the experiment.	20 marks
	Total	**50 marks**

In case of an integrated course 20% marks be earmarked for laboratory work.

For example:

During IA1

Laboratory work …….. 10 marks

Test (Mid-Term) ……..15 marks for the first 50% of the theory syllabus

Total …… ……..25 marks

During IA2

Laboratory work …….. 10 marks

Test (Mid-Term) ……..15 marks for the second 50% of theory syllabus

Total …… ……..25 marks

SEE to be conducted for theory portions only and assessed for 50 marks

10. Setting Questions Papers and Evaluation of Answer Scripts:

10.1 There shall be three sets of questions papers set for each course. Two sets of question papers shall be set by the internal and one set by external examiner for a course. The Chairperson of the BoE shall get the question papers set by internal and external examiners.

10.2 The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation.

10.3 There shall be double evaluation, viz, first valuation by the internal evaluator who has taught the course and second evaluation shall be an external examiner who is familiar with the course. The average marks of the two evaluations (internal examiner & external examiner) shall be the marks to be considered for declaration of results.

10.4 The examination for Practical work/ Field work/Project work will be conducted jointly by two examiners (internal and external). However, in case of non-availability of external examiner or vice versa, the Chairperson BoE at his discretion can invite internal / external examiners as the case may be, if required.

10.5 If a course is fully of (L=0):T: (P=0) type, then the examination for SEE Component will be as decided by the BoS concerned.

10.6 In case of a course with only practical component a practical examination will be conducted with two examiners and each candidate will be assessed on the basis of: a) Knowledge of relevant processes, b) Skills and operations involved, and c) Results / Products including calculation and reporting.

10.7 The duration for Semester-End practical examination shall be decided by the Controller of Examinations.

11. Evaluation of Minor Project / Major Project / Dissertation:

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	(IA1)	Periodic Progress and Progress Reports (25%)
Component – II	(IA2)	Results of Work and Draft Report (25%)
Component– III	(SEE)	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%.

12. All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.

13. Requirements to Pass a Course

13.1 A candidate's performance from all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (25 + 25 + 50). A candidate who secures a minimum of 40% in the SEE and an overall 40% (IA1+IA2+SEE) in a course is said to be successful.

13.2 **The Grade and the Grade Point:** The Grade and the Grade Point earned by the candidate in the subject will be as given below:

Marks, P	Grade, G	Grade Point (GP=V x G)	Letter Grade
90-100	10	v*10	O
80-89	9	v*9	A+
70-79	8	v*8	A

60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.

Here, P is the percentage of marks (P=[(IA1+IA2)+SEE] secured by a candidate in a course which is **rounded to nearest integer**. v is the credit value of course. G is the grade and GP is the grade point.

a. Computation of SGPA and CGPA

The Following procedure to compute the Semester Grade Point Average (SGPA)

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e

SGPA (Si) = ∑(Ci x Gi) / ∑Ci

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

b. Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade)
Course 1	**3**	**A**	**9**	**3X9=27**
Course 2	**3**	**B**	**8**	**3X8=24**
Course 3	**3**	**C**	**7**	**3X7=21**
Course 4	**3**	**O**	**10**	**3X10=30**
Course 5	**3**	**D**	**6**	**3X6=18**
Course 6	**3**	**O**	**10**	**3X10=30**
Course 7	**2**	**A**	**9**	**2X 9 = 18**
Course 8	**2**	**B**	**8**	**2X 8 = 16**
	22			**184**

Thus, **SGPA = 184 ÷ 22 = 8.36**

c. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (72) for two year post graduate degree in a specialization is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e

CGPA = ∑(Ci x Si) / ∑Ci

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

Illustration:
CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	22	8.36	22 x 8.36 = 183.92
2	22	8.54	22 x 8.54 =187.88
3	16	9.35	16x9.35=149.6
4	12	9.50	12x9.50=114
Cumulative	**72**		635.4

Thus, **CGPA** = $\frac{22x8.36+22x8.54+16x9.35+12x9.50}{72}$ = 8.83

13.3 **Conversion of Grades Into Percentage:**

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Illustration: CGPA Earned 8.83 x 10=88.30

14. Classification of Results

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows:

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	

5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

Overall percentage=10*CGPA

a. **Provisional Grade Card:** The tentative / provisional Grade Card will be issued by the Controller of Examinations at the end of every Semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average** (SGPA).This statement will not contain the list of DROPPED courses.

b. **Final Grade Card:** Upon successful completion of the Post Graduate Degree a Final Grade card consisting of grades of all courses successfully completed by the Candidate will be issued by the COE.

15. Attendance Requirement:

15.1 All students must attend every lecture, tutorial and practical classes.

15.2 In case a student is on approved leave of absence (e g:- representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.

15.3 Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc., during a semester shall not be permitted to appear to the end semester examination and such student shall seek re-admission

16. Re-Registration and Re-Admission:

16.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

16.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

17. **Absence during Internal Test:**

In case a student has been absent from an internal tests due to the illness or other contingencies he /

she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

18. Eligibility to Appear for Semester End Examination (SEE)

18.1 Only those students who fulfill 75% attendance requirement and who secure minimum 30% marks in IA1 and IA2 together in a course are eligible to appear for SEE examination in that course.

18.2 Those students who have 75% of attendance but have secured less than 30% marks in IA1 and IA2 together in a course are not eligible to appear for SEE examination in that course. They are treated as dropped the course and they will have to repeat that course whenever it is offered.

18.3 In case a candidate secures more than 30% in IA1 and IA2 together but less than 40% in aggregate of IA1, IA2 and SEE in a course is considered as unsuccessful and such a candidate may either opt to DROP that course or appear for SEE examination during the subsequent semesters / years within the stipulated period.

18.4 In such a case wherein he / she opts to appear for just SEE examination, then the marks secured in IA1 and IA2 shall get continued. Repeat SEE examination will be conducted in respective semesters.

19. Provision for Supplementary Examination

In case a candidate fails to secure a minimum of 40% (20 marks) in Semester End Examination (SEE) and a minimum of 40% marks overall (IA and SEE together), such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

20. **Provision to Carry Forward the Failed Subjects / Courses:**

A candidate who secures a minimum of 40% in the SEE and an overall 40% (IA1+IA2+SEE) in a course is said to be successful otherwise considered that the candidate has failed the course. A candidate is required to successfully complete all the courses before submission of major project report or dissertation report.

(It means that the candidate has no restrictions on the number of courses that can be carried forward)

21. **Provision for Appeal**

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

22. **Grievance Committee:**

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances. Grievance committees will be formed by CoE in consultation with VC

For every program there will be one grievance committee. The composition of the grievance committee is as follows:-

- The Controller of Examinations - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department – Member.

23. With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

M. Tech in Computer Science and Engineering

Scheme of Instructions

(Effective from the Academic Year 2020-21)

Sl. No	Course Code	Course Title	Course Type	Credit Pattern and Credit Value				No. of Hrs.
				L	T	P	C	
FIRST SEMESTER								
1	M20TC0101	Advanced Database Management Systems	HC	3	0	0	3	3
2	M20CS0101	Advanced Machine Learning	HC	3	0	1	4	5
3	M20TC0102	Advanced Java Programming	HC	3	0	0	3	3
4	M20TC0103	Advanced Algorithms	HC	3	0	0	3	3
5	M20TC0104	Internet of Things	HC	3	0	1	4	5
6	M20CI0101	Python for Artificial Intelligence	HC	2	0	1	3	4
7	M20TC0105	Mini Project	HC	0	0	2	2	4
Total Credits for the First Semester							**22**	**27**
SECOND SEMESTER								
1	M20TCS211	Cloud Computing Tools	SC	2	0	1	3	4
	M20TCS212	Advanced Web Technologies						
	M20TCS213	Distributed Computing						
2	M20TCS221	Big data Analytics	SC	3	0	1	4	5
	M20TCS222	Wireless and Mobile Networks						
	M20TCS223	User Interface (UI)/ User Experience (UX) Design						
3	M20TCS231	Unix System Programming	SC	3	0	1	4	5
	M20TCS232	Mobile Application Development						
	M20TCS233	Python for Data Analysis						
4	M20TCS241	High Performance Computing	SC	3	0	1	4	5
	M20TCS242	Program Analysis						
	M20TCS243	Block Chain Technology						
5	M20TCS251	Robotic Process Automation	SC	3	0	0	3	3
	M20TCS252	Agile Software Development						
	M20TCS253	Deep Learning						
6	M20TC0206	Cyber Security Lab	HC	0	0	2	2	4
7	M20TC0207	Mini Project	HC	0	0	2	2	4
Total Credits for the Second Semester							**22**	**30**

THIRD SEMESTER								
1	M20TCS311	Virtual and Augmented Reality	SC	3	0	1	4	5
	M20TCS312	Computer Vision						
	M20TCS313	Natural Language Processing						
2	M20TCO302	Open Elective	OE	4	0	0	4	4
3	M20TC0303	Project Work Phase-1	HC	0	0	4	4	8
4	M20TC0304	Internship/ Global Certification	HC	0	0	4	4	8
	Total Credits for the Third Semester						**16**	**25**
FOURTH SEMESTER								
1	M20TC0401	Project-Work Phase-2 and Dissertation	HC	0	0	12	12	28
	Total Credits for the Fourth Semester						**12**	28
Total Credits for all Four Semesters is 72.								

Note:Internship should be carried out in a reputed /Tier-1/R & D organization, preferably, internship should be with stipend. The internship should be approved by the REVA University authorities before completion of 3rd semester and the students should obtain the permission for the same by producing the necessary details of company, selection process, and the offer letter issued by the company. At the end of the Internship, detailed report must be submitted.

Students can take-up the internship only if it is approved by RU authorities.

Project work phase 1 comprises of literature survey, review paper writing, and problem formulation, identification of tools and techniques, and methodology for the project.

Project work phase – 2, in 4thsemester should have an outcome: publication in a reputed National/International Journal or a patent filing to earn 2 credits.

Global Certification programs: Students have to register for global certification programs of their choice such as networking, JAVA, ORACLE, etc. The students can also choose skill development programs conducted by the UIIC or School, which may not be globally certified. However, weightage is more for global certification courses (10% weightage is accounted less for non-global programs).

The registration must happen before beginning of the third semester.

I Year

Detailed Syllabus

I Semester
Syllabus

<table>
<tr><td>Course Title</td><td colspan="4">Advanced Database Management Systems</td><td>Course Type</td><td colspan="2">Theory</td></tr>
<tr><td>Course Code</td><td>M20TC0101</td><td>Credits</td><td colspan="2">3</td><td>Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td rowspan="2">Total Number of ClassesPer Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>0</td><td>0</td><td>0</td><td rowspan="2">Theory</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>0</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>3</td><td>3</td><td>39</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course introduces to new database technology with emphasis on object orientation. The focus is mainly on the data modeling aspect. The course gives an overview of motivation and background of the new developments, and is intended as an introduction to the most important advances with respect to the classical relational database systems. Effective collection, analysis, and maintenance of data is key to achieve rapid progress in almost all disciplines of science and engineering. This course covers the core principles and techniques of data and information management such as Object oriented concepts in relational databases, Architectures of Parallel and Distributed databases OLAP, Enhanced Data Models for Advanced Applications.

COURSE OBJECTIVES:

1. The objectives of this course are to:
2. Explain the concepts of DBMS and SQL
3. Discuss the Object oriented concepts and object relational Databases
4. Demonstrate the use of parallel and distributed databases in real world applications
5. Illustrate the development of Enhanced Data Model for given applications.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Solve queries using SQL for real world applications	1,2,3,4,5	1,2,3
CO2	Make use of the Object oriented concepts in relational databases for real world applications.	1,2,3,4,5	1,2,3
CO3	Design parallel and distributed databases, Query database and incorporate recovery mechanisms.	1,2,3,4,5	1,2,3
CO4	Develop Enhanced Data Model for given real world applications	1,2,3,4,5	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			

COURSE ARTICULATIONMATRIX

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	1							3	3	3
CO2	3	3	2	3	2							3	3	3
CO3	3	2	3	1	2							3	3	3
CO4	3	3	3	2	2							3	3	3

COURSE CONTENTS:

UNIT 1

Overview of DBMS and SQL: Introduction to DBMS and SQL, SQL Data Definition and Data Types, Schema change statements in SQL, Specifying basic constraints in SQL, Basic Queries in SQL, More Complex Queries in SQL, General Constraints as Assertions, Views in SQL, Database Programming, Embedded SQL

UNIT- 2

Overview of Object-Oriented Concepts, Object and Object-Relational Databases: Objects, Encapsulation, Polymorphism, Type and class hierarchies etc. Object model of ODMG, Object definition Language ODL; Object Query Language OQL; Overview of C++ language binding; Conceptual design of Object database; Overview of object relational features of SQL; Object-relational features of Oracle.

UNIT -3

Parallel and Distributed Databases: Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS; Distributed catalog management; Distributed Query processing; Updating distributed data; Distributed transactions; Distributed Concurrency control and Recovery.

UNIT- 4

Enhanced Data Models for Some Advanced Applications: Active database concepts and triggers; Temporal, Spatial, and Deductive Databases – Basic concepts. More Recent Applications: Mobile databases; Multimedia databases; Geographical Information Systems; OLAP - OLAP Architecture, Relational OLAP , Multidimensional OLAP , Relational vs. Multidimensional OLAP , Web based OLAP Major features & functions , Drill-Down and Roll-Up , Slice-and-Dice or Rotation

SELF-LEARNING COMPONENT:

Data warehousing, Data Marts, Getting data into the warehouse , Extraction , Transformation ,Cleansing , Loading, Summarization, Meta data, Data warehousing & ERP, Data warehousing & KM , Data warehousing & CRM , Data Mining , Data mining algorithms, Clustering, Classification, association rules, Knowledge discovery: KDD process, Decision trees ,

TEXT BOOKS:

1. Raghu Ramakrishnan and Johannes Gehrke " Database Management Systems", McGraw- Hill, 2003.

2. Elmasri and Navathe, "Fundamentals of Database Systems", Pearson Education, 2007.

REFERENCE BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, “Database System Concepts”, McGraw Hill, 2010.
2. C J Date, “Database Design and Relational Theory, Normal Forms and All that Jazz”, O ‘Reilly.inc 2012.
3. Jiawei Han, MichelineKamber, Jian Pei, “Data Mining: Concepts and Techniques”, Elsevier, 2011.
4. Connolly and Begg, “Database Systems”, Pearson Education, 2002.

JOURNALS/MAGAZINES

1. IEEE Transactions on Advance Data Base Management
2. Springer Journal of Advance Data Base Management
3. Elsevier Journal of Advance Data Base Management

SWAYAM/NPTEL/MOOCS:

1. https://www.udemy.com/ Data Base Management
2. https://www.coursera.org/learn/ Data Base Management
3. https://nptel.ac.in/courses/106106139/

<table>
<tr><td>Course Title</td><td colspan="4">Advanced Machine Learning</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>M20CS0101</td><td>Credits</td><td colspan="2">4</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="6">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of ClassesPer Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>0</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>4</td><td>5</td><td>5</td><td>39</td><td>26</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

The course introduces machine learning, with various aspects involved in machine learning, types of learning like supervised, unsupervised and reinforcement learning. It also introduces various methods of dimensionality reduction, reasons for dimensionality reduction, concepts of neural networks, different aspects involved in neural networks, their activation function, back propagation algorithm etc.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain the basic blocks of machine learning and the techniques involved.
2. Discuss the various Learning trees used in real world problems.
3. Illustrate the use of different Linear Models in real world problems.
4. Demonstrate the use of different dimensionality reduction techniques.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	Pos	PSOs
C01	Apply the basic blocks of machine learning and the techniques involved	1,2,3,4,5	1,2,3
C02	Analyze the various Learning trees used in real world problems.	1,2,3,4,5	1,2,3
C03	Design simple linear models to solve real world problems.	1,2,3,4,5	1,2,3
C04	Formulate different dimensionality reduction techniques to real world problems.	1,2,3,4,5	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			

COURSE ARTICULATIONMATRIX

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3	3							**3**	**3**	**3**
CO2	2	3	3	2	3							**3**	**3**	**3**
CO3	3	2	2	2	3							**3**	**3**	**3**
CO4	3	3	2	2	3							**3**	**3**	**3**

COURSE CONTENTS:

UNIT-1

Introduction : Learning – Types of Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm –– Inductive bias [1] , Bayesian Learning [1]

Learning with trees: Learning with Trees, Decision Trees, Constructing Decision Trees, Classification and Regression Trees.

UNIT-2

Learning with trees (contd...): Boosting, Bagging, Random Forest, Different ways to combine Classifiers Probabilistic Learning – Gaussian Mixture Models, Nearest Neighbor Methods [2]

Support Vector Machines - Optimal separation, kernels, the support vector machine algorithm, extensions to the SVM

UNIT-3

Linear models: Perceptron, Linear Separability, Linear Regression.

Multi-layer Perceptron, Going Forwards, Going Backwards: Back Propagation Error, Multi-layer Perceptron in Practice, Examples of using the MLP, Overview, and Deriving Back-Propagation

UNIT-4

Dimensionality reduction and evolutionary models: Dimensionality Reduction - Linear Discriminant Analysis, Principal Component Analysis, Factor Analysis, Independent Component Analysis .

Unsupervised learning: Different types of clustering methods, K means Algorithms, Vector Quantization, and Self-Organizing Feature Map

Unsupervised learning: Classification, Association

SELF- LEARNING:

Reinforcement learning -Introduction, Learning task, Q-learning –Qfunction, An Algorithm for Learning Q, An Illustrative Example, Convergence, Experimentation Strategies, Updating Sequence, Nondeterministic Rewards and Actions, Temporal Difference Learning.

TEXT BOOKS:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (India) Private Limited, 2013.
2. Stephen Marsland,” Machine Learning” – An Algorithmic Perspective”, Second Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.

REFERENCE BOOKS:

1. Ethem Alpaydin, “Introduction to Machine Learning 3e (Adaptive Computation and Machine Learning Series)” Third Edition, MIT Press, 2014
2. Peter Flach, “Machine Learning: The Art and Science of Algorithms that Make Sense of Data”, First Edition, Cambridge University Press, 2012.
3. Jason Bell, “Machine learning – Hands on for Developers and Technical Professionals”, First Edition, Wiley, 2014

JOURNALS/MAGAZINES:

1. IEEE Transactions on Pattern Analysis and Machine Intelligence
1. Springer Journal of Machine Learning
2. Elsevier Journal of Machine Learning with Applications

SWAYAM/NPTEL/MOOCS:

1. https://www.udemy.com/machinelearning/
2. https://www.coursera.org/learn/machine-learning
3. https://nptel.ac.in/courses/106106139/

PRACTICE:

Sl.No.	List of Programs
1.	PROCEDURE TO INSTALL R STUDIO: It is an integrated development environment (IDE) for R. It includes a console, syntax-highlighting editor that supports direct code execution, as well as tools for plotting, history, debugging and workspace management. Install R studio and Pacakages.
2.	FIND-S ALGORITHM: In Machine Learning, concept learning can be termed as "*a problem of searching through a predefined space of potential hypothesis for the hypothesis that best fits the training examplesl.* Implemrent the Find-S algorithm that starts with the most specific hypothesis.
3.	CANDIDATE ELIMINATION ALGORITTHM: The candidate elimination algorithm incrementally builds the version space from most general hypothesis to most specific hypothesis. Implement candidate elimination algorithm that considers positive instances and negative instances.
4.	LINEAR REGRESSION: It is regression technique which try to fit all possible values. Builds a linear relation. Consider any dataset to implement linear regression for analyze the data, do possible data preprocessing and data exploration.
5.	NAIVE BAYES: It is probabilistic approach undergoes bayes rule. Apply Navie Bayes algorithm using Gethub dataset for classification model on Flowers.
6.	KNN: It is mainly used for classification predictive problems. Select the number K of the neighbors. Calculate the Euclidean distance of K number of neighbors.
7.	K-MEANS: K-Means Clustering is an Unsupervised Learning algorithm, which groups the unlabelled dataset into different clusters.Implement KNN to calculate the variance and place a new centroid of each cluster
8.	APRIORI ALGORITHM: The Apriori algorithm uses frequent item sets to generate association rules, and it is designed to work on the databases that contain transactions. Determine the support of item sets in the transactional database and select the minimum support and confidence.

Course Title	Advanced Java Programming				Course Type	Theory	
Course Code	M20TC0102	Credits	3		Class	I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of ClassesPer Semester	Assessment in Weightage	
	Theory	3	3	3			
	Practice	0	0	0	Theory	CIE	SEE
	-	0	-	-	Practical		
	Total	3	3	3	39	50	50

COURSE OVERVIEW:

Advanced Java is everything that goes beyond Core Java – most importantly the APIs defined in Java Enterprise Edition, includes Servlet programming, Web Services, the Persistence API, etc. It is a Web & Enterprise application development platform which basically follows client & server architecture. Advance Java i.e. JEE (Java Enterprise Edition) gives you the library to understand the Client-Server architecture for Web Application Development. This course focuses on advanced concepts in the java programming starting from basic concepts of classes, objects, java database connection, servlets-The technology is used to create a web application (resides at server side and generates a dynamic web page) and java server pages, using which windows, web applications can be developed

COURSE OBJECTIVES:

The objectives of this course are to:

1. Describe the advanced concepts of java programming.
2. Explain the concepts used for developing web application.
3. Discuss different session management techniques used in web pages.
4. Demonstrate the establishment of communication between application and databases.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Summarize the fundamentals of Java like object oriented programming, exception handling and multithreading to solve real world problems.	1,2,3,4,5	1,2,3
CO2	Choose proper component, like java servlets, java server pages etc., to develop a web application using J2EE	1,2,3,4,5	1,2,3
CO3	Apply advanced java concepts to manage sessions and cookies for optimal performance	1,2,3,4,5	1,2,3
CO4	Develop an application to establish communication between application and database.	1,2,3,4,5	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			

COURSE ARTICULATIONMATRIX

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	1	2							3	2	3
CO2	2	3	1	2	3							2	3	3
CO3	3	2	1	3	2							2	2	3
CO4	2	3	1	3	2							2	3	3

COURSE CONTENTS: **UNIT-1**

Introduction to Java: Java and Java applications; Java Development Kit (JDK); Java is interpreted, Byte Code, JVM; Object-oriented programming; Classes: Classes in Java; Inheritance: Simple, multiple, and multilevel inheritance; Overriding, overloading. Exception handling: Exception handling in Java

Multi-Threaded Programming: What are threads? How to make the classes threadable; Extending threads; Implementing runnable; Synchronization; Changing state of the thread;

UNIT-2

Java 2 Enterprise Edition Overview, Database Access : Overview of J2EE and J2SE The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; Resultset; Transaction Processing; Metadata, Data types; Exceptions.

UNIT-3

Servlets : Background; The Life Cycle of a Servlet; Using Tomcat for Servlet Development; A simple Servlet; The Servlet API; The Javax.servlet Package; Reading Servlet Parameter; The Javax.servlet.http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking.

UNIT-4

JSP, RMI : Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects. Java Remote Method Invocation: Remote Method Invocation concept; Server side, Client side. IDE: Eclipse IDE, Netbeans IDE &Myeclipse IDE; Servers: Apache Tomcat Glassfish Server, JBoss Server & Weblogic Server. Functional Interfaces, Lambda Expressions, Working with Collections, Stream APIs (Streams and Collectors) and Socket Programming

SELF-LEARNING COMPONENT:

JAVA Model-View-Controller Pattern & Spring Framework.

TEXT BOOKS:

1. Bryan Basham, Kathy Sierra & Bert Bates, “Head First Servlets & JSP”, O’Reilly 2nd Edition.1999
2. Barry J. Holmes and Daniel T. Joyce, “Object-Oriented Programming With Java”, Second Edition, Jones And Bartlett Publishers,2000
3. Dale Skrien, “Object-Oriented Design Using Java”, McGraw-Hill Higher Education,2009
4. Danny Poo, “Object-Oriented Programming and Java”, Second Edition; Springer, 2008.

REFERENCE BOOKS:

1. Cay Horstmann “Big Java”, John Wiley and Sons 2nd Edition, 2001
2. Herbert Schildt, “The Complete Reference Java J2SE”, 5th Edition, TMH Publishing Company Ltd, New Delh

JOURNALS/MAGAZINES:

1. Elsevier Journal on Computer Languages, Systems, and Strucutres
2. ACM Transactions on Programming Languages and Systems

SWAYAM/NPTEL/MOOCS:

1.https://onlinecourses.nptel.ac.in/noc19_cs84/preview

2. https://nptel.ac.in/courses/106/105/106105191/

Course Title	Advanced Algorithms				Course Type	Theory	
Course Code	M20TC0103	Credits	3		Class	I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of ClassesPer Semester	Assessment in Weightage	
	Theory	3	3	3			
	Practice	0	0	0	Theory	CIE	SEE
	-	0	-	-			
	Total	3	3	3	39	50	50

COURSE OVERVIEW:

Emphasis is placed on fundamental **algorithms** and **advanced** methods of algorithmic design, analysis, and implementation. ... Domains include string **algorithms**, network optimization, parallel **algorithms**, computational geometry, online **algorithms**, external memory, cache, and streaming **algorithms**, and data structures.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain the problem-solving methods and provide a solid foundation in algorithm design and analysis.
2. Discuss sorting & string-matching algorithmic design paradigms.
3. Demonstrate a familiarity with major algorithms and data structures related to graph.
4. Design efficient algorithms for common engineering problems.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Apply iterative and recursive algorithms to model engineering problems in real world	1,2,3,4,5	1,2,3
CO2	Experiment with different sorting and string matching algorithms for real time data sets..	1,2,3,4,5	1,2,3
CO3	Analyse the search and graph algorithms for real world applications	1,2,3,4,5	1,2,3
CO4	Make use of Number Theoretic Algorithms and Probabilistic and Randomized Algorithms in real world applications.	1,2,3,4,5	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			

COURSE ARTICULATIONMATRIX

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	3							3	3	3
CO2	3	3	3	1	3							3	2	3
CO3	3	3	2	2	3							3	3	2
CO4	3	3	3	2	2							3	3	3

COURSE CONTENTS:

UNIT-1

Review of Fundamentals: Algorithms from Ancient to Modern Times – Toward a modern Theory of Algorithms – Computing in the Third Millennium – Guidelines for Algorithm Design – Recursion – Data Structures and Algorithm Design – Major Design Strategies – Analyzing Algorithm Performance – Designing and nalyzing some basic comparison based list algorithms – Asymptotic behavior of Functions – Asymptotic order formulae for three important series – Recurrence relations for complexity – Mathematical induction and proving the correctness of algorithms – Establishing lower bounds for problems.

UNIT-2

Sorting and string matching Algorithms: Merge Sorting and its analysis, Quick Sorting and its Analysis, Bubble Sort, Selection Sort, Shell sort, Bingo sort and Radix sort. String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

UNIT-3

Trees & Applications of Algorithms: Mathematical properties of Binary trees – implementation of trees and forests – Tree traversal – Binary search trees – Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Flow networks and Ford-Fulkerson method; maximum bipartite matching. Extending the Limits of Tractability: Finding small vertex covers, Coloring a set of circular arcs, Tree decompositions of Graphs.

UNIT-4

Number Theoretic Algorithms: Elementary notions; GCD; Modular Arithmetic; Solving modular linear equations; The Chinese remainder theorem; Primality testing; Integer factorization. Probabilistic and Randomized Algorithms: Probabilistic algorithms; Randomizing deterministic algorithms, Monte Carlo and Las Vegas algorithms; Probabilistic numeric algorithms.

SELF-LEARNING COMPONENT:

Mathematical induction and proving the correctness of algorithms – Establishing lower bounds for problems. Naïve string Matching; Mathematical properties of Binary trees – implementation of trees and forests – Tree traversal – Binary search trees.

TEXT BOOKS:

1. T. HCormen, C E Leiserson, R1Rivest and C Stein, " Introduction to Algorithms", Prentice-Hall of India, 2010.
2. M. Kenneth A. Berman, Jerome Paul "Algorithms", Cengage Learning, 2002.
3. Jon Kleinberg and Eva Tardos, "Algorithm Design", Pearson, 2016

REFERENCE BOOKS:

1. AnanyLevitin, “Introduction to the Design & Analysis of Algorithms”, Pearson, 2013
2. Ellis Horowitz, SartajSahni, S. Rajasekharan, “Fundamentals of Computer Algorithms”, Universities Press, 2007.
3. J. Kleinberg and E. Tardos, “Algorithm Design”, Addison Wesley, 2005.
4. V. Aho, J. E. Hopcraft, and J. D. Ullman, “Design and Analysis of Algorithms”, Addison-Wesley, 1974.

JOURNALS/MAGAZINES

1. IEEE Transactions on Advance Algorithms
2. Springer Journal of Advance Algorithms
3. Elsevier Journal of Advance Algorithms
4. ACM Transactions on Algorithms
5. ACM Transactions on Modeling and Computer Simulation (TOMACS)
6. Transactions on Parallel and Distributed Systems

SWAYAM/NPTEL/MOOCS:

1. https://www.udemy.com/ Advance Algorithms
2. https://www.coursera.org/learn/ Advance Algorithms
3. https://nptel.ac.in/courses/106106139/

Course Title	Internet of Things				Course Type		Integrated	
Course Code	M20TC0104	Credits	3		Class		I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of ClassesPer Semester		Assessment in Weightage	
	Theory	3	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	0	-	-				
	Total	3	5	5	39	26	50	50

COURSE OVERVIEW:

This course introduces the Concept of connecting processing devices together through a network using which things can communicate with each other using internet as means of communication between them. All the things should be IP protocol enabled in order to have this concept possible. Not one but multiple technologies are involved to make IoT a great success.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Explain the basics of embedded systems and embedded system design.
2. Describe Internet-of-Things and design principles.
3. Demonstrate the use of prototyping in development of real world application.
4. Illustrate the use of internet principles and techniques for writing embedded code.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Summarize the foundation in the Internet of Things, including the components, tools, and analysis.	1,2,3,4,5	1,2,3
CO2	Apply Internet-of-Things and design principles in development of real-world applications.	1,2,3,4,5	1,2,3
CO3	Design prototypes forimplementingIoT in Big Data and understand the utilization and modelling of extracted data development of real-world application.	1,2,3,4,5	1,2,3
CO4	Develop embedded IoT Solutions using sensors and components integration for the real time application	1,2,3,4,5	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			

COURSE ARTICULATIONMATRIX

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	2	3	3							**3**	**2**	**3**
CO2	2	1	3	3	2							**3**	**3**	**3**
CO3	3	2	2	3	3							**3**	**3**	**2**
CO4	3	2	2	3	3							**3**	**2**	**3**

COURSE CONTENTS:

UNIT-1

Introduction to Internet of Things: Introduction-Definition & Characteristics of IoT, Physical Design of IoT- Things in IoT , IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs,IoT Enabling Technologies- Wireless Sensor Networks, Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, IoT Levels & Deployment Templates.

UNIT-2

IoT and M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, Software Defined Networking, Network Function Virtualization, IoT Platform Design Methodology, Introduction, IoT Design Methodology, Step1: Purpose and requirement specification, Step2: Process Specification, Step 3: Domain Model Specification, Step 4: Information Model Specification, Step 5: Service Specification, Step 6: IoT Level Specification, Step 7: Function View Specification, Step 8: Operational View Specification, Step 9: Device and Component Integration, Step 10: Application Development, IoT System

UNIT-3

Logical Design Using Python: Introduction, Installing Python, Python Data Types and Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date Time applications, Classes, Python Packages of Interest for IoT.

IoT Physical Devices and End Points: What is and IoT Device, Exemplary Device Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry pi interfaces, programming raspberry pi with python, other IoT devices.

UNIT-4

Case Study & advanced IoT Applications: IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts. Sensors and sensor Node and interfacing using any Embedded target boards.

SELF-LEARNING COMPONENT:

Various sensors available in market – application of various sensor – Their specifications – code used to connect these sensors into Microcontroller board – Various microcontroller boards available in market – Arduino IDE download – usage of this IDE to carryout projects.

TEXT BOOKS:

1. Arshdeep Bahga, Vijay audisetti, Internet of Things," A Hands on Approach", University Press, 2014.
2. Michael Millen, "The Internet of Things", Pearson, 2015.

REFERENCE BOOKS:

1. Adrian McEwen & Hakim Cassimally, "Designing the Internet of Things", ISBN 978-81-265-5686-1 Wiley Publication, 2013
2. Dr. OvidiuVermesan, Dr. Peter Friess, "Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems", River Publishers, 2013

JOURNALS/MAGAZINES

1. IEEE Transactions on Internet of Things
2. Springer Journal of Internet of Things
3. Elsevier Journal of Internet of Things
4. IEEE Transactions on Wireless Communications
5. IEEE Sensors Journal
6. IEEE Internet of Things Journal
7. Elsevier, Journal of Network and Computer Applications,
8. Elsevier, Computer Law & Security Review
9. ACM, ACM Transactions on Internet Technology (TOIT)

SWAYAM/NPTEL/MOOCS:

1. https://www.udemy.com/ Internet of Things
2. https://www.coursera.org/learn/ Internet of Things
3. https://nptel.ac.in/courses/106106133/

PRACTICE:

SL.NO	List of Programs
1	There are lots of ways to control DC motors with an Arduino. But one of the easiest and most popular is with an L293D motor driver. The L293D motor driver is designed specifically to control DC motors, stepper motors, solenoids, and any other load with a high impedance. One of its main advantages is that it can control. Design and construct a module to drive DC motor clockwise and anti-clockwise using L293D with Arduino board.
2	Interfacing is the first step to create any useful project. So why don't we create an RFID based Access Control System or an RFID based Door Lock using Arduino? The system I have designed here is a simple version of the project. This project can be enhanced with a lot of features (which I will be doing in the next version of this project – Advanced RFID based Door Lock). Design and construct a module to build a RFID based Access Control System or an RFID based Door Lock using Arduino and display lock status on LCD.
3	The ESP8266 has been a growing star among IoT or WiFi-related projects. It's an extremely cost-effective WiFi module that – with a little extra effort – can be programmed to build a standalone web server. Design a module to control an LED from Webserver using NodeMcu or Esp8266 programming with Arduino IDE.
4	Most new cars today come with a host of advanced safety features including automated systems that assist the drive in maintaining control of the car and warning the driver of possible dangers. The problem, however, is that while these kinds of features greatly increase the safety of a car, they are exorbitantly expensive and only available in new, high-end cars not in old, low-end cars. Design a module for non-contact object detection using Arduino and proximity sensor (Car proximity alert).
5	To designing a intelligent "Graden Computer" with an optional digital plant moisture sensor/water pump controller that lights an LED to alert the user when it is time to water a potted plant, and/or turn on a water pump to quench the thirst, here is an Arduino Primer for you. No doubt, an Arduino can convert your favorite pots into self-watering planters, keeping your plants from drying out and reducing the time you spend watering. Design an intelligent Garden Computer with Arduino and soil moisture sensor that lights an LED to alert the user when it is time to water a potted plant.
	PART-B (IoT Projects)
6	The Arduino Yun solves that problem. The Yun is an Arduino with WiFi built in. Additionally, the Yun has a second microprocessor that runs a lightweight version of Linux and comes with Python preinstalled. This means that for $75, you can have sensors and buttons trigger Python scripts, and Python scripts trigger LEDs, motors and other actuators. And Python's just the language that comes with it — you can install Ruby, Node or PHP if that's your jam. Set up ArduinoYún to connect to WiFi
7	To control your room's temperature, we can build a smart temperature controller. In this case, we use a **PID** (**proportional–integral–derivative**) controller. When you set a certain temperature, a PID controller will change the temperature by turning either cooler or hotter. A PID controller program is developed using Python, which runs on the Raspberry Pi board. Build a smart temperature controller for your room

8	Dedicated control over room temperature is not only a key issue in providing work conditions that ensure employee satisfaction and hence increased work output; it is now a health and safety issue. The design considered the flexibility of using a microcontroller, PIC16F876A along with other peripheral devices such as LM35 temperature sensor, LCD display unit to form all-encompassing single system Build your own decision system based-IoT
9	Tracking multiple objects through video is a vital issue in computer vision. It's used in various video analysis scenarios, such as visual surveillance, sports analysis, robotic navigation, autonomous driving, human-computer interaction, and medical visualization. In cases of monitoring objects of a certain category, such as people or cars, detectors used to make tracking easier. Usually, it is done in two steps: Detecting and Tracking. Build a tracking vision system for moving objects
10	The robot constantly checks to see if it is within 0 meters of the GPS position, if it is then the App display will read "Destination Reached". As you can see sometimes it returns to the correct location and other times it is several feet off. Build a your own car robot based on GPS

<table>
<tr><td>Course Title</td><td colspan="4">Python for Artificial Intelligence</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>M20CI0101</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">I Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of ClassesPer Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>0</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>4</td><td>4</td><td>26</td><td>26</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course is an introduction to basic concepts of various fields of artificial intelligence like Artificial Neural Networks, Natural Language Processing, Machine Learning and its implementation in Python.

COURSE OBJECTIVES:

The objectives of this course are to

1. Explain the Basics concepts of Python and Artificial Intelligence.
2. Build an Intelligent Agent using AI concepts.
3. Develop a sentiment analyzer using python.
4. Illustrate the Concepts of Reinforcement Learning.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate fundamental understanding of artificial intelligence (AI) and python.	1,2,3,4,5	1,2,3
CO2	Apply basic principles of AI to solve real world applications.	1,2,3,4,5	1,2,3
CO3	Make use of AI principles to design a Speech recognizer.	1,2,3,4,5	1,2,3
CO4	Make use of python to Implement Q-Learning algorithm.	1,2,3,4,5	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			

COURSE ARTICULATIONMATRIX

Course Outcomes	Program Outcomes													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	3	2							3	3	2
CO2	2	3	2	3	3							2	3	3
CO3	3	2	3	3	2							3	3	2
CO4	3	2	3	2	2							3	2	3

COURSE CONTENTS:

UNIT-1

Python Basics: Introducing Python, Variables and Data Types, Making Choices, Using Lists, Functions, Working with Text, Executable Files.

Introduction to Artificial Intelligence: What is Artificial Intelligence?, Why do we need to study AI?, Applications of AI, Branches of AI, Defining intelligence using Turing Test, Making machines think like humans, Building rational agents, General Problem Solver, Solving a problem with GPS, Building an intelligent agent, Types of models,

UNIT -2

Natural Language Processing: Introduction and installation of packages, Tokenizing text data, Converting words to their base forms using stemming, Converting words to their base forms using lemmatization, Dividing text data into chunks, Extracting the frequency of terms using a Bag of Words model, Building a category predictor, Constructing a gender identifier, Building a sentiment analyzer, Topic modeling using Latent Dirichlet Allocation, Summary.

UNIT-3

Probabilistic Reasoning for Sequential Data: Understanding sequential data, Handling time-series data with Pandas, Slicing time-series data, Operating on time-series data, Extracting statistics from time-series data, Generating data using Hidden Markov Models, Identifying alphabet sequences with Conditional Random Fields, Stock market analysis, Summary.

Building A Speech Recognizer: Working with speech signals, Visualizing audio signals, Transforming audio signals to the frequency domain, Generating audio signals, Synthesizing tones to generate music, Extracting speech features, Recognizing spoken words, Summary.

UNIT-4

Reinforcement Learning: Understanding the premise, Reinforcement learning versus supervised learning, Real world examples of reinforcement learning, Building blocks of reinforcement learning, Creating an environment, Building a learning agent, Summary.

SELF –LEARNING COMPONENTS

Artificial neural networks, Machine Learning Techniques

TEXT BOOKS:

1) Tim Hall and J-P Stacey, “Python 3 for Absolute Beginners”, publishersApress,2009.
2) Prateek Joshi, “Artificial Intelligence with Python”,Packt publishers , 2017.

REFERENCE BOOKS:

1. Stuart Jonathan Russell, Peter Norvig, “Artificial Intelligence For Dummies”, Prentice-Hall, 201

JOURNALS/MAGAZINES:

1. Elsevier Journal of Artificial Intelligence
2. IEEE Transactions on Artificial Intelligence
3. Springer Jounal of Artificial Intelligence

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/Artificial intilligence/
2. https://www.coursera.org/learn/machine-learning
3. https://nptel.ac.in/courses/106106139/

PRACTICE:

Sl.No.	List of programs
1	Machine learning algorithms expect data to be formatted in a certain way before they start the training process. In order to prepare the data for ingestion by machine learning algorithms, we have to preprocess it and convert it into the right format. Apply the following preprocessing techniques on the given data set i) Binarization ii) Normalization iii) Mean removal iv) Scaling The dataset is available in the following website. https://github.com/PacktPublishing/Artificial-Intelligence-with-Python.
2.	Naïve Bayes is a technique used to build classifiers using Bayes theorem. Bayes theorem describes the probability of an event occurring based on different conditions that are related to this event. Build an Naïve Bayes classifier to classify an animal to Cheetah assuming the attributes.
3.	A Support Vector Machine (SVM) is a classifier that is defined using a separating hyperplane between the classes. This hyperplane is the N-dimensional version of a line. Given labeled training data and a binary classification problem, the SVM finds the optimal hyperplane that separates the training data into two classes. Build a Support Vector Machine classifier to predict the income bracket of a given person based on 14 attributes. Our goal is to see where the income is higher or lower than $50,000 per year. The income dataset available at https://archive.ics.uci.edu/ml/datasets/Census+Income.
4	Regression is the process of estimating the relationship between input and output variables. Regression analysis helps us in understanding how the value of the output variable changes when we vary some input variables while keeping other input variables fixed. Build a regression model for a single variable for any given Dataset.
5	A **Decision Tree** is a structure that allows us to split the dataset into branches and then make simple decisions at each level. This will allow us to arrive at the final decision by walking down the tree.Build a classifier using Decision Trees in Python.
6	Clustering is one of the most popular unsupervised learning techniques. This technique is used to analyze data and find clusters within that data. In order to find these clusters, we use some kind of similarity measure such as Euclidean distance, to find the subgroups. This similarity measure can estimate the tightness of a cluster. Apply K-Means clustering on two-dimensional data and analyze the data.
7	Apply unsupervised learning techniques to segment the market, based on customer shopping habits.
8	Build a model to find the relationship between the family members using logic programming.
9.	Build a python program **Predicting traffic** using Extremely Random Forest regressor.
10	Sentiment analysis is the process of determining the sentiment of a given piece of text Build a sentiment Analyzer using NLp concepts to determine whether a movie review is positive or negative.

Course Title	Mini Project				Course Type	Practice	
Course Code	M20TC0105	Credits	2		Class	I Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of ClassesPer Semester	Assessment in Weightage	
	Theory	0	0	0			
	Practice	2	4	4	Practice	CIE	SEE
	-	0	-	-			
	Total	**2**	**4**	**4**	**26**	**50**	**50**

COURSE OVERVIEW:

Project survey has to be completed and problem identification for the project must be done. Students must meet the guide and discuss with due PPT presentations at least two hours per Wk. and do the necessary ground work for Phase II devoting at least 6 hours per week.

COURSE OBJECTIVE (S):

1. To create an Industrial environment and culture within the department of CSE.
2. To provide students hands on experience on, troubleshooting, maintenance, innovation, record keeping, documentation etc thereby enhancing the skill and competency part of technical education.
3. To promote the concept of entrepreneurship.
4. To inculcate innovative thinking and thereby preparing students for main project.

COURSE OUTCOMES (CO'S):

On successful completion of this course, the student shall be able to:

CO#	Course Outcomes	POs	PSOs
CO1	Demonstrate in-depth knowledge on the project topic.	7 to 11	1,2,3
CO2	Identify, analyze and formulate complex problem chosen for project work to attain substantiated conclusions.	7 to 11	1,2,3
CO3	Design solutions to the chosen project problem.	7 to 11	1,2,3

CO4	Undertake investigation of project problem to provide valid conclusions.	7 to 11	1,2,3
CO5	Use the appropriate techniques, resources and modern engineering tools necessary for project work.	7 to 11	1,2,3
CO6	Apply project results for sustainable development of the society.	7 to 11	1,2,3
CO7	Understand the impact of project results in the context of environmental sustainability.	7 to 11	1,2,3
CO8	Understand professional and ethical responsibilities while executing the project work.	7 to 11	1,2,3
CO9	Function effectively as individual and a member in the project team.	7 to 11	1,2,3
CO10	Develop communication skills, both oral and written for preparing and presenting project report.	7 to 11	1,2,3
CO11	Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.	7 to 11	1,2,3

BLOOM'S LEVEL OF THE COURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	**Understand (L2)**	**Apply (L3)**	**Analyze (L4)**	**Evaluate (L5)**	**Create (L6)**
CO1			√	√	√	
CO2			√	√	√	
CO3			√	√	√	
CO4			√	√	√	
CO5			√	√	√	
CO6			√	√	√	
CO7			√	√	√	
CO8			√	√	√	
CO9			√	√	√	
CO10			√	√	√	
CO11			√	√	√	

COURSE ARTICULATION MATRIX

CO#/ POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1							3	3	3	3	3	3	3	3
CO2							3	3	3	3	3	3	3	3
CO3							3	3	3	3	3	3	3	3
CO4							3	3	3	3	3	3	3	3
CO5							3	3	3	3	3	3	3	3
CO6							3	3	3	3	3	3	3	3
CO7							3	3	3	3	3	3	3	3
CO8							3	3	3	3	3	3	3	3
CO9							3	3	3	3	3	3	3	3
CO10							3	3	3	3	3	3	3	3
CO11							3	3	3	3	3	3	3	3

Note: 1-Low, 2-Medium, 3-High

The following are the guidelines to be followed by the students to complete their research based mini projects.

1. The students can select their guides based on their area of interest in their previous semester.
2. In the beginning of the current semester the students shall corner the problem by performing the literature survey (by choosing the research papers of reputed Journals) in their area of interest.
3. The students shall choose a base paper from the list of papers they would have surveyed.
4. The students shall identify the research gaps in their selected research domain, and finalize their problem statement with objectives for the research based mini project.
5. The students shall be completing the synopsis presentation (phase-1 presentation (progress)), and phase-2 presentation (implementation with demo) as per the calendar set by the concerned coordinator.
6. Finally, the students shall complete their mini projects providing innovative solutions for the selected research problem and apply for patent / copyright / paper publication in SCOPUS indexed journals / research proposals / product development / and or startups.

COURSE CONTENTS:

Sample Mini Projects: (if any) Consider a mini project that includes work in most disciplines, ending in a stable executable for a 3-week iteration (any example of software project of candidate choice). Construct a discipline across iterations diagram considering the sample disciplines i.e., Requirements, Design, Implementation and Test.

Imagine there is ultimatelybe a 20-iteration project for evolutionary and iterative development. Design an evolutionary requirement analysis and show the diagram for the same 20-iteration project for evolutionary and iterative development.

II Semester
Syllabus

<table>
<tr><td>Course Title</td><td colspan="4">Cloud Computing Tools</td><td colspan="2">Course Type</td><td colspan="2">Integrated</td></tr>
<tr><td>Course Code</td><td>M20TCS211</td><td>Credits</td><td colspan="2">3</td><td colspan="2">Class</td><td colspan="2">II Semester</td></tr>
<tr><td rowspan="5">Course Structure</td><td>TLP</td><td>Credits</td><td>Contact Hours</td><td>Work Load</td><td colspan="2" rowspan="2">Total Number of ClassesPer Semester</td><td colspan="2" rowspan="2">Assessment in Weightage</td></tr>
<tr><td>Theory</td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>Practice</td><td>1</td><td>2</td><td>2</td><td rowspan="2">Theory</td><td rowspan="2">Practical</td><td rowspan="2">CIE</td><td rowspan="2">SEE</td></tr>
<tr><td>-</td><td>0</td><td>-</td><td>-</td></tr>
<tr><td>Total</td><td>3</td><td>5</td><td>5</td><td>26</td><td>26</td><td>50</td><td>50</td></tr>
</table>

COURSE OVERVIEW:

This course provides a technical description of cloud computing technologies, covering cloud infrastructure and platform services. It describes emerging technologies critical to cloud computing. It also covers the fundamentals of cloud mechanisms. It provides the basics of virtualization, different types of virtualizations. It also provides cloud based application development, and working with OpenNebula and Eucalyptus tools.

COURSE OBJECTIVES:

The main objectives of this course are:

1. Discuss the concepts of Virtualizations and its applications
2. Explain Cloud based application development using AWS
3. Demonstrate Cloud deployment using OpenNebula
4. Illustrate Cloud operations using Eucalyptus.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Understand different virtualization technique through theoretical concepts and practical training	1,2,3,4,5	1,2,3
CO2	Develop Cloud based applications with AWS	1,2,3,4,5	1,2,3
CO3	Experiment applications deployment using OpenNebula	1,2,3,4,5	1,2,3
CO4	Create Cloud based scenarios using Eucalyptus	1,2,3,4,5	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			

COURSE ARTICULATIONMATRIX

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	**PSO1**	**PSO2**	**PSO3**
CO1	3	2	3	2	3							3	3	3
CO2	3	2	3	3	3							3	3	2
CO3	3	2	3	2	3							3	3	3
CO4	3	2	2	3	3							3	2	3

COURSE CONTENTS:

UNIT- 1

Introduction To Cloud Computing And Resource Virtualization: Cloud Computing delivery models and services, Introduction to Virtualization, Layering and virtualization, Virtual machine monitors, Virtual machines, Performance and Security Isolation, Full virtualization and para virtualization, Hardware support for virtualization, Case study: Xen, a VMM based on para virtualization.

Unit -2

Cloud Based Application Development: Amazon Web Services: EC2 instances, Connecting clients to cloud instances through firewalls, Application and transport layer protocols in EC2, Launch and connect EC2 Linux instance, Use S3 in Java, Install Simple Notification Service on Ubuntu, Create EC2 Placement Group and use MPI

UNIT- 3

Containers and Cloud Native Computing: Introduction to containers, Overview of Dockers, Dockers Architecture and components (Docker Host – docker daemon, containers, images, Docker Client Docker Registry). Creating an application as docker Docker registry and introduction to dockerhub, Creating a docker image, Sharing images through registry (dockerhub), creating containers using docker, Virtual Machines vs Containers, Overview of Kubernetes , Kubernetes components and architecture.

UNIT- 4

Opennebula-A Cloud On VmwareVcenter: Overview: Open Cloud Architecture, VMware Cloud Architecture, OpenNebula Provisioning Model; OpenNebula Installation: Front-end Installation, MySQL Setup; Authentication Setup: SSH Authentication, x509 Authentication, LDAP Authentication

SELF-LEARNING COMPONENT:

Maintenance, Failures, and Debugging; Network Troubleshooting; Logging and Monitoring; Backup and Recovery; Customization; Upstream OpenStack; Advanced Configuration.

TEXT BOOKS:

1. Dan C. Marinescu, "Cloud Computing - Theory and Practice", Morgan Kaufmann is an imprint of Elsevier, 2013.
2. BirisLublinsky, Kevin T. Smith and Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN 13:9788126551071, 2015.
3. The Open Replacement for vCloud - Bring your VMware environment to the Cloud in 5 minutes. http://vonecloud.today/ ,http://docs.vonecloud.com/1.8/
4. A complete Guide to Docker. https:// docs.docker.com/get-started/resources/r Documentation
5. A introduction to Kubernetes. https://kubernetes.io/docs/concepts/

REFERENCE BOOKS:

1. Kevin Jackson, Cody Bunch, “OpenStack Cloud Computing Cookbook”, Packt Publishing, 2013.
2. Cloud services for your virtual infrastructure, Part 1: Infrastructure-as-a-Service (IaaS) and Eucalyptus. http://www.ibm.com/developerworks/library/os-cloud-virtual1/
3. YohanWadia, "The Eucalyptus Open-Source Private Cloud". http://www.cloudbook.net/resources/stories/the-eucalyptus-open-source-privatecloud as on
4. ArshdeepBahga, Vijay Madisetti, "Cloud Computing: A Hands-On Approach", University Press, 2016.
5. OpenNebula 5.8 Deployment guide, Ebook available at: http://docs.opennebula.org/pdf/5.8/opennebula_5.8_deployment_guide.pdf

JOURNALS/MAGAZINES:

1. Elsevier Journal of Cloud Computing
2. IEEE Transactions on Cloud Computing
3. Springer Jounal of Cloud Computing

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/ Cloud Computing /
2. https://www.coursera.org/learn/ Cloud Computing
https://nptel.ac.in/courses/106106149/

PRACTICE:

SL.NO	LISTOF PROGRAM
1	This directive is a special purpose directive and is used to turn on or off some features. This type of directives are compiler-specific i.e., they vary from compiler to compiler. Some of the #pragma directives are discussed below: **#pragma startup and #pragma exit**: These directives helps us to specify the functions that are needed to run before program startup(before the control passes to main()) and just before program exit (just before the control returns from main()). Design a Program on #pragrma using C.
2	OpenMP is a library for parallel programming in the SMP (symmetric multi-processors, or shared-memory processors) model. When programming with OpenMP, all threads share memory and data. OpenMP supports C, C++ and Fortran. The OpenMP functions are included in a header file called omp.h. Design a Program using Sections, omp for and omp single
3	Throughput computing focuses on delivering high volumes of computation in the form of transactions. Initially related to the field of transaction processing, throughput computing has since been extended beyond that domain. Throughput computing is realized by means of multiprocessing and multithreading, Multiprocessing is the execution of multiple programs in a single machine, where as multithreading relates to the possibility of multiple instruction streams within the same program. Design a Program using thread private directives.
4	Cloud computing is required by modern technology. Task scheduling and resource allocation are important aspects of cloud computing. Design a Program on scheduling.
5	Cloud computing transforms the way information technology (IT) is consumed and managed, promising improved cost efficiencies, accelerated innovation, faster time-to-market, and the ability to scale applications on demand. Design a Program using last private reduction, copying and shared.
6	A point-to-point communication always involves exactly two processes. One process sends a message to the other. This distinguishes it from the other type of communication in MPI, collective communication, which involves a whole group of processes at one time. Design a Program for Point to Point MPI calls
7	Login to the workshop cluster using user workshop username and OTP token. Copy the exercise files to user home directory. Familiarize user with LC's OpenMP environment. Write a simple "Hello World" OpenMP program. Successfully compile your program. Successfully run your program.Modify the number of threads used to run your program.
8	Login to the LC workshop cluster, if you are not already logged in. Sharing DO/for construct examples: review, compile and run. Work-Sharing SECTIONS construct example: review, compile and run.
9	Login to the workshop cluster. Orphaned directive example: review, compile, run. Get OpenMP implementation environment information .Hybrid OpenMP + MPI programs. Check out the "bug" program
10	**Mininet** is a system that supports the creation of lightweight logical nodes that can be connected into networks. These nodes are sometimes called **containers**, or, more accurately, **network namespaces**. Virtual-machine technology is not used. Install and configure Mininet SDN emulator with 2 traffic engineering experiment applications to understand how to program 'flow spaces' within networks to: (i) comply with enterprise network capacity provisioning policies, and (ii) balance the utilization of network resources – Use Iperf and Ping Tools to verify your SDN functionality

Course Title	Advanced Web Technologies				Course Type		Integrated	
Course Code	M20TCS212	Credits	3		Class		II Semester	
Course Structure	TLP	Credits	Contact Hours	Work Load	Total Number of ClassesPer Semester		Assessment in Weightage	
	Theory	2	3	3				
	Practice	1	2	2	Theory	Practical	CIE	SEE
	-	**0**	-	-				
	Total	**3**	**5**	**5**	**26**	**26**	**50**	**50**

COURSE OVERVIEW:

This course introduces the current and future forms of the Web, It is necessary to understand the underlying design principles and concepts, relevant issues and techniques. The fast changing nature of the Web means that such a deep understanding is essential to understand the latest developments and their potential. The topics covered in this course includes how to make web sites that serve "dynamic content": content that is based on returning or updating results in a database.

COURSE OBJECTIVES:

The objectives of this course are to:

1. Discuss the fundamentals of Client side caching concepts in the area of web services.
2. Illustrate the design of JavaScript based web based applications.
3. Discuss the PHP based web based applications.
4. Describe optimization and security issues of a web and the mechanisms to make it more secure.

COURSE OUTCOMES:

On successful completion of this course; the student will be able to:

CO#	Course Outcomes	Pos	PSOs
CO1	Summarize the fundamentals Client side caching concepts in the area of web services.	1,2,3,4,5	1,2,3
CO2	Design and Develop JavaScript based web based applications.	1,2,3,4,5	1,2,3
CO3	Design and Develop PHP based web based applications.	1,2,3,4,5	1,2,3
CO4	Optimize the web applications and mechanisms to make it more secure.	1,2,3,4,5,8	1,2,3

BLOOM'S LEVELOF THECOURSE OUTCOMES

CO#	Bloom's Level					
	Remember (L1)	Understand (L2)	Apply (L3)	Analyze (L4)	Evaluate (L5)	Create (L6)
CO1			√			
CO2			√			
CO3			√			
CO4			√			

COURSE ARTICULATIONMATRIX

Course Outcomes	Program Outcomes													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2							3	2	3
CO2	2	3	2	3	1							3	2	3
CO3	3	2	3	2	1							3	3	2
CO4	2	2	3	3	2			3				3	2	3

COURSE CONTENTS:

UNIT-1

Utilizing Client-Side Caching: Introduction, Understanding the Types of Caching, Controlling Caching , Dealing with Intermediate Caches, Cache-Control Revisited, Caching HTTP Responses, DNS caching and prefetching, Search Engines: Searching techniques used by search engines, keywords, advertisements, Search Engine Optimization (SEO) for individual web pages: header entries, selection of URL; SEO for entire website: Hyperlinks and link structure.

UNIT-2

JavaScript: Introduction, Operators, ControlStructures, looping constructs, functions, Array declaration and allocation, Handling Events Using JavaScript, data validation using regular expressions. Object oriented JavaScript, callbacks, closures, modules, AJAX, JQuery.

UNIT-3

PHP: Introduction, Data Types, Operators, Control Flow; Functions; Exception Handling, Storing and Retrieving Data, Arrays, String Manipulation and Regular Expressions, Object-Oriented PHP, Authentication with PHP, Interaction with File System and Server, Form processing, Handling Images, Session Management, Cookies, Debugging, Building CMS application.

UNIT- 4

Optimization: Optimizing images, Load balancers, Tuning MYSQL, query caching, query execution and optimization, traffic generation.

Security: Introduction, Handling user access and user input, Bypassing client-side controls, Authentication, Session hijacking, Attacks on data stores: SQL query log, SQL injections; Attacks on Users: XSS attacks; Cross-site Request Forgery (CXRF), DoS and DDoS attacks, DNS Hijacking.

SELF-LEARNING COMPONENT:

Practical application of the latest evolving web technologies. Topics include HTMLS, CSS/SASS, JavaScript, NodeJS, Polymer, NoSQL, asynchronous programming, functional programming, event driven systems, debugging, testing, workflow optimization, and deployment pipelines.

TEXT BOOKS:

1. Peter Smith, “Professional Website performance”, Wiley India Pvt. Ltd, 2019.
2. Luke Welling Laura Thomson “PHP and MySQL Web Development”, Pearson Education, 2009.

REFERENCE BOOKS:

1. Kogent Learning, “Web Technologies: HTML, JavaScript, PHP, Java, JSP, XML, AJAX – Black Book”, Wiley India Pvt. Ltd, 2009
2. Stuttard D., Pinto M., “The Web Application Hackers Handbook”., Wiley India Pvt. Ltd, 2016.
3. DeitelH.M., Deitel P.J., “Internet & World wide Web: How to program”, Pearson Education, 2007

JOURNALS/MAGAZINES:

1. Elsevier Journal of Advance Web Technology
2. IEEE Transactions on Advance Web Technology
3. Springer Jounal of Advance Web Technology
4. ACM Transactions on Internet Technology
5. ACM Transactions on Information Systems.

SWAYAM/NPTEL/MOOCs:

1. https://www.udemy.com/ Advance Web Technology/
2. https://www.coursera.org/learn/ Advance Web Technology
3. https://nptel.ac.in/courses/106106149/