REVA UNIVERSITY
Bengaluru, India

School of CSA

Master of Computer Applications (MCA)

HANDBOOK
2018-2019

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

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SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS

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Rukmini Educational
Charitable Trust

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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. Shyama Raju
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 REVA University.

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. S. Y. Kulkarni
Vice-Chancellor, REVA University

Director –Message

Welcome note to students

It's my pleasure to welcome you to the School of Computer Science and Applications. Computer, being considered as most significant and revolutionary invention of mankind has metamorphosed the planet earth completely. Predominantly School of Computer Science and Applications have acquired the control of the modern life in a myriad way.

The MCA program is designed keeping in view the current situation and possible future developments, both at national and global levels. This program is designed to give greater emphasis on computer applications. There are ample number of courses providing knowledge in specialized areas of network security, python programming and cloud computing etc. facilitating students to choose specialized areas of their interest. Adequate attention is given to provide students the basic concepts in computer applications.

The program is designed to expose students to various subjects having applications in computers, IT and electronics related industries through outcome based teaching and learning process which emphasizes practical exposure rather than memorization. A variety of activities such as mini projects, seminars, interaction with industries, cultural activities and social activities are in place to shape the all-round development of students.

The benefits of choosing MCA program are:

- Flexibility to choose various fields upon graduation.
- Opportunity to work on live problems.
- Opportunity to work on environmental related technologies.
- Opportunity for programmers to develop software for varied applications in different sectors.

Students after successful completion of MCA program:

- Can start-up their career in either government sector or private sector since there are ample employment opportunities in these sectors.
- Can also start their career as software programmers / engineers, testing engineers, data base administers, system and network administrators, multimedia / web programmers, web designers etc.,
- Can seek placements in diversified fields like banking, e-commerce, insurance, entertainment, and such others.

- The computer application trained graduates are sought after by varied firms for their software based skills.
- Can opt for higher studies in computer applications, IT, business management and so on.

The curriculum caters to and has relevence to local, reginal, natinal and global development needs. All courses are focussed on building skill, employability and entrepreneurship of students.
Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, gender, human values, environment and sustainability.
I am sure the students choosing MCA in REVA University will enjoy the curriculum, teaching and learning environment, the vast infrastructure and the experienced teachers involvement and guidance. We will strive to provide all needed comfort and congenial environment for their studies. I wish all students pleasant stay in REVA and grand success in their career.

Dr. S. Senthil
Director – School of Computer Science and Applications

RUKMINI EDUCATIONAL CHARITABLE TRUST

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju 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. Shyama Raju, 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. Shyama Raju 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.

The University is presently offering 23 Post Graduate Degree programs, 20 Degree and PG Degree programs in various branches of studies and has 12000+ students studying in various branches of knowledge at graduate and post graduate level and 302 Scholars pursuing research leading to PhD in 18 disciplines. It has 800+ well qualified, experienced and committed faculty members of whom majority are doctorates in their respective areas and most of them are guiding students pursuing research leading to PhD.

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 Pradhan Mantri Kaushal Vikas Yojana. 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, EMC^2, 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, M.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.

As a part of our effort in motivating and inspiring youth of today, REVA University also has instituted awards and prizes to recognize the services of teachers, researchers, scientists, entrepreneurs, social workers and such others who have contributed richly for the development of the society and progress of the country. One of such award instituted by REVA University is 'Life Time Achievement Award' to be awarded to successful personalities who have made mark in their field of work. This award is presented on occasion of the "Founders' Day Celebration" of REVA University in presence of dignitaries, faculty members and students gathering and the first "REVA Life Time Achievement Award" for the year 2015 has been awarded to Shri. Kiran Kumar, Chairman ISRO on the occasion of Founder's Day Celebration, 6th January, 2016 and the second "REVA Life Time Achievement Award" for the year 2016 has been awarded to Shri. Shekhar Gupta, Renowned Journalist on the occasion of Founder's Day Celebration, 6th January, 2017.

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 classes everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

Recognizing the fast growth of the university and its quality in imparting higher education, the BERG (Business Excellence and Research Group), Singapore has awarded BERG Education Award 2015 to REVA University under Private Universities category. The University has also been honoured with many more such honors and recognitions.

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".

Misson

- 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 SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS

The School of Computer Science and Applications is shouldered by well qualified, experienced and highly committed faculty. The state-of-the-art infrastructure digital classrooms, well equipped advanced computer laboratory, conference rooms and the serene academic atmosphere at REVA University will enhance the transfer as well as creation of knowledge. The School offers BCA, B. Sc. (Honors) in Computer Science with specialization in Cloud Computing and Big Data, MCA and MS

(Computer Science) programs. The School also has research program leading to doctoral degree. The curriculum of both graduate and post graduate degree programs have been designed to bridge the gap between industry – academia and hence they are industry oriented. These programs provide ample scope to enter into a wide range of business opportunities, entrepreneurship ventures and as well as job opportunities in different sectors. This is reflected in various core subjects / courses offered within the program. Further the school provides an interactive, collaborative peer tutoring environment that encourages students to break down complex problems and develop strategies for finding solutions across a variety of situations and disciplines. The school aims to develop a learning community of critical thinkers who serve as models of innovative problems solving in the university environment to enrich their academic and professional careers.

VISION

To transform students into good human beings, responsible citizens and competent professionals, focusing on assimilation, generation and dissemination of knowledge in the area of Computer Applications

MISSION

- To impart quality education to meet the needs of profession and society, and achieve excellence in teaching-learning and research in the area of Computer Applications;
- To attract and develop talented and committed human resource, and provide an environment conducive to innovation, creativity, team-spirit and entrepreneurial leadership in Computing field;
- To facilitate effective interactions among faculty and students of the School of Computer Applications, and foster networking with alumni, industries, institutions and other stake-holders; and
- To practice and promote high standards of professional ethics, transparency and accountability.

OBJECTIVES

- To impart programs at graduate, post-graduate and doctoral levels in the field of computer applications;
- To adopt innovative methods of teaching and promote student centric learning process;

- To create infrastructure of international standard and facilitate and create conducive environment for teaching, learning and research;
- To promote faculty development and encourage faculty members and students to organize and participate in national and international level conferences, seminars, symposia and such others;
- To encourage teachers and students to take-up interdisciplinary studies and research;
- To promote students participation in co-curricular and extension activities and develop their personality traits and team spirit.

ADVISORY BOARD

SL. No	Name and Affiliation
1	Dr. Anand Kumar Professor and Dean-Academics, MCA Department, M.S Engineering College

2	Dr. Muralidhar B.L Professor and Coordinator, MCA Programme, Bangalore University
3	Dr. Dharani Dhamre Professor, Dept of MCA, RVCE
4	Mr. ManikantanMohanavelu Head Training Tower-India, HP
5	Mr. Madusudan R Practice Lead, Engagement & System Operations-IBM
6	Mr. DharshanMaheshbhai Project Lead- Cognizant Technology Pvt Ltd
7	Mr. Ashish Tanwar, University Relations Manager-India, Dell

MASTER OF COMPUTER APPLICATIONS (MCA) PROGRAM

Program Overview

Computers have become ubiquitous part of modern life, and new applications are introduced every day. 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 levels of society.

The career opportunities for master of computer applications 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 computer industry specialists are some of the opportunities the graduates find.

The School of Computer Science and Applications at REVA UNIVERSITY is offering Master of Computer Application (MCA) programme to create motivated, innovative, creative thinking post - graduates to fill the roles of software Engineers who can conceptualize, design, analyze and develop computer software to meet the modern day industry requirements.

The programme is designed to meet the growing demand for qualified professionals in the field of Computer Applications. The MCA programme is inclined more toward application development and thus has more emphasis on latest programming languages and tools to develop better and faster applications. It covers various aspects of computational theory, network and database management, mobile technologies, electronics, mathematics, probability, statistics etc. The programme also deals with operation research, user interface design, M-commerce, e-commerce, internet of things, mobile computing, software testing and quality assurance, big data analytics, and many such areas intended to meet IT industry requirements.

Program Educational Objectives (PEO's)

The aim of the programme is to produce postgraduates with advanced knowledge and understanding of Computer Science and Applications with higher order critical, analytical, problem solving and transferable skills; with ability to think rigorously and independently to meet higher level expectations of ICT industry, academics, and research establishments or take up venture.

The Programme Educational Objectives are to prepare the students to:

PEO-1	Be skilled Computer Application Developers, Algorithm developers, Computer Programmers and to operate various commercial software tools to solve scientific and

	business problems,
PEO-2	be software engineers who can design, code, test and implement computer programs and adopt lifelong learning philosophy for continuous improvement and acquire higher degrees so as to work in colleges/ universities as professors or as scientists in research establishments
PEO-3	To work as a member of a team as well as lead a team and communicate effectively across team members, to be equipped to be competent in the field of computer science and be further trained to become an entrepreneur or act as administrators in public, private and government organisations
PEO-4	be aware of environmental, legal, cultural, social, ethical, public safety issues work along with engineering, medical, ICT professionals and scientists to assist them in their research and development work

Program Outcomes (POs)

1. **Computational Knowledge:** Apply knowledge of computing fundamentals, computing specialisation, mathematics, and domain knowledge appropriate for the computing specialisation to the abstraction and conceptualisation of computing models from defined problems and requirements.
2. **Problem Analysis:** Identify, formulate, research literature, and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.
3. **Design /Development of Solutions:** Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4. **Conduct investigations of complex Computing problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern Tool Usage:** Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.
6. **Professional Ethics:** Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

7. **Life-long Learning:** Recognise the need, and have the ability, to engage in independent learning for continual development as a computing professional.
8. **Project management and finance:** Demonstrate knowledge and understanding of t h e computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
9. **Communication Efficacy:** Communicate effectively with the computing community, and with society at large, about complex computing activities by being able to comprehend and write effective reports, design documentation, make effective presentations, and give and understand clear instructions.
10. **Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.
11. **Individual and Team Work:** Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.
12. **Innovation and Entrepreneurship:** Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment of the individual and society at large.

Programme Specific Outcomes (PSO)

After successful completion of the programme, the graduates will be able to

1. Demonstrate practical skills in a wide Variety of programming languages and software platforms.
2. Deliver intensive software solutions for real world applications with the help of advanced computational tools and techniques
3. Instill life-long learning skills through the development of a research environment and higher educational opportunities.

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS
Master of Computer Science & Applications – MCA Programme

Scheme of Instructions – 2018

First Semester

Sl. No	Course Code	Title	HC/SC FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	M18CA1010	System software and Operating Systems	HC	4	0	0	4	4
2	M18CA1020	Mathematical Foundation For Computer Science	HC	4	0	0	4	4
3	M18CA1030	Programming using C	HC	2	1	0	3	4
4	M18CA1040	Web Technologies	HC	2	1	0	3	4
5	M18CA1050	Management Information System	HC	4	0	0	4	4
6	M18CA1060	Fundamentals of Computer Organization	HC	2	0	1	3	4
7	M18CA1070	Sports/ Yoga/ Music /Dance/ Theatre	RULO	2	0	0	2	2
Practical Courses								
8	M18CA1080	C Programming lab	HC	0	0	2	2	4
9	M18CA1090	Web Technologies lab	HC	0	0	2	2	4
Total Credits				**20**	**2**	**5**	**27**	**34**

Second Semester

Sl. No	Code	Title	HC/ SC FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	M18CA2010	Object Oriented Programming using C++	HC	4	0	0	4	4
2	M18CA2020	Advanced Communicative English - I	FC	4	0	0	4	4
3	M18CA2030	Relational Database Management Systems	HC	2	1	0	3	4
4	M18CA2040	Data Structures and its Applications	HC	2	1	0	3	4
5	M18CA2050	Operations Research	HC	4	0	0	4	4
6	M18CA2060	Software Engineering	HC	4	0	0	4	4
Practical Courses								
7	M18CA2070	DS using C/ C++ lab	HC	0	0	2	2	4
8	M18CA2080	RDBMS Lab	HC	0	0	2	2	4
Total Credits				20	2	4	26	32

Third Semester

Sl. No	Code	Title	HC/ SC FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	M18CA3010	Data Mining and Data Warehousing	HC	2	1	0	3	4
2	M18CA3020	Computer Networks	HC	4	0	0	4	4
3	M18CA3030	Linux Programming	HC	2	1	0	3	4
4	M18CA3040	Artificial Intelligence	HC	4	0	0	4	4
5	M18CA3051	Advanced Web Technology	SC	2	0	1	3	4
	M18CA3052	Advanced Database Systems						
6	M18CA3061	Cloud Computing	SC	2	0	1	3	4
	M18CA3062	Software Testing and Quality Assurance						
7	M18CA3070	Soft Skills	RULO	2	0	0	2	2
Practical Courses								
8	M18CA3080	Linux Lab	HC	0	0	2	2	4
9	M18CA3090	CN Lab using NS2	HC	0	0	2	2	4
Total Credits				**18**	**2**	**6**	**26**	**34**

Fourth Semester

Sl. No	Code	Title	HC/ SC/ FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	M18CA4010	Design and Analysis of Algorithms	HC	4	0	0	4	4
2	M18CA4020	.NET Framework and Applications	HC	2	1	0	3	4
3	M18CA4030	Java Programming	HC	2	1	0	3	4
4	M18CA4040	Big Data Analytics Using R	HC	3	0	1	4	5
5	M18CA4051	Machine Learning	SC	2	1	0	3	4
	M18CA4052	Cyber Law and IT security						
6	M18CA4061	NOSQL	SC	2	0	1	3	4
	M18CA4062	Advanced Computer Networks using Linux						
7	M18CA4070	Soft Skills	RULO	2	0	0	2	2
Practical Courses								
8	M18CA4080	Java Lab	HC	0	0	2	2	4
9	M18CA4090	.NET Lab	HC	0	0	2	2	4
Total Credits				**17**	**3**	**6**	**26**	**35**

Fifth Semester

Sl. No	Code	Title	HC/SC FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	M18CA5010	Python Programming	HC	2	1	0	3	4
2	M18CA5020	Software Project Management	HC	2	1	0	3	4
3	M18CA5030	J2EE & J2ME Using Design Patterns	HC	2	1	0	3	4
4	M18CA5041	Internet of Things	SC	2	1	0	3	4
	M18CA5042	Mobile Computing and APP store Management						
5	M18CA5051	Deep Learning concepts & techniques	SC	2	1	0	3	4
	M18CA5052	System Simulation and Modelling						
6	M18CA5060	**Open Elective – Digital Marketing**	**OE**	**4**	**0**	**0**	**4**	**4**
7	M18CA5070	Swayam/MOOC	RULO	4	0	0	4	4
Practical Courses								
8	M18CA5080	Python Programming Lab	HC	0	0	2	2	4
9	M18CA5090	J2EE & J2ME Using Design Patterns Lab	HC	0	0	2	2	4
Total Credits				**18**	**5**	**4**	**27**	**36**

Sixth Semester

Sl. No	Code	Title	HC/ SC FC	Credit Pattern			Credits
				L	T	P	
1	M18CA6010	Internship / Global Certification	HC	2	0	2	4
2	M18CA6020	Major Project	HC	0	0	8	8
		Total		**2**	**0**	**10**	**12**

Note: Internship/ Global Certification + Project = 4+8

CREDIT SUMMARY

Semester	Credits
First	27
Second	26
Third	26
Fourth	26
Fifth	27
Sixth	12
Total	**144**

Master of Computer Applications (MCA) Program

Detailed Syllabus

(Effective from the Academic Year 2018-19)

FIRST SEMESTER

M18CA1010	SYSTEM SOFTWARE & OPERATING SYSTEMS	L	T	P	C
Duration:60 Hours		4	0	0	4

Course Objectives:

- To understand the relationship between system software and machine architecture.
- To understand the services provided by and the design of an operating system.
- To understand what a process is and how processes are synchronized and scheduled.
- To justify the need of memory management.
- To apply the concepts of operating systems in implementation.

Course Outcomes:

After completion of the Course the student shall be able to:

- Identify the relationship between system software architecture and machine.
- Trace the path of a source code to object code and to executable file.
- Describe, contrast and compare differing structures for operating systems.
- Analyze theory and implementation of processes, resource control (concurrency etc.), scheduling.
- Understand and analyze the Need of memory management, virtual memory and technique used to implement virtual memory.

Course Contents:

UNIT I **15 Hours**

Overview of System Software: Basics of system software: Definition, Machine architecture, Hypothetical machine architecture, SIC & SIC/XE, SIC & SIC/XE Programming examples.

Assemblers: Introduction to Assemblers, A simple SIC Assembler, Algorithms for one pass assembler& two pass assembler, MASM Assemblers.

UNIT II **15 Hours**

Compiler: Definition, History, Structure of compiler, Phases of Compiler, Lexical analyzer-Definition, Role, Regular expression & Transition diagram, Context Free Grammar-Definition, Ambiguity, Left Recursion: Parsing-Definition, Role of Parser , Types of parsing-Top down, Bottom Up Techniques.

UNIT III **15 Hours**

Process Management :Basics of Operating Systems: Definition –Types of Operating Systems, OS Service, System Calls, OS structure, Virtual Machine. Process& Threads: process concept, process scheduling, operations on processes, Inter-process communication, Multithreading.CPU Scheduling -Scheduling Concept, Algorithms, Comparing & Evaluation of Algorithms, Process synchronization-Concurrency and Race Conditions, Mutual exclusion requirements Software and hardware solutions, Semaphores , Monitors , Classical IPC problems and solutions, Deadlock- Characterization, Detection, Recovery, Avoidance and Prevention .

UNIT IV **15 Hours**

Basics of Memory Management : Definition, Logical and Physical address map, Memory allocation, Contiguous Memory allocation – Fixed and variable partition , Internal and External fragmentation and Compaction, Paging: Principle of operation , Page allocation ,Hardware support for paging ,Protection and sharing , Disadvantages of paging, Segmentation ,Segmentation with paging.**Virtual Memory:** Basics of Virtual Memory, Hardware and control structures, Locality of reference, Page fault , Working Set , Dirty page/Dirty bit , Demand paging, Page Replacement policies ,Allocation of frames , Thrashing.

Text Books:

1. Leland. L. Beck, D. Manjula: "System Software, An Introduction to Systems Programing",3rd Edition, Pearson, 2013 [CH 1,CH 2]
2. Silberschatz, Galvin, and Gagne, "Operating System Concepts", Sixth Edition, Wiley India Pvt Ltd, 2003.[CH 1, CH 3, CH 4, CH 5, CH 6, CH 7, CH 8,CH 9, CH 10]
3. Alfred Aho, Jeffrey Ullman, Monica S. Lam, Ravi Sethi: "Compilers: Principles, Techniques and Tools", Second Edition ,Pearson,2007[CH 1,CH 2,CH 3,CH 4]

Reference Books:

- D. M. Dhamdhere System Programming & Operating Systems, Second revised edition, Tata McGraw Hill.
- Gary Nutt, "Operating Systems", Third Edition, Pearson Education, 2004.
- Harvey M. Deital, "Operating Systems", Third Edition, Pearson Education, 2004.
- William Stallings, Operating Systems, Prentice Hall.
- Harvey M. Deitel, An introduction to operating systems. Addison-Wesley. Andrew Tanenbaum& Albert Woodhull, Operating Systems: Design and Implementation. Prentice-Hall.
- Douglas Comer, Operating System Design - The XINU Approach. Prentice-Hall.
- A.M. Lister, Fundamentals of Operating Systems. Macmillan (1979).

EXERCISES:

UNIT I

1. Write Simple programs in SIC to do the following: i) Add two numbers; ii) A=B+C-5
2. Convert the above SIC programs to machine language.

UNIT II

1. Prepare a list of regular expressions for: i)Valid email ii) Phone numbers for any 5 countries(Mobile and Land line)iii PAN number iv. Passport number v) student ID/USN vi) pincode vii)IP address viii) MAC address ix) Name of a person x)Decimal number rounded with 2 decimals

UNIT III

1. For the Restaurant ordering system, Design a hypothetical operating system, which will do the following?
    i. Decide on the need and level of concurrency control policy to be implemented and identify the possibilities of deadlock.
    ii. What are the resources available, suggest a scheduling algorithm to allocate the resources such that deadlock and starvation will not occur.
    iii. Decide the need of multi-threading and recovery policies. Justify your suggestion.

UNIT IV

1. Imagine that the above system is implemented as multi-tasking, multi-user and should work with very limited memory.

i) Decide page replacement policies.

ii) Suggest the need and duration of defragmentation module to be executed.

M18CA1020	MATHEMATICAL FOUNDATION FOR COMPUTER SCIENCE	L	T	P	C
Duration:60Hours		4	0	0	4

Course Objectives:

- To reflect on the concepts and operations of mathematical logic needed for computer science.
- To Examine and apply the class of functions which transform a finite set into another finite set which relates to input output functions in computer science.
- To interpret discrete knowledge in Computer Science through graph theory and its applications.

Course Outcomes:

After completion of the course students shall be able to:

- Formulate and interpret statements presented in Boolean logic. Reformulate statements from common language to formal logic. Apply truth tables and the rules of propositional and predicate calculus
- Demonstrate a working knowledge of set notation and elementary set theory, recognize the connection between set operations, critical thinking to arrive at conclusions from Venn Diagrams, syllogistic forms and prove elementary results involving sets
- Work with relations, functions and in particular bijections, direct and inverse functions. Gain and historical perspective of the development of modern discrete mathematics.
- Recognize apply, and interpret multiple representations of properties of graphs such as distinctive circuits or trees. Apply mathematical principles and techniques to solve problems in areas such as ancient systems of numeration.

Course Contents:

UNIT I **15 Hours**

Fundamentals of Logic : Basic Connectives and Truth Tables, Logic Equivalence: The laws of Logic, Logical Implications: Rules of Inference, The use of Quantifiers, Quantifier Definitions, and Proofs of Theorems.

UNIT II **15 Hours**

Set Theory Properties of Integers and Recurrence :Sets and its different types of sets, Set Operations and the Laws of Set Theory, Counting and Venn Diagrams, Principles of Inclusion and Exclusion, Permutations and Combinations with repetition. Mathematical Induction, Recursive definitions, The Greatest Common Divisor Euclidian Algorithms, The first order Linear recurrence relation.

UNIT III **15 Hours**

Relations and Functions : Cartesian products and Relations, Properties of Relations, Computer recognition, Zero One Matrices and Directed Graphs, Posets and Hasse Diagrams. Functions, Plain and One-to-One, Onto Functions, Stirling Numbers and the Second Kind, Special functions, The Pigeon-hole principle, Function composition and inverse functions.

UNIT IV **15 Hours**

Graph Theory and Trees: Terminology, Definitions, Properties and Examples, Connectivity and Adjacency, Euler and Hamilton, Representation and Isomorphism, Planarity and Chromatic Number, Directed Graphs and Weighted Graphs, Trees, different type trees and its properties.

Text Books:

1.Ralph P Grimaldi, B. V. Ramana, "Discrete & Combinatorial Mathematics, An Applied Introduction" 5th Edition, Pearson Education, 2004 (Chapter1: 1.1-1.4, Chapter 2: 2.1- 2.5, Chapter 3: 3.1-3.4, Chapter 4: 4.1-4.2,4.4, Chapter 5:5.1-5.6, Chapter 7:7.1-, 7.4,7.6, Chapter 10:10.1, Chapter 12: 12.1-12.4)

2. Eric Gosset "Discrete Mathematics with Proof" Wiley India, 2nd Edition, (Chapter 10:10.1-10.6) 2010.

Reference Books:

1. Kenneth H Rosen, "Discrete Mathematics & its Applications" 7th edition, McGraw-Hill, 2010
2. Tremblay and Manohar R, Discrete Mathematical Structures with Applications to Computer Science, Tata McGraw-Hill, New Delhi, 2003.
3. Y N Singh "Discrete Mathematical Structures" Wiley India, 1st edition, 2010
4. JayantGanguly: A Treatise on Discrete Mathematical Structures" Pearson, 2010
5. D.S. Malik & M.K Sen: Discrete Mathematical Structures: Theory & Applications, Cengage Learning, 2004.
6. NarsinghDeo, Graph Theory with Applications to Engineering and Computer Science, PHI Learning Pvt.Ltd., 2004.
7. Thomas Koshy: Discrete Mathematics with Applications, Elsevier, 2005, Reprint 2008.
8. K S Deshikachar, M Vinayaka Murthy and Udaya Rani V, "Discrete Mathematical Structures with Application to Computer Science", Subhas Stores, Bengaluru, 2001.

M18CA1030	PROGRAMMING USING C	L	T	P	C
Duration:60 Hours		2	1	0	3

Course Objectives:

- Introduce the concept of algorithms and flow charts to understand and analyze the problem to write optimized algorithm for given problem statements.
- Provide detailed understanding of basic concepts of C.
- Provide detailed understanding of control statements, function and arrays.
- Provide the knowledge of structures and unions.
- Introduce the concepts of Files for application data maintenance

Course Outcomes:

After completing this course, the student shall be able to

- Write an algorithm and draw flowchart for the given problem.
- Develop a program with the use of control statements, function and arrays.
- Construct a program to show the usage of details by implementing structures, unions and pointers.
- Develop an application by using files as database.

Course Contents:

UNIT I Basics of C Programming **15 Hours**

Introduction, The Problem Solving aspect, Classification of Programming Language, Structured Programming Concept, Flow charts, Algorithm. C Fundamentals: The C Character Set, Identifiers and Keywords, Data Types, Constants, Variables, Declarations, Expressions, Statements, Symbolic Constants.

UNIT II Operators, Control Statements & Arrays **15 Hours**

Operators and its types, Evaluation of arithmetic expressions. Control Statements: Branching, Looping, Nested Control Structures, switch, break, continue, goto Statement. Arrays and Strings.

UNIT III User-defined Functions **15 Hours**

Functions: Categories of Function, Function components, Passing Arguments to a Function, Recursion, Storage Classes. Passing Arrays and Strings to Functions.

UNIT IV Structures, Pointers, Files & DMA **15 Hours**

Structures & Unions: Passing Structures to Functions, Self Referential Structures. Pointers: Arrays, Structures, Functions, Operations on Pointers, Arrays of Pointers. Files & Preprocessor Directives: Dynamic Memory Allocation.

Application to be carried out throughout the syllabus:

Develop an employee file based on the menu-driven program for elementary database management employs all the basic technique of file handling in C. It consists of following features

1. Writing the data in binary file
2. Reading the data from binary file
3. Modify the record
4. Delete the record

Text Books:

1. Byron S. Gottfried, "Theory and Problems of Programming With C*"*, Second Edition, Tata McGraw Hill, 1996.
2. Yashwant Kanetkar, "Let us C ",BPB Publications,8th Revised edition (1 January 2008)

Reference Books:

1. Deitel and Deitel, "C How to Program", Pearson Education.6th edition,2010
2. Dennis M Ritchie, Brian W Kernighan, "The C Programming Language" , PHI, 2nd Edition,April 1,1988.
3. Balaguruswamy. E, "Programming in ANSI C",McGraw Hill Education (India) Private Limited, 6th Edition, May 2012.
4. Yashwant Kanetkar, "Understanding Pointers in C", BPB Publications, 4th Edition, March 2007.
5. Dr. Venugopal, "Mastering C", Tata McGraw-Hill Education, July 2006.

M18CA1040		L	T	P	C

Duration:60Hours	WEB TECHNOLOGIES	2	1	0	3

Course Objectives:

- Describe rich internet applications that use most recent client-side programming technologies.
- Apply client-side validations using Java Script.
- Capture core technical skills necessary for a complete understanding of front-end web development, including HTML5 and CSS, JavaScript, DOM.
- Demonstrate the displaying of XML documents using CSS and XSLT.

Course Outcomes:

Upon completion of this course, students shall be able to:

- Apply and design basic web page using HTML ,CSS and Java Script
- Demonstrate and develop HTML 5 & CSS Programming Skills ,Experience creating various small website project
- Understand the principles of creating an effective web page
- Design & develop Web applications using the web technologies tools

Course Contents:

UNIT I Fundamentals of HTML & CSS **15 Hours**

Introduction to HTML/XHTML: Origins and Evaluation of HTML and XHTML, Basic Syntax, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Syntactic Differences between HTML and XHTML. CSS: Introduction, Levels of Style Sheets, Style Specification Formats, Selector Forms, Property value forms, Font Properties, List Properties, Alignment of Text, Color, The box Model, Background Images, The and Tags

UNIT II HTML 5 **15 Hours**

Detecting HTML5 features – Canvas, Video, Local Storage, Web Workers, Offline Applications, Geolocation, Placeholders and input types, What Does It All Mean–Doctype, Root, Headers, Articles, Dates and Times, Navigation and Footers. Simple Shapes, Canvas, Paths, Texts, Gradients and Images.PlaceHolders, Autofocus Fields, Email, and NumbersAsSpinboxes and Sliders.

UNIT III The Basics of JavaScript and VB Script **15 Hours**

Object Orientation and JavaScript, Syntax, Primitives, Operations and Expressions, Screen Output and keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Constructors and Pattern Matching Using Regular Expressions, VB Script Basics, VBScript Data Types, VBScript Variables, VBScript Constants, VBScript Operators, mathematical, comparison, logical, Using Conditional Statements, Looping Through Code

UNIT IV Introduction to XML **15 Hours**

Introduction, Syntax of XML, XML document structure, Document Type Definitions, Namespaces, XML Schemas, Displaying Raw XML Documents with CSS. XSLT Style Sheets: Overview of XSLT, XSL Transformations for Presentation, XML Processors.

Text Books:

1. Robert W. Sebesta: Programming the World Wide Web, 4th & 7thEdition, Pearson education, 2009 & 2014 (Chapter 1& 4- 4th edition, 3 & 7- 7th edition)
2. Mark Pilgrim: HTML5 – Up and Running, O'REILLY| GOOGLE Press, 2014.(Chapter 2, 3, 4 & 9)

Reference Books:

1. Jeffrey C. Jackson: Web Technologies- A Computer Science Perspective, Pearson Education, Eleventh Impression, 2012.
2. Chris Bates: Web Programming Building Internet Applications, 3rd Edition, Wiley India, 2009.
3. Internet Technology and Web Design, Instructional Software Research and Development, (ISRD) Group, Tata McGraw Hill, 2011.
4. M. Srinivasan: Web Technology Theory and Practice, Pearson Education, 2012

M18CA1050	MANAGEMENT INFORMATION SYSTEMS	L	T	P	C
Duration:60Hours		4	0	0	4

Course Objectives:

- Provide the foundations for Information systems in Business.
- Enforce ability to understand the different types of Information systems.
- Impose control and strategic Planning at various levels of an organisation.
- Familiarize students with E-business applications.
- Assess the impact of the Internet and Internet technology on business electronic commerce and electronic business.
- Define an IT infrastructure and describe its components;
- Impart knowledge of various Information System solutions like ERP, CRM etc.
- Prepare to make informed decisions based on available information and technology resources
- Provide a deep understanding of the business and professional responsibilities related to the use of information systems in organizations

Course Outcomes:

Upon completion of this course, students shall be able to:

- To understand the basic principles and working of information Technology
- Describe the role of information Technology and information system in business
- To Contrast and compare how internet and other technologies support business process
- To give the overall perspective importance of application of internet technology in business administration
- To understand the management strength of the organization, to take advantage of the opportunities available.

Course Contents:

UNIT I Introduction to MIS & Decision Making: 15 Hours

System concepts, types of systems, Classes of systems, General model of MIS, Information, Classification of information, General model of a human as information Processor. MIS: Concept, Definition, Role and impact of MIS, Structure of a Management information system. Decision making concept & process, MIS and the role of Decision Support System.

UNIT II BPR & TQM 15 Hours

Introduction, Business process, process model of the organization, value stream model of the organization, what delay the business process, relevance of information technology, MIS and BPR. TQM of information systems, Strategic nature of IT decision, MIS choice of information technology

UNIT III Planning & EMS 15 Hours

Concept of corporate planning, Essentiality of strategic planning, Types of Planning, Tools of Planning, Characteristics of control process, the nature of control in an organization. Enterprise Management System (EMS)- Enterprise Resource Planning (ERP) System - ERP Model and Modules - Benefits of the ERP- ERP Implementation - Supply Chain Management (SCM)- Information Management in SCM - Customer Relationship Management (CRM)- EMS and MIS .

UNIT IV Client Server Architecture & E-Business Technology 15 Hours

Client server architecture, implementation strategies, Introduction to E-business, model of E-business, internet and World Wide Web, Intranet/Extranet, Electronic, Impact of Web on Strategic management, Web enabled business management, MIS in Web environment.

Text Books:

1. Waman S Jawadekar , Management Information Systems: Text & Cases, 4/e, Tata McGraw-Hill Education Pvt. Ltd., 2009.
2. James A O' Brien, George M Marakas, Ramesh Behl "Management Information System", 9th edition, McGrawHill, 2013.

Reference Books:

1. Davis & Olson , " Management Information Systems", 2nd Edition, TMH

M18CA1060	FUNDAMENTALS OF COMPUTER ORGANIZATION	L	T	P	C
Duration:60hours		2	0	1	3

Course Objectives:

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- Describe the organization and operation of a computer processor, primary and secondary memory, and peripheral devices and to give computer specifications.
- Use the "tools of the trade": basic instruments, devices and design tools.
- Work in a design team that can propose, design, successfully implement and report on a digital systems project.
- To impart the knowledge of concepts of sequential circuits enabling to analyse sequential systems in terms of state machines

Course Outcomes:

After completing the Course the students shall be able to:

- Create a gate-level implementation of a combinational logic function described by a truth table.
- The ability to understand, analyse and design various combinational and sequential circuits
- Recall the internal organization of computers, CPU, memory unit and Input/Outputs and the relations between its main components.
- Recognize and perform computations with the functional units of the processor
- Describe hierarchical memory systems including cache memories.

Course Contents:

UNIT I Number systems, Operations, codes and Logic Gates 15 Hours

Decimal numbers, Binary numbers, Number Base Conversions: Decimal-to-Binary conversion, Binary Arithmetic, 1’s and 2’s Complements of Binary Numbers, Hexadecimal Numbers, Octal numbers, Binary Coded Decimal (BCD). The Inverter, the AND Gate, the OR gate, the NAND Gate, the NOR Gate, the Exclusive-OR and Exclusive-NOR Gates, Basics of Digital Integrated Circuits.

UNIT II Boolean Algebra, Logic Simplification, Combinational and Sequential Logic 15 Hours

Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, DeMorgan's Theorems, Boolean Analysis of Logic Circuits, Simplification Using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Karnaugh Map, karnaugh Map SOP Minimization, POS Minimization, Adders, Subtractors and Flip-Flops.

UNIT III Basic Structure of Computers and Machine Instructions 15 Hours

Computer types, Functional Units, Basic Operational Concepts, Bus Structures, and Performance and Historical Perspective.Memory Locations and Address, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes.

UNIT IV INPUT/OUTPUT Organization and The Memory System 15 Hours

Accessing I/O Devices, Interrupts, Direct Memory Access and Buses.Some Basic Concepts, Semiconductor RAM Memories, Read-Only Memories and Cache Memories.Course Outcomes.

Text Books:

1. THOMOS L. FLOYD, "Digital Fundamentals", TENTH EDITION, PEARSON, 2014. Chapters (2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10 & 2.11, 3.1 to 3.7 & 4.1 to 4.9).
2. M.Morris Mano " Digital Logic and Computer Design", PEARSON, 2013. Chapters (4.1 to 4.4, 6.1 to 6.2 and 7.1 to 7.3)
3. Hamacher, Vranesic and Zaky, "Computer Organization", FIFTH EDITION, TATA McGRAW-HILL, 2015. Chapters (1, 2, 4 & 5)

Reference Books:

1. Digital Electronics: An Introduction To Theory And Practice By William Gothmann, Second Edition, PHI Publisher, 2015.
2. Digital Electronics by John Morris, Fifth Edition, 2016.
3. Fundamentals of Digital Circuits by Anand Kumar, Fourth Edition, 2014.
4. Digital Electronics Principles And Integrated Circuits by Anil K. Maini, second Edition, 2013.
5. Computer Organization and Design by David A. Patterson, John L. Hennessy, Fifth Edition, Morgan Kaufmann.

M18CA1070	SPORTS/ YOGA/ MUSIC /DANCE/ THEATRE	L	T	P	C
Duration:30Hours		2	0	0	2

Note: Music, Dance, and Theater courses are offered by the School of Performing Arts, whereas the Sports and Yoga courses are offered by the Department of Physical Education. The students have to choose any **ONE** of these courses.

A. YOGA FOR HEALTH

Course Objectives:

Following are the Course Objectives.

- To prepare the students for the integration of their physical, mental and spiritual faculties;
- To enable the students to maintain good health;
- To practice mental hygiene and to attain higher level of consciousness;
- To possess emotional stability, self control and concentration; and
- To inculcate among students self discipline, moral and ethical values.

Course Outcomes:

On completion of the course learners will be able to:

- Practice yoga for strength, flexibility, and relaxation.
- Learn techniques for increasing concentration and decreasing anxiety
- Become self disciplined and self-controlled
- Improve physical fitness and perform better in studies
- Gain self confidence to face the challenges in the society with commitment to serve the society

Course Contents:

UNIT I

1. **Yoga:** Introduction, Tips from Sage Patanjali's Yoga Sutras
2. **Surya Namaskara:-** 10 counts,12 counts,16 counts

UNIT II

1. **Asanas: Sitting-**Vajrasana, Dandasana, Padmasana, Matsyasana, Ardha Matsyendrasana, Suptavajrasana, Paschimottasana, Bakasana, Simhasana, Shirasasana.

2. **Asanas: Standing-**Tadasana, Trikonasana, Parshwa konasana, Veerabadrasana, Parivrutta trikonasana.

UNIT III

1. **Asanas:Prone Position-**Bhujangasana, Dhanurasana, Shalabhasana.**Asanas: Supine Position-**Sarvangasana, Sethubandha sarvangasana, Halasana,Karnapeedasana.
2. **Mudras-** Dhyana mudra, Chinmaya mudra, Namaste mudra, Nasika mudra

UNIT IV

1. **Pranayams:-** Ujjayi, Nadi Shodhana, Anuloma – Viloma, Basthrika, Bhramari, Sheethali

Dhyana & its types Competition format, Rules and their interpretations

B. VOLLEYBALL

Course Objectives:

- To learn the rules, fundamental skills, and strategies of volleyball.
- To develop skills in passing, setting, serving, spiking, and blocking.
- To learn basic offensive and defensive patterns of play.
- To develop a positive attitude towards volleyball as a lifetime sport and to improve physical fitness through participation in volleyball.

Course Outcomes:

On completion of the course learners will be able to:

- Learn basic skills and knowledge associated with volleyball.
- Apply these skills while playing volleyball and exhibit improved performance
- Improve physical fitness and practice positive personal and lifestyle.
- Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Contents:

UNIT I

1. Introduction about Volleyball
2. Players Stance, Receiving and passing
3. The Volley (Overhead pass), The Dig (Underhand pass), Service Reception

UNIT II

1. Service- Under Arm Service, Tennis Service, Side Arm Spin Service, Round Arm Service, High spin service, Asian serve / American serve (floating)
2. Setting the ball- Set for attack, Back set, Jump set

UNIT III

1. Smash/Spike- Straight smash, Body turn smash, Wrist outward smash, Wrist inward smash
2. Block- Single block, Double block, Three-man block
3. Rolls- Overhead pass & back rolling, One hand underhand pass with side rolling, Forward dive

UNIT IV

1. Attack Combination, Defense Systems, Libero play
2. Court marking, Rules and their interpretations and Duties of officials

C. **BASKETBALL**

Course Objectives:

- To learn the rules, fundamental skills, and strategies of Basketball
- To develop technical skills in passing, in ball handling, individual offense, individual defense, rebounding, screen, team offense, team defense and fast break.
- To learn basic offensive and defensive strategies of play.
- To develop a positive attitude towards Basketball as a lifetime sport and to improve physical fitness through participation in Basketball.
- To develop positive understanding and appreciation of the basketball game.

Course Outcomes:

On completion of the course learners will be able to:

- Learn basic skills and knowledge associated with basketball.
- Apply these skills while playing basketball and exhibit improved performance
- Improve physical fitness and practice positive personal and lifestyle.
- Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Contents:

UNIT I

1. Basketball: Introduction
2. Grip; Player stance- Triple threat stance and Ball handling exercises
3. Passing (Two hand/one hand)- Chest pass, Bounce Pass, Over head pass, Underhand pass, Hook Pass, Behind the back pass, Baseball pass, Side arm pass and passing in running.
4. Receiving-Two Hand receiving, One hand receiving, Receiving in stationary position, Receiving while jumping, Receiving while running.

UNIT II

1. Dribbling- How to start dribble, How to stop dribble, High / Low dribble with variations
2. Shooting- Layup shot and its variations, One hand set shot, One hand jump shot, Free throw, Hook shot, Tip-in shot.
3. Stopping- Stride/Scoot, Pivoting and Faking /Feinting footwork.

UNIT III

1. Rebounding- Defensive rebound, Offensive rebound, Box out, Rebound Organization.
2. Individual Defensive- Guarding the man with the ball and without the ball.
3. Offensive drills, Fast break drills, Team Defense/Offense, Team Tactics

UNIT IV

1. Court marking, Rules and their interpretations

D. **FOOTBALL**

Course Objectives:

- To learn the rules, fundamental skills, and strategies of football.
- To develop skills in passing, receiving, controlling the ball, dribbling, shielding, shooting, tackling, beating a defender and heading in football.
- To learn basic offensive and defensive patterns of play
- To use different parts of the body in utilizing the above skills while playing football
- To develop a positive attitude towards football as a lifetime sport and to improve physical fitness through participation in football.

Course Outcomes:

On completion of the course learners will be able to:

- Learn basic skills and knowledge associated with football.
- Apply these skills while playing football and exhibit improved performance

- Use the knowledge and understanding to perform, refine and adapt the above skills and related skills with precision, accuracy, fluency and clarity in any situation.
- Improve physical fitness and practice positive personal and lifestyle.
- Gain an understanding of the value of sports in attaining wellness, maintaining good health and developing spirit of teamwork.

Course Contents:

UNIT I

1. Football: Introduction
2. Kicks- Inside kick, Instep kick, Outer instep kick, Lofted kick, Chipping, Volley, Half Volley
3. Trapping- Trapping rolling the ball, Trapping bouncing ball with sole

UNIT II

1. Dribbling- With instep and outer instep of the foot.
2. Heading- From standing, running and jumping.
3. Feinting- With the lower limb and upper part of the body.

UNIT III

1. Tackling- Simple tackling, Slide tackling.
2. Throw-in- Standing and Sliding
3. Goal Keeping- Collection of balls, Ball clearance, throwing and deflecting.

UNIT IV

1. Ground marking, Rules and their interpretations

E. ATHLETICS (TRACK AND FIELD)

Course Objectives:

- To teach students the skilled techniques in sprints, relay running, hurdles, long jump, high jump, and shot put and practice them.
- To develop competence among students in demonstrating all the techniques covered in the course.

- To make students understand some of the scientific and empirical principles and their rationale underlying the development of skilled performance.
- To inculcate among students the habit of team work and cooperative learning and develop competence in detecting / correcting technique errors.
- To develop a positive attitude towards sports in general and athletics in particular and to improve physical fitness through participation in various athletic games / sports activities.

Course Outcomes:

On completion of the course learners will be able to:

- Display competencies in executing basic techniques and skills associated with select track and field events.
- Develop basic skills and techniques to improve one's running posture and take-off position for different jumps.
- Learn regular practice of select track and field events and improve physical fitness
- Appreciate track and field events by applying sports science knowledge to explain the execution of the events.

Course Contents:

UNIT I

1. Athletics: Introduction
2. Track Events - Steeple Chase, Race Walking, Middle and Long distance races
3. Race walking - Technique, Faults and Officiating.
4. Middle and Long distance races – Technique and Training

UNIT II

1. Jumping Events - High Jump and Triple Jump: Basic Skills and techniques
2. High Jump - Straddle Roll & Flop Technique, Approach, Take-off, Technique in the air, Clearance over the bar & Landing
3. Triple Jump – Hop, Step and Jump Technique, Approach, Take-off & Landing

UNIT III

1. Throwing Events - Discus Throw and Hammer Throw: Basic Skills and techniques

2. Discus Throw -Standing and Rotatory techniques,Grip, Stance, Rotation Technique, Power stance, Release and Reverse (Follow through)
3. Hammer Throw - Grip, Swings, Rotation foot work, Release and Follow through

UNIT IV

1. Rules, Officiating and Marking - Ground / Sector Marking, Interpretation of Rules.

Reference Books

Manual for Athletics Specialization (Athletics Part-I and Athletics Part-II)

1. Arthur E. Ellison (ed) (1994). Athletic Training and Sports Medicine.
2. Ballisteros, J.M. (1998). Hurdles Basic Coaching Manual, IAAF.
3. Bosen K.O. (1993). Teaching Athletics Skills and Technique.
4. Bosen K.O. (1990). Study Material on Hurdles for the Regular Course Students.
5. Doherty K. (1995). Track and Field Omni book.
6. Martin, David E. Peter N. Coe (1991). Training Distance Runner.
7. Howard S. (1981). Science of Track and Field Athletics.
8. Briggs Graeme (1987). "Track and field coaching Manual", Australian Track and Field Coaches Association. Rothmans Foundation National Sports Division.
9. Carr, Gerry (1999). "Fundamentals of Track and Field. Track Athletics 1 Title G.V. 1060 5.e. 368.
10. I.A.A.F. Level-II (2001). Text Book on Jumping Event.
11. Jarver, Jesse (1987). "The Jumps", Track and Field Coaching Manual Australia.

M18CA1080	C PROGRAMMING LAB	L	T	P	C
Duration:30Hours		2	0	0	2

Course Objectives:

- Advance structured and procedural programming understating and to improve C programming Skills.
- Provide students with understanding of code organization and functional hierarchical decomposition with using complex data types

Course Outcomes:

- Understanding a functional hierarchical code organization.
- Define and manage data structures based on problem subject domain.
- Work with textual information, characters and strings.

- Work with arrays of complex objects.
- Concept of object thinking within the framework of functional model and functional hierarchical code organization
- Handle possible errors during program execution.

Course Contents:

PART- A

- Implementation of the various Data Types with modifiers and type conversion in C.
  Ex: Create a calculator program which takes two values as input and implement addition, subtraction, multiplication and division by using all possible data types.
- Demonstration of nested if and switch... case structure.
  Ex: Create a menu driven implementation for program1 using switch or nested if.
- Implementation of various Control structures in C
  Ex:1) Use do while and modify program2 to repeat the menus as a choice for user to run the code until exit choice given. 2) Create a program to print first N Natural numbers.
- Implementation of single dimensional array, multidimensional arrays
  Ex:Create a program to sort first N numbers.,Create a program to add two matrices.
- Implementation of functions: call by value, call by reference, passing of arrays, Recursion
  Ex:Create a program to find factorial of a number using functions and return the value of factorial to the calling function.Create a program to find factorial of a number using recursion.
- Demonstration of various user defined string operations
  Ex:Create a program which reads a string and convert it in to upper case and read another string from the user to concatenate with previously string ex: String-1: REVA String 2: MCA result REVA MCA
- Demonstration of pointer operations.
  Ex: Create a program to read N integers and store them in an array, find the sum of all these elements using pointer. Output the given array and the computed sum with suitable heading.
- Implementation of structures and array of structures
  Ex: Define a student structure having the name, USN (university seat number), marks in five subjects, total and percentage of marks as its members. Marks of all the subjects are to be stored in an array. Develop a program to list the names of all the students who have failed.

- Implement Unions.

  Ex: Define a union student having the name, subject and percentage, assign values to 1st union variable and then display it and assign values to second union variable and display it, also show the differences in accession values of union.
- Implementation of pointers to structures.

  Ex: Create a structure called complex and add two complex numbers using a structure pointer.
- Demonstration of dynamic allocation of memory

  Ex: Create a dynamic array using dynamic memory allocation functions and find the sum of N numbers.

- Demonstration of various Text file operations.

  Ex: Create a program to Create and count number of characters in a file, Create a program to handle files with mixed data type

PART-B

Develop an employee record system using files.

M18CA1090	**WEB TECHNOLOGIES LAB**	**L**	**T**	**P**	**C**
Duration:30Hours		**0**	**0**	**2**	**2**

Course Objectives:

- Apply client-side validations using Java Script.
- Capture core technical skills necessary for a complete understanding of front-end web development, including HTML5 and CSS, JavaScript, DOM.

Course Outcomes:

Upon completion of this course, students shall be able to:

- Design basic web page using HTML, CSS and Java script.
- Develop a website that has a consistent outlook and its functionalities work on different platforms.

Course Contents:

PART-A

1. Create an HTML5 page to demonstrate the usage of
   a. Text Formatting tags
   b. Links
   c. Images
   d. Tables
2. Develop and demonstrate the usage of inline and external style Sheet using CSS.
3. Write a Program using JavaScript to display a table of the numbers from 5 to 15 and their squares and cubes using alert.
4. Develop and demonstrate using Java script, a XHTML document that display random numbers (integers).
5. Write a Program to demonstrate various event handlers when an image is moved from the top stacking position, it returns to its original position using JavaScript.
6. Develop using Java script, an XHTML document that uses onload and onfocus events.
7. Write a Program on xml to read Employee details and display the details using CSS.
8. Develop a web form to display the student details using XML and XSLT style sheets.

PART-B

1. Build a client-side web application in the following areas:
   a. Educational Institutions.
   b. Online shopping.
   c. Hospital Management System.
   d. Real Estate
   e. Reservation System.

SECOND SEMESTER

M18CA2010	OBJECT ORIENTED PROGRAMMING USING C++	L	T	P	C
Duration:60hours		4	0	0	4

Course Objectives:

- Outline the fundamentals of OOP concept
- Illustrate classes, objects and their uses.
- Examine the concept of Inheritance so that learner understands the need of inheritance.
- Incorporate polymorphism and virtual functions.
- Interpret console I/O operations and exception handling mechanism.

Course Outcomes:

At the end of the course, the learner shall be able to:

- Understand the fundamentals of OOPs concepts, Classes and Objects.
- Identify programming constructs related to inheritance to develop applications for solving problems.
- Apply overloading and virtual function concepts to design and develop solutions to real time problems.
- Interpret I/O operations, explore the techniques for exception handling and analyze file handling methods.

Course Contents:

UNIT I Fundamentals of OOP **15 Hours**

Object Oriented paradigm, Structured vs. Object Oriented Paradigm. Elements of Object Oriented Programming: Object, Classes, Encapsulation & data abstraction, Inheritance, Polymorphism etc., C++ Overview, different data types, operators, expressions- Functions in C++.**Classes and objects:** Introduction, Class Specification, Class Objects, access members, defining member functions, data

hiding, constructors, destructors, parameterized constructors, static data members, functions, scope resolution operator, passing objects as arguments, returning objects, friend functions & classes, arrays of objects, Dynamic objects – Pointers to objects-Friend Functions.

UNIT II Inheritance **15 Hours**

Types of Inheritance, Derived classes, protected access specifies in base class , public, private & protected inheritance ,constructors and destructors in derived classes, Ambiguity in multiple inheritance, function overriding.

UNIT III Polymorphism and Virtual Functions **15 Hours**

Function Overloading: Functions with different sets of parameters, default and constant parameters. Operator Overloading, Creating prefix and postfix forms of the increment and decrement Operators, operator Overloading using a Friend Function, Overloading new, delete, [ ],( ),→, the comma operator, Virtual base class and virtual destructor. Normal member functions accessed with pointers, virtual member function access, late binding, pure virtual function, abstract classes.

UNIT IV Managing console I/O operations and Exception handling **15 Hours**

C++ Streams and stream classes-Unformatted I/O operations-formatted console I/O operations-Managing output with manipulators- working with files. Exception handling: Basics of Exception handling-Exception handling mechanism-throwing mechanism-catching mechanism-Specifying exceptions.

Text Books:

1. Paul Deitel& Harvey Deitel, "C++ How to program", Pearson Education Asia, 7th Edition, 2010 (UNIT I & II).
2. E Balagurusamy, "Object oriented Programming with C++", 4th edition, 2008, Tata McGraw Hill.(UNIT III-Chapter 8 and chapter 9 & UNIT IV –chapter 10,11 & 13)
3. Schildt Herbert, The Complete Reference C++, Tata McGraw Hill, 4th Edition, 23rd reprint, 2009.

Reference Books:

1. M T Somashekar, D S Guru, Object Oriented Programming with C++, PHI, 2nd Edition , 2012.
2. Bhushan Trivedi, "Programming with ANSI C++", Oxford Press, Second Edition, 2012.

M18CA2020	ADVANCED COMMUNICATIVE ENGLISH–I	L	T	P	C
Duration:60hours		4	0	0	4

Course Objectives:

- To enable the learners develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Computer Applications.
- To ensure that once when the learners complete their Post-Graduation course and will be ready to face the world, these communication skills would help them to mould their career in a better way.
- To inculcate the habit of reading and writing Research Papers, Journals, Blogs, Articles and Reviews for their academic betterment.

Course Outcomes:

Upon completion of the course, learners shall be able to:

- Develop proper listening, reading, writing and speaking skills.
- Utilize their communicative skills to express themselves in their professional field.
- Build a professional and confident image in order to excel in their respective endeavours.

Course Contents:

UNIT	Description	Topics	Teaching Hours
I	**Language in Use**	1. Vocabulary Building 2. Auxiliaries (Modal and Primary) 3. Tenses 4. Idioms & Phrasal Verbs 5. Conditional Statements 6. Homonyms & Homophones	**12 Hours**

II	**Academic Writing**	1. Paragraphs 2. Email Etiquettes 3. Project Reports 4. Proposals	**12 Hours**
III	**Employability Skills – I**	1. Cover Letter & CV Writing 2. Group Discussions 3. Body Language & Gestures 4. Interview Skills	**12 Hours**
IV	**Employability Skills – II**	1. Personality Development 2. Face-to-face &Telephonic Conversations 3. Public Speaking Skills 3. Presentation Skills	**12 Hours**

Reference Books:

1. Green, David. Contemporary English Grammar Structures and Composition. New Delhi: MacMillan Publishers, 2010.
2. Thorpe, Edgar and Showick Thorpe. Basic Vocabulary. Pearson Education India, 2012.
3. Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Longman, 2003.
4. Murphy, Raymond. Murphy's English Grammar with CD. Cambridge University Press, 2004.
5. Rizvi, M. Ashraf. Effective Technical Communication. New Delhi: Tata McGraw-Hill, 2005.
6. Riordan, Daniel. Technical Communication. New Delhi: Cengage Publications, 2011.
7. Sen et al. Communication and Language Skills. Cambridge University Press, 2015.
8. Bansal, R.K. and J.B. Harrison. Spoken English. Orient Blackswan, 2013.
9. Raman, Meenakshi and Sangeeta Sharma. Technical Communication. Oxford University Press, 2015.
10. Thorpe, Edgar and Showick Thorpe. Objective English. Pearson Education, 2013.
11. Dixson, Robert J. Everyday Dialogues in English. Prentice Hall India Pvt Ltd., 1988.
12. Turton, Nigel D. ABC of Common Errors. Mac Millan Publishers, 1995.
13. Samson, T. (ed.) Innovate with English. Cambridge University Press, 2010.
14. Kumar, E Suresh, J. Savitri and P Sreehari (ed). Effective English. Pearson Education, 2009.
15. Goodale, Malcolm. Professional Presentation. Cambridge University Press, 2013.

M18CA2030	RELATIONAL DATABASE MANAGEMENT SYSTEMS	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- To introduce the basic concepts in Relational Databases and its design approaches.
- To provide practical experience in using Oracle9i software to develop and alter tables.
- To train the students to manipulate tables using updation, deletion and arithmetic operations.
- To provide the basic understanding to group data using built-in functions and join multiple tables.
- To expose the students in the creation and manipulation of tables using PL/SQL.

Course Outcomes:

Upon completion of the course, learners shall be able to:

- Relate all basic terminologies in Relational Databases, formulate relational algebra expressions, be skilled in understanding of normalization theory and apply such knowledge to the normalization of a database. (Level 1)
- Identify and recognize Oracle9i software to develop and formulate solutions to a broad range of query, and data update, delete & alter tables. (Level 2).
- Have a basic understanding to group data using built-in functions, arithmetic operations and join multiple tables. (Level 3).
- Demonstrate a new programming language PL/SQL to create and manipulate tables, records in databases.(Level 4 and 5).

Course Contents:

UNIT I Database Concepts **15 Hours**

Database Concepts: A Relational approach: Database, Relationships, DBMS, Relational Data Model, Integrity Rules and Theoretical Relational Languages. **Database Design**: Data Modeling and

Normalization : Data Modeling, Dependency, Database Design, Normal forms, Dependency Diagrams, Denormalization, Examples of Normalization.

UNIT II RDBMS Tools **15 Hours**

Overview: Personal Databases, Client/Server Databases, Oracle9i an introduction, SQL *Plus Environment, SQL, Logging into SQL *Plus, SQL *Plus Commands, Errors & Help Alternate Text Editors, SQL *Plus Worksheet, iSQL *Plus. **Oracle Tables:** DDL: Naming Rules and conventions , Data Types, Constraints, Creating Oracle Table, Displaying Table Information, Altering an Existing Table, Dropping, Renaming, Truncating Table, Table Types, Spooling, Error codes.

UNIT III Working with Table **15 Hours**

Working with Table: Data Management and Retrieval: DML, adding a new Row/Record, Customized Prompts, Updating and Deleting an Existing Rows/Records, retrieving Data from Table, Arithmetic Operations, restricting Data with WHERE clause, Sorting, Revisiting Substitution Variables, DEFINE command, CASE structure. **Functions and Grouping**: Built - in functions, Grouping Data. **Multiple Tables**: Join, Set operations.

PL/SQL: A Programming Language: History, Fundamentals, Block Structure, Comments, Data Types, Other Data Types, Declaration, Assignment operation, Bind variables, Substitution Variables, Printing, Arithmetic Operators.

UNIT IV PL/SQL **15 Hours**

PL/SQL Control Structures and Embedded SQL : Control Structures, Nested Blocks, SQL in PL/SQL, Data Manipulation, Transaction Control statements. **PL/SQL Cursors and Exceptions**: Cursors, Implicit & Explicit Cursors and Attributes, Cursor FOR loops, SELECT...FOR UPDATE, WHERE CURRENT OF clause, Cursor with Parameters Cursor Variables, Exceptions, Types of Exceptions.**PL/SQL Composite Data Types**: Records, Table, Varrays. Named Blocks: Procedures, Functions Packages, Triggers, Data Dictionary Views.

Text Book:

1. Database Systems Using Oracle – Nilesh Shah, 2nd edition, PHI.

Reference Books:

1. Database Management Systems – Arun Majumdar&Pritimoy Bhattacharya, 2007, TMH.
2. Database Management Systems – Gerald V. Post, 3rd edition, TMH.

M18CA2040	DATA STRUCTURES AND ITS APPLICATIONS	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- Provide the students with solid foundations in the basic concepts of programming: data structures
- Familiarize the concept of Abstract Data Types (ADT),
- Provide depth knowledge on structure, arrays, Pointers.
- Introduce the concept of Linear and Non- Linear Data Structures like Stacks, Queues ,List, Trees and Graphs.

Course Outcomes:

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

- Design or select an appropriate data structures for a particular problem,
- Package a set of data structures and algorithms as an abstract data type,
- Apply the knowledge of data structures in writing more efficient programs in a programming language,
- Develop Applications using Linear and Non-Linear Data Structures.

Course Contents:

UNIT I Basics of Data Structures **15Hours**

Introduction to Data Structures, Abstract Data Types (ADT) , Arrays, Recursion, Structures and Pointers.

UNIT II Linear Data Structures **15 Hours**

Stack: Applications of stack, Infix to postfix conversion, evaluation of expression. Queue: types of Queues, Applications of Queues. Linked List: Types of Linked lists, Applications of linked list.

UNIT III Sorting Methods **15 Hours**

Insertion, Selection , Bubble , Quick, Merge, Heap , Radix. Searching: Linear and Binary Search, Hashing Method , Hashing Function.

UNIT IV Non Linear Data Structures **15 Hours**

Need for non-linear structures, Trees and its representation, Binary Tree, Types of Binary Trees, Binary tree traversals , applications of trees , Binary Search Tree, Threaded Binary Tree. Balancing TREE, AVL trees, B-Trees.Introduction to Graph, Graph Traversal Techniques.

Text Books:

1. Ashok N Kamthane, "Introduction to Data Structures in C", Pearson Education (S) Pvt Ltd., New Delhi: 2005.
2. Yedidyah Langsam and Moshe J .Augenstein and Aaron M Tenanbanum, "Data Structures Using C and C++", 2nd Edition, Pearson Education Asia, 2002.
3. Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan (2008), Fundamentals of Data Structure in C, 2nd Edition, University Press, India.

Reference Books:

1. Jean-Paul Tremblay and Paul G Sorenson, "An Introduction to Data Structures with Applications", Second Edition, Tata McGraw-Hill Publishing Company Lt., New Delhi: 1995.
2. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education

M18CA2050	OPERATIONS RESEARCH	L	T	P	C
Duration:60Hours		4	0	0	4

Course Objectives:

- To provide the concept and an understanding of basic concepts in Operations Research Techniques for Analysis and Modeling in Computer Applications
- To understand develop and solve mathematical model of linear programming problems
- To understand develop and solve mathematical model of Transport and assignment problems
- To understand network modeling for planning and scheduling the project activities

Course Outcomes:

On completion of the course, learners will be able to:

- Formulate and model of a linear programming problem from a word problem and solve them graphically in 2 dimensions, while employing some convex analysis.
- Illustrate and apply the concepts of place a primal linear programming problem into standard form and use the simplex method or dual simplex method to solve it. Effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing.
- Recognize and compute / solve a number of classical linear programming problems and such as the minimum / maximum of the assignment problem, the transportation problem, the shortest-path problem, while taking advantage of the special structures of certain problems.
- Demonstrate the ability to apply analytical and theoretical skills to create quantitative models to solve real world problems in appropriate contexts

Course Contents:

UNIT I Introduction to Linear Programming and Overview of the OR Modeling 15 Hours

The origin of OR, the nature of OR, the impact of OR, defining the problem and gathering data, Formulating a mathematical model, deriving solutions from the model, testing the model, preparing to apply the model, implementation.

Formulation of linear programming problem (LPP), examples, Graphical solution, the LP Model, Special cases of Graphical method, assumptions of Linear Programming (LP), additional example.

UNIT II Solving LPP - The Simplex Method 15 Hours

The essence of the simplex method, setting up the simplex method, algebra of the simplex method, the simplex method in tabular form, special cases in the simplex method, tie breaking in the simplex method, adopting to other model forms (Two Phase method, Big-M method), post optimality analysis. The essence of duality theory, economic interpretation of duality, primal dual relationship, adapting to other primal forms.

UNIT III Transportation and Assignment Problems 15 Hours

The transportation problem, a stream line simplex method for the transportation problem, Least Corner Method, Matrix Minima Method, Vogel's Approximation Method for finding basic feasible solution and its optimal (U V Method) solution problem, the assignment problem, a special algorithm for the assignment problem.

UNIT IV Game Theory and Network Analysis 15 Hours

The formulation of two persons, zero sum games, solving simple games- a prototype example, games with mixed strategies, graphical solution procedure, Shortest Path: Dijkstra Algorithm; PERT-CPM problems (Cost Analysis, Crashing, Resource Allocation excluded).

Text Books:

1. Frederick S.Hillier& Gerald J.Lieberman: Introduction to Operations Research, 8thEdition, Tata McGraw Hill, 2006.
2. Hamdy A Taha: Operations Research - An Introduction, 7th Edition, Pearson Education 2007
3. Operations Research Problems & Solutions, V K Kapoor, Sultan Chand & Sons Educational Publishers, 2003.

Reference Books:

1. A Wayne L. Winston: Operations Research Applications and Algorithms, 4th Edition, Thomson Course Technology, 2003.
2. Theory and Problems of Operations Research, Richard Bronson and GovindasamiNaadimuthu, Schaum's Outline, Tata McGraw Hill, 2nd Edition, 1997.
3. P K Srimani and M Vinayaka Murthy, "Computer Oriented Numerical Methods & Linear Programming", Subhas Stores, Bengaluru, 2001

Case Study: Any one of the following (database) applications include 1) university course scheduling, 2) design of experiments, 3) stock portfolio optimization, 4) warehouse location, 5) vehicle routing, 6) product distribution, 7) staff scheduling, 8) quality control, 9) traffic light phasing, 10) police patrolling, 11) preventive maintenance scheduling, 12) economic forecasting, 13) power plant fuel allocation, 14) cost effective environmental protection, and 15) inventory control development (Oracle\SQL Server\VB etc.)

*** Instructions for Students' Assignments**: Each candidate will submit a journal which will have case studies on Decision Theory and Replacement theory

M18CA2060	SOFTWARE ENGINEERING	L	T	P	C
Duration:60Hours		4	0	0	4

Course Objectives:

- To provide an insight into the processes of software development
- To understand and practice analysis, design, development, testing of Software Engg.
- To develop skills to construct software of high quality with high reliability

Course Outcomes:

- Identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
- Apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare as well as global, cultural, social, environmental, and economic factors.
- Recognize ethical and professional responsibilities in engineering situations and make informed judgments which must consider the impact of engineering solutions in global, economic, environmental and societal contexts.
- Function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
- Acquire and apply new knowledge as needed, using appropriate learning strategies.

Course Contents:

UNIT I Introduction **15 Hours**

Introduction to Software Engineering: Defining the Discipline, Software Process, software engineering practice, software development myths. The Changing nature of Software, **Software Process structure**: Generic process model, defining a framework activity. **Process models:** Perspective and specialized process models, the unified process.

UNIT II: Requirement Analysis and Design - Traditional / WEB / Mobile applications

15 Hours

Understanding Requirements, Functional and Non-functional requirements, Requirements Modeling (Scenario-based & Class-based methods), Design Concepts, Architectural design (Webapp Design, Mobileapp Design), Software Configuration Management Process.

UNIT III Agile Implementation and Managing Change 15 Hours

AGILE development, Implementing AGILE process, Technology Directions, Project Management Concepts, Project Estimation and Scheduling, Risk Management, Maintenance and Re-engineering, PERT Cost Estimation methods.

UNIT IV Software Quality Management Process, Security, Process Improvement 15 Hours

Quality Concepts, Software Quality Assurance, Testing Strategies, Application Testing, Security Engineering, Verification Models, Software Process Improvement, The SPI Process, Trends and Return of Investment.

Text Books:

1. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

Reference Books:

1. Software Engineering, Ian Somerville, 9th edition, Pearson education.
2. Stephen Schach, Software Engineering 7th ed, McGraw-Hill, 2007.

M18CA2070	DS USING C/ C++ LAB	L	T	P	C
Duration:30Hours		0	0	2	2

Course Objectives:

- To teach efficient storage mechanisms of data for an easy access.
- To design and implementation of various basic and advanced data structures.
- To introduce various techniques for representation of the data in the real world.
- To develop application using data structures.
- To teach the concept of protection and management of data.
- To improve the logical ability.

Course Outcomes:

On completion of the course, learners shall be able to:

- Choose appropriate data structure as applied to specified problem definition
- Handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
- Apply concepts learned in various domains like DBMS, compiler construction etc.
- Use linear and non - linear data structures like stacks, queues , linked list etc.

Course Contents:

1. Design, Develop and Implement a menu driven Program in C for the following Array operations
   a. Creating an Array of N Integer Elements
   b. Display of Array Elements with Suitable Headings
   c. Inserting an Element (ELEM) at a given valid Position (POS)
   d. Deleting an Element at a given valid Position(POS)
   e. Exit.

Support the program with functions for each of the above operations.

2. Design, Develop and Implement a menu driven Program in C for the following operations on STACK of Integers (Array Implementation of Stack with maximum size MAX)
   a. Push an Element on to Stack
   b. Pop an Element from Stack
   c. Demonstrate how Stack can be used to check Palindrome
   d. Demonstrate Overflow and Underflow situations on Stack
   e. Display the status of Stack
   f. Exit

Support the program with appropriate functions for each of the above operations

3. Design, Develop and Implement a menu driven Program in C for the following operations on QUEUE of Integers (Array Implementation of Stack with maximum size MAX)
   a. Insert an Element on to queue
   b. Delete an Element from queue
   c. Demonstrate Overflow and Underflow situations on Queue.
   d. Display the status of Queue.

e. Exit

Support the program with appropriate functions for each of the above operation.

4. Design, Develop and Implement a Program in C for converting an Infix Expression to Postfix Expression. Program should support for both parenthesized and free parenthesized expressions with the operators: +, -, *, /, %(Remainder), ^(Power) and alphanumeric operands.

5. Design, Develop and Implement a Program in C for the following Stack Applications

a. Evaluation of Suffix expression with single digit operands and operators: +, -, *, /, %, ^

b. Solving Tower of Hanoi problem with n disks

6. Design, Develop and Implement a menu driven Program in C for the following operations on Circular QUEUE of Characters (Array Implementation of Queue with maximum size MAX)

a. Insert an Element on to Circular QUEUE

b. Delete an Element from Circular QUEUE

c. Demonstrate Overflow and Underflow situations on Circular QUEUE

d. Display the status of Circular QUEUE

e. Exit

Support the program with appropriate functions for each of the above operations

7. Design, Develop and Implement a menu driven Program in C for the following operations on Singly Linked List (SLL) of Student Data with the fields: USN, Name, Branch, Sem, PhNo

a. Create a SLL of N Students Data by using front insertion.

b. Display the status of SLL and count the number of nodes in it.

c. Perform Insertion / Deletion at Front of SLL(Demonstration of stack)

d. Perform rear insertion/ deletion at front of SLL(Demonstration of Queue)

e. Exit

8. Design, Develop and Implement a menu driven Program in C for the following operations on Doubly Linked List (DLL) of Employee Data with the fields: SSN, Name, Dept, Designation, Sal, Ph No

a. Create a DLL of N Employees Data by using end insertion.

b. Display the status of DLL and count the number of nodes in it

c. Perform Insertion and Deletion at End of DLL

d. Perform Insertion and Deletion at Front of DLL

e. Exit

9. Simulate the working of a circular linked list providing the following operations

a. Delete from the beginning

b. Delete from the end

c. Delete a given element

d. Display

e. exit

Insert is mandatory.

10. Implement quick sort.

11. Implement the search techniques of

a. Linear Search using iteration

b. Binary Search using recursion.

12. Design, Develop and Implement a menu driven Program in C for the following operations on Binary Search Tree (BST) of Integers

a. Create a BST of N Integers: 6, 9, 5, 2, 8, 15, 24, 14, 7, 8, 5, 2

b. Traverse the BST in Inorder, Preorder and Post Order

c. Search the BST for a given element (KEY) and report the appropriate message

d. Exit

13. Write a C program to traverse the nodes in a graph using i. Breadth First Search. ii. Depth First Search.

14. Write a Program to

a) Create AVL Tree

b) Insert element to AVL tree

c) Find the height of the AVL tree.

M18CA2080		**L**	**T**	**P**	**C**

Duration:30Hours	RDBMS LAB	0	0	2	2

Course Objectives:

- Use data manipulation language to query, update, and manage a database
- Build a simple database system and demonstrate competence with the Fundamental tasks involved with modeling, designing and implementing a DBMS.

Course Outcomes:

- Understand, analyze and apply common SQL statements including DDL, DML and DCL statements to perform different operations.
- Design different views of tables for different users and to apply embedded and nested queries.
- Design and implement a database for a given problem according to well known design principles that balance data retrieval performance with data consistency.

Course Contents:

LISTING – I : Creation of tables:

Table Name : Client_master : **Description** : Use to store information about clients.

Column Name	Data Type	Size	Attributes
Client_no	Varchar	6	Primary Key / First letter must start with 'C'.
Name	Varchar	20	Not Null
Address1	Varchar	30	
Address2	Varchar	30	
City	Varchar	1J	
State	Varchar	1J	
Pincode	Numeric	6	
Bal_due	Numeric	10,2	

Table Name : product_master

Description : Use to store information about products.

Column Name	Data	Size	Attributes

	Type		
Product_no	Varchar	6	Primary Key / first letter must start with ‘P'
Description	Varchar	J	Not Null
Profit_percent	Numeric	J,2	Not Null
Unit_measure	Varchar	10	Not Null
Qty_on_hand	Numeric	8	Not Null
Reorder_lvl	Numeric	8	Not Null
Sell_price	Numeric	8,2	Not Null, Cannot be 0.
Cost_price	Numeric	8,2	Not Null, Cannot be 0.

Table Name :salesman_master

Description : Use to store information about salesman working in the company

Column Name	Data Type	Size	Attributes
Salesman_no	Varchar	6	Primary Key / First letter must start with ‘S'
Salesman_name	Varchar	20	Not Null
Address1	Varchar	30	Not Null
Address2	Varchar	30	
City	Varchar	20	
Pincode	Varchar	6	
State	Varchar	20	
Sal_amt	Numeric	8,2	Not Null, cannot be 0
Tgt_to_get	Numeric	6,2	Not Null, cannot be 0
Ytd_sales	Numeric	6,2	Not Null
Remarks	Varchar	60	

Table Name : sales_order

Description : Use to store information about order

Column Name	Data Type	Size	Attributes
S_order_no	Varchar	6	Primary Key / First letter must start with ‘O'
S_order_date	Date		
Client_no	Varchar	6	Foreign Key references client_no of client_master table
Dely_addr	Varchar	2J	
Salesman_no	Varchar	6	Foreign Key references salesman_no of salesman_master table.
Dely_type	Char	1	Delivery : part (P) / full (F), Default ‘F'

Billed_yn	Char	1	
Dely_date	Date		Cannot be less than s_order_date
Order_status	Varchar	10	Values('ln Process', 'Fulfilled', 'BackOrder','Canceled')

Table Name : sales_order_details

Description : Use to store information about products ordered.

Column Name	Data Type	Size	Attributes
S_order_no	Varchar	6	Primary Key / Foreign Key references s_order_no of sales_order table.
Product_no	Varchar	6	Primary Key / Foreign Key references product_no of product_master table.
Qty_ordered	Numeric	8	
Qty_disp	Numeric	8	
Product_rate	Numeric	10,2	

Table Name : Challan_Header

Description : Use to store information about challans made for the order.

Column Name	Data Type	Size	Attributes
Challan_no	Varchar	6	Primary Key / first two letters must start with 'CH'.
S_order_no	Varchar	6	Foreign key references s_order_no of sales_order table.
Challan_date	Date		Not Null
Billed_yn	Char	1	Values('Y','N'), Default 'N'.

LISTING - II :lnsertion of values

1. **Data for client_mastr table:**

Client_no	Name	City	Pincode	State	Baldue
C00001	lvanBayross	Bombay	4000J4	Maharashtra	1J000
C00002	VandanaSaitwal	Madras	780001	Tamil Nadu	0
C00003	PramadaJaguste	Bombay	4000J7	Maharashtra	J000
C00004	BasuNavindgi	Bombay	4000J6	Maharashtra	0
C0000J	Ravi Sreedharan	Delhi	100001		2000
C00006	Rukmini	Bombay	4000J0	Maharashtra	0

2. **Data for Product_master table:**

Product_no	Description	Profit Percent	UOM	Qtyonhand	Reorderlvl	Sellprice	Costprice

P00001	1.44 Floppies	J	Piece	100	20	J2J	J00
P034J3	Monitors	6	Piece	10	3	12000	11280
P06734	Mouse	J	Piece	20	J	10J0	1000
P0786J	1.22 Floppies	J	Piece	100	20	J2J	J00
P07868	Keyboards	2	Piece	10	3	31J0	30J0
P0788J	CD Drive	2.J	Piece	10	3	J2J0	J100
P0796J	J40 HDD	4	Piece	10	3	8400	8000
P0797J	1.44 Drive	J	Piece	10	3	10J0	1000
P0886J	1.22 Drive	J	Piece	2	3	10J0	1000

3. Data for Salesman_master table:

Salesman No	Salesman Name	Add1	Add2	City	Pincode	State	Sal Amt	Tgt_toGet	YtdSales	Remarks
S00001	Kiran	A/14	Worli	Bomba y	400002	MAH	3000	100	J0	Good
S00002	Manish	6J	Nariman	Bomba y	400001	MAH	3000	200	100	Good
S00003	Ravi	P-7	Bandra	Bomba y	400032	MAH	3000	200	100	Good
S00004	Ashish	A/J	Juhu	Bomba y	400044	MAH	3000	200	1J0	Good

4. Data for sales_order table:

S_order_no	Sorderdate	Clientno	Dely Type	Bill YN	alesman No	Delydate	Order Status
O19001	12-jan-96	C00001	F	N	S00001	20-jan-96	lP
O19002	2J-jan-96	C00002	P	N	S00002	27-jan-96	C
O4686J	18-feb-96	C00003	F	Y	S00003	20-feb-96	F
O19003	03-apr-96	C00001	F	Y	S00001	07-apr-96	F
O46866	20-may-96	C00004	P	N	S00002	22-may-96	C
O10008	24-may-96	C0000J	F	N	S00004	26-may-96	lP

5.Data for sales_order_detailstable :

S_order_no	Product no	Qty ordered	Qtydisp	Product rate
O19001	P00001	4	4	J2J
O19001	P0796J	2	1	8400
O19001	P0788J	2	1	J2J0
O19002	P00001	10	0	J2J
O4686J	P07868	3	3	31J0

O4686J	P0788J	3	1	J2J0
O4686J	P00001	10	10	J2J
O4686J	P034J3	4	4	10J0
O19003	P034J3	2	2	10J0
O19003	P06734	1	1	12000
O46866	P0796J	1	0	8400
O46866	P0797J	1	0	10J0
O10008	P00001	10	J	J2J
O10008	P0797J	J	3	10J0

6. **Data for challan_headertable:**

Challan_no	Sorderno	Challandate	Billed
CH9001	O19001	12-dec-9J	Y
CH686J	O4686J	12-nov-9J	Y
CH396J	O10008	12-oct-9J	Y

7. **Data for challan_details table:**

Challan_no	Productno	Qtydisp
CH9001	P00001	4
CH9001	P0796J	1
CH9001	P0788J	1
CH686J	P07868	3
CH686J	P034J3	4
CH686J	P00001	10
CH396J	P00001	J
CH396J	P0797J	2

LISTING – III: SINGLE TABLE RETRIEVAL

1) Find out the names of all clients.
2) print the entire client_master table.
3) Retrieve the list of names and the cities of all the clients.
4) List the various products available from the product_master.
5) Find the name of all clients having 'a' as the second letter in their names.
6) Find out the clients who stay in city whose second letter is 'a' .

7) Find the list of all clients who stay in bombay or city delhi or city madras.
8) List all the clients who are located in 'Bombay'.
9) Print the list of clients whose bal_due are greater than value 10000
10) Print the information from sales_order table of order placed in month of january.
11) Display order information for client_no 'c00001' and 'c00002' ;
12) Find the products with description as '1.44 drive' and '1.22 drive' .
14) Find the product whose selling price is more than 1500 and also find the new selling price as original price * 15
15) Rename the new in the above query as new_price
16) Find the product whose cost price is less than 1500
17) List the product in sorted order of their description
18) Calculate the square root of price of each product.
19) Divide the cost of product '540 HDD' by difference between its price and 100.
20) List the names,city,state of clients not in the state of 'Maharashtra' .
21) List the product_no,description,sell_price of products whose description begin with letter 'M'
.22) List of all orders that were canceled in month of March.

LISTING – IV: TABLE UPDATIONS

1)Change the s_order_date of cllient_no'C00001' to 24/07/96
2)Change the selling price of '1.44 Drive' to Rs. 1150.00
3) Delete the record with order no 'O19001' from the order table
4) Delete all the records having delivery date before 10-jul-96
5)Change the city of client_no 'C00005' to 'Bombay'
6) Change the delivery date of order no 'O10008' to 16-08-96
7) Change the bal_due of client_no 'C00001' to 1000
8) Change the cost price of '1.22 Floppy Drive' to Rs.950.00

LISTING – V: SET FUNCTIONS AND CONCATENATION

1)Count the total no. of orders.
2)Calculate the average price of all the products.
3)Calculate the minimum price of product
4)Determine the maximum and minimum product price.Rename the title as max_price and min_price respectively.
5)Count the number of product having price greater than or equal to 1500.
6)Find all products whose qty_on_hand is less than recorder level.
7)Print the information of client_master,product_master,sales_order table in the following format for all the record.{cust_name}has placed order {order_no}on {s_order_date}.

LISTING – VI: JOINS AND CORRELATION

1) Find out the product which has been sold to 'ivanbayroos'.
2) Find out the product and their quantities that will have to delivered in the current month.
3) Find the product_no and description of moving products.

4) Find the names of the clients who have purchased 'CD Drive'.

5) List the product_no and s_order_no of customers having qty_ordered less than 5 from the order detail Table for the product '1.44 Floppies'.

6) Find the products and their quantities for the orders placed by 'VandanaSaitwal' and 'Ivan Bayross'.

7) Find the products and their quantities for the orders placed by client_no'C00001' and 'C00002'.

LISTING – VII: NESTED SUBQUERIES

1) Find the product_no and description of non-moving products(eg.products not being sold).

2)Find the customers name,address1,address2,city and pincode for the client who has placed order no "O19001'.

3) Find the client name who have placed order before the month of may,96.

4)Find out if product "1.44 Drive" is ordered by any client and print client_no name to whom it was sold.

5) Find the name of clients who have placed ordered worth RS. 10000 or more.

LISTING – VIII: PL/SQL

G details table.

LISTING – IX: PL/SQL

1. Create a database trigger to implement on master and transaction tables which are based on inventory management system for checking data validity. Assume the necessary fields for both tables.

2. Write a PL/SQL to raise the following Exception in Bank Account Management table when deposit amount is zero.

THIRD SEMESTER

M18CA3010	DATA MINING AND DATA WAREHOUSING	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- To understand Data Mining principles and techniques and introduce Data Mining as a cutting edge business intelligence.
- To discover interesting patterns, to analyze supervised and unsupervised models and estimate the accuracy of the algorithms.
- To identify Applications and Trends of Data mining.
- To expose the students to the concepts of Data Warehousing Architecture and Implementation.

Course Outcomes:

Upon Completion of the course, the students will be able to,

- Understand and apply the data mining techniques on various datasets.
- Develop the Multidimensional model and evaluate its performance
- Analyse and interpret the results of various mining techniques by applying in real time complex datasets.
- Apply and Integrate datamining techniques in various broad areas of research innovatively.

Course Contents:

UNIT I Data Mining & Techniques **15 Hours**

Data Mining: Introduction, Basic data mining tasks, data mining versus knowledge discovery in databases, Data mining issues, Data mining metrics, Social implications of data mining, Data mining from a database perspective. **Data Mining Techniques:** Introduction – A Statistical Perspective on data mining – Similarity Measures – Decision Trees.

UNIT II Classification, Clustering **15 Hours**

Classification: Introduction, Issues in Classification, Statistical, based algorithms, Distance, based algorithms, Decision tree, based algorithms, Neural network, based algorithms, Rule-based algorithms, Combining techniques.**Clustering:** Similarity and Distance Measures, Outliers, Hierarchical Algorithms: Agglomerative Algorithms, Divisive Algorithms, Partitional Algorithms: Minimum Spanning Tree, Squared Error Clustering algorithm, K-Means Clustering, Nearest neighbor algorithm, PAM algorithm, Bond Energy algorithm, Clustering with neural networks, clustering with genetic algorithms.

UNIT III Association rules& Applications **15 Hours**

Association rules: Introduction - Large item sets - Basic algorithms: Apriori algorithm, Sampling Algorithm, Partitioning, Parallel and Distributed algorithms, Advanced Association Rules Techniques, Measuring the quality of rules. **Data Mining Applications:** Data Mining for Financial Data Analysis , Data Mining for the Retail Industry, Data Mining for the Telecommunication Industry, Data Mining for Intrusion Detection.

UNIT IV Data Warehouse & Modeling **15 Hours**

Basic concepts : What is a Data Warehouse, Differences between operational database systems and Data Warehouses, Multi-tiered Architecture, Data Warehouse models, Extraction, Transformation and Loading, Metadata repository.**Data Warehouse modeling:** Data Cube and OLAP, Data cube: A Multidimensional Data model, Schemas for multidimensional data models, Dimensions: The role of concept hierarchies, Measures: Their categorization and computation, Typical OLAP operations.

Text Books:

1. Margaret H. Dunham, "Data mining introductory and advanced topics", Pearson education, 2003. [Units 1,2 and 3]
2. Jiawei Han, MichelineKamber&Jian Pei, "Data Mining Concepts and Techniques", Morgan Kaufmaan Publishers, 2011. [Unit 3 and 4]

Reference Books:

1. ArunK.Pujari, "Data Mining Techniques", Universities Press (India) Pvt. Ltd., 2003.
2. Alex Berson, Stephen J. Smith, "Data warehousing, Data mining, & OLAP", TMCH, 2001.
3. G. K. Gupta "Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India, 2006.
4.Pang-Ning Tan, Michael Steinbach and Vipin Kumar "Introduction to Data Mining", Pearson Education, 2007.

M18CA3020	COMPUTER NETWORKS	L	T	P	C
Duration:60Hours		4	0	0	4

Course Objectives:

- The subject will introduce the basics of computer networks to students through a study of layered models of computer networks and applications.
- To analyze the functions and design strategies of various layers.
- To understand network architectures and components required for data communication.
- To understand networking concepts and basic communication model.
- To gain knowledge of various application protocols standard developed for internet Layer

Course Outcomes:

After completion this course students will be able to

- Identify the components required to build different types of networks.
- Estimate the functionalities needed for data communication into layers.
- Understand the working principles of various application protocols.
- Identify the security issues and services available.

Course Contents:

UNIT I Introduction to Data communication & Network Models **15 Hours**

Introduction: Data communications-components, transmission modes; Networks- Intranet, Internet; Components of Network- Network hardware, Network software, types of addressing; Network types- LAN, MAN, WAN; Network Topology, Network Architecture- Peer-Peer, Client-Server, Distributed.**Reference Models:** OSI reference Model, TCP/IP model, Comparison between OSI &TCP/IP; Protocols & Network Standardization.

UNIT II Physical Layer **15 Hours**

Definition, functionalities, guided transmission media, wireless transmission media, data interface types- packet transmission, cell transmission; LAN transmission equipment – NIC, Repeater, Hub, Bridge, Switch, Gateway; WAN transmission -Modems Router, Multiplexers; Multiplexing –FDM, WDM, TDM; Switching techniques- message, circuit, packet switching; LAN transmission methods: Ethernet.

UNIT III Data Link Layer **15 Hours**

Definition, functionalities, Framing, Error correction & detection, Stop-and-wait protocol, Flow control, Sliding-window protocol, Multiple access Protocol- ALOHA1- _persistent, p-persistent and non-persistent; CSMA/CD & CSMA/CD; Collision free protocols.

UNIT IV Network & Transport Layer **15 Hours**

Network Layer: definition, functionalities, Routing Algorithm types, Static & Dynamic routing algorithm-distance vector, link - state, Congestion control algorithms, IP protocol- IPV4, IPV6; Internet control protocol- ICMP, ARP.**Transport Layer:** definition, functionalities, process-to-process delivery, TCP, UDP.

Text Books:

1. Data communications and Networking by Berhrouz A Forouzan , McGraw-Hill Publication [Chapters: 1,23]
2. Computer Networks by Andrew S. Tanenbaum , Pearson Publication.[Chapters: 1,2,3,4,5&6]
3. A guide to designing & Implementing Local and wide area network by Michael Paimer, Robert Bruce Sinclair, Thomson Publication. [Chapters:3,4,5]
4. Data and Computer Communications by William Stalling, Pearson Publication.

Reference Books:

1. W. Tomasi: Introduction to Data Communications and Networking, Pearson Education.
2. P.C. Gupta: Data Communications and Computer Networks, Prentice-Hall of India.

M18CA3030	LINUX PROGRAMMING	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- Introduce the student to Unix/Linux Kernel programming techniques

- Teach advanced C systems programming and debugging techniques in a Unix/Linux environment.
- Review basic concepts covered in the core Operating Systems course prerequisite as they are realized in the Linux platform.
- Discuss correct synchronization techniques for both application programs and kernel code running on Unix process as well as multiprocessor platforms.
- Review basic concepts covered in the core Operating systems course

Course Outcomes:

On completion of the course, learners will be able to:

- With the basic knowledge of operating system, understanding features and functionalities of LINUX operating system.
- Describe how computing resources are used by application software and managed by system software.
- Design and implement the concepts of shell programming.
- Analyze and interpret all the system administration tasks of LINUX

Course Contents:

UNIT I Linux Operating System **15 Hours**

Overview : Linux history, Linux features, distributions, Operating Systems and Linux, difference between Linux and Unix ,Linux software , Documentation .**Getting Started** : Install Issues ,Accessing Linux System ,the GNOME and KDE Desktops , Start up scripts, Linux Security, Command line Interface, Help Resources ,Windows Access and Applications .

UNIT II Linux Files, Directories and Archives **15 Hours**

Linux Files, File Structure, Types File and directory management commands, File and Directory Operations, Archiving and Compressing Files , system calls , The shell History ,Features ,Types of Shells **The Process**: Process basic , Ps, Internal and External Commands , running jobs in background ,nice ,at and batch ,cron, time commands File name Extension ,Standard Input/ Output and Redirection ,pipes : Pipes, FIFOs, System V IPC, Memory Management, library and system calls for memory.

UNIT III Shell Scripts and Programming **15 Hours**

Shell variable , shell commands, shell meta characters, file name substitution, command substitution, the environment, quoting, test command, expr, read, set and shift control structures, looping structure arithmetic in shell, shell script examples, Filters- Simple filter : pr, head, tail, cut, paste ,sort ,uniq ,tr commands The grep family, advanced filters-sed and awk.

UNIT IV System Administration **15 Hours**

File permissions, file ownership, links-soft links and hard links , root, administrator's privileges ,startup and shutdown ,Managing disk space ,GNOME Interface ,GNOME Desktop ,KDE Desktop , KDE Menus, Quitting KDE ,Desktop Operation, Accessing System Resources from the File Manager ,Desktop Like Files and URL Locations ,KDE Windows ,Virtual Desktops

Text Books:

1. Richard Petersen "The Complete Reference Linux ", sixth Edition Petersen TATA McGraw HILL [Chapter 1,2,3,4,5]
2. Sumitabha Das, "Unix Concepts and Applications", TMH, 4th Ed., 2009. 3. M>G Venkateshmurthy,"Unix and Shell Programming " Pearson Education
3. R. Stevens, "UNIX Network Programming", PHI, 3rd Ed., 2008.

Reference Books:

1. Ellen Siever, Stephen Figgins, Robert Love, Arnold Robbins, "Linux in a Nutshell", O'Reilly Media, 6th Ed., 2009.
2. Neil Matthew, Richard Stones, Alan Cox, "Beginning Linux Programming", 3rd Ed., 2004.
3. Robert Love, "Linux System Programming" ,O'Reilly Media, 2nd Ed., 2007.
4. Evi Nemeth, Garth Snyer, Trent R. Hein, "Linux Administrator Handbook", Pearson, 2nd Ed., 2007.
5. Mark G. Sobell, "A Practical Guide to Ubuntu Linux", Pearson, 2nd Ed., 2008.
6. Cox K, "Red Hat Linux Administrator's Guide", PHI, 2001.

M18CA3040	ARTIFICIAL INTELLIGENCE	L	T	P	C
Duration:60Hours		4	0	0	4

Course Objectives:

- Familiarize students with Artificial Intelligence principles and techniques
- Introduce the facts and concepts of cognitive science by computational model and their

applications

- Explore problem-solving paradigms, search methodologies and learning algorithms

Course Outcomes:

On successful completion of this module, students should be able to:

- Apply knowledge of various discipline and computing heuristic methodologies in state-space problems.
- Analyze a problem, identify and define the computing requirements appropriate to its solution.
- To design efficient algorithm to achieve optimized solution in complex situation and adaptive mechanism in case of uncertainty.
- Implement learning algorithms to apply and resolve in real world problems and evaluate a computer-based system, process, component or program to meet desired needs.
- Characterize various ways to represent the environmental knowledge and to infer from it.

Course Contents:

UNIT I **15 Hours**

Artificial Intelligence: Definition**,** AI Problems-Task Domains of Artificial Intelligence; Knowledge properties, Knowledge Representation.**Problems, Problem Spaces and Search:** Steps in building a System; Production Systems; Control Strategies-Requirements of a good control strategy; Problem Characteristics; Production System Characteristics-Categories of Production Systems

Heuristic search techniques: Generate-and-test, Hill Climbing-Simple Hill Climbing, Best First Search-OR Graphs

UNIT II **15 Hours**

Intelligent Agents: Agents and Environments; A Rational Agent – Performance measures; Examples of Agent Types and PEAS (Performance Measure, Environment, Actuators, Sensors) descriptions, Properties of Task environment; The Structure of Agents, Types of Agent Programs

Knowledge Representation: Introduction, Definition, Importance, Representation and Mappings-mappings between facts and representations, Representation of Facts; Approaches to Knowledge Representation-Properties, Types of Knowledge; Issues in Knowledge Representation-Important Attributes, Relationship among Attributes.

UNIT III **15 Hours**

Symbolic Reasoning under Uncertainty: Introduction to Nonmonotonic Reasoning; Logics for Nonmonotonic Reasoning, Default Reasoning and Minimalist Reasoning;**Learning:** Introduction, Different methods of Learning – Rote Learning, Inductive Learning, Reinforcement Learning, Unsupervised Learning, Supervised Learning, Analogy , Derivational and Transformational

Expert Systems: Introduction, Rule based and Knowledge based, knowledge acquisition, Maintenance and Manipulations**Planning:** Components of a Planning System; Goal Stacks Planning - A very Simple Blocks World Problem; Reactive Systems; Other Planning techniques.

UNIT IV **15 Hours**

Parallel and Distributed AI: Psychological modeling; Parallelism in Reasoning Systems; Distributed Reasoning Systems**Perception and Action:** A design for Autonomous Robot; Perception-Vision, Speech Recognition; Action-navigation, Manipulation; Robot Architectures

Fuzzy Logic Systems: Introduction; Crisp Sets; Fuzzy Sets; Fuzzy Terminology; Fuzzy Logic Control-Fuzzy Room Cooler.**Prolog:** Introduction; Converting English to Prolog Facts and Rules; Goals; Prolog Terminology; Variables; Control Structures; Arithmetic Operators; Matching in Prolog; Backtracking; Recursion.

LISP: Introduction, Syntax and Numeric Functions, Basic List Manipulation Functions, Functions, Predicates and Conditionals Input, Output and Local variables, Iteration and Recursion, Property List and Arrays.

Text Book:

1. Elaine Rich, Kevin Knight, Shivashankar B Nair, ”Artificial Intelligence”, 3rd Edition, Tata McGraw Hill, 2013

Reference Books:

1. Jean-Louis Ermine,”Expert Systems : Theory and Practice”,Prentice Hall of India, 1995
2. Stuart Russel, Peter Norvig,”Artificial Intelligence: A Modern Approach”, 3rdPearson 3rd edition 2013.

M18CA3051	ADVANCED WEB TECHNOLOGIES	L	T	P	C
Duration:60Hours		2	0	1	3

Course Objectives:

- Understand various forms of data representation and structures supported by the Perl language.
- Discuss the perl scripting and concepts of server programming by using PHP
- Differentiate use of AJAX objects over normal HTML objects
- Review the need of AngularJS

Course Outcomes:

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

- Design server webpage by using perl scripting
- Describe a server side webpage by using PHP
- Apply AJAX objects over normal HTML objects
- Develop a server side scripting by using SOAP architecture , Construct Angular views and templates by implementing built-in directive

Course Contents:

UNIT I Introduction to Angular JS **15 Hours**

Introduction, Client – Side Templates, Model View Controller(MVC), Data Binding, Dependency Injection, Directives, Examples. Anatomy of an Angular JS Application, Invoking Angular, Model View Controller, Templatees and Data Binding, Organizing Dependencies with Modules, Formating Data with Filters, Changing Views with Routes and $location, Talking to Servers, Changing the DOM with DirectivesValidating User Input.

UNIT II Programming in Perl **15 Hours**

Origins and uses of Perl, Scalars and their operations, Assignment statements and simple input and output, Control statements, Fundamentals of arrays, Hashes, References, Functions, Pattern matching, File input and output, Examples. CGI Scripting, Developing CGI Applications, Processing CGI, CGI.pm, CGI.pm methods, An Example, Adding Robustness, Carp, Cookies.

UNIT III Introduction to PHP **15 Hours**

Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling,

Files, cookies, Sessions Tracking. Building Web applications with PHP, Tracking users, Using Databases, Handling XML.

UNIT IV Introduction to Ajax and Ruby **15 Hours**

Introduction to Ajax: Overview of Ajax, Basics of Ajax, Return Document Forms, Ajax Toolkits, Security and Ajax,JSON.Introduction to Ruby: Origins and Users of Ruby, Scalar Types and Their Operations, Simple Input and Output, Control Statements, Fundamentals of Arrays, Hashes, Methods, Classes, Blocks and Iterators, Pattern Matching.

Text Books:

1. Brad Green &ShyamSeshadri: AnhularJS, O'ReillyPublications, 2015.[Chapter 1 &2]
2. Robert W. Sebesta: Programming the World Wide Web, 4th & 7thedition Pearson Education, 2009. [Chapter 8 & 11 - 4th edition, 10 & 14 – 7th edition]
3. Chris Bates: Web Programming Building Internet Applications 3rd edition Willey india, 2006. [Chapter 10, 13]

Reference Books:

1. Professional AJAX 2nd Edition, Nicholas C Zakas et al, Wrox publications, 2007.
2. SOA: Concepts, Technology and Design – Thomas Erl, Pearson, 2005.
3. P.J. DEITEL & H.M.DEITEL: Internet &World Wide Web How to Program, 4th edition.

ADVANCED WEB LAB

PART - A

1. Write a Perl Script which counts the word in a given file
2. Using PHP and MySQL develop a program to accept book information viz. Accession number, title, authors, edition and publisher from a web page and store the information in a database and to search for a book with the title specified by the user and to display the search results with proper headings.
3. Create a registration form using PHP which contains name, email, contact no, address and gender, display the details in other server page when user clicks the submit button.
4. Create a PHP programs necessary to implement the ticket reservation system using MYSQL Database.
5. Write an AJAX program for parsing a JSON file and formatting the output
6. Develop a web application for Airline Reservation System using PHP & AJAX

PART – B

Design a simple client side webpage using PHP and AJAX with following constraints

1. Should be a team project with max of two members
2. Most of the controls should be used from AJAX

3. Java script should be used for client scripting

M18CA3052	ADVANCED DATABASE SYSTEMS	L	T	P	C
Duration:60Hours		2	0	1	3

Course Objectives:

- Acquire knowledge on parallel and distributed databases and its applications.
- Articulate how data is stored in both primary and secondary storage
- Gain the information on various indexing techniques
- learn emerging and advanced data models
- Work with various query evaluation methods
- Acquire inquisitive attitude towards research topics in databases

Course Outcomes:

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

- Justify the need of indexing techniques to retrieve the data from different sources
- Analyze the plans to optimize the relational query evaluation
- Relate the different tuning techniques to increase the performance for a relational data model
- Model and represent the real-world data using emerging technologies.

Course Contents:

UNIT I Overview of Storage and Indexing **15 Hours**

Memory hierarchy: RAID, Disk space management, Buffer manager: Files of records, Page formats and record format, Structured Indexing, Data on external storage, File organizations and Indexing, Index data structures, Comparison of file organizations, Indexes and performance tuning. Intuition for tree indexes, Indexed sequential access method, B+trees , Hash-Based Indexing.

UNIT II Overview of Query Evaluation, External Sorting and Relational Query Optimizer 18 Hours

The system catalog, Introduction to operator evaluation, Algorithm for relational operations, Introduction to query optimization, A simple two-way merge sort, External merge sort, Evaluating Relational Operators,Translating SQL queries in to Relational Algebra, Estimating the cost of a plan, Relational algebra equivalences, alternative plans, Nested sub-queries, other approaches to query optimization.

UNIT III Physical Database Design and Tuning 12 Hours

Normalization, Guidelines for index selection, examples, Clustering and indexing, Indexes that enable index-only plans, Tools to assist in index selection, Overview of database tuning, Choices in tuning the conceptual schema, Choices in tuning queries and views, Impact of concurrency, DBMS benchmarking, Operational databases, transaction management.

UNIT IV Advanced databases 15 Hours

Parallel databases, Distributed databases, Information retrieval and XML data, Object relational databases, Mobile databases, Multimedia databases, geographic databases, temporal databases, biological databases,Cloud Based Databases

Text Books:

1. Raghu Ramakrishnan and Johannes Gehrke: Database Management Systems, 3rd Edition, McGraw-Hill, 2003[Chapters:8,9,10,11,12,13,14,19,22,23,27,29]

Reference books:

1. Michael Rosenblum and Dr. Paul Dorsey," PL/SQL FOR DUMMIES",WILLEY Publications 2006
2. Elmasri and Navathe: Fundamentals of Database Systems,5th Edition, Pearson Education, 2007.
3. Conolly and Begg: Database Systems, 4th Edition, Pearson Education, 2002.
4. Steven Feuerstein,"oracle PL/SQL Programming",OREILLYpublications,Sixth edition 2014.

M18CA3061	CLOUD COMPUTING	L	T	P	C
Duration:60Hours		2	0	1	3

Course Objectives:

- To introduce the broad perceptive of cloud architecture and model
- To distinguish between the various types of Virtualization.
- To be familiar with the lead players in cloud.
- To choose the right cloud providers as per need.
- To learn to design the trusted cloud Computing system

Course Outcomes:

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

- Understand the fundamentals of Cloud Computing and evaluate ideas for building cloud computing environments
- Explain the fundamental concepts of Virtualization and analyze the characteristics of virtualized environments.
- Analyze existing cloud architecture to design and develop new systems using software tools that can solve real time problems without harming environment.
- To familiarize with the AWS Cloud environment and apply the knowledge gained in developing cloud computing applications in various areas and analyze their usage.

Course Contents:

UNIT I Fundamentals of Cloud Computing **15 Hours**

Cloud computing at a glance, the vision of cloud computing, Defining a cloud, A closer look, Historical developments, Building cloud computing environments Application development. Characteristics of Cloud computing. Scalability, types of scalability. Horizontal Scalability and Cloud Computing. Computing platforms and technologies,Principles of Parallel and Distributed Computing.

UNIT II Fundamental concept and Models **15 Hours**

Basics of Virtualization, Characteristics of virtualized environments, and Taxonomy of virtualization techniques, - Types of Virtualization- OS virtualization, Application level virtualization, Programming Language virtualization and Desktop Virtualization. Virtualization and cloud computing, Technology examples, Xen: paravirtualization, VMware: full virtualization.

UNIT III Cloud Infrastructure Mechanisms and Architecture 15 Hours

Fundamentals of Cloud Architecture, The cloud reference model, Cloud Delivery Models: Infrastructure-as-a-Service (IaaS), Platform-as-a-Service (PaaS), Software-as-a-Service (SaaS), Comparing Cloud Delivery Models, Cloud Deployment Models: Public Clouds, CommUnity Clouds, Private Clouds, Hybrid Clouds, Introduction to Cloud Software Environments , Aneka.Framework overview, Anatomy of the Aneka container, Aneka Deployment modes-Private, Public and Hybrid.

UNIT IV AWS Cloud platform 15 Hours

Amazon Web Services Cloud: Amazon Web Services overview, working with Amazon Simple Storage Service (S3), Elastic compute cloud: security groups, key pair, launch Linux and windows instances.Working with Amazon Machine Images. Deploy applications to Amazon EC2.Amazon machine images modification, EC2 applications, Simple queue Service, SQS applications, Elastic Block Storage, RDS, beanstalk

Text Books:

1. RajkumarBuyya, Christian Vechiolla, ThamaraiSelvi, "Mastering Cloud Computing , Elsevier publications, 2013, USA (Chapter 1, 2, 3, 4, 5.1, 5.2, 5.3, 9.1 and 10)
2. Programming Amazon Web Services: S3, EC2, SQS, FPS, and SimpleDB Paperback ,by James Murty
3. AWS System Administration: Best Practices for Sysadmins in the Amazon Cloud Paperback – March 25, 2015 by Mike Ryan (Author)
4. Amazon Web Services For Dummies Paperback – September 10, 2013 by Bernard Golden

Web Link:

1. https://aws.amazon.com/documentation

Reference Books:

1. RajkumarBuyya, James Broberg, AndrzejGoscinski, "Cloud Computing: Principles and Paradigms", Wiley, India .
2. Kai Hwang, Geoffrey C Fox, Jack G Dungaree, "Distributed and Cloud Computing, From ParallelProcessing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Thomas Erl, Zaigham,Mahmood, Ricardo Puttini, " Cloud Computing:Concepts, Technology & Architecture", Prentice Hall/Pearson

Online References:

1. Getting started with Amazon book series available on AWS Book references http://www.amazon.com/Getting-Started-AWS-Amazon-Services-ebook
2. For Azure online documentations https://docs.microsoft.com/en-us/azure/

CLOUD COMPUTING LAB

List of Experiments:

1. Amazon Elastic Block Store(Hands on lab by students)

   a) Create Standard Volume
   b) Create and delete snapshots
   c) Create Provisioned I/o Volume
   d) Assign volumes to Windows server 2012 and Ubuntu 14.04 server
   e) Disassociate and Delete volumes

2. Amazon Elastic Load Balancing (ELB)(Hands on lab by students)

   a) Exercise 2.1
      i. Launch Two Ubuntu EC2 Instances- apache web servers with user data
      ii. Edit HTML files to both the servers
      iii. Test your web Servers through internet
   b) Exercise 2.2
      i. Create Elastic Load Balancer
      ii. Add both the Ubuntu servers to ELB
      iii. Test your Elastic Load Balancer
      iv. Delete your Elastic Load Balancer

3. Auto Scaling and Bootstrapping (Hands on lab by students)

   a) Overview Of Autoscaling
   b) ELB: Configuring The Elastic Load Balancer for Autoscaling group
   c) Configuring The AMI For Our Web Application
   d) Auto Scaling And Bootstrapping
   e) Scale out VM's though stress test
   f) Scaling VM 's based on low utilization

4. AWS- Webappand RDS(Hands on lab by students)

   a) RDS- An overview
   b) RDS –read replica
   c) RDS- Multi AZ failover
   d) RDS snapshots

i. Lab 1 : Create a RDS instance
ii. Lab 2 : connecting to an RDS instance
iii. Lab 3 : creating a RDS snapshots and restoring snapshot
iv. Lab 4: Deleting RDS snapshots

e) Deploy Web application in Amazon Ec2 (media wiki)
f) Connect your Media wiki web application with RDS instances securely
g) Make media wiki available on public url for user sign up and write knowledge wiki
h) Delete Your RDS instance

5. AWS S3 (Hands on lab by students)

a) AWS s3- Overview and pricing
b) Create Bucket and Folder
c) Upload, download, share and delete object
d) Delete Bucket

References Books:

1. RajkumarBuyya, ChristaianVecchiola, S. ThamaraiSelvi Master Cloud Computing, TMH Education, 2013
2. ArshdeepBahga, Vijay Madisetti, Cloud Computing: A Hands-on Approach, Universities Press, 2014..
3. https://aws.amazon.com/training/intro_series/
4. https://aws.amazon.com/getting-started/
5. https://aws.amazon.com/
6. https://aws.amazon.com/free/
7. https://blog.webspecia.com/cloud/iaas-paas-saas-explained-examples-comparison
8. http://aws.amazon.com/training/self-paced-labs/
9. Instructor led AWS Training - http://aws.amazon.com/training/

M18CA3062	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
Duration:60Hours		2	0	1	3

Course Objectives:

- Explain the concepts and process of testing activates that occur within the process.
- Describe the various Testing Technique and Design different type of Test cases.
- Characterize the look and feel and usage aspects of Usability and Accessibility Testing.
- Describe the Test Planning, Management, and Execution and design checklist and Templates for planning and Execution.

- Demonstrate the framework, Design of Test Automation.
- Analyze the different perspective of test metrics and measurements.

Course Outcomes:

At the end of this course, the students will be able to:

- Understand fundamental concepts in software testing, to identify software process, strategies to analyze the testing requirements.
- Obtain the knowledge on various types of software testing methods to develop suitable test cases by implementing best policies.
- Learn and demonstrate various software evaluation techniques and relationship of Software Quality Assurance to software life cycle.
- Comprehend the concepts related to Software Quality Attributes, Metrics.

Course Contents:

UNIT I A perspective on Testing, Examples **15 Hours**

Basic definitions, Test cases, Insights from a Venn diagram, Identifying test cases, Level of testing, Examples: Generalized pseudo code, The triangle problem, the Next Date function, The commission problem, The SATM (Simple Automation Teller Machine) problem, The currency converter, Saturn windshield wiper.

UNIT II Boundary value testing, Equivalence class testing, Decision table based testing **15 Hours**

Boundary value analysis, Robustness testing, Worst-case testing, special value testing, Examples, Random testing, Equivalence classes, Equivalence test cases for triangle problem, Next Date function and commission problem, Guidelines and observations, Decision tables, Test cases for triangle problem.

UNIT III Path Testing, Data flow testing, Levels of Testing, Integration Testing **15 Hours**

DD Paths, Test coverage metrics, Basis path testing, guidelines and observations, Definition Use testing, Slice based testing, Guidelines and observations. Traditional view of testing levels, Alternative life cycle models, the SATM systems, separating integration and system testing.case studies: Development of test cases using various software testing tools like UFT,SELENIUM etc.

UNIT IV Software Quality, Maturity Models **15 Hours**

Five views of software quality, McCall's quality and criteria, ISO 9126 Quality characteristics, Quality Metrics, ISO 9000:2000 Software Quality Standard, The basic idea in Software Process, Capability Maturity Model, Test Process Improvement, Testing Maturity Model.

Text Books:

1. Paul C Jorgensen, "Software Testing A Craftsman's Approach", Aueredach publications, 3rd edition, 2011. **[Chapters: 1, 2, 5, 6, 7, 9, 10, 12, 13]**
2. KshirasagaraNaik, PriyadarshiTripathy: Software Testing and Quality Assurance, Wiley India 2012.[C**hapters 17 & 18]**

Reference Books:

1. Mauro Pezze, Michael Young, Software testing and Analysis- Process, Principles and Techniques, Wiley India, 2012.
2. M.G.Limaye: Software Testing-Principels, Techniques and Tools – McGraw Hill, 2009.

SOFTWARE TESTING LAB

Course Contents:

- Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Derive test cases for your program based on decision-table approach, execute the test cases and discuss the results.
- Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle, or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on boundary-value analysis, execute the test cases and discuss the results.
- Design and develop a program in a language of your choice to solve the triangle problem defined as follows: Accept three integers which are supposed to be the three sides of a triangle and determine if the three values represent an equilateral triangle, isosceles triangle, scalene triangle,

or they do not form a triangle at all. Assume that the upper limit for the size of any side is 10. Derive test cases for your program based on equivalence class partitioning, execute the test cases and discuss the results.

- Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of dataflow testing, derive different test cases, execute these test cases and discuss the test results.
- Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of boundary value testing, derive different test cases, execute these test cases and discuss the test results.
- Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of equivalence class testing, derive different test cases, execute these test cases and discuss the test results.
- Design, develop, code and run the program in any suitable language to solve the commission problem. Analyze it from the perspective of decision table-based testing, derive different test cases, execute these test cases and discuss the test results.

M18CA3070	SOFT SKILLS	L	T	P	C
Duration:30Hours		2	0	0	2

Note: The students will have to undergo Skill Development course being conducted by Training and Placement cell of the University.

M18CA3080	LINUX LAB	L	T	P	C
Duration:30Hours		0	0	2	2

Course Objectives:

- Teach advanced C systems programming and debugging techniques in a Unix/Linux environment.
- Discuss correct synchronization techniques for both application programs and kernel code running on Unix process as well as multiprocessor platforms.

Course Outcomes:

- Write shell scripts in order to perform basic shell programming
- Use basic Linux commands.
- Use Linux pipes and file redirection efficiently to manipulate data.

Course Contents:

- Write a non-recursive shell script which accepts any number of arguments and prints them in the reverse order (For example, if the script is named rags, then executing args A B C should produce C B A on the standard output
- Write a shell script that accepts two file names as arguments, checks if the permissions for these files are identical and if the permissions are identical, output common permissions and otherwise output each file name followed by its permissions
- Write a shell script which accepts valid log-in names as arguments and prints their corresponding home directories, if no arguments are specified, print a suitable error message.
- Write a shell script that accept one or more filenames as argument and convert all of them to uppercase, provided they exist in current directory
- Write a shell script that accepts as filename as argument and display its creation time if file exist and if it does not send output error message.
- Write a shell script to display the calendar for current month with current date replaced by * or ** depending on whether the date has one digit or two digits
- Write a shell script to compute the sum of number passed to it as argument on command line and display the result.
- Write a shell script that delete all lines containing a specific word in one or more file supplied as argument to it.
- Write a shell script that gets executed displays the message either “Good Morning” or “Good Afternoon” or “Good Evening” depending upon time at which the user logs in
- Write a shell script that accept a list of filenames as its argument, count and report occurrence of each word that is present in the first argument file on other argument files.
- Write a shell script that determine the period for which a specified user is working on system.
- Write a shell script that accept the file name, starting and ending line number as an argument and display all the lines between the given line number
- Write an awk script to delete duplicated line from a text file. The order of the original lines must remain unchanged.

M18CA3090	COMPUTER NETWORK LAB USING NS2	L	T	P	C
Duration:60Hours		0	0	2	2

Course Objectives:

- To understand networking concepts and basic communication model.
- To gain knowledge of various application protocols standard developed for internet Layer

Course Outcomes:

After completion this course students will be able to

- Estimate the functionalities needed for data communication into layers
- Understand the working principles of various application protocols.

Course Contents:

PART – A [Programs using Packet tracer]

1. Study of different types of Network cables and practically implement the cross-wired cable and straight through cable using clamping tool.
2. Study of basic network command and Network configuration commands using command prompt and packet tracer.
3. Connect the computer in local area network.
4. Set upNetwork topology using packet tracer software.

PART –B [Programs using NS2]

1. Create a Simple Star Topological LAN in windows and provide provision for sharing the files using NS2
2. By using NS2 simulator setup a star topology with 7 nodes (n1 to n7) with n1 as source and n7 as destination n1 should be connected to router n2 and n7 is connected to network router n6 except n1 and n7 all reaming nodes are connected to n4.

3. Set up network using NS2 with source n1 connected to n4 through n2 and n3. Create an application with TCP as transport layer and calculate amount of time spent in retransmissions.
4. Create a network as like program 3 and measure number of pocket dropped at n4 because of congestion.
5. Capture the traffic of your LAN and identify the IP Address of your default router

PART - C

1. Create a messenger application by using the socket programming which should establish communication between two systems
   OR
2. Create a FTP application to transfer the file from one application to other application in different system

FOURTH SEMESTER

M18CA4010	DESIGN AND ANALYSIS OF ALGORITHMS	L	T	P	C
Duration:60Hours		4	0	0	4

Course Objectives:

- Analyze the asymptotic performance of algorithms.
- Provide the knowledge on the Analysis and design of Algorithms.
- Demonstrate a familiarity about Divide and Conquer & Decrease and Conquer algorithm design technique and data structures used.
- Synthesis algorithms that employs graph computations as a key components in Dynamic Programming & Greedy Technique.

- Evaluate the Limitations, Approximation and randomizations factors of an Algorithms

Course Outcomes:

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

- Analyze the fundamental principles underlying algorithm analysis and design and be able to apply them in specific instances.
- Elucidate algorithms asymptotically and compute the performance analysis of algorithms with the same functionality.
- Synthesize divide-and-conquer algorithms using recurrences for evaluating the performance of the algorithms.
- Examine the complexities of various problems in different domains.
- Design an efficient algorithm for a problem using a Dynamic programming or Greedy paradigm along with a proper data structure.

Course Contents:

UNIT I Introduction & Brute Force **15 Hours**

Fundamentals of Algorithmic Problem Solving, Important Problem Types, Fundamental Data Structures, Notation of Algorithms, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Recursive and Non Recursive Algorithms with Examples, Brute Force: Selection Sort, Bubble Sort, Sequential Search, String Matching.

UNIT II Divide and Conquer & Decrease and Conquer **15 Hours**

Divide and Conquer: Merge Sort, Quick Sort and Binary Search .Decrease and Conquer: Insertion Sort, Depth First and Breadth First search and Topological Ordering. Transform and Conquer: Heap Sort.

UNIT III Dynamic Programming & Greedy Technique **15 Hours**

Dynamic Programming: Warshall's and Floyd's Algorithm, 0/1 Knapsack Problem. Greedy Technique: Introduction, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Fractional Knapsack. Time and Space Tradeoff: Input Enhancement in string matching.

UNIT IV Limitations, Back Tracking & Approximation Algorithms 15 Hours

Limitations of Algorithm power**:** Lower bound Arguments, Decision Trees, P, NP and NP Complete Problems Back Tracking: Introduction, N- Queens Problem, Sum of subset Problem. Branch and Bound: Introduction, Knapsack Problem, Assignment problem, Approximation Algorithms: Introduction, Travelling Salesman problem.

Text Books :

1. AnanyLevitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 3rd Edition, Copyright © 2012 (Chapters 1-9, 11 and 12).

2. Horowitz E., Sahani S., Rajasekharan S, "Fundamentals of Computer Algorithms", Galgotia Publication 2005(Chapters 1, 3-8, 11 and 12).

Reference Books:

1. Michael T Goodrich and Roberto Tamassia, "Algorithm Design- Foundations, Analysis and Internet examples", Wiley India publications, 2014 (Chapters 4-7 and 13).
2. R C T Lee, S S Tseng, R C Chang, Y T Tsai : Introduction to Design and Analysis of Algorithms: A Strategic Approach, Tata McGraw Hill, 2012 (Chapters 2-5, 8 and 9).
3. Thomas H. Coremen., Charles E, Leiserson , and Ronald L. Rivest , "Introduction to Algorithms", Eastern Economy Edition , 3rd Edition, 2009(Chapters 3,4,6,7,22,25).
4. Jon Kleinberg, Eva Tardos, "Algorithm Design", Pearson Publication,2015(Chapters 2-6 and 8).

M18CA4020	.NET FRAMEWORK AND APPLICATIONS	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- The course primarily focus on using platform and components of platform.
- Gain knowledge and write programs in C# programming language which is second pillar towards application development.
- To understand and follow best practices to connect front end and back end using ADO.Net, which is third pillar.

- To design and develop user interface and functionality respectively for windows application.
- To design and develop web application using C# language and ASP.Net.

Course Outcomes:

Students be able to:

- Problem Solving skills -to analyze real life problem find the develop algorithmic steps to solve it
- Utilize the .Net Framework to build distributed enterprise Applications
- Develop and design establish connection between front end to to back end using Tools
- Design user interface and develop functionality for Window and Web applications

Course Contents:

UNIT I .NET Framework 4.0 **15Hours**

Introduction to the .NET Platform, .NET Architecture: Common Language Runtime (CLR), .NET Framework class Library, Common Type Specification (CTS), Common Language Specifications (CLS), Interoperability, Assemblies and its types, Shared assemblies and GAC, Visual studio IDE-new project, solution explorer, toolbox, editors and designers, properties window, build & debug tools; CLR Debugger, Deployment of .net applications, **monolithic vs. component-based applications, Execution Model. Introduction to C# Language**: Data Type, Reference Type and Value type, Global, Stack and Heap Memory, constants, variables & its scope, Program structure, command line arguments, Boxing and Unboxing, Operators, Implicit and Explicit Casting, Control statements, Arrays and Strings, OOPS concept, Class, Object, Class members, types of Classes.

UNIT II C# programming Features **15Hours**

Encapsulation, Inheritance, Polymorphism- Method overloading, Operator overloading, Method overriding; Interfaces- implicit interface, explicit interface; Properties, Indexers (custom indexers), Collections, Exception Handling, Garbage Collection, Delegates and Events, Input and Output (Directories, Files, and Streams) Reflection and Attributes.

UNIT III Windows Programming &ADO.NET **15 Hours**

Windows Programming: Introduction to Windows Forms, Hello World! Program, Handling Events on Tools (buttons, Textboxes, Radio buttons, combo boxes, Grid and List Views, Date Picker, List box).

ADO.NET: ADO.Net Architecture, Connected and Disconnected Data model, connecting database using ADO.Net, SQL Server & ADO.Net, CURD operation- inserting, deleting and updating Database, Executing Stored Procedures.

UNIT IV Web Applications Using ASP.NET 15 Hours

Web Application: Introduction to Web browser, HTML, CSS, Java script, IIS7 (web server), Web page vs Web forms, SPA vs MPA, Navigation using sitemap & menu strip, State Management, Deploying your website.

Text Books:

1. The Book of Visual Studio .NET—A Guide for DevelopersbyRobert B. Dunaway, No Starch Press,2002(forIntroductionto.NetPlatform).https://doc.lagout.org/Others/No%20Starch%20Press%20%20The%20Book%20of%20Visual%20Studio.NET.pdf
2. The Complete Reference C# 4.0 by Herbert Schildt , 1st edition, McGrawHill publication (For Introduction to C# language and unit 2)
3. Programming Microsoft Windows with C# by Charles Petzold , Microsoft Press publication, 2002 (for unit 3)
4. Windows Forms Programming using C#, A practical guide to windows application development in .NET
   by Erik Brown, 2nd edition, Manning Publications (for unit 3)
5. Ado.Net The Complete Reference by (English, Paperback, Michael Otey), 1st edition, McGrawHill publication (For unit 3)
6. Beginning ASP.NET 4: in C# and VB by ImarSpaanjaars , Wiley publications , March 2010 (for unit 4)

Reference Books:

1. Pro C# 5.0 and the .NET 4.5 Framework (Expert's Voice in .NET), Andrew Troelsen, Sixth Edition, Apress publishers.
2. C# 2012 Programming, Covers .Net 4.5, Black Book: Kogent Learning Solutions
3. Professional C# 5.0 And .Net 4.5.1 by Christian Nagel, Jay Glynn, Morgan Skinner
4. Microsoft Ado.Net 4 Step by Step by – Tim Patrick, 2014
5. Build Your Own Web Site The Right Way Using HTML & CSS, by Ian Lloyd
6. Professional JavaScript for Web Developers – by Nicholas C. Zakas
7. Microsoft® ASP.NET and AJAX: Architecting Web Applications (Developer Reference) 1st Edition by Dino Esposito_
8. www.msdn.microsoft.com

9. www.asp.net

M18CA4030	JAVA PROGRAMMING	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- Understand the fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- Understand the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries, etc.
- To use the Java SDK environment to create, debug and run simple Java programs

Course Outcomes:

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

- Learn Fundamentals to Design and Develop Java Application for real Life problems
- Apply the fundamentals to Effectively create and use objects from predefined class libraries
- Analyze the problem and solve Using interfaces, inheritance, and polymorphism as programming techniques.
- Design and formulate the problems using multithreading and evaluate the problem using exceptions.

Course Contents:

UNIT I Java Programming Fundamentals **15 Hours**

Java Programming Fundamentals: Key Attributes of Object-Oriented Programming, JDK, Java Keywords, Identifiers in Java, Java Class Libraries, Data Types, Literals, Variables, Scope and Lifetime of Variables, Type conversion, Operators and Operator Precedence,if statement, Nested ifs, if-else-if Ladder, Switch Statement, Nested switch statements, for Loop, Enhanced for Loop, While Loop, do-while Loop, Use break, Use continue, Nested Loops. Introducing Classes, Objects and Methods Reference Variables and Assignment, Methods, Returning from a Method, Returning Value, Parameterized Constructors, new operator, Garbage Collection and Finalizers, this Keyword.,

Multidimensional Arrays, For-Each Style for Loop,String Handling, String Fundamentals, String Constructors, String Operations.

UNIT II Methods and Classes **15 Hours**

Methods and Classes: Controlling Access to Class Members, Pass Objects to Methods, How Arguments are passed, Returning Objects, Method Overloading, Overloading Constructors, Recursion, Understanding Static, Introducing Nested and Inner Classes, Varargs:Variable-Length Arguments. Inheritance Basics, Member Access and Inheritance, Constructors and Inheritance,Using super to Call Superclass constructors, Using super to Access Superclass Members, Creating a Multilevel Hierarchy, When are Constructors Executed,Superclass References and Subclass Objects, Method Overriding, Overridden Methods support polymorphism, Why Overridden Methods, Using Abstract Classes,Using final, The Object Class.

UNIT III Interfaces **15 Hours**

Interfaces: Interface Fundamentals, Creating an Interface, Implementing an Interface, Using Interface References, Implementing Multiple Interfaces, Constants in Interfaces,Interfaces can be extended, Nested Interfaces, Final Thoughts on Interfaces.Package Fundamentals, Packages and Member Access, Importing Packages, Static Import Exception Handling The Exception Hierarchy, Exception Handling Fundamentals, The Consequences of an Uncaught Exception, Exceptions Enable you to handle errors gracefully, using Multiple catch clauses, Catching subclass Exceptions, try blocks can be nested,Throwing an Exception, A Closer look at Throwable, using finally, using throws, Java's Built-in Exceptions, New Exception features added by JDK 7, Creating Exception Subclasses.

UNIT IV Multithreading **15 Hours**

Multithreading fundamentals, The Thread Class and Runnable Interface, Creating Thread, Creating Multiple Threads, Determining When a Thread Ends, Thread PrioritiesSynchronization, using Synchronization Methods,The Synchronized Statement, Thread Communication using notify(), wait() and notify All(), suspending, Resuming and stopping Threads. Enumerations Constructors, methods, instance variables and enumerations, Auto boxing,Annotations (metadata), Auto boxing and Annotations Enumerations, Java Enumeration are class types, The Values() and Valueof() Methods .

Text Books:

1. Java Fundamentals, A comprehensive Introduction by Herbert Schildt, Dale Skrien. Tata McGraw HillEdition 2013. (Chapters:1,2,3,4,5,6,7,8,9,10,11,12,13,15,22,23,24,25,26)

Reference Books:

1. Java Programming by Hari Mohan Pandey, Pearson Education, 2012.
2. Java 6 Programming, Black Book, KoGenT, Dreamtech Press, 2012.
3. Java 2 Essentials, Cay Hortsmann, second edition, Wiley.

M18CA4040	BIG DATA ANALYTICS USING R	L	T	P	C
Duration:60Hours		3	0	1	4

Course Objectives:

- To understand the basics of Big Data
- To know the role and use of Big Data in various relevant industries
- To have a clear idea on the various tools and techniques used with big data
- To get the overview of various types of Big Data Analytics

Course Outcomes:

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

- Identify the concept and challenges of big data and its existing technologies.
- Understand Hadoop Distributed File System (HDFS) and Map Reduce Concepts
- Understand the basics in R programming in terms of constructs, control statements, string functions
- Apply the R programming from a statistical perspective

Course Contents:

UNIT I Overview of Big Data **15Hours**

Introduction to BigData and its importance, Understanding the Characteristics of Big Data-The Vs, Types of Data- Examples of structured, unstructured and Semi-structured data. Understanding the Waves of managing Data, Big Data architecture, Big Data Technology Components.Industry

examples of Big Data , big data and Digital marketing, fraud and big data, risk and big data, credit risk management, big data and healthcare, advertising and big data.

UNIT II Analytics and Big Data **15 Hours**

Data Science: Business Intelligence vs Data Science. Role of a Data scientist, Profile of a Data Scientist.**Big Data Analytics**- Importance of Big Data Analytics, Types of Big data Analytics: Diagnostic, Descriptive, Predictive and Prescriptive analytics. Data Analytics Life cycle –the six Phases Viz. Discover, Data Preparation, Model Planning, Model Building, Communicate Results, Operationalize. Analysis Vs Reporting.**Technologies and tools**: Introduction to distributed computing, Hadoop and Hadoop Eco system, cloud and big data, Introducing Map Reduce. Examples of Map Reduce.

UNIT III Basics of R **15 Hours**

Basics of R: Basic Math – Variables - Data Types - Vectors - Calling Functions - Function Documentation - Missing Data. Advanced Data Structures: data.frames - Lists - Matrices – Arrays.Reading Data into R: Reading CSVs - Excel Data - Reading from Databases - Datafrom Other Statistical Tools - R Binary Files. Writing R functions – Control statements – Loops.

Statistical graphics-Visualization.

UNIT IV Basic Statistics **15 Hours**

Basic Statistics: Summary Statistics - Correlation and Covariance - T-Tests - ANOVA. Linear Models: Simple Linear Regression - Multiple Regression. Generalized Linear Models: Logistic Regression - Poisson Regression – Polynomial Regression. Nonlinear Models: Nonlinear Least Squares - Generalized Additive Models - Decision Trees - Random Forests.

Reference Books:

1. Paul Buhler, WajidKhattak and Thomas Erl, “Big Data Fundamentals: Concepts, Drivers & Techniques”, Prentice Hall Publications, 2016.
2. Norman Matloff, “The Art of R Programming”, published by William Pollock, 2011.

R PROGRAMMING LAB

Course Contents:

Lab Exercises

1. Program to Perform the following Statistical operations in the vector sequence
    a. Sum
    b. Length
    c. Median
    d. Standard Deviation
    e. Variance
    f. Summary
    g. Min
    h. Max
2. Program to create Simple Calculator
3. Program to import data set and perform the various statistical operations
4. Program to perform matrix operations
5. Program to perform t test
6. Program to perform ANOVA operations
7. Program to Perform Regression Analysis
8. Program to merge the dataset
9. Program to perform Scatter Plot
10. Program to plot 3D Graphs

M18CA4051	MACHINE LEARNING	L	T	P	C
Duration:6Hours		2	1	0	3

Course Objectives:

- The course describes the basic components of Machine Learning
- The course differentiates broad categories of Machine learning
- Compare different types of algorithms used in Machine Learning domain with limitations
- Examine the limitations of various machine learning algorithms and the way to evaluate performance of machine learning algorithms

Course Outcomes:

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

- The student will be able to explain concepts and theories of Machine Learning

- The students will be able to formulate innovative ideas or techniques of machine learning for the real world problems
- The students can apply Machine Learning algorithms for specific problems.
- The students can understand the challenges and issues related to machine learning application areas

Course Contents:

UNIT I Introduction **15 Hours**

Overview of ML, broad categories of Machine learning- **Supervised**, **Unsupervised**, **Semi-supervised**, and **Reinforcement Learning**, Applications areas of Machine Learning. Examples and Case studies.**Supervised Learning:** Introduction, Classification and Linear Regression, k-Nearest Neighbor, Linear models, Decision Trees, Naive Bayes Classifiers, Kernelized Support Vector Machine (SVM) Algorithm.Neural Networks (deep learning), Comparison of different algorithms, discussions on case studies.

UNIT II Unsupervised Learning **15 Hours**

Unsupervised Learning: Introduction, types and challenges, preprocessing and scaling of datasets, Dimensionality reduction, feature extraction. Principal Component Analysis (PCA),
k-means, agglomerative, and DBSCAN clustering algorithms. Comparison of different cluster algorithms, discussions on Case studies.

UNIT III Semi Supervised & Reinforcement **15 Hours**

Semi-supervised: Introduction, discussion on Generative models and Graph-based methods. **Reinforcement:** Introduction, the learning task, Q learning –function, convergence, & updating sequence, rewards and actions, relationship to dynamic programming, discussions on Case studies

UNIT IV Analytical Learning **15 Hours**

Analytical Learning: Inductive and Analytical learning problems, Prolog-Ebg, Deductive learning, Explanation-based learning, knowledge level learning.

Combining Inductive and Analytical Learning: Approaches, KBANN algorithm with example, TangentProp algorithm, EBANN algorithm, FOCL algorithm.

Text Books:

1. Introduction of Machine Learning with Python – by Andreas C Muller & Sarah Guido – O'Reilly & Shroff publishers. Chapters 1, 2 and 3.
2. Introducing Python, Oreilly Publications .Chapters 1 to 6
3. Machine Learning by Tom M Mitchell – McGraw Hill Education publication – 2013. Chapter 11,12, and 13.

References Books:

1. Machine Learning: The Art and Science of algorithms – by Peter Flach – Cambridge University Press. Chapter 12
2. Machine Learning - by EthemAlpaydin – PHI learning private limited. Chapter 1, 7, 16, 18, 19
3. Bayesian Reasoning and Machine Learning – by David barber - Cambridge University Press. Chapter 13, 15
4. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2006
5. Semi-Supervised Learning - by Olivier Chapelle, Bernhard Sch¨olkopf, and Alexander Zien - The MIT Press Cambridge
6. The Elements of Statistical Learning – by Trevor Hastie, Robert Tibshirani and Jerome Friedman – Springer 2017 publication
7. Python Programming for absolute beginners-3rd Edition by Michael Dawson
8. IEEE Transactions on Artificial Intelligence & Machine Learning
9. Journal of Machine Learning Research

Lab Modules:

1. Implementation of regression algorithm
2. Implementation of Naïve Bayes algorithm
3. Implementation of Decision Tree algorithm
4. Implementation of K-means algorithm
5. Implementation of PCA algorithm
6. Implementation of SVM algorithm
7. Implementation of Q- algorithm

The above algorithms has to be executed on different sets/types of datasets.

M18CA4052	CYBER LAW AND IT SECURITY	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- To provide an understanding of principal concepts, major issues, technologies and basic approaches in information security.

- Develop an understanding of information assurance as practiced in computer operating systems, distributed systems, networks and representative applications.
- Gain familiarity with prevalent network and distributed system attacks, defenses against them and forensics to investigate the aftermath.
- Develop a basic understanding of cryptography, how it has evolved and some key encryption techniques used today
- To familiarize various cyber threats, attacks, vulnerabilities and defensive mechanisms

Course Outcomes:

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

- Differentiate active and passive attacks and Convert the given readable information to cipher text.
- Calculate private and public keys, learn the importance and working of firewalls and IDPS to protect organization data from intruders
- Describe the types of computer forensics technology.
- Gain the knowledge on importance of cyber laws

Course Contents:

UNIT I Information System And Application Security **15 Hours**

Introduction to Information Systems and Security , Information Systems, Types of IS, Development of IS, Introduction to Information Security, Need for Information Security, Threats to Information Systems, Information Assurance , Cyber Security, Security Risk Analysis.Introduction to Application Security, Data Security Considerations, Security Technologies, Security Threats, Security Threats to E-Commerce, E-Cash and Electronic Payment System, Credit/Debit/Smart Cards , Digital Signature Requirements of Digital Signature System Components of Digital Signature

UNIT II Cryptography and security technologies **15 Hours**

Types of attacks, a short History of Cryptography; Cryptographic techniques, Symmetric and asymmetric key algorithm, Cryptography Tools ,Attacks on Cryptosystems. A model for network

security, Firewalls; Protecting Remote Connections, Intrusion Detection Systems (IDS),Honey Pots, Honey Nets.

UNIT III Computer forensics **15 Hours**

Computer Forensics Fundamentals Introduction to Computer Forensics, Use of Computer Forensics in Law Enforcement, Computer Forensics Assistance to Human Resources/Employment Proceedings, Computer Forensics Services, Benefits of Professional Forensics Methodology. Types of Computer Forensic Technology, Specialized Forensics Techniques, Hidden Data and How to Find It, Spyware and Adware, Encryption Methods and Vulnerabilities ,Protecting Data from Being Compromised ,Internet Tracing Methods ,Security and Wireless Technologies ,Avoiding Pitfalls with Firewalls ,Biometric Security Systems.

UNIT IV Introduction to Security Policies and Cyber Laws **15 Hours**

Need for an Information Security Policy, Information Security Standards — ISO , Introducing Various Security Policies and Their Review Process , Introduction to Indian Cyber Law, Objective and Scope of the IT Act, 2000, Intellectual Property Issues, Overview of Intellectual-Property-Related Legislation in India, Patent, Copyright , Software License.

Text Books:

1. Surya Prakash ,RitendraJoel,Praveenkumar Shukla, "Information security and cyberlaw", Dreamtech, 2014[Chapter:1,2,3,5]
2. Michael E. Whitman and Herbert J. Mattord: Principles of Information Security, 2nd Edition, Thomson, 2005. [Chapter:6,7]
3. William Stallings: Network Security Essentials: Applications and Standards, Pearson Education, 2000.[Chapter:1,2]
4. John R. Vacca, Computer Forensics: Computer Crime Scene Investigation, 2nd Edition, Charles,River Media, 2005 [Chapters:1,2]

Reference Books:

1. Robert Jones, "Internet Forensics: Using Digital Evidence to Solve Computer Crime", O'Reilly Media, October, 2005.
2. NinaGodbole, SunitBelapur, "Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley India Publications, April, 2011.

M18CA4061		L	T	P	C

Duration:60Hours	NOSQL	2	0	1	3

Course Objectives:

- Classify the latest trends in databases.
- Summarize the features of NoSQL systems.
- Distinguish NoSQL databases with each other andrelational systems
- Compare the various NoSQL Data models.
- Acquire knowledge in parallel, distributed databases and its applications.
- Understand the usage of advanced data models.
- Learn emerging databases like MongoDB, HBase etc.

Course Outcomes:

The student should know and understand:

- Define, understand, compare and use the four types of NoSQL Databases (Document-oriented, KeyValue Pairs, Column-oriented and Graph) along with the concepts of aggregate databases.
- Demonstrate an understanding of the detailed architecture, define objects, load data, query data of Column-oriented NoSQL databases and Key-Value Pair NoSQL databases.
- Explain the detailed architecture, define objects, load data, query data and performance tune Document-oriented NoSQL databases.
- Evaluate NoSQL database development tools and programming languages, advanced concepts and Perform hands-on NoSql database lab assignments that will allow students to use the four NoSQL database types.

Course Contents:

UNIT I Introduction to NOSQL **15 Hours**

Introduction to NoSQL Definition of NOSQL-Challenges in traditional RDBMS, History of NOSQL,WhyNoSQL, Need for NOSQL- Big Data and NoSQL, Need for schema less databases.. Aggregate data models, Distribution models, Types of NOSQL Data base models- key-value Column store, document data models and Graph Data modelsDistribution models, CAP theorem.

UNIT II Key-Value Stores and Column stores **15 Hours**

Introduction to Key-value stores- Exploring RedisRedis data model Storing Data in and Accessing Data from Apache Redis –Querying in Redis using examples Redis use cases. Introduction to Column stores- Exploring HBASE – HBASE data model. Storing Data CRUD operations in HBASE.

UNIT III Document stores and its applications **15 Hours**

Introduction to Document stores, Exploring MongoDB, MongoDB data model, Storing Data in and Accessing Data from MongoDB, Querying in MongoDB using examples, Interact with MongoDB using Language Binding PHP.

UNIT IV Advanced NOSQL **15 Hours**

Big Data processing with MongoDB, MongoDB storage architecture-Horizontal Scaling through sharding.Import and Export commands in MongoDB,MongoDB Database Administration, MongoDB Indexing.

Text Books:

1. Pramod. J. Sadalge, Martin Fowler, NoSQL distilled, A brief guide to emerging world of Polyglot persistence. Addison-Wesley 2013.(Chapter 1-4,5.3.1,9)
2. Lars GeorgeHBase: A definitive Guide, OReilly publications,2011.(Unit 2)
3. Josiah L. Carlson, Redis in Action,Manning Publications, 2013.(Unit 2)
4. The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing, Apress 2010.(Chapter 4,6).

Reference Books:

1. "Professional NOSQL" by ShashankTiwari, 2011, WROX Press .(Chapter 1, 4)
2. Kristina Chodorow, MongoDB: The Definitive Guide, 2nd Edition, O'Reilly publications,2013.

Reference Websites:

1. www.mongodb.org
2. www.redis.io
3. www.hbase.apache.org

Unit wise Text books reference.

Unit 1- R1- Chapter 1, T1-Chapter 1-4,5.3.1
Unit 2-www.redis.io,www.hbase.apache.org(T2 & T3)
Unit 3-T4-chapter 4,6
Unit 4-T1:Chapter 9;R1-Chapter 4

NoSQL Laboratory

1. NoSQL Lab CRUD operations in Key-value stores Redis
2. CRUD operations using Column family stores HBASE.
3. CRUD- Operations using MongoDB
4. Connecting MongoDB using PHP
5. Import and Export Big Data using MongDB
6. Indexing in MongoDB

M18CA4062	ADVANCED COMPUTER NETWORKS USING LINUX	L	T	P	C
Duration:60Hours		2	0	1	3

Course Objectives:

- Students are made to be aware first on Computer networking basic.
- To understand importance to create a platform to work on networking using Linux by installation mechanism.
- To move on to actual Linux networking concepts by using Linux network commands.
- Lastly have some knowledge on wireless networking using Linux.

Course Outcomes:

On completion of the course, learners will be able to:

- Students will be in position to recall and analyze concepts of computer networking.
- Students can install Linux operating system.
- Set, delete and trouble shoot network mechanism process through Linux network commands.
- Students will be position to explore and work on wireless network.

Course Contents:

UNIT I Introduction to Networking and Wireless LAN **18 Hours**

Revisiting Networking Concepts-(understanding protocols- SDU, PDU, DHCP, DNS, NAT, ARP; types of Addresses and schemes, Cables types- straight-through cables, crossover cables, cabling

rules of thumb; DTE, DCE) .Wireless LAN - Benefits of WLAN, WLAN modes, Overview on general architecture of IEEE 802.11, WLAN standards- HyperLAN/1, HyperLAN/2; WLAN Configuration, Attacks on wireless networks, Security services, WEP protocol.

UNIT II Linux Installation Mechanism 12 Hours

Linux Distribution Flavors, downloading of Linux distribution of your choice (Ubuntu or Red Hat Linux), preparing to install Linux, setup the partition, Installing Linux software.

UNIT III Linux Networking Commands 15 Hours

Working with Linux networking commands to enable/disable task and for troubleshooting – ifconfig, ping, traceroute, netstat, nslookup, whois, hostname, telnet, finger, dig, scp, nmap, netcat, ifup/ifdown, mii-tool, ethtool,tshark, curl, wget.

UNIT IV Linux Wireless Networking 15 Hours

Common wireless Networking terminology – wireless access points, service set ID, Encryption; How to configure your NICs IP address –a) Determining your IP address, Changing your IP, Multiple IP addresses on a single in wired vswireless Linux compatible NICs, Networking with Linux wireless tools -iwconfig

Text Books, PDF & Website:

1) For - Benefits of WLAN, Attacks on wireless networks, Security services, WEP protocol refer Chapter 9, 12 from WIRELESS NETWORKS, by P. Nicopolitidis, M. S. Obaidat G. I. Papadimitriou, A. S. Pomportsis , JOHN WILEY & SONS, LTD publications. 1st edition.
2) For- WLAN standards- HyperLAN/1, HyperLAN/2; WLAN Configuration refer MOBILE AND WIRELESS DESIGN ESSENTIALS by Martyn Mallick , Wiley publications, 2011 print edition.
3) For- Overview on general architecture of IEEE 802.11 refer WIRELESS COMMUNICATION STANDARDS by Todor Cooklev, IEEE publication, 2004 print edition.
4) For unit 2 refer epdf- Linux Installation and Getting Started Copyright c 1992–1996 Matt Welsh Version 2.3, 22 February 1996 – Chapter 2.https://www.mdw.la/papers/linux-getting-started.pdf
5) For unit 3,4 refer website: www.Linuxhomenetworking.com

References Books:

1) A Practical Guide to Advanced Networking – 3rdEdition, Jeffery.S.Beassley, Piyasat Nikaew, Pearson Publication, 2012.

2) Advance Networking concept applied using Linux on IBM z by Lydia Parziale Ben Louie Eric Marins Tiago Nunes dos Santos SrivatsanVenkatesan ; Publication – Redbooks. (PDF - http://www.redbooks.ibm.com/redbooks/pdfs/sg247995.pdf)
3) Linux network administrator guide 4th edition pdf by Tom Baults,Terry Dawson, Gregor N Purdy, Orielly media publications.
4) http://www.penguintutor.com/linux/basic-network-reference
5) www.tldp.org

ACN USING LINUX LAB PROGRAMS

Course Contents:

1) A practical guide to perform how to download and install Linux operating system.
2) Follow a step carried out to perform Linux partition which act as foundational step for dual booting.
3) A practical demonstration :
    - To find Status of a link in a network. (using ethtool)
    - Using ping to test Network connectivity and difference between ping and telnet.
    - To find how number of hops taken to reach destination also determine packets traveling path (using trace route)
    - To use tshark and difference between tshark and wireshark.
    - To test network bandwidth (usingnetcat).
4) A practical guide to configure NIC (wired or wireless)
5) A practical guide to use DHCP and relationship between DHCP and DNS.

M18CA4070	SOFT SKILLS	L	T	P	C
Duration:30Hours		2	0	0	2

Note: The students will have to undergo Skill Development course being conducted by Training and Placement cell of the University.

M18CA4080	JAVA PROGRAMMING LAB	L	T	P	C
Duration: 30Hours		0	0	2	2

Course Objectives:

- Understand the fundamentals of programming such as variables, conditional and iterative execution, methods, etc.
- To use the Java SDK environment to create, debug and run simple Java programs

Course Outcomes:

- Understand the basic programming constructs of Java. Apply suitable OOP concepts to develop Java programs for a given scenario.
- Exemplify the usage of Packages, Interfaces, Exceptions and Multithreading

Course Contents:

1. a) Write a JAVA program to demonstrate Constructor Overloading and Method Overloading.
   b) Write a JAVA program to implement Inner class and demonstrate its Access protection.

2. Write a program in Java for String handling which performs the following:
   a) Checks the capacity of StringBuffer objects.
   b) Reverses the contents of a string given on console and converts the resultant string in upper case.
   c) Reads a string from console and appends it to the resultant string of (ii).

3. a). Write a JAVA program to demonstrate Inheritance.
   b). Simple Program on Java for the implementation of Multiple inheritance using interfaces to calculate the area of a rectangle and triangle.

4. Write a JAVA program which has
   a) A Class called Account that creates account with 500Rs minimum balance, a deposit()method todeposit amount, a withdraw() method to withdraw amount and also throws LessBalanceException ifan account holder tries to withdraw money which makes the balance become less than 500Rs.
   b) A Class called LessBalanceException which returns the statement that says withdraw amount (Rs)is not valid.
   c) A Class which creates 2 accounts, both account deposit money and one account tries to withdrawmore money which generates a LessBalanceException take appropriate action for the same.

5. Write a JAVA program using Synchronized Threads, which demonstrates Producer

Consumerconcept.

6. Write a JAVA program to implement a Queue using user defined Exception Handling (also make useof throw, throws).

7. Complete the following:

a. Create a package named shape.

b. Create some classes in the package representing some common shapes like Square, Triangle, and Circle.

c. Import and compile these classes in other program.

8. Write a JAVA program to create an enumeration Day of Week with seven values SUNDAY throughSATURDAY. Add a method isWorkday( ) to the DayofWeek class that returns true if the value onwhich it is called is MONDAY through FRIDAY. For example, the call DayOfWeek.SUNDAY.isWorkDay( ) returns false.

9. Write a JAVA program which has

a. A Interface class for Stack Operations

b. A Class that implements the Stack Interface and creates a fixed length Stack.

10. Write a JAVA program which has

a. A Class that implements the Stack Interface and creates a Dynamic length Stack.

b. A Class that uses both the above Stacks through Interface reference and does the Stack operations that demonstrates the Runtime binding.

M18CA4090	**.NET PROGRAMMING LAB**	**L**	**T**	**P**	**C**
Duration: 30Hours		**0**	**0**	**2**	**2**

Course Objectives:

- Gain knowledge and write programs in C# programming language which is second pillar towards application development.
- To design and develop user interface and functionality respectively for windows application.
- To design and develop web application using C# language and ASP.Net.

Course Outcomes:

Students be able to:

- Write programs using C# with proper understanding on programming concepts and logic.
- Establish connection between front end and back end using ADO.Net
- Design user interface and develop functionality for windows and web application.

Course Contents:

PART – A

1. Design and develop a C# program following constrains
   i. Room class with 1 abstract method and 1 Virtual Method in it
   ii. Class-Room and Lab classes should inherit Room Class
   iii. Class-Room should override both abstract and virtual method from Room Class
   iv. Lab class Should override only abstract class
   v. Display proper messages in the main class

2. Design and develop a C# program which should create a class 'Arithmetic Operations' which should have methods sum, sub, mul and div with two integer arguments and no return type. Access these methods by creating delegate. Perform all this operations on the same input and display the results.

3. Design and develop a C# program which creates an event named file created. This event should fire as soon as a file is created. Inside the event handling method open the file in write mode and insert a text "DATA INSERTED SUCCESSFULLY" in to the file. Display the content in the main function.

4. Design and develop a C# Program which should create a table in SQL SERVER database and insert some content in to that table and display that content in the console.

5. Design and develop a windows form for student and accept his
usn(in Text box, should have 10 characters only),
name(in textbox, should not have numbers in it),
address(in multiline textbox) ,
Course(in combo box),
Sem(in combo box with 1 to 6 sems)
Section(in combo box with minimum three sections for each course) ,
Year of Joing(in combo box with years staring from 2007 to till year should increase the year based on current year)
Accept these details with proper validation and insert them in SQL SERVER database.

PART – B

1.Design an ASP.Net website using C# by following the constraints listed below
   i. Should be a team project with max of two members
   ii. Should use any version control software for version management

iii. Database with stored procedures is must
iv. Should have minimum of 3 reports

Following concepts are must

i. Different Master pages for Different Users
ii. Sessions
iii. Login Screen
iv. Grid View, List View
v. Crystal Reports
vi. DLL for all the database processing
vii. DLL for all the validations
viii. Disconnected data modal for filling combo-box and grid-views

FIFTH SEMESTER

M18CA5010	PYTHON PROGRAMMING	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- Introduce the concepts of Python programming.
- Explain python lexical features and syntax of python structures and flow control
- Illustrate the use of python functions

Course Outcomes:

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

- Analyze requirements of software systems for the purpose of determining the suitability of implementing in Python;
- Analyze and model requirements and constraints for the purpose of designing and implementing software systems in Python;
- Design and implement Python software solutions that accommodate specified requirements and constraints, based on analysis or modeling or requirements specification.
- Understand the GUI development in Python

Course Contents:

UNIT I Introduction to Python **15 Hours**

Getting started: The Game over program, Examining the game over program, introducing python, setting up python on windows and other operating systems, introducing IDLE, back to the game over program. Types, variables and simple I/O, introducing the useless trivia program, using quotes with strings, using escape sequences with strings, concatenating and repeating strings, working with numbers, user input, string methods, right types, converting values, back to the trivia program. Branching, while loops and program planning, using the if, else, else-if statements, creating while loops, infinite loops, values as conditions, compound conditions, planning your programs, guess my number game.

UNIT II Loops, strings and tuples **15 Hours**

For loops, strings and tuples: using for loops, using sequence operators and functions with strings, indexing strings, string immutability, building a new string, slicing strings, tuples, jumble game. Lists and dictionaries – using Lists, list methods, understanding when to use tuples and lists, nested sequences, shared references, dictionaries, hangman game. Functions, creating functions, parameters and return values, keyword arguments, default parameters, global variables, tic-tac toe game.

UNIT III Files and Exceptions **15 Hours**

Files and Exceptions: reading and writing to text files, storing complex data, handling exceptions, and trivia challenge game. Software objects, caretaker program, object oriented basics, creating

classes, methods and objects, constructors, attributes, class attributes and static methods, object encapsulation, private attributes and methods, attribute access.

UNIT IV GUI development **15 Hours**

GUI development – examining GUI, understanding event driven programming, root window, labels, buttons, creating a GUI using a class, binding widgets and event handlers, text and entry widgets and Grid layout manager, check buttons, radio buttons, mad lib program. Graphics – Pizza panic game, creating a graphics window, setting background image, understanding the graphics coordinate system, displaying sprite, text, message, moving sprites, dealing with screen boundaries, mouse input, collisions, Sound, animation and program development – reading keyboard, rotating a sprite, creating an animation, working with sound and music.

Text Books:

1. Python Programming for absolute beginners by Michael Dawson, Course Technology-A part of CENGAGE Learning, 3rd Edition
2. Python Programming, Michael Dawson, 3rd Edition, Course technology PTR, 2010.
3. Robert Galanakis, Practical Maya Programming With Python, Shroff Publishers & Distributors, 2014.
4. Mark Lutz , Python Programming, Shroff Publishers & Distributors, 2011

References Books:

1. Introducing Python by Bill Lubanovic(chapters 1-6), Oriely Publications, 1st Edition
2. Web Site Link : https://www.python.org/

M18CA5020	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- Will be able to understand the fundamental principles of Software Project management & also have a good knowledge of responsibilities of project manager and to handle the various projects.
- Be familiar with the different methods and techniques used for project management.

- By the end of this course student will have good knowledge of the issues and challenges faced while doing the Software project Management.
- Will be able to know the reasons for the software projects failures and how that failure probability can be reduced effectively.
- Will be able to do the Project Scheduling, Tracking, Risk analysis, Quality management.
- Will be able to estimate the Project Cost using different techniques.

Course Outcomes:

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

- Understand the software project planning, design and development process to relate the project with all other project management activities (Level 1).
- Identify, classify various types of risks and recognize the importance of project cost evaluation (Level 2).
- Implement the risk management techniques and the optimum resource allocation to develop quality projects.(Level 3).
- Analyze and illustrate Agile Project Management using SCRUM to develop reliable software projects. (Level 4 and 5).

Course Contents:

UNIT I Introduction to Software Project Management **15 Hours**

Project Definition – Contract Management – Activities Covered By Software Project Management.Management Activities.**Project Evaluation:** Project Portfolio Management, Cost Benefit Evaluation Techniques, Risk Evaluation, Strategic programme Management, Creating a programme, Aids to program management. An Overview of Project Planning: Introduction To Stepwise Project Planning. Step 0 to Step 10.

UNIT II Activity Planning **15 Hours**

Objectives – Project Schedule – Sequencing and Scheduling Activities –Network Planning Models – Forward Pass – Backward Pass – Activity Float – Shortening Project Duration – Activity on Arrow Networks. Risk Management: Introduction, Nature of Risk, categories of Risk, A framework for

dealing with Risk, Risk Identification, Risk Planning, Risk Management, Evaluating risks to Schedule PERT technique, Monte Carlo Simulation.

UNIT III Monitoring and Control **15Hours**

Creating Framework – Collecting The Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back To Target – Change Control. **Managing Contracts**– Introduction – Types Of Contract – Stages In Contract Placement – Typical Terms Of A Contract – Contract Management – Acceptance.

UNIT IV Introduction to Agile and DEVOPS **15 Hours**

Introduction: Values, Principles, agile Manifesto, SCRUM Methodology: Roles and Responsibilities in Scrum, Implementing Scrum Process, Estimating Scrum Project, Challenges and Benefits of APM, Case Study: APM Using Scrum,.

Text Book:

1. TB1: "Software Project Management", Bob Hughes, Mike Cotterell&Rajib Mall, Fifth Edition, Tata McGraw Hill, 2016. **(Chapters: 1, 2, 3, 6, 7, 9, 10)**

Reference Books:

1. Software Engineering Project management, Wiley Edition Second Edition edited by Richard H Thayer Foreword by Edward Yourdon
2. "Managing Global Projects", Ramesh, Gopalaswamy,Tata McGraw Hill, 2001.

M18CA5030	J2EE & J2ME USING DESIGN PATTERNS	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- The objective of the course is to enable the student to gain mastery in various advanced J2EE and J2ME patterns used in Software Industry.
- To know the major Software Design Patterns available in J2EE and J2ME framework to meet demanding Software Engineering problems encountered in various Industries.
- To get hands on experience working with the various J2EE and J2ME patterns.
- To enable the students to understand the J2EE Specifications to produce well designed, effective web applications using JSP and supportive technologies

Course Outcomes:

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

- Understand some advanced programming concepts, Identify the context and understand the connection to JDBC.
- Analyze a problem and determine what problem elements to represent as functions or objects
- Develop Applications using Struts and JDBC with more complex programs from simpler parts
- Develop applications that implement GUIs, Understand some advanced programming concepts

Course Contents:

UNIT I Servlets and JSPs **15 Hours**

Servlets: Introduction, Life cycle of Servlet, Handling GET and POST requests, Servlet handling from data, Cookies and Session Tracking. Java Server Pages: Basics and Overview, JSP architecture, JSP tags and JSP expressions, Lifecycle of a JSP Model View Controller (MVC), JSP Objects, JSP Beans Tags, Working with Databases.

UNIT II Struts **15 Hours**

Struts: Introduction to the Apache Struts, MVC Architecture, Struts Architecture, How Struts works? Introduction to the Struts Controller, Introduction to the Struts Action Class, Using Struts ActionForm Class, Using Struts HTML Tags, Introduction to Struts Validator Framework Client Side Address Validation in Struts, Custom Validators Example, Developing Application with Struts.

UNIT III J2ME Architecture and Development Environment **15 Hours**

J2ME overview, wireless technology, Radio data networks, mobile radio networks, messaging, personal digital assistants, set top boxes, smart cards, J2ME architecture, Run-time environment, Java language for J2ME, Hello world J2ME style, J2ME wireless toolkit.

UNIT IV J2ME Database Concepts and JDBC Objects **15 Hours**

Data, database, database schema, JDBC driver types, overview of the JDBC process, database connection, statement objects, ResultSet, Metadata, data types, exceptions.

Text Books:

1. Jim Keogh, The Complete Reference J2EE , Tata McGrawHill Publishing Company Ltd,2002. (unit 1- Chapter 11 and chapter 12)
2. Jim Keogh, The Complete Reference J2ME , Tata McGrawHill Publishing Company Ltd,2002. (unit 3- chapter 3, unit 4- chapter 9 and 10)

Reference Books:

1. A Brain Friendly Guide Head First Servlets and JSPs, Bryan Basham, Kathy Sierra and Bert Bates, Oreilly, 2nd Edition. (Reference for unit 1)

2. Programming Jakarta Struts By Chuck Cavaness, Oreilly. (unit 2)

M18CA5041	THE INTERNET OF THINGS	L	T	P	C
Duration:60Hours		2	1	0	3

Prerequisites:
Knowledge Analog and Digital Communication, Probability and Information Theory, fundamentals of Wireless communication

Course Objectives:

The objectives of this course are to:

- Discuss the basics of things in IoT
- Identify different IoT applications and their application areas.
- Explain the emerging field of wireless sensor networks, which consist of many tiny, low-power devices equipped with sensing, computation, and wireless communication capabilities.
- Describe operating systems, radio communication, networking protocols

Course Outcomes:

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

- Understand and analyze the usability of the IoTs across various real-world applications
- Analyze low-power devices equipped with sensing, computation, and wireless communication capabilities.
- Illustrate of environmental parameters measurement and monitoring by exposing participants to the comprehensive fundamentals of Smart Sensors and Internet of Things
- Understand the operating systems, radio communication, networking protocols and develop application with a programming language.

Course Contents:

UNIT I Introduction to Internet of Things **15Hours**

Definition & Characteristics of IoT, Physical Design of IoT, Things in IoT, IoT Protocols, Logical Design of IoT, IoT Functional Blocks , Communication Models, ,IoT Enabling Technologies,Wireless Sensor Networks, Cloud Computing , Big Data Analytics, Communication Protocols **Domain Specific IoT:**Home Automation, Smart Cities, Smart Surveillance, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle

UNIT II Overview of Wireless Sensor Networks & Architectures **15 Hours**

Architecture of Sensor MOTE, Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks. Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Operating Systems and Execution Environments, Network Architecture - Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III Networking Sensors **15 Hours**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols and Wakeup Concepts - S-MAC, the Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT IV Advanced topics in IoT **15 Hours**

Logical Design of IOT using Python, Introduction to Python, Basics of Programming with Rasphberry PI with PYTHON and Arduino Board , IOT Physical devices and end points. Python Packages of Interest for IoT-JSON. IoT Physical Servers & Endpoints, Introduction to cloud storage Models for IOT.

Text Books:

1. Internet of Things-An Hands on Approach- Vijay Madisetti (Author), ArshdeepBahga, 2014. (Chapter 1, 2, 5)
2. Holger Karl and Andreas Willig, “Protocols and Architectures for Wireless Sensor Networks", John Wiley, 1st edition, 2005. (chapter 1 -5)

Reference Books:

1. FrancisDaCosta, Rethinking Internet of things, Apress Open Edition, 2013
2. Adrian McEwen, Hakim Cassimally, Design of Internet of Things, 2014 John Wiley and Sons, Ltd.

M18CA5042	MOBILE COMPUTING AND APP STORE MANAGEMENT	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- To impart basic understanding of the wireless communication systems.
- To expose students to various aspects of mobile and ad-hoc networks.
- Illustrate user interfaces for interacting with apps and triggering actions
- Interpret tasks used in handling multiple activities
- Identify options to save persistent application data
- Learn to setup Android application development environment

Course Outcomes:

On completion of the course, learners will be able to:

- Explain various Mobile Computing application, services and architecture.
- Understand various technology trends for next generation cellular wireless networks.
- Implement adaptive, responsive user interfaces that work across a wide range of devices.
- Demonstrate methods in storing, sharing and retrieving data in Android applications
- Describe the steps involved in publishing Android application to share with the world

Course Contents:

UNIT I Mobile Computing Application and Services **15 Hours**

Introduction to mobile computing, Middleware and Gateways, Application and services, Internet-Ubiquitous networks, Architecture and three-tier architecture for Mobile Computing, Design consideration for Mobile Computing.Spread spectrum – Direct sequence, Frequency hoping. Medium Access Control - SDMA, FDMA, TDMA, CDMA, Cellular concepts- channel assignment strategy-hand off strategy interface and system capacity- improving coverage and capacity in cellular system, Satellite Systems-GEO, LEO, MEO. Wireless Communication Systems- Telecommunication Systems- GSM- GSM services & features, architecture -DECT features & characteristics, architecture.

UNIT II Mobile Computing Architecture **15 Hours**

Wireless LANS: Wireless LAN Standards – IEEE 802 Protocol Architecture, IEEE 802.11 System Architecture, Protocol Architecture & Services, Cellular Networks: Channel allocation, multiple access, location management, Handoffs. MAC Layer & Management, Routing - Classification of RoutingAlgorithms, Algorithms such as DSR, AODV, DSDV, Mobile Agents, Service Discovery.

UNIT III Introduction to Android **15 Hours**

Introduction to Android Architecture: Introduction, History, Features and Android Architecture. Android Application Environment, SDK, Tools: Application Environment and Tools, Android SDK. Programming paradigms and Application Components - Part 1: Application Components, Activity, Manifest File, Programming paradigms and Application Components.

UNIT IV User Interface Design **15 Hours**

User Interface Design part 1: Views &View Groups, Views : Button, Text Field, Radio Button, Toggle Button, Checkbox, Spinner, Image View, Image switcher, Event Handling, Listeners, Layouts : Linear, Relative, List View, Grid View, Table View, Web View, Adapters. User Interface Design

part 2: Menus, Action Bars, Notifications : Status, Toasts and Dialogs, Styles and Themes, Creating Custom Widgets, Focus, Touch Mode, Screen Orientation.

Text Books

1. Asoke K. Talukder, Hasan Ahmad, Mobile Computing Technology- Application and Service Creation, 2nd Edition, McGraw Hill Education. (chapter 1 & 2)
2. Professional Android 4 Development by Reto Meier, John Wiley and Sons, 2012 .(Chapter 1, 2,3)

Reference Books:

1. Erik Hellman, "Android Programming – Pushing the Limits", 1st Edition, Wiley India Pvt Ltd, 2014.
2. Dawn Griffiths and David Griffiths, "Head First Android Development", 1st Edition, O'Reilly SPD Publishers, 2015.
3. J F DiMarzio, "Beginning Android Programming with Android Studio", 4th Edition, Wiley India Pvt Ltd, 2016. ISBN-13: 978-8126565580 4. Anubhav Pradhan, Anil V Deshpande, " Composing Mobile Apps" using Android, Wiley 2014, ISBN: 978-81-265-4660-2
4. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference", Google Developer Training Team, 2017.

BASIC ANDROID LAB

The experiments are:

1. Display Hello World

2. Add two Edit Text. When a number is entered in Edit Text 1, the square of that number should be displayed in Edit Text 2.

3. Add an Edit Text and a button. When the button is clicked, the text inputted in Edit Text should be retrieved and displayed back to the user.

4. Add two Edit Text and a button. When the button is clicked, the text inputted in Edit Text 1 should be retrieved and displayed in EditText2.

5. Program a calculator

6. Create a Module convertor for height

7. Create a Module convertor for height and weight in the same application. Selection of height/weight can be done using a spinner.

8. Add a spinner. When the spinner is selected, there should be three options (e.g., android, java, testing). When you click on each option, it should go to another page containing some other

components. Each of these pages should have a “back” button, which on pressing will take you back to the page with the spinner.

9. Create applications to include Action Bar, Menus, Dialogs and Notifications

10. Create a user login form and registration form. First time users have to register through the registration form and the details should be stored in the database. Then they can login using the login page.

M18CA5051	DEEP LEARNING CONCEPTS & TECHNIQUES	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- Illustrate the foundation of neural networks and deep learning.
- Formulate deep networks for different applications.
- Demonstrate different deep learning architectures.
- Validate deep learning techniques in object recognition and computer vision.

Course Outcomes:

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

- Model Neuron and Neural Network, and to analyze ANN learning, and its applications.
- Perform Pattern Recognition, Linear classification with neural networks
- Develop single layer/multiple layer Perception learning algorithms
- Design of another class of layered networks using deep learning principles.

Course Contents:

UNIT I Foundations of Neural network and Deep Learning 15 Hours

Neural Networks: The biological Neuron-The perceptron-Multilayer feed forward networks. Training neural networks: Back propagation learning. Activation function: Linear-sigmoid- tanh-hard tanh-soft max-rectified linear. Loss functions: Loss function notation-loss function for regression-loss

function for classification-loss function for reconstruction. Hyper parameters: Learning rate, regularization, momentum, sparsity.

UNIT II Fundamentals of Deep networks **15 Hours**

Defining deep learning and deep networks- advantages in network architecture-from feature engineering to automated feature learning-common architecture principles of deep networks: Parameters-layers-activation function-loss function-optimization methods-hyper parameters. Building blocks of deep networks: RBMs-auto encoders- variational auto encoders.

UNIT III Major Architecture of Deep networks **15 Hours**

Unsupervised pre trained networks: Deep belief networks-generative adversarial networks-convolutional neural networks (CNNs): Biological inspiration-intuition-CNN architecture overview-input layers-convolutional layers-pooling layers-fully connected layers-other applications of CNNs

UNIT IV Recurrent and recursive neural networks **15 Hours**

Recurrent neural networks: Modelling the time dimension-3D volumetric input-general recurrent neural network architecture-LSTM networks-domain specific applications and blended networks. Recursive neural networks: Network architecture- varieties of recursive neural networks- Basic concepts in tuning deep networks and vectorization. Applications in object recognition and computer vision.

Text Books

1. Josh Patterson and Adam Gibson, “Deep Learning A practitioners Approach”,Shroff publishers & Distributors, First edition 2017.(Chapter 2,3,4,6,7 & 8)

Reference Book

1. Aurelian Geron, “Hands-On Machine Learning with Scikit-Learn & Tensor Flow”, Shroff publishers & Distributors, First edition, 2017.
2. Langoog fellow, Yoshuabengio and Aaron courville , “Deep Learning”, MIT press, First edition, 2016.
3. Li Deng and Dong Yu, “Deep LearningMethods and Applications”,Foundations and Trends *in* Signal Processing,2014.
4. Michael A. Nielsen, "Neural Networks and Deep Learning", Determination Press, 2015

Web sites

1. www.deeplearning.net
2. www.deeplearning.stanford.edu

3. www.deeplearning.cs.toronto.edu

DEEP LEARING CONCEPTS AND TECHNIQUES

LAB COMPONENTS

Course Contents:

- Modeling CSV data with multilayer perceptron Networks.
- Modeling Sequence data by using Recurrent Neural Networks.
- Modeling Handwritten images using CNNs.
- Tuning Deep Networks.
- Vectoring Image data.

M18CA5052	SYSTEM SIMULATION AND MODELLING	L	T	P	C
Duration:60Hours		2	1	0	3

Course Objectives:

- Learn the benefits of simulation and modeling in a range of important application areas.
- To discuss the General Principles and Simulation Software & explain the event– scheduling, time-advance algorithm in computer networks.
- Introduce discrete event stochastic models and queuing models
- Describe the essentials of probability & random process.
- Interpret verification and validation of the different models.

Course Outcomes:

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

- Outline the various applications of simulation.
- Describe the role of important elements of simulation in modeling paradigm.
- Analyse importance of queuing models in real world situations.
- Generate Random numbers using different techniques.
- Describe Output analysis for discrete-event simulation algorithms.

Course Contents:

UNIT I Introduction: 15 Hours

When simulation is the appropriate tool and when it is not appropriate, Advantages and Disadvantages of Simulation, Areas of application, Systems and system environment, Components of a system, Discrete and continuous systems, Model of a system, Types of Models : Discrete-Event System Simulation, Steps in a Simulation Study. Simulation examples: Single server, Two server, Multi server and Inventory problems.

UNIT II General Principles, Simulation Software and Queuing Models: 15 Hours

Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling, List processing. Simulation in Java, Characteristics of queuing systems, Queuing notation Simulation ,Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues.

UNIT III Statistical Models, Random-Numbers and Random Variate Generation 15Hours

Review of terminology and concepts, Random Variables, Probability Distribution, Probability distribution function, Useful statistical models, Discrete distributions, Continuous distributions, Poisson process, Empirical distributions. Properties of random numbers, Generation of pseudo-random numbers, Techniques for generating random numbers, Tests for Random Numbers, Random-Variate Generation: Inverse transform technique, Acceptance-Rejection technique, Special properties.

UNIT IV Input, Output Modeling, Verification and Validation: 15 Hours

Data Collection, Identifying the distribution with data, Parameter estimation, Goodness of Fit Tests, Fitting a non-stationary Poisson process, Selecting input models without data, Multivariate and Time-Series input models, uniformity and independence, Chi-Square test, K-S Test. Types of simulations with respect to output analysis, Stochastic nature of output data, Absolute measures of performance and their estimation, Output analysis for terminating simulations, Output analysis for steady-state simulations. Verification, Calibration, and Validation, Optimization: Model building, verification and validation, Verification of simulation models, Calibration and validation of models

Text Books:

1. Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol: Discrete-Event System Simulation, 5th Edition, Pearson, 2015. **(**Chapters1 to 12)
2. Averill M. Law, "Simulation Modeling and Analysis",TataMcGraw-Hill, 4thedition,2007**. (C**hapters 7, 8).

Reference Books:

1. Sheldon M Ross, "Simulation", Elsevier Publication, 5th Edition, 2014(chapters 4, 7, 8 and 11).

OPEN ELECTIVE

M18CA5060	**DIGITAL MARKETING**	**L**	**T**	**P**	**C**
Duration:60Hours		**4**	**0**	**0**	**4**

Course Objectives:

- To develop industry background knowledge to knowledgeably navigate Internet Marketing topics including online advertising, search, social media, and online privacy.
- To evaluate an experiment quantitatively and qualitatively to measure the effectiveness of business decisions and online advertising effectiveness in particular.
- To design and implement an experiment.
- To apply best practices for social media marketing.

Course Outcomes:

Upon Completion of the course, the students will be able to:

- To identify the techniques involved in formulating the search engine optimization.
- To analyze and evaluate the process involved digital advertisement.
- To Design and develop the process involved in digital marketing using Email.
- To Analyze and interpret the techniques involved in social media marketing

Course Contents:

UNIT I **15 Hours**

Introduction To Digital Marketing: Start with the Customer and Work Backward, What Are the 3i Principles? **Search Engine Optimization (Seo):** An Introduction, Search Engine Result Pages: Positioning, Search Behavior, Goals, On-Page Optimization, Off-Page Optimization, Analyze.

UNIT II **15 Hours**

Pay Per Click: An Introduction, Goals, Setup, Manage, Analyze. **Digital Display Advertising :**An Introduction, Display Advertising: An Industry Overview, Define, Format, Configure, Analyze

UNIT III **15 Hours**

Email Marketing: An Introduction, Data—Email Marketing Process, Design and Content, Delivery, Discovery. **Mobile Marketing:**An Introduction, Opportunity, Optimize, Advertise, Analyze.

UNIT IV **15 Hours**

Social Media Marketing (Smm): An Introduction, Goals, Channels, Implementation, Analyze, Laws and Guidelines

Text Books:

1. Ian Dodson–" THE ART OF DIGITAL MARKETING : The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns",1st Edition, Wiley Publications, 2016. (Chapters : 1, 2, 3, 4, 5, 6, 7, 8, 9).

Reference Books:

1. Damian Ryan – "UNDERSTANDING DIGITAL MARKETING : Marketing Strategies for engaging the digital generation" 4th Edition, Kogan Page, 2017.

2. Ryan Deiss and Russ Henneberry – "DIGITAL MARKETING : For Dummies ", , John Wiley & Sons, Inc, 2017.
3. Alan Charlesworth – " DIGITAL MARKETING : A Practical Approach", 2nd Edition, Routledge, 2009.

M18CA5070	SWAYAM/MOOC	L	T	P	C
Duration:60Hours		4	0	0	4

MOOC / SWAYAM Online Courses: Globally, MOOC (Massive Open Online Course) platforms are gaining much popularity. Considering the popularity and relevance of MOOCs, Government of India has also launched an indigenous platform, SWAYAM. SWAYAM (Study Webs of Active Learning for Young Aspiring Minds) is basically an integrated MOOCs platform for distance education that is aimed at offering all the courses from school level (Class IX) to post-graduation level. The platform has been developed collaboratively by MHRD (Ministry of Human Resource Development) and AICTE (All India Council for Technical Education) with the help of Microsoft and is capable of hosting 2,000 courses.

A student shall register and successfully complete any of the courses available on SWAYAM / MOOC. Student shall inform the MOOC / SWAYAM coordinator of the school about the course to which he/she has enrolled. The duration and credits of the course shall vary depending upon the agency offering MOOC / SWAYAM courses. The student should submit the certificate issued by the agency offering SWAYAM / MOOC courses to the Coordinator of the school, the grades obtained in the course shall be forwarded to concerned authority of the University.

M18CA5080	PYTHON PROGRAMMING LAB	L	T	P	C
Duration:30Hours		0	0	2	2

Course Objectives:

- Introduce the concepts of Python programming.

- Explain python lexical features and syntax of python structures and flow control
- Illustrate the use of python functions

Course Outcomes:

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

- Analyze and model requirements and constraints for the purpose of designing and implementing software systems in Python;
- Design and implement Python software solutions that accommodate specified requirements and constraints, based on analysis or modeling or requirements specification.

Course Contents:

PART-A

1. Demonstrate runtime reading of Strings.
   i) Illustrate the concept of String Slicing.
   ii) Also demonstrate a minimum of 5 functions defined on Strings.
2. Write a program to add two integers and print the result on the screen. Accept the values at runtime.
3. Demonstrate the usage of math and cmath module.(For Ex. Program to find the roots of a Quadratic Equation)
4. Illustrate the usage of files with the help of different functions defined on Files(such as write, read(demonstrate all four forms), open, and close(use both the forms of closing a file)
5. Write a program to find the largest of two numbers
6. Write a program to find the biggest of three numbers
7. Design a menu driven program to check whether the number is
   i)A perfect number or not

   ii)Armstrong number or not

   iii)Palindrome or not
8. Show the different operations defined on Lists, Tuples and Dictionaries
9. Write a program to find the factorial of a number using functions and without using functions. Accept the input at runtime.
10. Demonstrate the i) Designing of a class ii) Creation of Object of that class iii) accessing the methods and instance variables in the class. The student is at the liberty of choosing their own Description of the object for designing the class.

PART-B

A few programs on GUI and a mini project.

M18CA5090	J2EE & J2ME USING DESIGN PATTERNS LAB	L	T	P	C
Duration: 30Hours		0	0	2	2

Course Objectives:

- To know the major Software Design Patterns available in J2EE and J2ME framework to meet demanding Software Engineering problems encountered in various Industries.
- To get hands on experience working with the various J2EE and J2ME patterns.

Course Outcomes:

- Able to demonstrate systematic knowledge of backend and front end by developing an appropriate application.
- Able to demonstrate a web application and mobile application by developing an appropriate application.

Course Contents:

- Simple Application using JDBC API.
- Develop a Bookstore Application as a web application using JSPs and servlets. Backend the data should be stored in database using JDBC concepts.
- Develop a Banking Account Application using Struts concept. You can also use JSP or Servlets, JDBC concepts.
- Using the J2ME database concepts, develop a product order and delivery database. Use all the concepts used in the theory.

**** Note:** Since students will be developing an entire application, number of programs is less but in turn they will be developing 4 different applications. **

Sl. No	Code	Title	HC/ SC FC	Credit Pattern			Credits
				L	T	P	
1	M18CA6010	Internship / Global Certification	HC	2	0	2	4
2	M18CA6020	Major Project	HC	0	0	8	8
		Total		**2**	**0**	**10**	**12**

SIXTH SEMESTER

Note:

1. Project Work and Dissertation will be mandatory of 8 Credits

2. The student can select either Internship or Certification Course for 4 Credits.

Guide Lines

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 Wk..

- The project should be inter disciplinary
- Team size should be of max ***one*** members
- Use any version control software
- Project should be of Research Based
- Proper and meaningful reports should be generated by making use of latest reporting tools
- Project report should follow standard template with the following contents:
    a) Abstract
    b) Introduction to project
    c) Literature Review
    d) Basic Diagrams like (DFD, ER, Class diagram, etc..)
    e) Methodology
    f) Result Analysis
    g) Concussion
    h) Future enhancement
    i) Bibliography
- Project reports should be submitted for evaluation .

CAREER DEVELOPMENT AND PLACEMENT

Having a degree will open doors to the world of opportunities for you. But Employers are looking for much more than just a degree. They want graduates who stand out from the crowd and exhibit real life skills that can be applied to their organizations. Examples of such popular skills employers look for include:

a. Willingness to learn
b. Self motivation
c. Team work
d. Communication skills and application of these skills to real scenarios
e. Requirement of gathering, design and analysis, development and testing skills
f. Analytical and Technical skills
g. Computer skills
h. Internet searching skills
i. Information consolidation and presentation skills
j. Role play
k. Group discussion, and so on

REVA University therefore, has given utmost importance to develop these skills through variety of training programs and such other activities that induce the said skills among all students. A full-fledged Career Counseling and Placement division, namely Career Development Center (CDC) headed by well experienced senior Professor and Dean and supported by dynamic trainers, counselors and placement officers and other efficient supportive team does handle all aspects of Internships and placements for the students of REVA University. The prime objective of the CDC is to liaison between REVA graduating students and industries by providing a common platform where the prospective employer companies can identify suitable candidates for placement in their respective organization. The CDC organizes pre-placement training by professionals and also arranges expert talks to our students. It facilitates students to career guidance and improve their employability. In addition, CDC forms teams to perform mock interviews. It makes you to enjoy working with such teams and learn many things apart from working together in a team. It also makes you to participate

in various student clubs which helps in developing team culture, variety of job skills and overall personality.

The need of the hour in the field of Computer Applications is not only knowledge in the subject, but also the skills to do the job proficiently, team spirit and a flavour of innovation. This kept in focus, the CDC has designed the training process, which will commence from second semester along with the curriculum. Special coaching in personality development, career building, English proficiency, reasoning, puzzles, and communication skills to every student of REVA University is given with utmost care. The process involves continuous training and monitoring the students to develop their soft skills including interpersonal skills that will fetch them a job of repute in the area of his / her interest and march forward to make better career. The School of Computer Science and Applications also has emphasised subject based skill training through lab practice, internship, project work, industry interaction and many such skilling techniques. The students during their day to day studies are made to practice these skill techniques as these are inbuilt in the course curriculum. Concerned teachers also continuously guide and monitor the progress of students.

The University has also established University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director to facilitate skill related training to REVA students and other unemployed students around REVA campus. The center conducts variety of skill development programs to students to suite to their career opportunities. Through this skill development centre the students shall compulsorily complete at least two skill / certification based programs before the completion of their degree. The University has collaborations with Industries, Corporate training organizations, research institutions and Government agencies like NSDC (National Skill Development Corporation) to conduct certification programs. REVA University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana.

The University has also signed MOU’s with Multi-National Companies, research institutions, and universities abroad to facilitate greater opportunities of employability, students’ exchange programs for higher learning and for conducting certification programs.

Programme Regulations

Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Three Years Graduate Degree Programs, 2016

1. **Teaching and Learning Process:**

   The teaching & learning process under CBCS – CAGP of education in each course of study will have three components, namely**:**

   (i) L= Lecture (ii) T= Tutorial (iii) 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 that equip students to acquire the much required skill component.

2. **Courses of Study and Credits**

   a. The study of various subjects in MCA degree program is grouped under various courses. Each of these courses carries credits which are based on the number of hours of teaching and learning.
   b. 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.
   c. **The total duration of a semester is 20 weeks inclusive of semester-end examination.**

d. **A course shall have either or all the four components.** That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

e. The total credits earned by a student at the end of the semester upon successfully completing the course are L + T + P. **The credit pattern of the course is indicated as L: T: P**

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

a. Core Course:

A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course. The CORE courses of Study are of THREE types, viz – (i) Foundation Course, (ii) Hard Core Course, and (iii) Soft Core Course.

b. Foundation Course (FC):

The foundation Course is a core course which should be completed successfully as a part of graduate degree program irrespective of the branch of study. These would include basic courses in Languages, courses of study prescribed by the University.

c. Hard Core Course (HC):

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.

d. Soft Core Course (SC):

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.

e. O**pen Elective Course:**

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 O**pen Elective Course.**

f. Project Work / Dissertation:

Project work / Dissertation work is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A project work carrying **FOUR or SIX** credits is called **Minor Project** work / **Dissertation.** A project work of **EIGHT, TEN, TWELVE or SIXTEEN** credits is called **Major Project** work / **Dissertation**. **A Minor Project work may be a hard core or a Soft Core as decided by the BOS / concerned. But the Major Project shall be Hard Core.**

3. Scheme, Duration and Medium of Instructions:

3.1. The MCA Degree program is of 6 semesters - 3 years duration. A candidate can avail a maximum of 12 semesters - 6 years as per double duration norm, in one stretch to complete the MCA, including blank semesters, if any. Whenever a candidate opts for blank semester, he/she has to study the prevailing courses offered by the School when he/she resumes his/her studies.

3.2. The medium of instruction shall be English.

4. Credits and Credit Distribution

4.1. A candidate has to earn 144 credits for successful completion of Three Year MCA degree with the distribution of credits for different courses as decided by the Board of Studies.

4.2. The concerned BOS based on the credits distribution pattern given above shall prescribe the credits to various types of courses and shall assign title to every course including project work, practical work, field work, self study elective, as **Foundation Course(FC), Hard Core(HC) or Soft Core(SC) or Open Elective(OE)**.

4.3. A candidate can enroll for a maximum of 30 credits and a minimum of 20 credits per Semester. However he / she may not successfully earn a maximum of 30 credits per semester. This maximum of 30 credits does not include the credits of courses carried forward by a candidate.

4.4. Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to VI semester and complete successfully 144 credits in 6 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.

Add- on Proficiency Certification:

To acquire **Add on Proficiency Certification** a candidate can opt to complete a minimum of 4 extra credits either in the same discipline /subject or in different discipline / subject in excess to 144 credits for the Three Year MCA Degree program.

5. **Add on Proficiency Diploma:**

6.1. To acquire **Add on Proficiency Diploma,** a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 144 credits for the Three Year MCA Degree program.

6.2. The A**dd on Proficiency Certification / Diploma** so issued to the candidate contains the courses studied and grades earned.

6. Scheme of Assessment & Evaluation

7.1. The Scheme of Assessment and Evaluation will have two parts, namely;

i. Internal Assessment (IA); and

ii. Semester End Examination

7.2. Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment and Semester End Examination of UG non engineering programs and PG programs shall carry 50 marks each (i.e., 50 marks internal assessment; 50 marks semester end examination).

7. 3. The 50 marks of Internal Assessment shall comprise of:

Internal Test	=	30 marks
Assignments	=	10 marks
Seminars	=	10 marks

7.4. There shall be three internal tests conducted as per the schedule given below. The students have to attend all the three tests compulsorily.

- 1st test for 15 marks at the end of 5th week of the beginning of the Semester;
- 2nd test for 15 marks at the end of the 10th week of the beginning of the Semester; and
- 3rd test for 15 marks at the end of the 15th week of the beginning of the Semester.

7.5. The coverage of syllabus for the said three tests shall be as under:

- For the 1st test syllabus shall be 1st unit of the course;
- For the 2nd test it shall be 2nd unit and 1st half of the 3rd unit;
- For the 3rd test the syllabus will be 2nd half of the 3rd unit and complete 4th unit.

7.6. Out of 3 tests, the highest marks scored in **two tests** are automatically considered while assessing the performance of the students.

7.7. The Semester End Examination for 50 marks shall be held during 18th and 19th week of the beginning of the semester and **the syllabus for the semester end examination shall be entire 4 units**.

7.8. The **duration of the internal test shall be 75 minutes and for semester end examination the duration shall be 3 hours.**

Summary of Continuous Assessment and Evaluation Schedule

Type of Assessment	Period	Syllabus	Marks	Activity
First Test	2nd half of 5th Week	1st Unit	15	Consolidation of 1st Unit
Allocation of Topics for Assignments	6th Week	First Unit and 1st half of second unit		Instructional process and Continuous Assessment
Submission of Assignments	7th Week	First Unit and 1st half of second unit	5	Instructional process and Continuous Assessment
Seminars	8th Week	First unit and 1st half of second unit	5	Instructional process and Continuous Assessment
Second Test	2nd half of 10th Week	Second unit and 1st half of third unit	15	Consolidation of 2nd and 3rd Unit
Allocation of Topic for 2nd Assignment	11th Week	2nd half of second unit and 3rd Unit		Instructional process and Continuous Assessment
Submission of Assignments	12th Week	2nd half of second unit and 3rd Unit	5	Instructional process and Continuous Assessment
Seminars	13th Week	2nd half of second unit and 3rd Unit	5	Instructional process and Continuous Assessment
Third Test	2nd half of 15th Week	Second half of third unit and complete 4th Unit	15	Consolidation of 2nd half of 3rd Unit and entire 4th Unit
Semester End Practical Examination	16th Week	Entire syllabus	50	Conduct of Semester - end Practical Exams
Preparation for Semester–End Exam	16th & 17th Week	Entire Syllabus		Revision and preparation for semester–end

				exam
Semester End Theory Examination	18th Week & 19th Week	Entire Syllabus	50	Evaluation and Tabulation
	End of 20th Week			Notification of Final Grades

Note: 1. Examination and Evaluation shall take place concurrently and Final Grades shall be announced latest by 5 days after completion of the examination.

1. Practical examination wherever applicable shall be conducted after 3rd test and before semester end examination. The calendar of practical examination shall be decided by the respective School Boards and communicated well in advance to the Registrar (Evaluation) who will notify the same immediately

8.0. Evaluation of Practicals and Minor Project / Major Project / Dissertation

8.1. The performance in the practice tasks / experiments shall be assessed on the basis of:

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting.

8.2 The 50 marks meant for continuous assessment of the performance in carrying out practicals shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	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**

The 50 marks meant for Semester End (C3) Examination, shall be allocated as under:

i	Conduction of semester end practical examination	30 marks
ii	Write up about the experiment / practical conducted	10 marks

iii	Viva Voce	10 marks
	Total	**50 marks**

8.3. The duration for semester-end practical examination shall be decided by the concerned School Board.

8.4 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:

i	Periodic Progress and Progress Reports (25%)
ii	Results of Work and Draft Report (25%)
iii	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%.

9.1 Provision to Carry Forward the Failed Subjects / Courses:

A student who has failed in a given number of courses in odd and even semesters shall move to next semester of immediate succeeding year and final year of the study. However, he / she shall have to clear all the courses of all semesters within the double duration, i. e., within six years of admission of the first semester failing which the student has to re-register to the entire program.

9.2 Re-Registration and Re-Admission:

a) 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 end semester examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

b) In such a 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.

10. Attendance Requirement:

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

10.2 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.

10.3 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 as provided above.

10.4 Teachers offering the courses will place the above details in the School Board meeting during the last week of the semester, before the commencement of examination, and subsequently a notification pertaining to the above will be brought out by the Director of the School before the commencement of examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

11. Challenge Valuation

a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 10 days after the announcement of the results. This challenge valuation is only for SEE.

b. The answer scripts for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

12. Grade Card and Grade Point:

a. **Provisional Grade Card**: The tentative / provisional Grade Card will be issued by the Registrar (Evaluation) at the end of every semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average** (SGPA).

b. Final Grade Card: Upon successful completion of MCA Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Registrar (Evaluation).

c. **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>90	9	v*9	A+
70 > 80	8	v*8	A
60> 70	7	v*7	B+
55 > 60	6	v*6	B
50 > 55	5.5	V*5.5	C
40> 50	5	v*5	P
0-40	0	v*0	F
ABSENT			AB

O - Outstanding; A-Excellent; B-Very Good; C-Good; D-Fair; E-Satisfactory; F - Fail

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

i. 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 in a given semester, i.e :

$$\textbf{SGPA (Si)} = \sum(\textbf{Ci x Gi}) / \sum\textbf{Ci}$$

where C_i is the number of credits of the i^{th} course and G_i is the grade point scored by the student in the i^{th} course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Point	Grade letter	Credit Point (Credit x Grade point)
Course 1	**4**	**8**	**A**	**4X8=32**
Course 2	**4**	**7**	**B+**	**4X7=28**
Course 3	**3**	**9**	**A+**	**3X9=27**
Course 4	**3**	**7**	**B+**	**3X7=21**
Course 5	**3**	**6**	**B**	**3X6=18**
Course 6	**3**	**5**	**P**	**3X5=15**
Course 7	**2**	**7**	**B+**	**2X7=14**
Course 8	**2**	**8**	**A**	**2X8=16**
	24			**171**

Thus, **SGPA = 171 ÷ 24 = 7.13**

Illustration No. 2

Course	Grade Point	Grade letter	Credit	Credit Point (Credit x Grade)
Course 1	**9**	**A+**	**4**	**4X9=36**
Course 2	**8**	**A**	**4**	**4X8=32**
Course 3	**7**	**B+**	**3**	**3X7=21**
Course 4	**10**	**O**	**3**	**3X10=30**
Course 5	**5**	**C**	**3**	**3X5=15**
Course 6	**6**	**B**	**3**	**3X6=18**
Course 7	**10**	**O**	**2**	**2X10=20**
Course 8	**8**	**A**	**2**	**2X8=16**
			24	**188**

Thus, **SGPA = 188 ÷ 24 = 7.83**

Illustration No.3

Course	Credit	Grade Point	Grade Letter	Credit Point (Credit x Grade point)
Course 1	4	10	O	4 x 10 = 40
Course 2	4	9	A+	4 x 9 = 36
Course 3	3	7	B+	3 x 7 = 21
Course 4	3	8	A	3 x 8 = 24
Course 5	3	9	A+	3 x 9 = 27
Course 6	3	9	A+	3 x 9 = 27
Course 7	4	10	O	4 x 10 = 40
	24			215

Thus**, SGPA = 215 ÷ 24 = 8.99**

ii. Cumulative Grade Point Average (CGPA):

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (144) for MCA degree is calculated taking into account all the courses undergone by a student over all the semesters of a program i. e.,

$$\mathbf{CGPA = \sum(Ci \times Si) / \sum Ci}$$

where S_i is the SGPA of the i^{th} semester and C_i 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 (i_{th})	No. of Credits (C_i)	SGPA (S_i)	Credits x SGPA (C_i X S_i)
1	24	6.83	24 x 6.83 = 163.92
2	24	7.13	24 x 7.13 = 171.12
3	24	7.83	24 x 7.83 = 187.92
4	24	8.99	24 x 8.99= 215.76
5	24	8.68	24 x 8.68 = 208.32
6	24	9.20	24 x 9.20 = 220.80
Cumulative	144		1167.84

Thus, **CGPA** = $\frac{24x6.83+24x7.13+24x7.83+24x8.99+24x8.68+24x9.20}{144}$ = 8.11

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 8.11 x 10 = 81.10

12.1 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) G	Letter Grade	Performance	FGP 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	P	Pass	Satisfactory
CGPA <4	-	F	Fail	-

Overall percentage=10*CGPA

12.2 Provision for Appeal

If a candidate is not satisfied with the evaluation of C1 and C2 components, he/she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, which were evaluated. He/she can do so before the commencement of 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 taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

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

- The Registrar (Evaluation) - 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.

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

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