REVA
UNIVERSITY
Bengaluru, India

School of CSA

B.Sc (Honour's)
(Computer Science - Cloud Computing and Big Data)

HANDBOOK
2019-2020

SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS

Bachelor of Science (Honour's) Computer Science-Cloud Computing and Big Data

HANDBOOK

2019

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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 Bachelor of Science with specialization in Cloud Computing & Big Data 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 Cloud Computing and Big Data analytics. This program on Cloud computing & Big Data will teach both the fundamental concepts of how and why Cloud systems works, as well as Cloud technologies such as Amazon AWS, Microsoft Azure, and Open Stack. Students will learn concepts like virtualization, private & public clouds. They will also become proficient in "Big Data" on various platforms. Besides a hands-on project, this program will include knowledge transfer by Industry experts. The lab sessions cover cloud application development and deployment, use of cloud storage, creation and configuration of virtual machines and data analysis on cloud using data mining tools. 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.

Students after successful completion of Bachelor of Science with specialization in Cloud Computing & Big Data program:

- Can design cloud-based Solutions/Architecture
- Can develop and deploy cloud application using popular cloud platforms
- Can build private cloud, Public Cloud & Hybrid Cloud
- Can design and develop highly scalable cloud-based applications by creating and configuring virtual machines on the cloud
- Can perform big data analysis in cloud

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 Bachelor of Science (Cloud Computing & Big Data) 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 27th February, 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 center, 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 Defense Dr. Sathish Reddy, Scientific Advisor, Ministry of Defense, 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 organizes 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 recognized 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 every day 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 honored 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".

Mission

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

Objectives

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

ABOUT 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. Manikantan Mohanavelu Head Training Tower-India, HP
5	Mr. Madusudan R Practice Lead, Engagement & System Operations-IBM
6	Mr. Dharshan Maheshbhai Project Lead- Cognizant Technology Pvt Ltd
7	Mr. Ashish Tanwar, University Relations Manager-India, Dell

Programme Overview

The Bachelor of Science (Honors) Computer Science-Cloud Computing and Big Data programme is designed keeping in view the current situation and possible future developments, both at national and global levels. This programme is designed to give greater emphasis on Cloud Computing and Big Data analytics. This programme on Cloud computing & Big Data will teach both the fundamental concepts of how and why Cloud systems works, as well as Cloud technologies such as Amazon AWS, Microsoft Azure, and Open Stack. Students will learn concepts like virtualization, private & public clouds. They will also become proficient in "Big Data" on various platforms. Besides a hands-on project, this program will include knowledge transfer by Industry experts. The lab sessions cover cloud application development and deployment, use of cloud storage, creation and configuration of virtual machines and data analysis on cloud using data mining tools. 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.

There is a dearth for cloud engineers, data scientists, data analysts, cloud architects. This programme aims in fulfilling the demand by sending graduates equipped for the industry.

The School of Computer Science and Applications at REVA UNIVERSITY has designed to offer B.Sc(H) (Computer Science-Cloud Computing and Big Data) programme as an undergraduate degree programme to create motivated, enthusiastic, thinking and creative graduates to fill the roles as computer algorithm developers, computer programmers, computer application developers, professors, scientists, professionals and administrators.

The B.Sc(H) (Computer Science-Cloud Computing and Big Data) programme at **School of Computer Science and Applications** has been designed and developed by industry experts. The cloud related subjects are handled by corporate trainers and it is in par with the industry standards.

The curriculum is outcome based and it imbibes required theoretical concepts and practical skills in the domain. By undergoing this programme, students develop critical, analytical thinking and problem solving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in communication skills and interdisciplinary topics to enhance their scope. The above mentioned features of the programme, advanced teaching and learning resources, and experience of the faculty members with their strong connections with industry and research organizations makes this programme unique.

Program Educational Objectives (PEO's)

The programme acts as a foundation degree and helps to develop critical, analytical and problem solving skills at first level. The foundation degree makes the graduates employable in IT industries, scientific organisations and also to assume administrative positions in various types of organisations. With further acquisition of higher level degrees help the graduates to pursue a career in academics or scientific organisations as a researcher.

The Programme Educational Objectives are to prepare the students to:

PEO-1	Be cloud engineers , data analysts, data scientists and cloud architects and Operate various cloud related commercial software tools to solve scientific and business problems.
PEO-2	Be computer Application Developers, Algorithm developers, Computer Programmers and to Work alongside engineering, medical, ICT professionals and scientists to assist them in setting up a cloud in their area of domain.
PEO-3	Adopt lifelong learning philosophy for continuous improvement to which qualifies them to become professionals in various levels as administrators in public, private organisations or as scientists in research establishments
PEO-4	Understand environmental, legal, cultural, social, ethical, public safety issues and Work as a member of a team and communicate effectively across team members to set his/her own enterprise with further training

Program Outcomes for B.Sc (Honors) In Computer Science- Cloud Computing And Big Data

After undergoing this programme, a student will be able to:

- **PO 1: Disciplinary knowledge**: Capable of demonstrating comprehensive knowledge and understanding of computer science with specialization in Cloud computing and Big data analytics that form a part of B.Sc(Honors) in Computer Science –Cloud Computing and Big Data

- **PO 2: Scientific reasoning**: Ability to analyze, and understand concepts in computer science, critically evaluate ideas, logical reasoning and experiences in programming, algorithm development and application development.

- **PO 3: Problem solving**: Capacity to extrapolate and apply competencies to solve different kinds of non-familiar problems, such as design cloud-based Solutions/Architecture, develop and deploy scalable cloud application using popular cloud platforms, build private cloud, Public Cloud & Hybrid.

- **PO 4: Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development and provide solutions for the same using domain knowledge in Cloud computing.

- **PO 5: Research-related skills:** Ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyze, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation in data analytics.

- **PO 6: Ethics:** Conduct as a responsible citizen by recognizing different value systems and understand the moral dimensions of decisions, and accept responsibility for them.

- **PO 7: Cooperation/Team work:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team.

- **PO 8: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups

- **PO 9: Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes.

PROGRAMME SPECIFIC OUTCOMES:

1. Design cloud-based Solutions or Architecture, and use the popular cloud platforms to develop and deploy cloud applications.

2. Provide computer based solutions for real life problems by developing specific software products.

3. Design and develop a highly scalable cloud-based applications by configuring virtual machines on the cloud

School of Computer Science and Applications

B.Sc. (Honors) - Scheme 2019-2022

FIRST SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit value L	T	P	Credits	Weekly Contact Hours
1	B19BS1010	Discrete Mathematical Structures	HC	4	0	0	4	4
2	B19BS1020	Programming in C	HC	2	1	0	3	4
3	B19BS1030	Operating Systems And Linux Foundation	HC	2	1	0	3	4
4	B19BS1040	Computer Organization and Architecture	HC	4	0	0	4	4
5	B19BS1050	Environmental Studies	FC	2	0	0	2	2
6	B19BS1060	Technical English	FC	2	0	1	3	4
7	B19BS1070	Sports/Music/Yoga/Dance	RULO	2	0	0	2	2
Practical Courses								
8	B19BS1080	C Programming Lab	HC	0	0	2	2	4
9	B19BS1090	Linux Lab	HC	0	0	2	2	4
Total Credits				**18**	**2**	**5**	**25**	**32**

SECOND SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern Value			Credit	Working Hrs.
				L	T	P		
1	B19BS2010	Probability and Statistics	HC	4	0	0	4	4
2	B19BS2020	Cloud Computing and Virtualization Foundation	HC	3	0	1	4	5
3	B19BS2030	Advanced Linux	HC	2	1	0	3	4
4	B19BS2040	Relational Database Management Systems	HC	3	0	1	4	5
5	B19BS2050	Data Structures Using C	HC	2	1	0	3	4
6	B19BS2060	Constitution of India & Professional Ethics	FC	2	0	0	2	2
Practical Courses								
7	B19BS2070	Data Structures Lab	HC	0	0	2	2	4
8	B19BS2080	Advanced Linux Lab	HC	0	0	2	2	4
Total Credits				16	2	6	24	32

THIRD SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Value L	T	P	Credit	Working Hrs.
1	B19BS3010	Cloud Computing Architecture and Design	HC	2	1	0	3	4
2	B19BS3020	Analysis and Design of Algorithms	HC	4	0	0	4	4
3	B19BS3030	Computer Networks	HC	4	0	0	4	4
4	B19BS3040	Data mining & Data warehousing	HC	4	0	0	4	4
5	B19BS3050	Python Foundation	HC	2	1	0	3	4
6	B19BS3061	Advanced Virtualization Concepts	SC	2	1	0	3	4
	B19BS3062	Linear Algebra						
	B19BS3063	E-Commerce						
7	B19BS3070	Soft skills	RULO	2	0	0	2	2
Practical Courses								
8	B19BS3080	Cloud Computing Architecture and Design Lab	HC	0	0	2	2	4
9	B19BS3090	Python Foundation Lab	HC	0	0	2	2	4
Total Credits				**20**	**3**	**4**	**27**	**34**

FOURTH SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Value			Credit	Working Hrs.
				L	T	P		
1	B19BS4010	Public Cloud – AWS,AZURE and GOOGLE	HC	2	1	0	3	4
2	B19BS4020	Software Engineering	HC	4	0	0	4	4
3	B19BS4030	Automation Tools For Cloud Deployment	HC	3	0	1	4	5
4	B19BS4040	Cloud Developer tools and Ecosystem	HC	2	1	0	3	4
5	B19BS4051	Advanced Computer Networks	SC	2	1	0	3	4
	B19BS4052	Cyber Physical systems						
	B19BS4053	The Internet Of things						
6	B19BS4061	Programming with Ruby & Golang	SC	2	0	1	3	4
	B19BS4062	Introduction to Web Programming						
	B19BS4063	Java Programming						
7	B19BS4070	Mooc/Swayam	RULO	2	0	0	2	2
8	B19BS4080	Soft Skills		2	0	0	2	2
Practical Courses								
9	B19BS4090	Public Cloud – AWS,AZURE and GOOGLE Lab	HC	0	0	2	2	4
10	B19BS4100	Cloud Developer tools and Ecosystem lab	HC	0	0	2	2	4
Total Credits				**19**	**3**	**6**	**28**	**37**

FIFTH SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern Value			Credit	Working Hrs.
				L	T	P		
1	B19BS5010	Building Private Cloud with Open Stack	HC	2	1	0	3	4
2	B19BS5020	Big Data Analytics using Hadoop	HC	2	0	1	3	5
3	B19BS5030	Machine learning foundation with Python	HC	3	0	1	4	5
4	B19BS5041	Pubic Cloud Networking & Security	SC	2	0	1	3	4
	B19BS5042	C# and .NET						
	B19BS5043	Advanced JAVA for Micro-services architecture						
5	B19BS5051	Cyber Security	SC	2	1	0	3	4
	B19BS5052	Cloud APP development						
	B19BS5053	Cloud Migration and Disaster recovery						
6		Open Elective	OE	4	0	0	4	4
7	B19BS5070	Soft Skills	RULO	2	0	0	2	2
Practical Courses								
8	B19BS5080	Building Private Cloud with Open Stack Lab	HC	0	0	2	2	4
9	B19BS5090	Minor Project	HC	0	0	4	4	8
Total Credits				17	2	9	**28**	**40**

Open Elective Courses offered to other Schools

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern			Credits	Working Hrs.
				L	T	P		
1	B19BS5061	Fundamentals of Cloud Computing	OE	4	0	0	4	4
2	B19BS5062	Basics of Data Analytics						

SIXTH SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern Value				Working Hrs.
				L	T	P	C	
1	B19BS6010	DevOps	HC	3	0	1	4	5
2	B19BS6021	Deployment &Management of Private Cloud	SC	3	0	1	4	5
	B19BS6022	ENTREPRENEURSHIP AND MANAGEMENT						
	B19BS6023	Machine learning and AI on cloud						
Practical Courses								
3	B19BS6030	Major Project	HC	0	0	10	10	20
Total Credits				6	0	12	18	30

CREDIT SUMMARY

Semester	Credits
First	25
Second	24
Third	27
Fourth	28
Fifth	28
Sixth	18
Total	150

Credit Distributions:

Semester	Hard Core (HC)	Fundamental Core(FC)	Soft Core(SC)	Open Elective(OE)	Others (Soft skills,RULO)	Swayam /Mooc	Project	Total Credits
I	18	5	-	-	2		-	**25**
II	22	2	-	-	-	-	-	**24**
III	22	-	3	-	2		-	**27**
IV	18	-	6	-	2	2	-	**28**
V	16	-	6	4	2			**28**
VI	4	-	4	-	-	-	10	**18**
Total	**100**	**7**	**19**	**04**	**08**	**02**	**10**	**150**
Total Credits for the Programme								**150**

DETAILED SYLLABUS

FIRST SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern value			Credits	Weekly Contact Hours
				L	T	P		
1	B19BS1010	Discrete Mathematical Structures	HC	4	0	0	4	4
2	B19BS1020	Programming in C	HC	2	1	0	3	4
3	B19BS1030	Operating Systems And Linux Foundation	HC	2	1	0	3	4
4	B19BS1040	Computer Organization and Architecture	HC	4	0	0	4	4
5	B19BS1050	Environmental Studies	FC	2	0	0	2	2
6	B19BS1060	Technical English	FC	2	0	1	3	4
7	B19BS1070	Sports/Music/Yoga/Dance	RULO	2	0	0	2	2
Practical Courses								
8	B19BS1080	C Programming Lab	HC	0	0	2	2	4
9	B19BS1090	Linux Lab	HC	0	0	2	2	4
Total Credits				**18**	**2**	**5**	**25**	**32**

B19BS1010	DISCRETE MATHEMATICAL STRUCTURES	L	T	P	C
Total Hours: 60		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:

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

- Acquire the basic knowledge of set theory, functions and relations concepts needed for designing and solving problems.
- Acquire the knowledge of logical operations and predicate calculus needed for computing skill.
- Able to design and solve Boolean functions for defined problems.
- Apply the acquired knowledge of graph theory, design discrete problems to solve by computers.

COURSE CONTENT:

UNIT I Set Theory, Properties of Integers   **15 Hours**

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 and Mathematical Induction.

UNIT II Fundamentals of Logic   **15 Hours**

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

UNIT III Relations and Functions   **15 Hours**

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

UNIT IV Graph Theory   **15 Hours**

Terminology, Definitions, Properties and Examples, Connectivity and Adjacency, Euler and Hamilton, Representation and Isomorphism, Planarity and Chromatic Number, Directed Graphs and Weighted Graphs, Trees and its properties and types.

Text Books:

1. Ralph P Grimaldi, B.V.Ramana, "Discrete & Combinatorial Mathematics, An Applied Introduction" 5th Edition, Pearson Education, 2004.
2. Eric Gosset "Discrete Mathematics with Proof" Wiley India, 2nd Edition, 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. Dr.D.S.C, "Discrete Mathematical Structures", Fourth Edition, 2014 – 2015.
9. K S Deshikachar, M Vinayaka Murthy and Udaya Rani, " Discrete Mathematical Stuctures with Application to Computer Science", Subhas Stores, Bengaluru, lates

B19BS1020		L	T	P	C
	PROGRAMMING USING C	**2**	**1**	**0**	**3**
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- Explain the basic programming concepts.
- Illustrate the importance of Algorithm to write the Program (in small steps).
- Divide a problem into its logical set of components.
- Describe how a good program design can reduce coding and debugging time.
- State the Problem Definition clearly.
- Introduce the concepts of Files for application data maintenance
- Provide detailed understanding of control statements, function and arrays.
- Illustrate the use of pointers and Strings.

At the end of the course students will be able to

- Design Algorithms and Flowcharts to solve real world problems.
- List various data types and operators and develop programs to evaluate arithmetic   expressions and mathematical functions.
- Identify the suitable control statements and implement the solution for any problem.
- Design programs to handle list of data and strings using arrays.
- Apply the categories of user defined functions to implement the concept of modularity also implement program using Structures and Unions.
- Explore pointers in implementing programs, especially in memory management and file handling.

COURSE CONTENT:

UNIT I Computer Problem-Solving& Fundamental Algorithms   15 Hours

Computer Basics, Introduction To Computer Problem-Solving, Fundamental Algorithms: Introduction, Exchanging the Values of Two variables, Counting, Summation of a Set of Numbers, Factorial Computation,

Generation of the Fibonacci sequence. Basics of C Programming: History of C, Importance of C, Basic Structure of C Programs, Introduction, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Declaration of Storage Class, Assigning Values to Variables.

UNIT II Operators and Expression   15 Hours

Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Increment and Decrement Operators, Conditional Operator, Bitwise Operators, Special Operators, Arithmetic Expressions, Evaluation of Expressions, Precedence of Arithmetic Operators. Structured Constructs**:** Decision Making and Branching, Decision Making and Looping.

UNIT III Array and Functions   15 Hours

Introduction, One-Dimensional Arrays, Initialization of One-Dimensional Arrays, Two Dimensional Arrays, Initializing Two Dimensional Arrays, Multi-Dimensional Arrays, Character Arrays and Strings: Introduction, Declaring and Initializing String Variables, Reading Strings from Screen, Writing Strings to Screen, String-Handling Functions. User-Defined Functions: Introduction, Need for User-Defined Functions Elements of User-Defined Functions, Definition of Functions, Return Values and their types, Function Calls, Function Declaration, Category of Functions, No arguments and No return values, Arguments but No return values, Arguments with return values, No arguments but returns a value, Recursion.

UNIT IV User Defined Data Types, Structures and Unions   15 Hours

Introduction, Defining a Structure, Declaring Structure Variables, Accessing Structure Members, Structure Initialization, Copying and Comparing Structure Variables, Operations on Individual Members, Arrays of

Structures, Arrays with Structures, Structures within Structures, Unions. Introduction to Pointers: Introduction and Understanding pointers, accessing the address of a variable, Declaring pointer variables, Initialization of pointer variables, accessing a variable through its pointer. File Management in C: Introduction, Defining and Opening a File, Closing a File, Input/ Output Operations on Files.

Text Books:

1. V. Rajaraman, Neeharika Adabala, "Fundamentals of Computers", 6th Edition, PHI, 2015. (Chapter 1)
2. R.F Dromey, "How to Solve it by Computer" Pearson, Fourteenth Impression, 2013. (Chapter 1 & 2)
3. E. Balaguruswamy, "Programming In ANSI C", 3rd edition, McGraw Hill Education, 2006.(Chapter 1 to 12)

References Books:

1. Mahapatra, "Thinking in C", PHI Publications, 1998.
2. YashwantKanetkar, "Let Us C", 13th Edition, PHP, 2013.
3. Ashok N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education, 6th Impression , 2009
4. Anami, Angadi, and Manvi, "Computer Concepts and C Programming – A Holistic approach", PHI 2008

B19BA1030	OPERATING SYSTEMS AND LINUX FOUNDATION	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- Provide Storage foundational knowledge of Linux
- Provide understanding of Linux operating file system
- Understand and work multiple Linux operating System (RHEL and Ubuntu)
- Enabling Knowledge: the operation, implementation and performance of modern operating systems, and the relative merits and suitability of each for complex user applications
- Throughout the course, practical aspects that pertain to the most popular operating systems such as Unix/Linux and Windows, and some instructional operating systems will be studied.

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Install and configure Redhat Linux Enterprise server 7
- Install and configure Ubuntu 14.04 LTS server
- Work on file directories
- Install and Configure services like SSH,Web, DNS,NFS ,Proxy Server
- Basic Linux Security (SElinux)

- Explain the objective and functions of modern operating systems.
- Describe how computing resources are used by application software and managed by system software.
-

COURSE CONTENT:

UNIT I Introduction to Operating system   **15Hours**

Batch Systems, Multiprogramming and Time Sharing, Parallel, Distributed and real time Systems, Operating System Structures, Components & Services, and System calls, System programs, Virtual machines.

Introduction to Linux: Introduction and Installing of Red Hat and Ubuntu Linux Operating System, Interfaces basics like Login, Desktop and Help

UNIT II   **15 Hours**

Process Management: Process Concept, Process Scheduling, Co – Operating process, Threads, Inter process communication, CPU Scheduling Criteria, Scheduling algorithm, Multiple Processor Scheduling, Algorithm evolution.**Interacting With Shell And Desktop :**Introduction, Environment, Introduction to Shell , Shell configuration, Secure shell, GNOME, KDE.

UNIT III   **15 Hours**

Memory Management : Logical and Physical address space, Swapping, Contiguous allocation, Paging, Segmentation, Virtual memory-Demand paging and its performance, Page replacement algorithms, Allocation of frames, thrashing, page size and other considerations.

Basic Linux Administration: Basic System administration, Managing users, Software Management, File System Management, RAID and LVM, Devices and modules, Kernel administration, virtualization, Backup Management, dump/restore.

UNIT IV   **15 Hours**

File management: File Concepts, Access methods, Directory Structure, Protection and consistency, File system structure, Allocation methods, Free space management, Directory Implementation, Recovery.

Linux Network, Security And Services Configuration: Install and configure apache web server, NFS, Mail server, Proxy server, Selinux, firewall, App Armor, NIS, Domain Name System, Samba.

Text books:

1. Red Hat Fedora Core 7 And Red Hat Enterprise Linux: The Complete Reference Books, McGraw-Hill Education
2. Ubuntu: The Complete Reference Books , Richard Petersen , McGraw-Hill Education
3. Abraham Silberschatz and Peter Baer Galvin, "Operating System Concepts", 7th Edition, Pearson Education, 2002.
4. " Operating System" by Gary Nutt, Pearson/Addison Wesley – 2004

Reference Book:

1. A Book by Mark G. Sobell A Practical Guide to Fedora and Red Hat Enterprise Linux, Seventh Edition
2. H.M.Deitel, "Operating Systems", Pearson Learning Solutions, 3rd Edition, 2003.
3. William Stallings, "Operating Systems", 6th Edition, Pearson Education, 2010.
4. Stuart, "Operating systems: Principles, Design and Implementation", 1st Edition 2008, Cengage Learning India

B19BS1040	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
Total Hours: 60		4	0	0	4

COURSE OBJECTIVES:

- To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
- To prepare students to perform the analysis and design of various digital electronic circuits.

COURSE OUTCOMES:

After studying this course the students would gain enough knowledge about:

- Have a thorough understanding of the fundamental concepts and techniques used in Digital ele
- Understand and examine the structure of various number systems and its Application in digital design.
- Analyze various combinational and sequential Logic Circuits.
- Design various combinational and sequential Logic Circuits.
- Identify basic requirements for a design application and propose a cost Effective solution.
- Understand basic structure of computer and control unit operations..
- Perform computer arithmetic operations.

COURSE CONTENT:

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   **15 Hours**

Boolean Operations and Expressions, Laws and Rules of Boolean Algebra, De Morgan's Theorems, Boolean Analysis of Logic Circuits, Simplification Using Boolean Algebra, Standard Forms of Boolean Expressions, Boolean Expressions and Truth Tables, The Karnaugh Map, SOP Minimization, POS Minimization.

UNIT III Combinational Logic, Sequential Logic and Basic Structure of Computers   **15 Hours**
Combinational Logic: Introduction, Design Procedure, Adders, Sequential Logic: Introduction, Flip-Flops.

Basic Structure of Computers: Computer types, Functional Units, Basic Operational Concepts, Bus Structures, and Performance and Historical Perspective

UNIT IV Machine Instructions and INPUT/OUTPUT Organization   15 Hours

Memory Locations and Address, Memory Operations, Instructions and Instruction Sequencing, Addressing Modes. INPUT/OUTPUT Organization: Interrupts, Direct Memory Access and Buses.

Text Books:

1. Tokheim "Digital Electronics Principles and Applications', 6th Edition, McGraw-Hill, 2015. Chapter 1 (1.1, 1.2, 1.3)

2. 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 and 2.11). Chapters (3.1 to 3.7) and (4.1 to 4.9)

3. 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)

4. Hamacher, Vranesic and Zaky, "Computer Organization", FIFTH EDITION, TATA McGraw-Hill, 2015. Chapters (1.1, 1.2, 1.3, 1.4 and 1.6) Chapters (4.2, 4.4 and 4.5) Chapters (5.1 to 5.3)

B19BS1050		L	T	P	C
	ENVIRONMENTAL STUDIES				
Total Hours: 30		2	0	0	2

COURSE OBJECTIVES:

- To familiarize students with environmental issues as how to conserve, preserve our environment.

COURSE OUTCOMES:
- Students will be able to develop concern for environment and its related aspects

COURSE CONTENT:

UNIT I Introduction   07 Hours
Multidisciplinary nature of environmental studies – Definition -Scope and importance -Need for public awareness.

UNIT II Natural Resources   08 Hours
Renewable and non-renewable -Problems associated - Forest resources-Water resources-Mineral resources-Food resources-Energy resources-Land resources and their conservation.

UNIT III Environmental Pollution   **07 Hours**

Definition- Causes - Effects and control measures of air - Water-Soil-Marine-Noise-Thermal – Nuclear Pollutions - Solid waste management-Prevention of pollution.

UNIT IV   **08 Hours**

Social Issues and the Environment Unsustainable   to   sustainable   development, Environmental ethics, Climate changes,   global warming, Wildlife protection act, Public awareness- Human Population and the Environment- Population growth-Population explosion - Human rights - Value education - Role of information technology in environment and human health - HIV/Aids -Women and child welfare - Case studies.

Text Books:

Desai R.G. - Environmental studies, Himalaya Publication House.

Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

haruchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,

Jadhav, H &Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi.

Rao M N. &Datta, A.K. 1987. Waste Water treatment, Oxford & IBH Publ. Co. Pvt. Ltd.

B19BS1060	**TECHNICAL ENGLISH**	**L**	**T**	**P**	**C**
Total Hours: 30		**2**	**0**	**1**	**3**

COURSE OBJECTIVES:

- To develop basic communication skills in English for the learners of BS Cloud Computing.
- To prioritize listening and reading skills among learners of BS Cloud Computing.
- To simplify writing skills needed for academic as well as workplace context.
- To examine that the learners use the electronic media such as internet and supplement the learning materials used in the classroom.

COURSE OUTCOMES:

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

- Interpret audio files and comprehend different spoken discourses/ excerpts in different accents (Listening Skills).
- Demonstrate speaking ability with clarity, confidence and comprehension and communicate with one or many listeners using appropriate communicative strategies (Speaking Skills).
- Make use of reading different genres of texts adopting various reading strategies (Reading Skills).
- Develop the ability to write cohesively, coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic (Writing Skills).

UNIT I Functional English   **07 Hours**

Grammar: Prepositions; Verbs, Listening: Listening to audio (verbal & sounds), Speaking: Debating Skills, Reading: Skimming a reading passage; Scanning for specific information Writing: Email communication

UNIT II Interpersonal Skills   **08 Hours**

Grammar: Tenses; Active & Passive Voice, Listening & Speaking: Listening and responding to video lectures / Talks, Reading: Reading Comprehension, Writing: Letters

UNIT III Multitasking skills   **07 Hours**

Grammar: Idioms; Phrasal Verbs, Listening & Speaking: Listening to specific task; focused audio tracks and responding, Reading: Reading and interpreting visual material, Writing: Types of paragraph (cause and effect / compare and contrast / narrative / analytical); Note Taking/ Note Making

UNIT IV Communication skills   **08 Hours**

Grammar: Direct and indirect speech, Listening & Speaking: Watching videos / documentaries and responding to questions based on them; Role plays, Reading: Making inference from the reading passage; predicting the content of a reading passage, Writing: Cover Letter & CV

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, latest.
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.

B19BS1070	SPORTS/ YOGA/ MUSIC /DANCE/ THEATRE	L	T	P	C
Total Hours:30		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
UNIT I

- **Yoga: Introduction, Tips from Sage Patanjali's Yoga Sutras**

- **Surya Namaskara:-** 10 counts,12 counts,16 counts

UNIT II

- Asanas: Sitting-Vajrasana, Dandasana, Padmasana, Matsyasana, Ardha Matsyendrasana, Suptavajrasana, Paschimottasana, Bakasana, Simhasana, Shirasasana.
- Asanas: Standing-Tadasana, Trikonasana, Parshwa konasana, Veerabadrasana, Parivrutta trikonasana.

UNIT III

- Asanas:Prone Position-Bhujangasana, Dhanurasana, Shalabhasana.
- Asanas: Supine Position-Sarvangasana, Sethubandha sarvangasana, Halasana, Karnapeedasana.

- Mudras- Dhyana mudra, Chinmaya mudra, Namaste mudra, Nasika mudra

UNIT IV

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

- Dhyana & its types

- Competition format, Rules and their interpretation.

A. 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 CONTENT:

UNIT I

- Introduction about Volleyball

- Players Stance, Receiving and passing

- The Volley (Overhead pass), The Dig (Underhand pass), Service Reception

UNIT II

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

UNIT III

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

UNIT-IV

- Attack Combination, Defense Systems, Libero play

- Court marking, Rules and their interpretations and Duties of officials.

B. BASKETBALL

- 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 CONTENT:

UNIT I

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

UNIT II

- Dribbling- How to start dribble, How to stop dribble, High / Low dribble with variations
- Shooting- Layup shot and its variations, One hand set shot, One hand jump shot, Free

throw, Hook shot, Tip-in shot.

- Stopping- Stride/Scoot, Pivoting and Faking /Feinting footwork.

UNIT III

- Rebounding- Defensive rebound, Offensive rebound, Box out, Rebound Organization.

- Individual Defensive- Guarding the man with the ball and without the ball.

- Offensive drills, Fast break drills, Team Defense/Offense, Team Tactics

UNIT IV

- Court marking, Rules and their interpretations

C. FOOTBALL

COURSE OBJECTIVES:

- To learn the rules, fundamental skills, and strategies of football.

- To develop skills in passing, receiving, controlling the ball, dribbling, and 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 CONTENT:

UNIT I

Football: Introduction

- Kicks- Inside kick, Instep kick, Outer instep kick, Lofted kick, Chipping, Volley, Half

Volley

- Trapping- Trapping rolling the ball, Trapping bouncing ball with sole

UNIT II

- Dribbling- With instep and outer instep of the foot.

- Heading- From standing, running and jumping.

- Feinting- With the lower limb and upper part of the body.

UNIT III

- Tackling- Simple tackling, Slide tackling.

- Throw-in- Standing and Sliding

- Goal Keeping- Collection of balls, Ball clearance, throwing and deflecting.

UNIT IV

- Ground marking, Rules and their interpretations.

D. 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 CONTENT:

UNIT I

- Athletics: Introduction

- Track Events - Steeple Chase, Race Walking, Middle and Long distance races

- Race walking - Technique, Faults and Officiating.

- Middle and Long distance races – Technique and Training

UNIT II

- Jumping Events - High Jump and Triple Jump: Basic Skills and techniques

- High Jump - Straddle Roll & Flop Technique, Approach, Take-off, Technique in the air, Clearance over the bar & Landing

- Triple Jump – Hop, Step and Jump Technique, Approach, Take-off & Landing

UNIT III

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

- Discus Throw -Standing and Rotatory techniques, Grip, Stance, Rotation Technique, Power stance, Release and Reverse (Follow through)

- Hammer Throw - Grip, Swings, Rotation foot work, Release and Follow through

UNIT IV

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

Reference Books

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

9. Coaches Association. Rothmans Foundation National Sports Division.

10. Carr, Gerry (1999). "Fundamentals of Track and Field. Track Athletics 1 Title G.V. 1060 5.e. 368.

11. I.A.A.F. Level-II (2001). Text Book on Jumping Event.

12. Jarver, Jesse (1987). "The Jumps", Track and Field Coaching Manual Australia.

B19BS1080	C PROGRAMMING LAB	L	T	P	C
Total Hours: 30		0	0	2	2

COURSE CONTENT:

Lab Experiments:

1. Program to read and print the size of variables of different data type.

2. A person has deposited some amount in bank. Write a program to calculate simple interest and compound interest on amount for a period.

3. In Delhi, four wheelers run on the basis of even or odd number. Write a program to identify whether vehicle registration number is even or odd.

4. People frequently need to calculate the area of things like rooms, boxes or plots of land where quadratic equation can be used. Write a program to find the coefficients of a quadratic equation and compute its roots.

5. Consider the age of 3 persons in a family, Write a program to identify the eldest person among three of them.

6. Consider student's marks in Computer Test. Write a Program display the grade obtain by student in Computer Test based on range.

7. Calculator allows you to easily handle all the calculations necessary for everyday life with a single application. Write a program to design a basic calculator that performs the basic operations and you want to give choice to user to perform
   a. Addition of two numbers
   b. Subtraction of two numbers
   c. Multiplication of two numbers.
   d. Division of two numbers.
   e. Wrong choice

8. In a stock market at the end of the day we do the summation of all the transactions.

a. Write a program to display numbers (transactions) from1 to n.

b. Write a program to find the sum of n natural numbers.

9. Read your ATM Pin Number. Write a program to identify your Pin Number is palindrome or not**.**

10. Read your Landline Number. Write a program to print the reverse of it and also find sum of digits of your Landline Number.

11. Create a Contact list of n friends, Write a program to read and print the Phone number of your friend's.

12. In computer based applications, matrices play a vital role in the projection of three dimensional image into a two dimensional screen, creating the realistic seeming motions. Write a program to perform matrix Multiplication and check compatibility of matrix.

13. You have joined a startup company of N employees; Write a program is to sort all employee id.

14. A student has taken 10 books from the library. Every time he take's the book, Librarian read's its ISBN Number. Write a program to identify whether book is issued to him or not based on ISBN Number.

15. Suppose students have registered for workshop, and their record is maintained in ascending order based on student id. Write a program to find whether a particular Student has registered for that particular workshop or not

16. In a CCP test you scored less marks compared to your friend, Write a program to swap your marks with your friend.

17. Assume you went to mall to watch movie with your friend. Write a program to interchange your place with a person who is sitting next to your friend.

18. In a memory game, you first enter a string wait for a time and again enter second string, Write a program to check both sting were same or not.

19. Read your first and last name in two different strings; Write a program to combine these two strings into third string.

20. Assume a person has entered a Password, Write a program so that he can know the length of his password.

B19BS1090	LINUX LAB	L	T	P	C
Total Hours: 30		0	0	2	2

COURSE CONTENT:

1. Learn installation procedure of Ubuntu and Red hat Linux server.
2. Create files and directories
3. Change or modify permission on files and directories
4. Install and configure nfs server
5. Configure nfs client and work on mount points
6. Work on Linux desktop interface
7. Configure DNS server
8. Install and configure web server

SECOND SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern Value			Credit	Working Hrs.
				L	T	P		
1	B19BS2010	Probability and Statistics	HC	4	0	0	4	4
2	B19BS2020	Cloud Computing and Virtualization Foundation	HC	3	0	1	4	5
3	B19BS2030	Advanced Linux	HC	2	1	0	3	4
4	B19BS2040	Relational Database Management Systems	HC	3	0	1	4	5
5	B19BS2050	Data Structures Using C	HC	2	1	0	3	4
6	B19BS2060	Constitution of India & Professional Ethics	FC	2	0	0	2	2
Practical Courses								
7	B19BS2070	Data Structures Lab	HC	0	0	2	2	4
8	B19BS2080	Advanced Linux Lab	HC	0	0	2	2	4
Total Credits				**16**	**2**	**6**	**24**	**32**

B19BS2010	PROBABILITY AND STATISTICS	L	T	P	C
Total Hours: 60		4	0	0	4

COURSE OBJECTIVES:

- To help students understand the basics of probability & statistics

- To acquaint students with various statistical methods.

- To cultivate statistical thinking among students.

- To prepare students for future courses having quantitative components.

COURSE OUTCOMES:

Upon successful completion of the course one should be able to

- Organize, present and interpret statistical data, both numerically and graphically, Create quantitative models to solve real world problems in appropriate contexts

- Compute and interpret the coefficient of Skewness, Correlation and Regression" for bivariate data

- Recognize the role of and application of probability theory, descriptive and inferential statistics in many different fields

- Illustrate and apply the concepts of discrete and continuous random variables, the discrete and continuous probability distributions. Frame problems using multiple mathematical and statistical representations of relevant structures and relationships and solve using standard techniques

COURSE CONTENT:

UNIT I Introduction   15 Hours

Meaning of Statistics and its definition-Functions-Scope/Characteristics-limitations. Collection of data Classification of data , preparation of frequency distribution and tabulation of data. Diagrammatic representation of bar and pie diagrams, Graphical representation of median and mode by - histograms, smoothed frequency curve, frequency polygon, Cumulative frequency curves (ogives).Measure of Central Tendency - Arithmetic Mean (Average), Partition values – Median, quartiles, deciles, percentile and Mode and its applications**.**

UNIT II Measures of Dispersion, and Skewness   15 Hours
Methods of Dispersion Range, Quartile deviation, Mean deviations: Standard deviations and Coefficient of Variation and its applications. Measure of skewness: Meaning, uses and problems on Karl Pearson's coefficient of skewness and Bowley's co-efficient of skewness and its applications.

UNIT III Probability   **15 Hours**

Random experiments, trial, sample space, events. Approaches to probability- classical, empirical, subjective and axiomatic. Theorems on probabilities of events. Addition rules of probability. Conditional probability, independence of events and multiplication rule of probability. Bayes theorem (no proof any theorem) and its applications**.**

UNIT IV Random variables and Expectations   **15 Hours**

Definition, Random Variable, Discrete and continuous random variables, Distribution function probability mass and density function problems. Mathematical expectation - discrete random variable and its problems. Joint probability function for pdf, pmf and marginal distribution function of Discrete and Continuous Random Variable simple problems.

Text Books:

1. Gupta. S.C and Kapoor V.K. Fundamentals of Mathematical Statistics, Sultan Chand and sons, (2001)
2. Freund J.E., Mathematical Statistics, Prentice hall, (2001)

Reference Books:

1. Berenson and Levine, Basic Business Statistics, Prentice- Hall India (1996, 6[th]edition)

2. S.P.Gupta, "Statistical methods"- Sultan Chand & Sons, New Delhi, latest Edition

3. Ross Sheldon, A First Course in Probability, Macmillan , (6th edition)

4. Medhi.J, "Statistical methods - An introductory text", new age publications, 2009 edition.

5. D.C. Montogomery and G.C.Runger, "Applied Statistics and Probability for engineers", New Jersey,John Wiley and Sons, 3rd edition, 2003.
6. P K Srimani and M Vinayaka Murthy, "Probability and Statistics", Subhas Stores, 2000

B19BS2020	CLOUD COMPUTING AND	L	T	P	C
Total Hours: 60	VIRTUALIZATION FOUNDATION	3	0	1	4

COURSE OBJECTIVES:

The objective of this course is to:

- Provide storage foundation knowledge on Cloud Computing concepts

- Demystify cloud and virtualization

- Understand multiple Hypervisors/Virtualization technologies used in cloud data centre with hands on experience

- Ability to Install and configure Microsoft hyper infrastructure

- Ability to Install and manage Windows server 2016

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Understand basics of virtualization

- Understand what is Cloud Computing and its business case

- Understand what is Private ,Public ,and Hybrid Cloud Computing

- Understand what is IaaS, PaaS and SaaS

- Understand the cloud Security and compliance issues

- Able to create and launch Windows and Linux Cloud Servers

- Understand the benefits and limitations of Cloud Computing

- Understand how to choose a right service provider

- Design and implement Microsoft virtualization on windows 2016 server

COURSE CONTENT:

UNIT I Virtualization basics   **15 Hours**

Evolution of virtualization, Virtualization basics, types of virtualization Full virtualization and Para virtualization, Virtual box installation and create virtual machine, install Ubuntu and centos Linux in virtual machine, KVM Installation and Create virtual machines on KVM hypervisor.

UNIT II Cloud Computing foundation   **15 Hours**

Understanding cloud computing, characteristics of Cloud computing, basic concepts and terminologies, benefits and limitations of Cloud computing, Cloud infrastructure framework, the business case of going cloud.

UNIT III Cloud Computing Service & Deployment Models   **15 Hours**

Understand   cloud computing service models Infrastructure-As-A-Service, Platform-As-A- Service, Software-As-A-Service, Storage-As-A-Service and also Understand Cloud Deployment models like Private cloud, Public Cloud, Hybrid cloud, and community cloud, Introduction to Cloud Computing Security whitepaper "Nine Notorious threats in Cloud Computing Cloud Security Alliance

UNIT IV Microsoft Windows server latest with Hyper-v Virtualization   **15 Hours**

Microsoft 2016 server Introduction and installing web server, nfs, cifs ,dns role, Active directory ,iSCSI role on windows server, Learning Power shell, Hyper-V Basics , Hyperv-v virtual machine operations, Hyper Networking, Hyper storage, Building a Failover Cluster,

Text books:
1. Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and More by Kris Jamsa.
2. Mastering Windows Server 2016 Jordan Krause by October 2016.

Reference Book:

1. Windows Server 2016 Hyper-V Cookbook - Second Edition, Charbel Nemnom, Patrick Lownds.

B19BS2030	ADVANCED LINUX	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

The objective of this course is to:

- Understand advanced topics of Linux operating system

- Understand Linux troubleshooting

- Automating Linux common and advanced tasks using scripting

COURSE OUTCOMES:

A student who successfully completes the course will have the ability 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 CONTENT:

UNIT I Configuring Server on Linux: 15 Hours

Configure web server and securing your web traffic using SSL, troubleshooting web   server, Configure FTP server and ftp client, configure windows file sharing Samba server, Configuring NFS Server

UNIT II Linux scripting   15 Hours

The Bourne Again Shell (bash), background of scripting Writing Simple Shell Scripts, Executing and debugging shell scripts Understanding shell variables , Special shell positional parameters ,Reading in parameters ,Parameter expansion in bash ,Performing arithmetic in shell scripts ,Using programming constructs in shell scripts ,The "if . . . then" statements ,The case command ,The "for . . . do" loop ,The "while . . . do" and "until . . . do" loops, Trying some useful text manipulation programs ,The general regular expression parser ,Remove sections of lines of text (cut) ,Translate or delete characters (tr) The stream editor (sed) ,Using simple shell scripts ,setting up CRON job, Backup script **.**

UNIT III Linux Networking   and Linux advanced administration   15 Hours

Network Administration Ubuntu and Centos (Configure DNS,DHCP, routes, work   with network interface and network files, Linux Administration (Starting and stopping services, understand working with logs, working with LVM , Software package management like apt-get on Ubuntu and yum for centos. Monitoring (understanding and working logs, centralizing the logs)

UNIT IV Linux troubleshooting and security   15Hours

Security (understand basic security in Linux, securing user accounts, securing passwords, securing the file system, monitoring user accounts and file system, introduction to   implementing Linux security with cryptography , Enhanced Linux security, securing Linux on   network   . Troubleshooting (Bios setup troubleshooting, troubleshooting init process, rescue mode and troubleshooting memory issues. Managing Processes (listing processes, background foreground process, killing processes, introduction PID Namespaces)

Text Books:

1. Your Unix the ultimate Guide by Sumitabha Das

2. Linux Bible, 8th Edition Christopher Negus, Christine Bresnahan (Contributions by) ISBN: 978-1-118-21854-9
3. Practical Guide to Ubuntu Linux ,A, 4/E by Mark G. Sobell

B19BS2040	RELATIONAL DATABASE MANAGEMENT SYSTEMS	L	T	P	C
Total Hours: 60		3	0	1	4

COURSE OBJECTIVES:

- To introduce the basic concepts in Database Systems and Relational Databases.

- To expose the students to the steps in building E-R Diagrams and Normalization.

- To train the students in the practical skills using Oracle9i software to develop and alter tables.

- To equip the students with skills 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.

COURSE OUTCOMES:

- Students will understand all basic terminologies in Database Systems and Relational Databases.
- Students will be skilled in building E-R Diagrams and performing Normalization.

- Students will be trained to use Oracle9i software to develop and alter tables, and to manipulate tables using updation, deletion and arithmetic operations.

- Students will have a basic understanding to group data using built-in functions and join multiple tables.

COURSE CONTENT:

UNIT I Introduction   15 Hours

Database System Applications – Purpose of Database Systems – View of Data – Database Languages – Relational Databases – Databases Design – Data Storage and Querying – Transaction Management – Database Architecture – Database Users and Administrator.Relational Model: Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Operations.

UNIT II Database Design   15 Hours

Overview – Entity-Relationship Model – Constraints – Removing Redundant Attributes – E-R Diagrams – Reduction to Relational Schemas – E-R Design Issues – Extended E-R Features. Relational Database Design: Features of Good Relational Designs – Atomic Domains and First Normal Form – Decomposition using Functional Dependencies – Functional-Dependency Theory– Algorithms for Decomposition – Decomposition using Multivalued Dependencies – More Normal Forms.

UNIT III Oracle9i   **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 IV Working w i t h Table   **15 Hours**

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.

Text Books:

1. Database System Concepts – Abraham Silberschatz, Henry F. Korth and S. Sudarshan, 6th

   Edition, McGraw-Hill. (Units 1 and 2)

2. Database Systems Using Oracle – Nilesh Shah, 2nd edition, PHI. (Units 3 and 4)

Reference Books:

1. Database Management Systems – ArunMajumdar&Pritimoy Bhattacharya, 2007, TMH.

2. Database Management Systems – Gerald V. Post, 3rd edition, TMH.

RDBMS LAB

Practical List - 1

1. Create the following Tables and Insert the below data.

Salesmen

SNUM	SNAME	CITY	COMMISSION
1001	Piyush	London	12 %
1002	Sejal	Surat	13 %
1004	Miti	London	11 %
1007	Rajesh	Baroda	15 %

1003   Anand   New Delhi   10 %

SNUM   : A unique number assigned to each salesman. SNAME   :   The   name   of salesman.

CITY   : The location of salesmen.

COMMISSION: The Salemen's commission on orders.

Customers

CNUM	CNAME	CITY	RATING	SNUM
2001	Harsh	London	100	1001
2002	Gita	Rome	200	1003
2003	Lalit	Surat	200	1002
2004	Govind	Bombay	300	1002
2006	Chirag	London	100	1001
2008	Chinmay	Surat	300	1007
2007	Pratik	Rome	100	1004

CNUM : A unique number assigned to each customer.
CNAME : The name of the customer.
CITY   : The location of the customer.

RATING : A level of preference indicator given to this customer. SNUM : The number of salesman assigned to this customer.
Orders

ONUM	AMOUNT	ODATE	CNUM	SNUM

3001	18.69	10/03/97	2008	1007
3003	767.19	10/03/97	2001	1001
3002	1900.10	10/03/97	2007	1004
3005	5160.45	10/03/97	2003	1002
3006	1098.16	10/03/97	2008	1007
3009	1713.23	10/04/97	2002	1003
3007	75.75	10/04/97	2004	1002
3008	4723.00	10/05/97	2006	1001
3010	1309.95	10/06/97	2004	1002
3011	9891.88	10/06/97	2006	1001

ONUM : A unique number assigned to each order.
AMOUNT : The amount of an order.

ODATE : The date of an order.

CNUM : The number of customer making the order.
SNUM : The number of salesman credited with the sale.

Practical List - 2

1)Alter salesman table by setting snum as primary key.
2)Alter customer table by setting cnum as primary key.
3)Alter orders table by setting onum as primary key.
4)Alter orders table by adding snum and cnum as foreign keys
5)Alter customer table by adding snum as foreign keys
6) Insert any five records in customers table.

7) Update the name of the customer in the customers table from Lalit to Girish
8)Remove all orders from customer Chirag from the orders table.

Practical List - 3

1. Produce the order no, amount and date of all orders.

2. Give all the information about all the customers with salesman number 1001.

3. Display the following information in the order of city, sname,snum and commission.

4. List of rating followed by the name of each customer in Surat.

5. List of all orders for more than Rs. 1000.

6. List all customers whose names begins with letter 'A' to 'G'.

7. List of names and cities of all salesmen in London with commission above 10%.

8. List all customers excluding those with rating <= 100 unless they are located in Rome.

9. List all orders for more than Rs.1000 except the orders of snum<1006 of 10/03/97.

10. List all orders with zero or NULL amount.

Practical List - 4

1) Display cnum, cname, city from customer details table.
2) Display all snum without duplicates from all orders.
3) Display names and commissions of all salespeople in london.
4) All customers who were either located in Rome or had a rating above 200.
5) All customers with NULL values in city column.
6) All orders taken on Oct 3Rd and Oct 4th 1997.
7) Largest order taken by each salesperson with order value more than $3000.
8) Select each customer's smal est order.
9) Count the number of salespeople currently listing orders in the order table.
10) All customers serviced by Piyush or Miti.

Practical List - 5

Solve the following using PL/SQL Block.

1) Reverse of a Number
2) Factorial of a number
3) Write a PL/SQL to update the rate field by 20% more than the current rate in inventory table which has the following fields: Prono, ProName and Rate. After updating the table a new field (Alter) called for Number of item and place for values for the new field without using PL/SQL block.

4) Write a PL/SQL to split the student table into two tables based on result (One table for ―Pass‖ and another for ―Fail‖). Use cursor for handling records of student table. Assume necessary fields and create a student details table.

B19BS2050	DATA STRUCTURES USING C	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- Assess how the choice of data structures and algorithm design methods.

- Choose the appropriate data structure and algorithm design method for a specified application.
- Write programs using function-oriented design principles.

- Solve problems using data structures such as linear lists, stacks, queues, binary trees, heaps, binary search trees, and graphs and writing programs for these solutions.

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 their knowledge of data structures in writing more efficient programs in a programming language,
- Understands the importance of Data structures.

- Develop Applications using Linear and Non-Linear Data Structures.

COURSE CONTENT:

UNIT I Basics of Data Structures   15 Hours

Data Structures, Classifications (Primitive & Non Primitive), Data structure Operations, Review of Arrays-Inserting and deleting operations, String operations, Structures, Unions, Pointers and Dynamic Memory Allocation Functions.

UNIT II Linear Data Structures   15 Hours

Stack: Definition, Array representation, Linked list representation, Operations, Recursion, Towers of Hanoi, Applications of stack (Infix to postfix conversion, evaluation of expression). Queue:Definition, Array representation, Linked list representation, Operations, Applications; Types of queues: Simple queue, Circular queue, Double ended queue, Priority queue.

UNIT III Linked List   15 Hours

Definition, Singly linked list: Representation in memory, Traversing, Insertion, Deletion and Searching; Memory allocation; Garbage collection; Doubly linked list; Header linked list; Circular linked list. Searching: Linear and Binary

Search. Sorting: Insertion, Selection, Bubble, Quick, Merge. Hashing: Hash Table organizations, Hashing Functions, Static and Dynamic Hashing.

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, 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. – (Chapter 1to 11)
2. YedidyahLangsam and Moshe J. Augenstein and Aaron   M Tenanbanum, "Data Structures Uisng C and C++", 2nd Edition, Pearson Education Asia, 2002. – (Chapter 1 to 8)

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. Horowitz, Ellis, Sahni, Sartaj, Anderson-Freed, Susan (2008), Fundamentals of Data Structure in C, 2nd Edition, University Press, India.
3. Mark Al en Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education.
4. Balaguruswamy, "Data Structures using C", McGraw Hil Edition India Pvt. Ltd, 2013.

B19BS2060	CONSTITUTION OF INDIA & PROFESSIONAL ETHICS	L	T	P	C
Total Hours: 60		2	0	0	2

COURSE OBJECTIVES:

- To know and understand about the Fundamental Rights, Duties and other Rights which is been given by our law.

- To provide and gain knowledge
- To prepare students in the practicality of Constitution perspective and make them face the world as abona fide citizen.
- To attain knowledge about ethics and also know about professional ethics.

- To explore ethical standards followed by different companies.

COURSE OUTCOMES :

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

- Strengthen the knowledge on Indian constitutional law and make the practical implementation of it.

- Understand the fundamental rights and human rights.

- Get the knowledge to explain the duties and more importantly practice it in a right way.

- Adopt the habit of raising their voice against a non-constitutionality of any laws and upon any legal discrimination as we have session of debates on Constitutional validity.

- Get exposed about professional ethics and know about etiquettes about it.

- Know about ethical standards of different companies which will increase their professional ability.

COURSE CONTENT:

UNIT I Constitution of India   12 Hours

Definition, Making of Indian Constitution, Preamble to the Constitution of India, Fundamental Rights under Part III; Rights to Equality, Right to Freedom, Right against Exploitation, Rights to Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies. Fundamental Duties of the Citizen, Significance and Characteristics. Elements of National Significance; National Flag, National Anthem, National Emblem**.**

UNIT II Union and State   10 Hours

Organs of the Government; Legislature, Executive and Judiciary .Union and State Executives: President Vice President, Prime Minister, Supreme Court, Cabinet, Governor, Council of Ministers, Electoral process, Election Commission. Right to Information (RTI), Consumer and Consumer Protection.

UNIT III Ethics   12 Hours

Meaning, Definition, Evolution, Need of ethics, Aristotle an Ethics, Utilitarianism, Kantianism, Professional ,Ethics, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees.

UNIT IV Engineering Ethic   10 Hours

Definition Scope and needs, Ethics in Consumer Protection, Due Care theory, Environmental Ethics, Ethical Code of Conduct in ethics. Best Ethical Companies in India and Abroad; Corporate Social Responsibilities, Code of Conduct and Ethical Excellence.

Text book:

1. M V Pylee, An introduction to Constitution of India.

B19BS2070		L	T	P	C
	DATA STRUCTURES LAB	0	0	2	2
Total Hours:30					

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COURSE CONTENT:

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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 operations

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, **PhNo**

    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.

PART – B

1. Programs may be decided by External and Internal examiners.

B19BS2080		L	T	P	C
Total Hours:30	**ADVANCED LINUX LAB**	0	0	2	2

COURSE CONTENT:

1. Configure web server security for access over https

2. Configure ftp server

3. Configure samba server

4. Write a workable scripts to install web server

5. Write scripts to install MySQL- database server

6. Write scripts to check if ,if else based parameters

7. Setup cron job

8. Work with system logs and service logs

9. Manage system processes

10. Troubleshooting issues with memory and init process

THIRD SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Value Pattern			Credit	Working Hrs.
				L	T	P		
1	B19BS3010	Cloud Computing Architecture and Design	HC	2	1	0	3	4
2	B19BS3020	Analysis and Design of Algorithms	HC	4	0	0	4	4
3	B19BS3030	Computer Networks	HC	4	0	0	4	4
4	B19BS3040	Data mining & Data warehousing	HC	4	0	0	4	4
5	B19BS3050	Python Foundation	HC	2	1	0	3	4
6	B19BS3061	Advanced Virtualization Concepts	SC	2	1	0	3	4
	B19BS3062	Linear Algebra						
	B19BS3063	E-Commerce						
7	B19BS3070	Soft skills	RULO	2	0	0	2	2
Practical Courses								
8	B19BS3080	Cloud Computing Architecture and Design Lab	HC	0	0	2	2	4
9	B19BS3090	Python Foundation Lab	HC	0	0	2	2	4
Total Credits				**20**	**3**	**4**	**27**	**34**

B19BS3010	CLOUD COMPUTING ARCHITECTURE AND DESIGN	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- Get understanding of Cloud Data center Infrastructure framework
- Understand components which help achieve cloud infrastructure

COURSE OUTCOMES:

- Compare the strengths and limitations of cloud computing
- Identify the architecture, infrastructure and delivery models of cloud computing
- Apply suitable virtualization concept.
- Choose the appropriate cloud player, Programming Models and approach.
- Address the core issues of cloud computing such as security, privacy and interoperability
- Design Cloud Services and Set a private cloud.

COURSE CONTENT:

UNIT I Cloud computing architecture and design: **15 Hours**

Virtual data center concepts, Cloud data center concepts, cloud data center building blocks , like cloud virtualization, cloud networking, cloud storage ,cloud databases , Cloud self-service portal . Cloud management software introduction – Openstack, Cloudstack, Microsoft system center, VMware cloud management software.

UNIT II Hybrid cloud architecture   **15 Hours**

Introduction to hybrid cloud architecture, on premise to public cloud (hybrid architecture) AWS and Google cloud (hybrid architecture) , Connecting multi clouds, Multi cloud management concepts (discuss software like manage IQ) , Disaster recovery and backup in Public clouds with region and across region .

UNIT III Docker   **15 Hours**

Docker concepts, docker and virtualization differences, docker hub, docker networking, docker volume, docker image, docker compose, docker swarm , docker enterprise edition

UNIT IV Security, SLA Management and Disaster recovery planning: **15 Hours**

Data in cloud, and how much security is required, responsibilities of each service models, security strategies, areas of focus on security, define SLA's and factors that impact SLA, Disaster recovery approach for your cloud, disaster recovery strategies for IaaS, PaaS, SaaS and hybrid clouds , case study

Text Books:

1. Cloud Computing: Concepts, Technology & Architecture (The Prentice Hall Service Technology Series from Thomas Erl) Hardcover – May 20, 2013 ,by Thomas Erl (Author)
2. Architecting the Cloud: Design Decisions for Cloud Computing Service Models (SaaS, PaaS, and IaaS) Hardcover – January 28, 2014 by Michael J. Kavis (Author)
3. Mastering Citrix® XenServer® by Martez Reed
4. VMware vsphere 5.5 or above official documentation

B19BS3020	ANALYSIS AND DESIGN OF ALGORITHMS	L	T	P	C
Total Hours: 60		4	0	0	4

COURSE OBJECTIVES:

- Analyze the asymptotic performance, prove the correctness and to analyze the running time of the basic
- Algorithms.
- To design algorithms using the dynamic programming; greedy method and recite algorithms that employ this
- Strategy.
- Demonstrate Tree and graph traversal techniques.
- Evaluation of Backtracking algorithms.

COURSE OUTCOMES:

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

- Analyse the fundamental principles underlying algorithm analysis and design and be able to apply them in   specific instances
- Validate algorithms asymptotically and compute the performance analysis of algorithms with the same functionality.
- Design an efficient algorithm for a problem using a specified paradigm along with a proper data structure.
- Realise essential algorithm design techniques such as divide-and conquer, dynamic programming and the greedy methods and many of its applications
- Implement various algorithms on graph data structures, including finding the minimum spanning tree and shortest path.

UNIT I Introduction and Divide & Conquer Technique   15 Hours

Definition of algorithm, Characteristics of algorithm, Important problem types, Fundamentals of Algorithmic Problem Solving using flow chart, Different methods to find the GCD of two integers, Order of Growth, Basic efficiency classes, Asymptotic Notations, Time and space complexity of an algorithms.

Divide and Conquer: General Method, Binary Search, Merge Sort and Quick Sort.

UNIT II Greedy Method   15 Hours

General method, Fractional Knapsack Problem, Job Sequencing with deadline, Spanning trees, Minimum cost spanning trees: Prim's algorithm, Kruskal's Algorithm, Single Source Shortest Paths problems-Dijkstra's algorithm

UNIT III Dynamic Programming   15Hours

Introduction to Graphs, Types of graphs, Representation of graphs, Terms related to graph, General Method, Multistage Graphs, Warshall's Algorithm for Transitive Closure, All pair Shortest Paths, 0/1–knapsack, Flow Shop Scheduling.

UNIT IV Basic Traversal & Search techniques: 15Hours

Traversal techniques for Trees: Binary Tree, Properties of Binary Tree, Types of Binary Tree, And And Binary Tree Traversal Techniques: Pre-order traversal, In-order traversal and post-order traversal. Search techniques for graphs: Breadth First Search (BFS), Depth First Search (DFS). **Backtracking:** General method, 4-Queens Problem, Sum of Subset Problem, Graph Coloring, Hamiltonian Circuit Problem.

Text Books:

1. SaraBaase, Allen Van Gelder, Computer Algorithms, Introduction to design and Analysis, 3^{rd}edition Pearson Publication, 2006 (Chapters 4, 5, 7, 8 and 9).
2. Horowitz E., Sahani S., Rajasekharan S, "Fundamentals of Computer Algorithms", Galgotia Publication 2005(Chapters 1, 3- 6 and 7).
3. Fundamentals of Computer algorithm – Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran., 2005 (Chapters 1, 3, 4, 5, 6 and 7).

Reference Books:

1. A. M Padma Reddy, "Design and Analysis of Algorithms", Sri nandi Publications, 2017(Chapters 1-9).
2. Srikanth S, ""Design and Analysis of Algorithms", Skyward Publishers, 2015 (Chapter 1-8).
3. Chitra Ravi, "Design and Analysis of Algorithms", Subhas Publishers, 2015 (Chapter 1-8).

B19BS3030	COMPUTER NETWORKS	L	T	P	C
Total Hours: 60		4	0	0	4

After successful completion of this course students will be able to

- Identify the different components and their respective roles in a communication System
- Design an enterprise network employing the common LAN technologies and be able to evaluate the advantages and disadvantages
- Describe the importance and functions of the OSI layers Physical, data link, network and transport layer

COURSE OUTCOMES:

- To master the fundamentals of data communications and networks by gaining knowledge of data transmission concepts.
- Understanding the operation of physical and data link layer.
- Learning the algorithms used to design data networks.
- Understanding the principles of transport and application layers.

COURSE CONTENT:

UNIT I Introduction   **15 Hours**

Uses of computer networks, Network Hardware, Network Software, Reference Models, Network Standardization. The Physical Layer: Guided Transmission Media, Wireless Transmission, and Digital modulation and multiplexing, Switching: Circuit switching, packet switching. Mobile telephone system.

UNIT II The Data Link Layer   **15 Hours**

Data link layer design issues, Error Detection and Correction, Sliding window protocol, Example Data link protocols. MAC sub layer: channel allocation problem, Multiple Access Protocols, Ethernet, Wireless LANs, data link layer switching,

UNIT III The Network Layer   **15 Hours**

Network layer design issues, Routing algorithms, Congestion control algorithms, Quality of Service, The network layer in the internet.

UNIT IV Transport Layer   **15 Hours**

Elements of Transport protocols, UDP, TCP, Performance issues. **Application Layer:** Domain Name system, Electronic Mail, WWW.

Text Book:

1. Andrew S Tanenbaim, David J Wetherall "Computer Networks", Pearson Education, 5th Edition,

Elsevier Inc, 2014. Chapter-1, 2, 3, 4, 5, 6, 7

Reference Books:

1. Data Communications and computer Network, Prakash C Guptha, Second Edition,   PHI learning Pvt Ltd, Nov 2014.
2. "Introduction to Data Communication & Networking" BehrouzFerouzan, 5th Edition, Mc Graw Hill Education Pvt Ltd 2013
3. Larry &Peterson & Bruce S Davis; Computer networks-A System Approach, 5th Edition, Elsevier Inc, 2014.

B19BS3040	DATA MINING &DATA WAREHOUSING	L	T	P	C
Total Hours: 60		4	0	0	4

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,

- Discover and measure interesting patterns from different kinds of databases.
- Evolve Multidimensional Intelligent model from typical system.
- Discover the knowledge imbibed in the high dimensional system.
- Evaluate various mining techniques on complex data objects

COURSE CONTENT:

UNIT I   **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   **15 Hours**

Classification: Introduction – Issues in Classification - Statistical – based algorithms - Distance – based algorithms – Decision tree - based algorithms. **Clustering:** Introduction – 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.

UNIT III   15 Hours

Association rules: Introduction - Large item sets - Basic algorithms: Apriori algorithm – Sampling Algorithm – Partitioning - 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   15 Hours

Data Warehouse 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 modelling:** 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. Pang-Ning Tan, Michael Steinbach, Vipin Kumar: Introduction to Data Mining, Addison Wesley, 2005.
2. G. K. Gupta: Introduction to Data Mining with Case Studies, 3rd Edition, PHI, New Delhi, 2009.

Reference Books:
1. Data Mining and Data Warehousing, Bharat Bhushan Agarwal, SumitPrakahsTayal, University Science Press, First Edition 2009, New Delhi.
2. Alex Berson and Stephen J. Smith: Data Warehousing, Data Mining, and OLAP Computing McGrawHill Publisher, 1997.
3. Arun K Pujari: Data Mining Techniques University Press, 2nd Edition, 2009.

B19BS3050	PYTHON FOUNDATION	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- To Define the implementation of python language
- To Identify various features in python
- To solve the given problem using the syntactical structures of python language.

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Ability to write programs using ruby and python

- Develop simple web application using python and Ruby and connect to database to store student information
- Understand how to connect python with backend database

COURSE CONTENT:

UNIT I Introduction to Python   15 Hours

Introduction of python, origin, Programming Basics and Strings, Numbers and Operators, Variables Names for Values, Program Files, Directories ,Changing Data Through Names**,** Copying Data**,** Accessing a Tuple Through Another Tuple

UNIT II Decision making in Python   15 Hours

Making Decisions: Comparing Values for Sameness, Comparing Values for Difference, More Than or Equal, Less Than or Equal**,** Reversing True and False, Repetition, Handling Errors

UNIT III Functions in Python   15 Hours

Functions: Grouping Code under a Name, Describing a Function in the Function**,** Layers of Functions

UNIT IV Classes and Objects in Python   15 Hours

Classes and Objects: What is an Object, Defining a Class, Creating an Object from the Class, Objects and their Scope, Inheritance, Overriding a method, Writing simple programs using classes and objects in Python.

Text Books:

1. Introducing Python by Bill Lubanovic(chapters 1-6), Oriely Publications, 1st Edition
2. Python Programming for absolute beginners by Michael Dawson, Course Technology-A part of CENGAGE Learning, 3rd Edition

B19BS3061	ADVANCED VIRTUALIZATION CONCEPTS	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

The objective of this course is to:

- Get understanding of Advanced virtualization concepts
- Hands-on knowledge on advanced virtualization

COURSE OUTCOMES:

- Get understanding of advanced virtualization
- Hands-on lab on advanced virtualization on kvm clustering
- Hands-on knowledge on thin hypervisor (docker)
- Hands-on on knowledge on container orchestration

COURSE CONTENT:

UNIT I Advanced virtualization concepts: **15 Hours**

Virtualization clustering techniques, (hyperv- clustering, Xen clustering, VMware esxi clustering and KVM clustering), Shared storage virtualization clustering technologies (NFS, CIFS and SAN) ,   OS-level virtualization and para -virtualization concepts

UNIT II Windows containers (virtual containers to run apps) :   **15 Hours**

Introduction to Docker on windows, docker volume for windows containers, docker networking for windows containers, docker images for windows containers, widnwos container operations, docker compose .

UNIT III Container Orchestration: **15 Hours**

Introduction to container orchestration, Orchestration tools concepts Kuberentes, kubernetes architecture, kubernetes master components introduction, Kubernetes Minnion node components and role of each component in kubernetes architecture. Setup a kubernetes cluster of one master and one minion node . Deploy PODS, replication controller, replication sets, deployment, persistent volumes, persistent volume claims, load balancer, auto scaling of PODS , and rolling updates of deployment

UNIT IV Container Orchestration advanced: **15 Hours**

Introduction to   Terraform and helm. Terraform architecture, terraform providers, install terraform client , terraform with kubernetes integration, write terraform templates , deploy application containers on kubernetes using terraform code . Helm architecture, tiller server , install helm client , Helm with kubernetes integration, deploy application containers on kubernetes using helm code

Lab Experiment:

1. Install and configure docker on windows 2016 and above
2. Perform widnows Container operations (deploy, login, stop, start and delete)
3. Windows container volume, create, attach and delete
4. Windows container docker image, create and push to docker hub
5. Windows Docker networking, create multiple networks
6. Deploy 4 virtual machines running centos7 OS
7. SSH to to VM1 and configure it Kubernetes master node
8. SSH to to VM2 and configure it Kubernetes Minion node-01
9. Write pod.yaml and create Kuberentes POD – create and manage PODS
10. Write deployment.yaml and create Kuberentes deployment – create and manage deployments
11. Write replica.yaml and create Kuberentes replica and service
12. Deploy micro service with volume service for persistent data
13. Kubectl cli
14. POD Autoscaling
15. Rolling Updates
16. POD CPU and Memory reservation
17. Bring down complete cluster and recover back
18. Deploy kubernetes cluster on GKE
19. Connect to cluster
20. Deploy micro service and expose to google load balancer and access from internet

B19BS3062		L	T	P	C
	LINEAR ALGEBRA				
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

This course will:

- Recall basic concepts of matrices and matrix algebra
- Present methods of solving systems of linear equations
- Demonstrate basic concepts of vector spaces
- Interpret the concepts of linear transformations by using the matrices

COURSE OUTCOMES:

Develop methods of computing and using eigen values and eigenvectors

Students in this course will able to:

- Solve the system of Linear Equations by using Matrix Algebra
- Derive the Norms and Inner Product Spaces
- Summarize the vector space properties.
- Analyze different forms of the Linear Transformations.

COURSE CONTENT:

UNIT I   15 Hours

Vector Spaces, Subspaces, Linear Combinations and Systems of Linear Equations, Linear Dependence and Linear Independence, Bases and Dimension, Maximal Linearly Independent Subsets; Linear Transformations, Null Spaces, and Ranges, The Matrix Representation of a Linear Transformation, Composition of Linear Transformations, and Matrix Multiplication, Invertibility and Isomorphisms, The Change of Coordinate Matrix, The Dual Space; Elementary Matrix Operations and Elementary Matrices, The Rank of a Matrix and Matrix Inverses, Systems of Linear Equations.

UNIT II   15 Hours

Properties of Determinants, Cofactor Expansions, Elementary Operations and Cramer's Rule; Eigenvalues and Eigenvectors, Diagonalizability, Invariant Subspaces and the Cayley-Hamilton Theorem; Inner Products and Norms, (No theorem proof).

UNIT III   15 Hours

The Adjoint of a Linear Operator, Normal and Self-Adjoint Operators, Unitary and Orthogonal Operators and Their Matrices, Orthogonal Projections and the Spectral Theorem; Bilinear and Quadratic Forms (No theorem proof).

UNIT IV   15 Hours

The Diagonal form, The Triangular form; The Jordan Canonical Form; The Minimal Polynomial; The Rational Canonical Form (No theorem proof).

Reference Books:

1. S. Friedberg, A. Insel, and L. Spence - Linear Algebra, Fourth Edition, PHI, 2009.
2. Jimmie Gilbert and Linda Gilbert – Linear Algebra and Matrix Theory, Academic Press, An imprint of Elsevier.
3. I. N. Herstein – Topics in Algebra, Vikas Publishing House, New Delhi.
4. Hoffman and Kunze – Linear Algebra, Prentice-Hall of India, 1978, 2nd Ed.,
5. P. R. Halmos – Finite Dimensional Vector Space, D. Van Nostrand, 1958.
6. S. Kumeresan – Linear Algebra, A Geometric approach, Prentice Hall India, 2000.

B19BS3063	E-COMMERCE	L	T	P	C
Total Hours: 60		2	1	0	3

The objectives of the course are:

- To introduce the concept of electronic commerce, and to understand how electronic commerce is affecting business enterprises, governments, consumers and people in general. In addition, we will study the development of websites using relevant software tools.
- Acquaint students with a fundamental understanding of the environment and strategies in the New Economy.
- Provide analytical tools to understand opportunities in unserved or underserved New Economy markets.
- Provide a fundamental understanding of the different types and key components on business models in the New Economy.
- Provide guiding principles behind the design and strategy of the customer web interface.
  Provide insights on how to implement strategy in the New Economy.

COURSE OUTCOMES:

Gain Knowledge on:

- The basic concepts and technologies used in the field of E-Commerce.
- E-Payment systems.
- Inter Organizational and Intra Organizational E-Commerce.
- Advertising and Marketing on Internet.
- Apply compression and decompression techniques and codec required for Video Conferencing
- Follow ethics in the usage of Smart Card and Digital Token.
- Understand and analyze the difference between functional testing and structural testing.
- Analyze the performance of fault based testing, planning and Monitoring the process

COURSE CONTENT:

UNIT I Introduction   **15 Hours**

Electronic Commerce and physical commerce, The DIGITAL phenomenon, Different types of Ecommerce, examples, E-Commerce scenarios, Advantages of E-Commerce, Myths about E-commerce. **Technologies (Fundamentals):** Internet and WWW, web system architecture, URL, An overview of the internet, overview of HTTP, HTTP.TB 1: Chapter – 01 & 02

UNIT II Internet payment systems   **15 Hours**

Characteristics of payment systems, 4C payment methods, SET protocol for credit card payment, E –Cash, E-Check, Micropayment system, Overview of smart card, MONDEX.**Consumer oriented E-Commerce:**

Traditional retailing and e-retailing, Benefits of e-retailing, Key success factors, Models of e-retailing, Features of e-retailing.TB 1: Chapter – 10 & 11.

UNIT III Business oriented E- Commerce   **15 Hours**

Features of B2B e-commerce, Business models, Integration-**Services:** Categories of e-services, Web-enables services, Matchmaking services, TB 1: Chapter – 12 & 13.

UNIT IV Web advertising and web publishing   **15 Hours**

Traditional versus internet advertising, Internet advertising techniques and strategies, Business models for advertising and their revenue streams, Pricing model and measurement of the effectiveness of advertisements, Web publishing-goals and criteria, web site development methodologies, logical design of the user interface I-abstract user interface object, logical design of the user interface-II flow of interaction, Usability testing and quality assurance, Web presence and visibility.TB 1: Chapter – 14.

Text Books:

1. 'E-Commerce, fundamentals and Applications' by Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang, WILEY Edition.

Reference Books:

1. Ravi Kalakota, Andrew B. Whinston, Frontiers of Electronic Commerce, Pearson Education, 2009.
2. S.Jaiswal, E-Commerce, Galgotia, revised edition, 2008.

B19BS3070	SOFT SKILLS	L	T	P	C
Total Hours:30		2	0	0	2

B19BS3080	CLOUD COMPUTING ARCHITECTURE AND DESIGN LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. ESXi Hypervisor – Installation and Configure
2. vCenter – Installation and Configure
3. Virtual Machine (Linux) – Create and Manage on ESXi
4. Virtual Machine (Windows) – Create and Manage on ESXi
5. Configure Cluster and High Availability of VMware Esxi server
6. Xen Server – Installation and Configure
7. Xen Center – Installation and Configure
8. Virtual Machine (Linux) – Create and Manage on Xen server
9. Virtual Machine (Windows) – Create and Manage on Xen Server
10. Configure Cluster and High Availability on Xen Server

B19BS3080	PYTHON FUNDATION LAB	L	T	P	C
Total Hours:30		0	0	2	2

- Lab 01: Write a Python program to establish DB connection &Accept queries from user & execute it & return the result.

- Lab 02: Write a Python program which accepts the radius of a circle from the user and compute the area

- Lab 03: Define a class Person and its two child classes: Male and Female. All classes have a method "getGender" which can print "Male" for Male class and "Female" for Female class.

- Lab 04: Define a function that can accept an integer number as input and print the "It is an even number" if the number is even, otherwise print "It is an odd number".

- Lab 05: A website requires the users to input username and password to register. Write a program to check the validity of password input by users.
  Following are the criteria for checking the password:

  1. At least 1 letter between [a-z]

  2. At least 1 number between [0-9]

  1. At least 1 letter between [A-Z]

  3. At least 1 character from [$#@]

  4. Minimum length of transaction password: 6

  5. Maximum length of transaction password: 12

  Your program should accept a sequence of comma separated passwords and will check them according to the above criteria. Passwords that match the criteria are to be printed, each separated by a comma.

  Example

  If the following passwords are given as input to the program:

  ABd1234@1, aF1#, 2w3E*, 2We3345

  Then, the output of the program should be:

  ABd1234@1

- Lab 06: Write a program that computes the net amount of a bank account based a transaction log from console input. The transaction log format is shown as following:

  D 100

  W 200

  D means deposit while W means withdrawal.

  Suppose the following input is supplied to the program:

  D 300

  D 300

  W 200

  D 100

  Then, the output should be:500

FOURTH SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Value			Credit	Working Hrs.
				L	T	P		
1	B19BS4010	Public Cloud – AWS,AZURE and GOOGLE	HC	2	1	0	3	4
2	B19BS4020	Software Engineering	HC	4	0	0	4	4
3	B19BS4030	Automation Tools For Cloud Deployment	HC	3	0	1	4	5
4	B19BS4040	Cloud Developer tools and Ecosystem	HC	2	1	0	3	4
5	B19BS4051	Advanced Computer Networks	SC	2	1	0	3	4
	B19BS4052	Cyber Physical systems						
	B19BS4053	The Internet Of things						
6	B19BS4061	Programming with Ruby & Golang	SC	2	0	1	3	4
	B19BS4062	Introduction to Web Programming						
	B19BS4063	Java Programming						
7	B19BS4070	Mooc/Swayam	RULO	2	0	0	2	2
8	B19BS4080	Soft Skills		2	0	0	2	2
Practical Courses								
9	B19BS4090	Public Cloud – AWS,AZURE and GOOGLE Lab	HC	0	0	2	2	4
10	B19BS4100	Cloud Developer tools and Ecosystem lab	HC	0	0	2	2	4
		Total Credits		19	3	6	28	37

B19BS4010	PUBLIC CLOUD –AWS,AZURE AND GOOGLE	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

- Hands on knowledge on Amazon cloud

- Hands on knowledge on Azure cloud

- Hands-on knowledge on Google cloud

COURSE OUTCOMES:

- Ability to deploy a customer's complete web infrastructure with end to end to design with auto scaling mode, load balancer and public DNS on Amazon cloud and azure cloud
- Ability to provision cloud storage, Cloud database services, deploying web application and connecting to database service securely
- Ability to control access and roles to the cloud for a customer account
- Able to configure virtual private cloud in Amazon cloud
- Ability to provision and manage customer web infrastructure and manage on AWS and azure cloud.

COURSE CONTENT:

UNIT I Microsoft Azure Cloud Foundation   **15 Hours**
Azure overview, choosing a subscription, exploring the portal, examining Azure services like compute services, Data Services, App services, network services, Designing a system for Azure with case study, Interacting with Azure windows and Linux virtual machines, attaching and detaching cloud storage to Azure virtual machines.

UNIT II Microsoft Azure Cloud Intermediate   **15Hours**
Deploy, configure, monitor, and scale websites, Implement virtual machine workloads, images, disks, networking and storage, Configure, deploy, manage, and monitor cloud services, Implement blobs, Azure files, SQL databases, and recovery services, Manage access and configure diagnostics, monitoring, and analytic, Implement an Azure Active Directory and integrate apps, Configure and modify virtual networks

NIT III Amazon Web Services Cloud   **15Hours**
Amazon Web Services overview, working with Amazon Simple Storage Service (S3), Elastic compute cloud: security groups, key pair, launch Linux and windows instances.

UNIT IV Amazon Cloud Intermediate   **15 Hours**

Amazon machine images modification, EC2 applications, Simple queue Service, SQS applications, Elastic Block Storage, Dynamo DB, AWS networking, AWS security ,RDS, beanstalk, code pipeline, code commit

Text Books:

1. Learning Windows Azure Paperback – October 16, 2014, **by Geoff Webber-Cross**
2. Implementing Microsoft Azure Infrastructure Solutions, By Michael Washam, Rick Rainey
3. Programming Amazon Web Services: S3, EC2, SQS, FPS, and SimpleDB Paperback ,**by James Murty**
4. AWS System Administration: Best Practices for Sysadmins in the Amazon Cloud Paperback – March 25, 2015 by Mike Ryan (Author)
5. Amazon Web Services For Dummies Paperback – September 10, 2013 **by Bernard Golden (Author)**

Reference Books:

1. Getting started with Amazon book series available on AWS Book references http://www.amazon.com/Getting-Started-AWS-Amazon-Services-ebook
2. Google Cloud Platform for Architects: Design and manage powerful cloud solutions Kindle Edition by Vitthal Srinivasan (Author), Janani Ravi (Author), Judy Raj (Author)

B19BS4020	SOFTWARE ENGINEERING	L	T	P	C
Total Hours: 60		4	0	0	4

COURSE OBJECTIVES:
- To classify the various Software Process Models.
- To analyze a given problem and identify requirements.
- To design a software using standard software engineering techniques.
- To apply well defined software testing strategies to produce quality software.

COURSE OUTCOMES:

After the completion of the course the student will be able to:

- Apply knowledge of software engineering to analyze and identify requirements.
- Design and manage the development of a computing-based system, component or process to meet desired needs within realistic constraints in one or more application domains.
- Function with multidisciplinary teams
- Perform software testing using well defined strategies to produce quality software.

UNIT I Introduction   15 Hours

The Nature of Software, Software Engineering, the Software Process, and Process Models: A Generic Process Model: Defining a Framework Activity, Identifying a Task Set. Process Assessment and Improvement, Perspective Process Models: The Waterfall Model, Incremental Process Model, Evolutionary Process Models. Agile Development: What is Agility? Agility and the Cost of Change, Agile Process: Agility Principles, Human Factors, Extreme Programming (XP), Other Agile Process Models: Adaptive Software Development (ASD), Scrum, Dynamic System Development Method(DSDM), Crystal, Feature Driven Development(FDD).

UNIT II Requirements Modeling   15 Hours

Understanding Requirements: SRS Template (Example Case Study) ,Developing Use Case, Requirements Modeling: Requirements Analysis, Scenario Based Methods, UML Models That Supplement the Use Case, Class-Based Methods, Behavior, Flow oriented models – DFD's,And Web/Mobile Apps.

UNIT III Design Concepts   15 Hours

Design Concepts: The Design Process, Design Concepts, The Design Model, User Interface Design: The Golden Rules, User Interface Design Patterns. WebApp Design: Design Goals, A design pyramid for web app, WebApp interface design.

UNIT IV Software Quality Assurance and Software Testing   15 Hours

Elements of Software Quality Assurance, SQA Tasks, Goals, and Metrics, Six Sigma for Software Engineering, Software Reliability. Software Testing: Humans and Errors, Bugs, Faults and Failures, Purpose of Software Testing, Testing Techniques, Types of Testing, Basic Concepts and definitions. Testing life Cycle, Software Testing Verification and Validation Techniques, Static Testing, Testing Tool: Introduction, Automation Testing Framework, Types of automation tools, Case Study, Test Planning.

Text book:
1. Roger S. Pressman – "SOFTWARE ENGINEERING, A Practitioner's approach", 7th Edition, McGRAW-HILL Publication, 2010. (UNIT I – IV) (Chapters: 1, 2, 3, 5, 6, 7, 8, 11, 13, 16)
2. SandeepDesai, Abhishek Srivastava–"SOFTWARE TESTING : A Practical Approach", 2nd Edition, PHI Learning Pvt Ltd, 2016 (UNIT IV –Software Testing) (Chapters: 1, 2, 3, 4, 6, 7)

Reference Books:

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

Example Case Study for SRS:

The railway reservation system functions as follows;

The passenger is required to fill in a reservation form giving detail of his journey. The counter clerk ensures whether the place is available. If so, entries arc made in i register, tickets are prepared, amount is computed and cash is accepted. A booking statement is prepared in triplicate format from the reservation register. One

copy of it is retained as office copy; the other is pasted on compartment and third is passed on to the train conductor. Besides booking statement, cash statement is prepared at the end of each shift. Prepare SRS and system specification for above system.

B19BS4030	AUTOMATION TOOLS FOR CLOUD DEPLOYMENT	L	T	P	C
Total Hours: 60		3	0	1	3

COURSE OBJECTIVES:

- Introduction to Chief Configuration Management Framework
- Introduction to Puppet configuration management framework
- Introduction to Ansible configuration management framework
- Hands on Knowledge on install and configure Chef and puppet

COURSE OUTCOMES:

- Ability to build chef ,ansible and puppet server infrastructure to manage nodes
- Ability to write infrastructure deployment code like cookbook(chef) , manifests (puppet)
- Bootstrap windows server,rhel,Ubuntu nodes and deploy web servers on them
- Able to automate package deployment on win and Linux nodes

COURSE CONTENT:

UNIT I Chef Automation tool   **15 Hours**

Introduction, The Chef Server, Installing and configuring the Chef Server, Install and configure chef workstation on windows and Linux, Bootstrap a windows 2016, red hat Linux and Ubuntu server, chef-solo. Modelling your chef infrastructure, integrating with the cloud, working with cookbooks, chef environments, advanced cook books

UNIT II Puppet Automation tools   **15 Hours**

Introduction to puppet architecture and components, deploy puppet server, deploy puppet nodes, Configure puppet master and agent nodes to communicate, write manifests to automation deployment of OS update, install software, start services, copy a file, create user and groups on the nodes via puppet master

UNIT III Ansible   foundation   **15Hours**

Introduction to ansible, ansible architecture and components, Deploy ansible master, register ansible master managed nodes windows, Centos and Ubuntu, write ansible playbooks to automation deployment of OS update, install software, start services, copy a file, create user and groups on the nodes via Ansible master on Windows node, centos node, and Ubuntu node

UNIT IV Ansible advanced   **15Hours**

 Introduction to ansible tower, Role based access on ansible tower, run playbooks via ansible tower, adhoc ansible commands , understanding handlers in ansible ,working with ansible variables, working with templates , error handling in playbook, use run once , working with ansible vault , working with cloud modules like aws, google cloud and azure cloud

Text Books:

1. Chef: Powerful Infrastructure Automation Paperback – Import, 16 May 2017 by John Ewart (Author), Matthias Marschall (Author), Earl Waud (Author)
2. Book on puppet : Learning Puppet Jussi Heinonen
3. https://www.packtpub.com/networking-and-servers/learning-puppet

HANDS ON LAB

1. Chef server- Install and configure
2. Install and configure Chef-Workstation on Ubuntu
3. Install and configure Chef-Workstation on Windows 7
4. Create and apply a cookbook for Ubuntu server ,centos7 and win 2016
5. Creating dependency cookbook
6. Install and configure puppet server and puppet nodes
7. Write manifest to automate deployment of web infrastructure on centos7, Ubuntu and windows 2016 server
8. Install and configure ansible master and ansible windows centos7 and Ubuntu nodes
9. Write playbooks for -
   o   User and group management
   o   Os updates and upgrades
   o   Install and uninstall software,
   o   Start and stop services
   o   Copy files to nodes
   o   Error handling,
   o   Working with variables
   o   Run once

Aws ec2 module to launch instance, stop and start

B19BS4040	CLOUD DEVELOPER TOOLS AND ECOSYSTEMS	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- The objective of this course is to:
- Describe Kubernetes and what it is used for
- Deploy single and multiple container applications on Kubernetes
- Use Kubernetes services to structure N-tier applications
- Manage application deployments with rollouts in Kubernetes
- Ensure container preconditions are met and keep containers healthy

COURSE OUTCOMES:

The student should know and understand:

- Enable the ability to use the same APIs for all your private and public data centers.
- Use Kubernetes as a tool to offer "container-as-a-service" capabilities to their teams.
- Automate many traditional operational tasks such as Load Balancing, High Availability, Resource utilization, etc.
- Empower both operational and development organizations to synchronize service delivery and common application outcomes.
- Use Kubernetes to support multi-tenancy and a multi-data center control place as an alpha feature.

COURSE CONTENT:

UNIT I Kubernetes Developer   15 Hours

Introduction to Kubernetes ,minikube setup your practice cluster, Kubernetes api primitives, creating pods, namespaces, configmaps ,security contexts, resource requirements, secrets, service accounts, Liveliness and readiness probes, container logging, metrics server, monitoring applications , debugging, Labels, selectors, annotations, rolling updates and rollback, jobs and cron jobs, services and network polices

UNIT II AWS Developer   15 Hours

AWS Global infrastructure, AWS shared security model, Identity and access management (STS and roles), Key management services, AWS inspector, Application load balancers, AWS lambda , Elastic container services, Elastic beanstalk,S3 operations (encryption, object versioning, lifecycle polices, static web hosting ,CORS, cloud front, DynamoDB, Relational Database services (RDS) , SNS and SQS,API Gateway , Cloud watch, Cloud formation

UNIT III Google Developer   **15 Hours**

Introduction to Google cloud developer Tools, Building and testing applications on Google cloud, Building a CI pipeline, Deploy apps on Compute engine, kubernetes engine and App engine, Cloud functions, Deployment Manager, Deploy app on kubernetes engine and connect to Google cloud SQL , Deploy app on kubernetes engine and connect to Data store /firestore, stack driver monitoring of your compute engine, application health check, Cloud source repositories

UNIT IV Open shift and Cloud foundry   **15 Hours**

Introduction to agile, CI/CD, Devops, and micro services. Pivotal cloud foundry introduction and components and architecture, cloud controller, Diego, logregator, routing, Build packs, droplets and container images, cloud foundry cli, orgs and spaces working on manifests, blue green deployment, push aps of different languages like ruby, java, python and ,node.js on cloud foundry , 12factor.net concepts, scaling your apps, logging and monitoring . Introduction to Open shift , origin, OKD , Install minishift, Open shift commands, deploy apps on Open shift and scale apps on Open shift .

Text Books:

1. Kubernetes developer : the Kubernetes for Application Developers eBook
2. Aws Certified Developer - Associate Guide Paperback – 2017 by Vipul Tankariya Bhavin Parmar (Author)
3. Google Cloud Platform for Developers by Ted Hunter, Steven Porter
4. Open shift EBook : https://www.openshift.com/resources/ebooks/openshift-for-developers
5. Cloud Foundry: The Definitive Guide: Develop, Deploy, and Scale 1st Edition, Kindle Edition by Duncan C. E. Winn (Author)

B19BS4051	**ADVANCED COMPUTER NETWORKS**	**L**	**T**	**P**	**C**
Total Hours: 60		**2**	**1**	**0**	**3**

<div style="background-color:green">**COURSE OBJECTIVES:**</div>

In this course students will be able to

- Identify and work on different routing protocols
- Propose knowledge of Internetworking
- Describe different types of routing mechanisms
- Describe the Transport layer protocols and its functionality.
- Understand motivation, parameters and Functions of Quality of service.

- To master the fundamentals of data communications and networks by gaining knowledge of data transmission concepts.
- Analyze the computer network with suitable network protocols and routing algorithms.
- Analyze different routing protocols and traffic engineering methods deployed in networking.
- Understand networking algorithms

COURSE CONTENT:

UNIT I Transmission Networks   15 Hours

Introduction, PDH Networks, SONET/SDH Networks, DWDM Network, Wireless Transmission: Wireless media, Wireless Systems, Spread Spectrum Technology.

UNIT II Routing and Internet Protocol   15 Hours

Routing, Static routing, Dynamic routing, Distance Vector Routing Algorithm, Link State Routing, Open Shortest Path First Routing protocol. Address types of the TCP/IP stack, IP Address format, IPv4 Packet Format, Hierarchical Addressing, Sub netting, ICMP, IPv6, Introduction to SDN, VXLAN, GRE and VPN.

UNIT III End-To-End Protocols   15 Hours

Simple De-multiplexer (UDP), Reliable Byte Stream (TCP), Remote Procedure Call, Congestion Control and Resource Allocation-Issues in Resource Allocation, Queuing Disciplines, TCP Congestion Control.

UNIT IV Quality Of Service   15 Hours

Motivation for QoS, Parameters, and Functions required for supporting QoS, Traffic Control, Leaky Bucket algorithm, Token Bucket Algorithm, Explicit Congestion Notification (ECN), and Resource Reservation Protocol (RSVP).

Text Books:

1. Computer Networks, Natalia Olifer, Victor Olifer, First Edition, John Wiley, 2015   UNIT-1: Chapter 10, 11

2. Larry &Peterson & Bruce S Davis; Computer networks-A System Approach, 5th Edition, Elsevier Inc, 2014. Chapter 4, 5,6.

3. Data Communications and computer Network, Prakash C Guptha, Second Edition, PHI learning Pvt Ltd, Nov 2014. Chapter 23.

Reference Books:

1. "Introduction to Data Communication & Networking" BehrouzFerouzan, 5th Edition,

   Mc Graw Hill Education Pvt Ltd 2013

   3. Andrew S Tanenbaim, "Computer Networks", Pearson Education, 5th Edition, Elsevier Inc, 2014.

B19BS4052	CYBER PHYSICAL SYSTEMS	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- To develop an understanding of the underlying principles behind integration of computation (software), networking and physical processes to design useful engineering systems.
- It primarily deals with effective orchestration of software and physical processes.

COURSE OUTCOMES:

- Understand the significance of the integration of computation with the physical process.
- Build high confidence systems with real-time and concurrent behaviors.
- Analyze computational systems that interact with physical processes.
- Design useful applications of cyber physical systems

COURSE CONTENT:

UNIT I 15 Hours

Foundations of Cyber Physical Systems, Modelling Dynamic Behaviours, Continuous Dynamics: Properties of Systems, Feedback Control, Discrete Dynamics: The notion of state, Finite-State Machines, Extended State Machines, Hybrid Systems, Composition of State Machine, Concurrent Models of Computation.

UNIT II 15 Hours

Models of sensors and actuators, Common Sensors, actuators, Embedded Processors, Types of Processor, Parallelism,Memory,Technologies,

UNIT III 15 Hours

Input and Output, Real-Time Task Scheduling. Types of Real-Time tasks and their characteristics. Multitasking, Different Task Scheduling algorithms

UNIT IV 15 Hours

Analysis and verification: Invariants and temporal logic, Equivalence and refinement, reachability analysis and model checking, Quantitative analysis, Security and Privacy, applications of Cyber Physical Systems

Text Books:

1. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, Second Edition, MIT Press, 2017.
2. R.Mall, Real Time Systems: Theory and Practice, Pearson Education,2007.

B19BS4053	THE INTERNET OF THINGS	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- Discuss the basics of thing*s* 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:

- Create the IoT applications with the help of IoT enabled Technologies
- Sketch protocols for IoT Applications
- Analyze low-power devices equipped with sensing, computation, and wireless communication capabilities.
- Describe the operating systems, radio communication, networking protocols

COURSE CONTENT:

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

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 IoTs :** Home Automation, Smart Cities, Smart Surveillance, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle

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

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 Sensor   **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, IOT Physical devices and end points. Python Packages of Interest for IoT-JSON. IoT Physical Servers & Endpoints, Introduction to cloud storage Models for IOT.

Textbooks

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)

References

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.

B19BS4061	PROGRAMMING WITH RUBY & GOLANG	L	T	P	C
Total Hours: 60		2	0	1	3

COURSE OBJECTIVES:

The objective of this course is to:

- Provide Storage foundational knowledge of Software programming using Ruby
- learn the basic syntax and semantics of the ruby language and programming environment
- ruby on rails
- interactive with databases

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Ability to write programs using ruby
- Develop web application in Ruby and connect to database
- Understand how to connect ruby application with backend database
- Design web based applications rails using ruby commands

COURSE CONTENT:

UNIT I Foundations and core of Ruby   **15Hours**

Bootstrapping Your Ruby Literacy, Objects, methods, and Local variables, Organizing objects with classes, Modules and Program organization, The default object (self) ,scope and visibility ,and control flow techniques, Built in essentials , strings, symbols, scalar objects, Collection of container objects, collection central :

Enumerable and Enumerator, Regular expression , File and I/o operations , callbacks, hooks, and Runtime Introspection

UNIT II Ruby testing & Ruby on rails   **15Hours**

A test driven fible, Test driven development basics, test driven rails, What makes great tests, Adding data to tests, setting up cucumber, Integration testing with cucumber, unit testing using java scripts, Getting started with ruby on rails, Develop and design UI /UX, the frontend interface, ,frontend styling and production deploy , Add signup forms, add admin user functionality , Testing for security, adding user, roles, troubleshooting and debugging

UNIT III Go and the Operating System   **15Hours**

Where is Go going? The advantages of Go, Compiling Go code, Executing Go code,Two Go rules, Downloading Go packages, UNIX stdin, stdout, and stderr, About printing output, Using standard output, Getting user input, About error output, Writing to log files Error handling in Go, Using Docker, Understanding Go Internals, The Go compiler, Garbage collection, Calling C code from Go, Calling Go functions from C code, The defer keyword, Two handy UNIX utilities, Your Go environment, The go env command, The Go assembler, Node trees, Creating Web Assembly code

UNIT IV   **15Hours**

Working with Basic Go Data Types, Numeric data types, Go loops, Go arrays, Go slices, Go maps, Go constants, Go pointers, Times and dates, Measuring execution time, The Uses of Composite Types 1About composite types Structures, Tuples, Regular expressions and pattern matching, Strings The switch statement, Calculating Pi with high accuracy, Developing a key-value store in Go, Go and the JSON format

Text Books:

1. the-well-grounded-rubyist-second-edition
2. Rails-Test-Prescriptions-Healthy-Codebase
3. Build Your Own Ruby on Rails Web Applications 1st Edition by Patrick Lenz (Author)
4. Mastering GO by Mihalis Tsoukalos 2nd Edition.

Reference:

1. Web docs : https://www.tutorialspoint.com/ruby

B19BS4062	INTRODUCTION TO WEB PROGRAMMING	L	T	P	C
Total Hours: 60		2	0	1	3

The objectives of this course are to:

- 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.

COURSE OUTCOMES:

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

- Apply different elements of html in webpage
- Classify functionality of internet and web system
- Analyze various properties of CSS in HTML
- Demonstrate form controls in HTML
- Construct events handlings in JavaScript
- Analyze dynamic documents with JavaScript

COURSE CONTENT:

UNIT I Fundamentals of Web   **15 Hours**

Fundamentals of Web: A Brief Introduction to the Internet, The World Wide Web, Web Browsers, Web Servers, Uniform Resource Locators, Multipurpose Internet Mail Extensions, The Hypertext Transfer Protocol. Introduction to XHTML: Basic Syntax, Standard XHTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, Syntactic Differences between HTML and XHTML.CSS: Levels of Style Sheets, Style Specification Formats, Selector Forms, Property Value Forms, Font Properties, List Properties, Color, Alignment of Text, The Box Model, Background Images, The <span> and <div> 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. A Form of Madness–Placeholders, Autofocus Fields, Email, and Numbers AsSpinboxes and Sliders.

UNIT III JavaScript and XHTML Documents   **15 Hours**

The Basics of JavaScript: Overview of JavaScript, Object Orientation and JavaScript, General Syntactic Characteristics, Primitives Operations and Expressions JavaScript: Screen Output and Keyboard Input, Control Statements, Object Creation and Modification, Arrays, Functions, Pattern Matching Using Regular

Expressions, Errors in Scripts. The Document Object Model, Element Access in JavaScript, Events and Event Handling. Handling Events from Body Elements, Handling Events from Button Elements, Handling Events from Text Box and Password Elements, The DOM 2 Event Model. Dynamic Documents with JavaScript: Introduction, Positioning Elements, Moving Elements, Element Visibility

UNIT IV Introduction to Angular -JS   and Introduction to XML   15 Hours

ANGULAR JS: Understanding jQuery, Event Manipulation Methods, AngularJS Template & live data binding, Struts architecture & versions

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 Edition, Pearson Education, 2008**.** (Chapters: 1, 2, 3, 4, 5 and 6)

2. Achyut S. Godbole and AtulKahate, Web Technologies, Tata McGraw Hill, 2003.

3. Jason Hunter, William Crawford, Java Servlet Programming, O'Reilly Publications, 1998.

Reference Books:

1. M.Deitel, P.J.Deitel, A.B.Goldberg, "Internet & World Wide Web How to program", 3rd Edition, Pearson Education / PHI, 2004.

2. Chris Bates, "Web Programming Building Internet Applications",

 3rd Edition, Wiley India, 2006. 3. XueBai et al, "The Web Warrior Guide to Web Programming", Thomson, 2003.

3. Sklar, "The Web Warrior Guide to Web Design Technologies", 1st Edition, Cengage Learning India.

Web Programming Laboratory

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. 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 use of on load and on focus events.
7. 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.

B19BS4063	JAVA PROGRAMMING	L	T	P	C
Total Hours: 60		2	0	1	3

COURSE OBJECTIVES:

- To provide Storage foundational knowledge of Software programming using core Java and advanced java
- To learn the basic syntax and semantics of the Java language and programming environment using if loops with while, for and do statements
- To understand the concepts of classes and objects

COURSE OUTCOMES:

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

- Ability to write programs using java.
- Develop simple web application using java and connect to database to store student Information

COURSE CONTENT:

UNIT I Java Foundation   15 Hours

Origin of Java, Object oriented programming, Java development kit, Write and run your fist simple java program, Data Types and Operators and Program control statements, Class fundamentals, defining class, Methods, and objects, data type and operators ,arrays, string, Bitwise operators

UNIT II Java Object Oriented program and Java E HTML5   **15 Hours**

Basics of Inheritance, constructors, defining packages and member access, Exception hierarchy, using try and catch. JAVA EE 7 HTML5 PRODUCTIVITY, Java EE 7, Enhanced HTML5 support, Java EE 7 architecture, Java EE Platform, A working example.

UNIT III Advanced Java   **15 Hours**

Java –Data structures, Collections, Generics, networking, Java sending email, Java multi-threading , Java DB connection ‚Java Scripting GUI Programming in Java: Designing Graphical User Interfaces in Java, Components and Containers, Basics of Components, Using Containers, AWT Components

UNIT IV Basics of Servlet   **15 Hours**

 Servlet, Basics of Web Servlet API, Servlet Interface, Generic Servlet, HttpServlet, Servlet Life Cycle, Working with Apache Tomcat Server, Steps to create a servlet in Tomcat, How servlet works? Servlet in NetBeans

Text Books:

1. Java: A Beginner's Guide(Paperback) by Herbert Schildt

2. Java EE 7 Developer Handbook by Peter A. Pilgrim

B19BS4070	MOOC /SWAYAM	L	T	P	C
Total Hours:30		2	0	0	2

COURSE CONTENTS:

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.

B19BS4080	SOFT SKILLS	L	T	P	C
Total Hours:30		2	0	2	2

B19BS4090	PUBLIC CLOUD –AWS,AZURE AND GOOGLE LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. Azure Windows and Linux Virtual machine create, connect ,stop and delete
2. Deploy IIS and Apache2 web server on win/Linux vm respectively
3. Create Azure Load balancer
4. Perform Azure VM autoscaling
5. Azure blob storage
6. Google cloud Windows and Linux Virtual machine create, connect ,stop and delete
7. Deploy IIS and Apache2 web server on win/Linux vm respectively
8. Create Google Load balancer
9. Perform Google cloud VM autoscaling
10. Google cloud storage (create buckets, store and retrive data)
11. AWS cloud Windows and Linux Virtual machine create, connect ,stop and delete
12. Deploy IIS and Apache2 web server on win/Linux vm respectively
13. Create AWS Elastic Load balancer
14. Perform AWS cloud VM autoscaling
15. AWS s3 (create buckets, store and retrieve data)
16. VM snapshots and recovery on three cloud providers
17. Volume backup and recovery on three cloud providers

B19BS4100	CLOUD DEVELOPER TOOLS AND ECOSYSTEMS LAB	L	T	P	C
Total Hours:30		**0**	**0**	**2**	**2**

LAB EXPERIMENTS:

1. Kuberentes minkube installation
2. Kubernetes namespaces, configmap and secret
3. Kuberentes pod deplyments
4. Kubernetes rolling update and rollback
5. Perform liveliness probes in kubernetes
6. Kuberentes other operations
7. Deploy app on AWS ec2 , beanstalk, and ECS
8. Deploy app on aws ec2 and connect to aws RDS instance
9. Perform static web hosting on s3 and object versioning
10. Aws s3 cors config
11. Deploy app on Google cloud compute engine, app engine and GKE
12. Deploy app on compute engine and connect to CLOUD-SQL
13. Deploy app on container and connect to CLOUD-data store
14. Create repositories on google cloud CSR
15. Deploy apps on Cloud foundry using java, ruby, node.js and python apps
16. Scale application on cloud foundry
17. Perform clodu foundry cli iperations
18. Deploy apps on open shift
19. Scale application on open shift
20. Perform open shift cli operations

FIFTH SEMESTER

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern Value			Credit	Working Hrs.
				L	T	P		
1	B19BS5010	Building Private Cloud with Open Stack	HC	2	1	0	3	4
2	B19BS5020	Big Data Analytics using Hadoop	HC	2	0	1	3	5
3	B19BS5030	Machine learning foundation with Python	HC	3	0	1	4	5
4	B19BS5041	Pubic Cloud Networking & Security	SC	2	0	1	3	4
	B19BS5042	C# and .NET						
	B19BS5043	Advanced JAVA for Micro-services architecture						
5	B19BS5051	Cyber Security	SC	2	1	0	3	4
	B19BS5052	Cloud APP development						
	B19BS5053	Cloud Migration and Disaster recovery						
6		Open Elective	OE	4	0	0	4	4
7	B19BS5070	Soft Skills	RULO	2	0	0	2	2
Practical Courses								
8	B19BS5080	Building Private Cloud with Open Stack Lab	HC	0	0	2	2	4
9	B19BS5090	Minor Project	HC	0	0	4	4	8
Total Credits				**17**	**2**	**9**	**28**	**40**

Open Elective Courses offered to other Schools

Sl. No	Code	Title	HC/ SC/ OE	Credit Pattern			Credits	Working Hrs
				L	**T**	**P**		
1	B19BS5061	Fundamentals of Cloud Computing	OE	4	0	0	4	4
2	B19BS5062	Basics of Data Analytics						

B19BS5010	BUILDING PRIVATE CLOUD WITH OPEN STACK	L	T	P	C
Total Hours:45		2	1	0	3

COURSE OBJECTIVES:

- Build Open Stack private cloud while leveraging and integrating KVM virtualization technology to spin cloud instances /VM's

COURSE OUTCOMES:

- Ability to deploy Open Stack single node on Centos
- Ability to deploy Open Stack single node on Ubuntu
- Ability to deploy Open Stack multi node on Centos
- Ability to deploy Open Stack multi node on Ubuntu
- Perform Openstack cloud operations on compute, storage and network

COURSE CONTENT:

UNIT I OpenStack ecosystem introduction Single node OpenStack-KVM on Ubuntu   15 Hours

OpenStack ecosystem, components and its role in OpenStack, OpenStack architecture, Deploying Ubuntu server and installing nova, glance, neutron, cinder keystone and build private cloud on single machine. Deploying Centos 7 or above and installing nova, glance, neutron, cinder keystone and build private cloud on single machine

UNIT II OpenStack Mulitnode setup on Ubuntu KVM   15 Hours

OpenStack Installation Module, Deployment Planning for OpenStack, Ubuntu Server Installation, Network and Disk Partitioning on Linux , NTP Server Installation and Configuration, MySQL Server – Theory and Lab, OpenStack Keystone Module – Theory and Lab, Create Keystone users ,tenants, and roles, OpenStack Glance -An Overview, and create linux Glance images, Cinder Module – Theory and Lab, Neutron services – Theory and Lab, Nova services – Theory, and lab , Horizon Module – Theory and Lab, OpenStack CLI operations

UNIT III   Single node OpenStack-KVM on Centos7   15 Hours

OpenStack ecosystem, components and its role in OpenStack, OpenStack architecture, Deploying Ubuntu server and installing nova, glance, neutron, cinder keystone and build private cloud on single machine. Deploying Centos 7 or above and installing nova, glance, neutron, cinder keystone and build private cloud on single machine

UNIT IV Centos 7 - OpenStack Mulitnode setup   15 Hours

OpenStack Installation Module, Deployment Planning for OpenStack, Ubuntu Server Installation, Network and Disk Partitioning on Linux , NTP Server Installation and Configuration, MySQL Server – Theory and Lab, OpenStack Keystone Module – Theory and Lab, Create Keystone users ,tenants, and roles, OpenStack Glance -An Overview, and create Linux Glance images, Cinder Module – Theory and Lab, Neutron services – Theory and Lab, Nova services – Theory, and lab , Horizon Module – Theory and Lab, OpenStack CLI operations both Hosts, Install nova-compute with installer

Text Books:
   1. OpenStack Cloud Computing Cookbook, 2nd Edition ,By Kevin Jackson, Cody Bunch
   2. OpenStack Cloud Computing: Architecture Guide by John Rhoton, Jan De Clercq

Reference guides/Links for labs

   1. http://docs.OpenStack.org
   2. http://docs.OpenStack.org/admin-guide-cloud/content/

B19BS5020	BIG DATA ANALYTICS USING HADOOP	L	T	P	C
Total Hours: 60		2	0	1	3

COURSE OBJECTIVES:

The objective of this course is to:

- Understand Hadoop basics and perform Hadoop administration

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Ability to install and configure Hadoop on single machine
- Ability to install and configure Hadoop on Multiple machine (cluster)
- Ability to perform Hadoop administrative taks
- Get a strong foundation knowledge about Hadoop

COURSE CONTENT:

UNIT I Hadoop Foundation :   **15 Hours**

Motivation for Hadoop /Big Data, Hadoop concepts, hdfs, getting started with Hadoop frameworks and Hadoop Installation checking the pre-requisites, install Hadoop on local Ubuntu machine, download Hadoop, configuring and running Hadoop, understand three modes of Hadoop, configuring the base directory of Hadoop, formatting the name node, starting Hadoop, using HDFS, run your first Program Hello world of MapReduce, Monitoring Hadoop from the web browser, YARN, Hadoop I/o

Chapter 1-5 (Hadoop-The.Definitive.Guide_4.edition_a_Tom.White_April-2015.pdf)

UNIT II MapReduce and Hadoop ecosystem: **15 Hours**

Developing a MapReduce program, setting up the development environment, writing a unit test with MRunit, MapReduce workflows, How MapReduce works, Failures, MapReduce types and format, MapReduce features, Pig, Hive, spark and Flume concepts and handson lab

Chapter 6-9 (Hadoop-The.Definitive.Guide_4.edition_a_Tom.White_April-2015.pdf)

UNIT III Big data on Amazon Web Service cloud   and azure cloud   **15Hours**

What is AWS Elastic MapReduce, the EMR Architecture, EMR use cases, Programming Hadoop on AWS EMR, Hello world , mapper implementation, reducer implementation, driver implementation, Executing Hadoop jobs on AWS EMR,: creating EC2 key pair and S3 bucket, how to launch EMR cluster, viewing results. AWS EMR cluster management, monitoring and troubleshooting, EMR best practices, EMR launch, monitor EMR cluster via Command line, Hadoop streaming and Advanced customization on EMR. Introducing HDInsight, Understanding Windows Azure HDInsight Service, Provisioning Your HDInsight Service Cluster, Automating HDInsight Cluster Provisioning, Submitting Jobs to Your HDInsight Cluster, Exploring the HDInsight Name Node ,run hive and spark jobs on azure hd insight

UNIT IV Big data on Google cloud   **15 Hours**

 Google cloud DataProc introduction, deploy Dataproc cluster, connect to master node, run hive and spark programs, Google cloud storage bucket operations, Google cloud Dataflow ,stream data processing on dataflow , Bigquerry, import datasets to bigquerry and run queries on Google cloud bigquerry platform, Bigtable concepts and architecture, Store data and analysis of data on bigtable

Text books:

1. Pro Apache Hadoop Paperback – September 10, 2014 by Jason Venner (Author), Sameer Wadkar (Author), Madhu Siddalingaiah (Author)
2. Hadoop Beginner's Guide Paperback – February 22, 2013 by Garry Turkington (Author)

Reference Books:

1. Pro Apache Hadoop Paperback – September 10, 2014 by Jason Venner (Author), Sameer Wadkar (Author), Madhu Siddalingaiah (Author)
2. Hadoop Beginner's Guide Paperback – February 22, 2013 by Garry Turkington (Author)

LAB EXPERIMENTS

1. Setup single node Hadoop cluster
2. Setup multi node Hadoop cluster
3. Run Hadoop sample jobs
4. Install configure Hive perform analytics
5. Install and configure Spark and perform simple job
6. Install and work on Spark
7. Deploy AWS EMR cluster and run Hadoop, hive and spark jobs
8. Deploy Azure HDinsight cluster and run Hadoop, hive and spark jobs
9. Deploy Google cloud Dataproc cluster and run Hadoop, hive and spark jobs
10. Import datasets on Bigquerry and run sql querries
11. Store and retrieve data from Bigtable

B19BS5030	MACHINE LEARNING FOUNDATION WITH PYTHON	L	T	P	C
Total Hours: 60		3	0	1	4

- To introduce students to the basic concepts and techniques of Machine Learning.
- To develop skills of using recent machine learning software for solving practical problems.

COURSE OUTCOMES:
- Ability to understand machine learning
- Understand popular tools in machine learning
- Ability to perform popular ML models

COURSE CONTENT:

UNIT I ML concepts Foundation   **15 Hours**

Evolution of Machine Learning , Define Machine Learning (ML) ,Define Supervised Learning , Define Un-Supervised Learning , Define reinforcement learning, Define Semi-supervised Learning , Define Federated Learning, Machine Learning in Banking and Finance Industry, Machine Learning in Healthcare, Machine Learning in Transportation, Machine Learning in Government, Machine Learning in Media and entertainment

UNIT II ML Program foundation   **15 Hours**

Data Types (Numerical, categorical and Ordinal)**,** Just enough Python for ML **,**Lab : Simple python exercise**,** Introduction to NumPy and simple lab on numpy**,** Introduction to SciPy and simple lab on Scipy **,** Introduction to Pandas and simple lab exercise**,** Introduction to MatPlotLib and simple lab exercise

UNIT III AI Foundation   **15 Hours**

Understand concepts of AI, Deep Learning and NLP, **Classification Lab** – Classify images using Tensorflow and visualise using Matplotlib **Clustering Lab** – Customer segmentation, **Regression Lab** – Predict pricing of house Scikit-learn NumPy and Pandas, **Recommendation Lab** – Provide recommendations using Natural Language Processing using live data of training services company (using Nltk tool kit),

UNIT-IV ML Advanced Models Programming   **15 Hours**

Sentiment Analysis Lab – Movie review (Positive or negative) using Natural Language Processing, **Reinforcement Learning Lab** – Place agent in one of the room and goal is to reach outside the building, **Association Lab** – Perform Market basket analysis for e-commerce, Tensorflow labs on sample data from public dat sets

Lab experiments

1. Numpy lab exericses
2. Scipy lab exericses
3. Matplotlib lab exericses
4. Classification Lab – Classify images using Tensorflow and visualize using Matplotlib
5. Clustering Lab – Customer segmentation,
6. Regression Lab – Predict pricing of house Scikit-learn NumPy and Pandas, Recommendation Lab – Provide recommendations using Natural Language Processing using live data of training services company (using Nltk tool kit),
7. Sentiment Analysis Lab – Movie review (Positive or negative) using Natural Language Processing,
8. Reinforcement Learning Lab – Place agent in one of the room and goal is to reach outside the building,
9. Association Lab – Perform Market basket analysis for e-commerce.

B19BS5041	PUBLIC CLOUD NETWORKING AND SECURITY	L	T	P	C
Total Hours: 60		2	0	1	3

COURSE OBJECTIVES:

- Understand how networking and security is managed in Google cloud
- Understand how networking and security is managed in AWS cloud

COURSE OUTCOMES:

- Ability to understand and Networking in AWS cloud
- Ability to understand and security in AWS cloud
- Ability to understand and Networking in Google cloud
- Ability to understand and security in Google cloud

COURSE CONTENT:

UNIT I AWS Networking   **15 Hours**

AWS Cloud - Virtual Private Cloud concepts, private and public Subnets, route tables ,NAT gatways, Internet gateways , VPC endpoints, Elastic IP address, Elastic network interfaces, VPC Peering with region and VPC peering across regions, Transit VPC, AWS Direct connect concepts, AWS Route 53 concepts and record sets, Elastic load balancers, Cloud front distribution with s3 bucket, VPC cloud formation templates

UNIT II AWS Security   **15 Hours**

AWS Security best practices , Shared security model , Logging and Monitoring like s3 events, Cloud Watch logs, AWS config, AWS Inspector, Cloud Trail logging, VPC flow logs, Cloud Watch ec2 agent logs, s3 access logs. Infrastructure security of Cloud Front, Signed URL, Cloud Front geo restrictions , Web application firewall and AWS shield , VPC NACLS and security groups , IAM Policies for s3 bucket level policies and ec2 instance policies, key management services, Data at rest encryption.

UNIT III Google Cloud Networking   **15 Hours**

Google Cloud - Virtual Private Cloud concepts,   Subnets, route ,NAT gateways, Internet gateways , Static IP address, VPC Peering with region and VPC peering across regions, VPC peering across projects, Google cloud interconnect options, Cloud DNS concepts and record sets, Global and regional load balancers,   VPC deployment using deployment manager

UNIT IV Google Cloud Security   **15 Hours**

Google cloud Resource manager, Google Cloud IAM, service accounts, Shared VPC, Data encryption in Google cloud, Google cloud Key management service, Cloud Armor, Cloud security scanner, Compute engine and Kuberentes engine security, cloud storage access permissions, Stackdriver monting and logging of compute engine vms, Google shared security responsibility model , Google cloud data centre compliance certifications

Lab Experiments

- Create a private load balancer add & run ec2 vm in private subnet
- Create a aws vpc peering and add nacl rules
- Configure aws cloud watch logs agent on ec2 vm
- Configure aws cloud trial for one of the region
- Setup aws cloud front distribution and setup geo restrictions
- Configure s3 bucket level policy
- Configure google vpc peering within and across projects
- Configure data encryption in google cloud
- Use key management service in google
- Configure stack driver logging agent on compute engine vms
- Configure stack driver monitoring agent on compute engine vms

Text Books:

1. Learning Windows Azure Paperback – October 16, 2014, by Geoff Webber-Cross
2. Implementing Microsoft Azure Infrastructure Solutions, By Michael Washam, Rick Rainey
3. Programming Amazon Web Services: S3, EC2, SQS, FPS, and Simple DB Paperback ,by James Murty

4. Google Cloud Platform for Architects: Design and manage powerful cloud solutions Kindle Edition by Vitthal Srinivasan (Author), Janani Ravi (Author), Judy Raj (Author)

B19BS5042	C# and .NET	L	T	P	C
Total Hours: 60		2	0	1	3

COURSE OBJECTIVES:

- To learn the basic concepts of .NET Framework
- To learn the concepts of object oriented programming using C#.NET
- To get the knowledge on the windows programming using C#.NET
- To get the knowledge on the ADO.NET
- To get knowledge on the basic concept of ASP.NET

COURSE OUTCOMES:

- Able to design a simple console application with basic concepts of C#.NET
- Able to apply the concepts of Object Oriented Programming using C#.NET
- Able to design an application which connects with databases
- Able to design a website ASP.NET

COURSE CONTENT:

UNIT1 .NET Framework 4.0   **15 Hours**

Introduction to the .NET Platform , Common Language Runtime(CLR) , The Common Type Specification(CTS) , The Common Language Specifications (CLS) ,Interoperability, Assemblies , Shared Assemblies, Private Assembles, GAC .NET Base Classes , CLR Debugger, Deployment of .net applications, Hallo world console application using c#, Visual studio IDE, Introduction to C# , Data Type, Operators, Flow Control and Iteration , Arrays and Strings, Basics of C# Classes, Members of the Class, Reference Types and Value Types, Boxing and Unboxing, Reflection, The Preprocessors, Name Spaces.

UNIT II Object Oriented Programming in C#   **15 Hours**

Object-Oriented Programming in C#, Encapsulation, Inheritance , and Polymorphism, Interfaces, Introduction to .NET Collections (including Custom Collections) ,Generic Programming, Custom Indexers, Exception Handling, Garbage Collection , Input and Output (Directories ,Files, and Streams) Delegates and Events- Type Reflection and Attributes, Operator Overloading ,Expression and operations: using the?? (Null Coalescing) Operator, using the :(scope resolution) operator and using the is and as operator.

UNIT III Data Access with ADO.NET   **15 Hours**

Windows Programming: Windows Forms, Handling Events on Tools(buttons, Textboxes, Radio buttons, combo boxes, Grid and List Views, Date Picker, List box, etc…). ADO.NET: Connected and Disconnected

Data modal, Creating Table from Application, Inserting, Deleting and Updating Database, Executing Stored Procedures.

UNIT IV Web Applications Using ASP.NET   **15 Hours**

Web Application: Creating web page with navigations using Site map and menu strip, Creating and Applying Master page, understanding of state management by using sessions, cookies, view state and application object. Validates, Deployment of an ASP.NET webpage in IIS7.

Text Books:

1. C# 2012 Programming, Covers .Net 4.5, Black Book: Kogent Learning Solutions

2. Pro C# 5.0 and the .NET 4.5 Framework (Expert's Voice in .NET), Andrew Troelsen, Sixth Edition, Apress publishers.

Reference Books:

Professional C# 5.0 And .Net 4.5.1 by Christian Nagel , Jay Glynn, Morgan Skinner

B19BS5043	ADVANCED JAVA FOR MICRO-SERVICES ARCHITECTURE	L	T	P	C
Total Hours: 60		2	0	1	3

COURSE OBJECTIVES:
- The objective of this course is to familiarize students with micro service and its build.

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Understand micro services architecture.
- Use Spring boot for micro services
- Use Spring Cloud for micro services.

COURSE CONTENT:

UNIT I Introducing Micro services   **15Hours**

Independent modules, intermodal communication, e-commerce micro service, understanding self-contained micro services, message oriented micro services, advanced micro services.

UNIT II Micro service architecture   **15Hours**

Mesh app and Service architecture, classify services, Domain centric partitions, inner architecture of micro services, CQRS., distributed messaging.

UNIT II 15Hours

Spring boot – Spring initializer, Spring boot starter, spring boot dependencies, maven plugin, running & testing the Spring boot application, spring HAL browsers , HATESOA, REST controller

UNIT IV 15Hours

Spring Cloud – Feign client, Coding, Build and test, Hystrix fallback, dashboard, Ribbon, Eureka.Zuul API gateway.

Textbook:

1. Practical Microservices Architectural Patterns - Event-Based Java Microservices with Spring Boot and Spring Cloud by Binildas Christudas.

B19BS5051		L	T	P	C
	CYBER SECURITY				
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:
- Explain security concepts, Ethics in Network Security.
- Identify security threats, and the security services and mechanisms to counter them
- Comprehend and apply relevant cryptographic techniques
- Comprehend security services and mechanisms in the network protocol stack
- Illustrate the integrity and authentication process
- Familiarize various cyber threats, attacks, vulnerabilities and defensive mechanisms

COURSE OUTCOMES:
- Relate the cryptographic techniques.
- Explore integrity and authentication process
- Familiarize various cyber threats, attacks, vulnerabilities and defensive mechanisms
- Demonstrate the security policies and practices
- Implement the cryptographic techniques and know the real time applications of various cryptographic techniques.

COURSE CONTENT:

UNIT I 15 Hours

Security and Cryptography: Security Trends, Security Services, Security attacks, Security mechanisms, A Model for Network security. A short History of Cryptography, Cryptographic techniques, Symmetric and asymmetric key algorithm, Cryptography Tools, Attacks on Cryptosystems.

UNIT II 15 Hours

Security Technology: Physical design; Firewalls; Protecting Remote Connections, Intrusion Detection Systems (IDS), Honey Pots, Honey Nets.

UNIT III 12 Hours

Cybercrime and cyber offenses: Introduction to Cybercrime and Laws Introduction, Cybercrime: Definition and Origins of the word, Cybercrime and information Security, Cybercriminals, Classifications of Cybercrimes, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes, Cyber offenses: How Criminals Plan the Attacks,· Social Engineering, Cyber talking, Cyber cafe and Cybercrimes, Bot nets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT IV 18 Hours

Tools and Methods: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Key loggers and Spywares, Virus and Worms, Trojan Horses and Backdoors, Steganography DoS and DDoS Attacks, SQL Injection, Buffer Overflow, Attacks on Wireless Networks, identity theft. Cybercrimes and Cyber security: The Legal Perspectives, Cybercrime and the Legal Landscape around the World, Why Do We Need Cyber laws: The Indian Context, The Indian IT Act, Challenges to Indian Law and Cybercrime Scenario in India, Consequences of Not Addressing the Weakness in Information Technology Act, Digital Signatures and the Indian IT Act, Amendments to the Indian IT Act, Cybercrime and Punishment.

Text Books:

1. Nina Godbole, SunitBelapur, "CYBER SECURITY UNDERSTANDING CYBER CRIMES, COMPUTER FORENSICS AND LEGAL PERSPECTIVES", Wiley India Publications, April, 2011.
2. Robert Jones, "INTERNET FORENSICS: USING DIGITAL EVIDENCE TO SOLVE COMPUTER CRIME", O'Reilly Media, October, 2005.
3. Michael E. Whitman and Herbert J. Mattord, "PRINCIPLES OF INFORMATION SECURITY", 2nd Edition, Thomson, 2005.
4. William Stallings, "NETWORK SECURITY ESSENTIALS: APPLICATIONS AND STANDARDS", Pearson Education, 2000.

Reference Books:

1. Marjie T. Britz, "COMPUTER FORENSICS AND CYBER CRIME: AN INTRODUCTION" – Pearson Education.
2. Chwan-Hwa (John) Wu,J. David Irwin, "INTRODUCTION TO COMPUTER NETWORKS AND CYBER SECURITY" - CRC Press.

B19BS5052	CLOUD APP DEVELOPMENT	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- The objective of this course is to gain knowledge of developing applications in the cloud.

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Develop cloud based applications
- Deploy the application on real cloud
- To analyze and trouble shoot the problems while deploying application on cloud
- Use application based technologies for developing application using cloud
- Use public cloud like IBM Bluemix, Amazon AWS, Google cloud platform or Microsoft Azure for developing an application
- Work with real cloud services

COURSE CONTENT:

UNIT I Cloud Based Applications   15 Hours

Developing web service, Understanding cloud ecosystem- SaaS/PaaS, Popular APIs. Designing Code for The Cloud: Designing cloud infrastructure; Web Browsers and the Presentation Layer- Understanding Web browsers attributes and differences. Building blocks of the presentation layer: HTML, HTML5, CSS, Silver-light, flash, java script, JQuery, Boot Strap

UNIT II Web Development Techniques and Frameworks: 15 Hours

Working with AJAX controls, JQuery, JSON, XML, REST. Working on Application development Frameworks e.g. Ruby on Rails ,.Net, Java API's or JSF; Deployment Environments – Platform As A Service(PAAS) ,Amazon, vmForce, Google App Engine, Azure, Heroku, AppForce

UNIT III Developing and Deploying an Application in the real cloud   15 Hours

Study the design, development, testing and deployment of an application in the cloud using a development framework and deployment platform

UNIT-IV Using real cloud services: 15 Hours

Working with compute, Data intensive services, load balancing and scaling services available on real cloud platforms

Text Book:

1. Azure in Action by Chris Hay, Brian Prince
2. Introducing Windows Azure by Henry Li
3. Developing Applications for the Cloud on the Microsoft Windows Azure Platform by Eugenio Pace, Dominic Betts,
4. Developing with Google App Engine by Eugene Ciuran
5. Using Google App Engine by Charles Severance
6. Programming Google App Engine by Dan Sanderson

B19BS5053	CLOUD MIGRATION AND DISASTER RECOVERY	L	T	P	C
Total Hours: 60		2	1	0	3

COURSE OBJECTIVES:

- To understand the implementation and design Disaster recovery and business continuity in public clouds with on premise and within public cloud

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Best practices to prepare, deploy and maintain a disaster recovery and business continuity plan
- Different approaches taken by the organization's contingency plan to avoid risks on-site and on cloud

COURSE CONTENT:

UNIT I   Cloud BCP and Disaster recovery Concepts   15 Hours

Business continuity concepts, Disaster recovery concepts, Recovery point objective and recovery time objective, On-premise to Public cloud DR solutions, DR solutions with Google cloud using multi regions , DR solutions with AWS cloud using multi regions , DR solutions with Azure cloud using multi regions , DR strategies like Backup & Restore, Pilot Light, Warm standby , Multi site solutions.

UNIT II Cloud BCP and Disaster recovery Lab exercises   15 Hours

Putt BCP and DR concept's in practice , Perform VM backup and restore in AWS in same region and across regions, Perform volume backup and restore in AWS in same region and across regions , Perform VM backup and restore in Google cloud in same region and across regions, Perform volume backup and restore in Google cloud in same region and across regions, Perform VM backup and restore in Azure cloud in same region and across regions, Perform volume backup and restore in Azure cloud in same region and across regions, use

AWS route 53 and ELB as part of DR strategy , use AWS cloud DNS and Google load balancing as part of DR strategy , use Azure DNS and azure load balancer service as part of DR strategy

UNIT III   Cloud Automation – part 1   15 Hours

Terraform concepts, Automate aws operations with terraform, Automate Azure cloud operations with terraform, Automate Google cloud operations with terraform . Automate aws operations using Ansible, Automate azure cloud operations using Ansible , Automate Google cloud operations using Ansible .

UNIT IV   Cloud Automation – part 2   15 Hours

AWS Cloud formation   concepts and   Automate aws operations with cloud formation, Google cloud Deployment manager concepts and automate Google cloud operations using Deployment manager , Azure resource manager template concepts and automate azure cloud operations using Azure resource manager template. Automate aws operations using chef , Automate azure cloud operations using chef , Automate Google cloud operations using chef

Lab Experiments:

1. Perform VM backup and restore in AWS in same region and across regions,
2.   Perform volume backup and restore in AWS in same region and across regions ,
3.   Perform VM backup and restore in Google cloud in same region and across regions,
4. Perform volume backup and restore in Google cloud in same region and across regions,
5. Perform VM backup and restore in Azure cloud in same region and across regions,
6. Perform volume backup and restore in Azure cloud in same region and across regions,
7.   use AWS route 53 and ELB as part of DR strategy ,
8. use AWS cloud DNS and Google load balancing as part of DR strategy ,
9. use Azure DNS and azure load balancer service as part of DR strategy
10. Automate aws operations with terraform,
11. Automate Azure cloud operations with terraform,
12. Automate Google cloud operations with terraform.
13. Automate aws operations using Ansible ,
14. Automate azure cloud operations using Ansible ,
15. Automate Google cloud operations using Ansible.
16. AWS Cloud formation concepts and Automate aws operations with cloud formation,
17. Google cloud Deployment manager concepts and automate Google cloud operations using Deployment manager.
18. Azure resource manager template concepts and automate azure cloud operations using Azure resource manager template.
19. Automate aws operations using chef ,
20. Automate azure cloud operations using chef ,
21. Automate Google cloud operations using chef .

Text Books:

1. Planning Cloud-Based Disaster Recovery for Digital Assets: The Innovative Librarian's Guide-By Robin M. Hastings

2. Disaster Recovery and Business Continuity- By Thejendra B.S.
3. Enterprise Cloud Security and Governance: Efficiently Set Data Protection and Privacy Principles- By Zeal Vora
4. Rethinking Disaster Recovery: The Impact of Cloud Computing-By Bryan Strawser.

B19BS5070	SOFT SKILLS	L	T	P	C
Total Hours:30		2	0	0	2

B19BS5080	BUILDING PRIVATE CLOUD WITH OPEN STACK LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. Deploy Openstack single node private cloud on Ubuntu OS
2. Deploy Openstack single node private cloud on Centos
3. Deploy Openstack Multi node private cloud on Ubuntu OS
4. Deploy Openstack Multi node private cloud on Centos
5. Create virtual networks,
6. Create virtual routers
7. Create nova instances
8. Create volumes and attach to nova instances
9. Create images and register on cloud

B19BS5090	MINOR PROJECT	L	T	P	C
Total Hours:60		0	0	4	4

Guide Lines

- The project should be inter disciplinary
- Team size should be of max **two** members
- Use any version control software
- Project should be of Client/Server based
- Latest database servers with PL/SQL statements is must
- 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) Basic Diagrams like (DFD, ER, Class diagram, etc.)
    d) Database and stored procedure design
    e) Screen shots
    f) Concussion
    g) Future enhancement
    h) Bibliography
- Project reports should be submitted for evaluation

B19BS5061	FUNDAMENTALS OF CLOUD COMPUTING	L	T	P	C
Total Hours: 60		4	0	0	4

COURSE OBJECTIVES:

- To learn how to use Cloud Services.
- To implement Virtualization
- To implement Task Scheduling algorithms.
- Apply Map-Reduce concept to applications.
- To build Private Cloud.
- Broadly educate to know the impact of engineering on legal and societal issues involved

COURSE OUTCOMES:

- Understand Introduction to Cloud Computing

- Understanding the roots and essential characteristics of cloud computing
- Understanding the Management and Monitoring Process of Cloud Computing.
- Understand Migration and Business model of Cloud.

COURSE CONTENT:

UNIT I Introduction to cloud computing   15 Hours

Introduction to Cloud Computing, History of cloud computing, Cloud Computing Architecture , Introduction to Mainframes, Clustering, Grid Computing, Utility computing, Edge Computing, SOA, Servers, Datacenters, 5 Characteristics of Cloud computing, Trends of cloud computing, Standards and needs for cloud computing, Network protocols and Web Services, APIs, Comparing Traditional and Cloud Data Center Costs, Virtualization and Cloud Computing, Security and Privacy in Cloud.

UNIT II CLOUD DEPLOYMENT AND SERVICE DELIVERY MODELS   15 Hours

Cloud resources, Middleware, Cloud service models: IaaS, PaaS, SaaS, XaaS, cloud computing – separation of responsibilities, Pricing, Billing, Pay as You Go, Monitoring, SLA, QoS, Cloud deployment services: Public, Private, Hybrid, Community cloud.

UNIT III Cloud Applications   15 Hours

Existing problems in cloud computing, cloud adoption barriers, Web 2.0 applications, Cloud Technologies and platforms – AWS, EC2, S3, GAE, Azure, Hadoop, Salesforce.com, Aneka, Parallel and Distributed Computing, MapReduce in cloud, Hadoop in cloud, Scaling, Elasticity, Cloud Storage, Relational Databases and NoSQL. Scientific applications, Healthcare: ECG analysis in the cloud, Biology: protein structure prediction, Geosciences: satellite image processing,

UNIT IV Business models of cloud   15 Hours

Cloud Economics, Implementing Data security using Open Web Application Security Project, Migration to Cloud, B2C, B2B, and C2C, Big Data in Cloud, Analytics in Cloud, Understanding Future Trends of Cloud, Internet of Things (IoT), Business Innovation through Cloud Computing, Business and consumer applications, CRM and ERP, Social networking, Media applications.

Text Books:

1. Seize the Cloud - A Manager's Guide to Successwith Cloud Computing by Erik van Ommeren • Sogeti USA, Martin van den Berg • Sogeti Netherlands.
2. Cloud Computing for Dummies by Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper.

3. Cloud Computing – Concepts and Practices by NareshSehgal&Pramod Chandra.

Reference Books:

1. " Mastering Cloud Computing" by -RajkumarBuyya, Christian Vechiolla, Thamarai S, Elsevier Publications

2. "Cloud Computing : Principles and Paradigms" by – RajkumarBuyya, James B, A Goscinski,

3. "Cloud Computing : A practical Approach" by Toby V, A velte, Robert E, 2009

4. "Cloud Application Architectures: Building Applicatios and Infrastructure in the cloud"

B19BS5062		L	T	P	C
	BASICS OF DATA ANALYTICS				
Total Hours: 60		4	0	0	4

COURSE OBJECTIVES:

In this course the students will learn

- The principles and methods of statistical analysis, but will also put them into practice using a range of real-world data sets.
- provide a basic understanding of data analysis using statistics and to use computational tools on problems of applied nature

COURSE OUTCOMES:

- Understand concepts, terminologies, and characteristics of Big Data.
- Understand different data types of Big Data.
- Understand what drives Big Data in business
- Understand challenges & planning for Big Data adoption
- Understand the processing concepts of Big Data

COURSE CONTENT:

UNIT I   **15Hours**

Understanding Big Data Concepts and terminologies, Big Data Characteristics, Different types of data.

UNIT II   **15 Hours**

Business Motivation & Drivers of Big Data Market place dynamics, Business Architecture, Business Process Management, ICT, IoE.

UNIT III   **15 Hours**

Big Data Adoption & Planning Considerations Organization Prerequisites, Data Procurement, Privacy, Security, Provenance, Real-time Support, Performance Challenges, Governance requirements, Methodology, Big Data Analytics Life cycle.

UNIT IV   **15 Hours**

Big Data Processing Concepts Parallel Data Processing, Distributed data Processing, Hadoop, Processing Workloads, Cluster, Processing in Batch Mode, Processing in real time mode.

Text Book:

1. Big Data Fundamental by Thomas Erl, WajidKhattak& Paul Buhler

SIXTH SEMESTER:

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern Value				Working Hrs.
				L	T	P	C	
1	B19BS6010	DevOps	HC	3	0	1	4	5
2	B19BS6021	Deployment &Management of Private Cloud	SC	3	0	1	4	5
	B19BS6022	ENTREPRENEURSHIP AND MANAGEMENT						
	B19BS6023	Machine learning and AI on cloud						
Practical Courses								
3	B19BS6030	Major Project	HC	0	0	10	10	20
Total Credits				**6**	**0**	**12**	**18**	**30**

B19BS6010	DEVOPS	L	T	P	C
Total Hours: 60		3	0	1	4

COURSE OBJECTIVES:

- Understand the DevOps culture and implement DevOps complete CI/CD pipeline

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:

- Understand DevOps
- Its principles and complete 360 degree picture on source control to code analysis to deployment
- Work on containerization
- Deploy and configure Jenkins

COURSE CONTENT:

UNIT-I: DevOps Foundation   **15 Hours**

Waterfall Model concepts and challenges, Agile model concepts and benefit, DevOps Concepts and tools like Source code management tools (Github,bitbucket) , static code analysis (sonarqube, fortify) , Build tools (maven ,ant , gradle) Orchestration tools (Jenkins, bamboo CI), Build servers, Artifacts repositories (nexus, anti-factory), testing tools like cucumber, selenium, Infrastructure and configuration management tools (terraform, ansible. Chef, puppet)   , ELK and other important concepts in Continuous integration and continuous deployment pipeline

UNIT-II: AWS DevOps   **15 Hours**

AWS Devops tools introduction ,features and concepts of Amazon cloud devops tools like AWS code commit, AWS code deploy, AWS code Pipeline, AWS code build, AWS code star , AWS X-Ray, AWS beanstalk, AWS opsworks concepts, AWS Elastic container service (kubernetes) . Jenkins integration with EC2 for slave nodes, Terraform with aws EC2

UNIT-III: Google cloud DevOps   **15 Hours**

Google cloud Devops introduction, features and concepts of Google cloud Devops tools like Google Cloud source repositories (CSR), integration of CSR with github and bit bucket, CI/CD with cloud build, Container registry, Google kubernetes engine, Google cloud deployment manager, Spinakker pipeline, Terraform with GCP kubernetes engine, Terraform with GCP cloud other services, Jenkins CICD pipeline on Google cloud, Jenkins with Google cloud compute engine and google cloud storage

Building CI?CD Pipeline of Jenkins, Github, Docker, docker hub and Kuberentes, Jenkisn with sonarqube and nexus repo ,Jenkins with SonarQube .nexus and cucumber, Jenkins with sonarqube, dockerhub, terraform and kubernetes , Bamboo CI with Sonarqube ,nexus repo , docker build server, Docker hub and kubernetes , Bamboo CI with fortify, nexus repo and docker build server with kubernetes, Bamboo CI with terraform and kubernetes ,Jenkins .net application Pipeline,Jenkins java spring boot application Pipeline , Jenkins python application Pipeline

Text Book:

1. DevOps for Beginners: DevOps Software Development Method Guide for Software Developers and It Professionals: **by Joseph Joyner (Author)**
2. DevOps: From Newbie to Professional. Fast and Simple Guide to DevOps - by Dan Warnock
3. Learning Ansible by Madhurranjan Mohaan, Ramesh Raithatha , November 2014

Reference Books:

1. Official documentation for Docker https://www.Docker.com/
2. Official documentation for GitHub : www.GitHub.com
3. Official documentation for Sonar qube www.sonarqube.org/
4. Official documentation for Jenkins https://jenkins.io/

B19BS6021	DEPLOYMENT &MANAGEMENT OF PRIVATE CLOUD	L	T	P	C
Total Hours: 60		3	0	1	4

COURSE OBJECTIVES:

The objective of this course is to:

- Deploying a OpenStack   private cloud with high availability
- Install and configure a Private cloud using Microsoft System Centre Product using Microsoft Hyper-v latest server virtualization backend

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:
- Deploying OpenStack cloud in Highly available for controller ,network and compute nodes.

COURSE CONTENT:

UNIT I High availability components on ubuntu 18.04.   **15 Hours**

HA Proxy concepts, Keepalived concepts, rabbitmq concepts, horizon dashboard concepts, configure dual HA proxy nodes with keepalived on VM1 and VM2 hsoting Ubuntu 18.04 server. deploy 2 node (VM3 and VM4

hostign Ubuntu 18.04 server) and configure the component level clustering of rabbitmq cluster horizon , keystone concepts, keystone clustering

UNIT II Building OpenStack High Availability on **Ubuntu 18.04**   **15 Hours**

Install two OpenStack controller on different machines (VM 3 and VM4) , Configure OpenStack services on both controllers like Keystone, rabbitmq , nova, cinder ,glance ,horizon , test and validate the HA configure 2 KVM hosts (VM5 and vm6 hosting on Ubuntu) and shared storage and integrate with OpenStack controllers and , test failover of cloud

UNIT III High availability components on Centos 7   **15 Hours**

 HA Proxy concepts, Keepalived concepts, rabbitmq concepts, horizon dashboard concepts, configure dual HA proxy nodes with keep lived on VM1 and VM2 hosting Ubuntu 18.04 server. deploy 2 node (VM3 and VM4 hosting Centos7 server) and configure the component level clustering of rabbitmq cluster horizon , keystone concepts, keystone clustering

UNIT IV Building OpenStack High Availability on **Centos7**   **15 Hours**

Install two OpenStack controller on different machines (VM 3 and VM4) , Configure OpenStack services on both controllers like Keystone, rabbitmq , nova, cinder ,glance ,horizon , test and validate the HA configure 2 KVM hosts (VM5 and vm6 hosting on Centos7) and shared storage and integrate with OpenStack controllers and , test failover of cloud

Text Books:

1. Open Stack Operations Guide ,Set Up and Manage Your OpenStack Cloud , By Tom Fifield, Diane Fleming, Anne Gentle, Lorin Hochstein, Jonathan Proulx, Everett Toews, Joe Topjian
2. OpenStack Cloud Computing Cookbook Second Edition by Kevin Jackson (Author), Cody Bunch (Author)
3. Microsoft System Center latest Unleashed Paperback – June 11, latest by Chris Amaris (Author), Rand Morimoto (Author), Pete Handley (Author), David Ross (Author)
4. Introducing Microsoft System Center latest R2 Technical Overview by Mitch Tulloch with Symon Perriman and the System Center Team(http://download.microsoft.com/download/C/8/A/C8A5F520-F31E-4BB4-B972-8D2525D17C38/Microsoft_Press_ebook_Introducing_System_Center_latest_PDF.pdf)
5. Pro Linux High Availability Clustering By Sander van Vugt
6. Learning OpenStack Networking (Neutron) by James Denton
7. Building OpenStack Highly Available Infrastructure by Anil Bidari (to Be launched soon)

Reference Website:
1. Web docs : https://www.microsoft.com/en-us/cloud-platform/system-center

B19BS6022	ENTREPRENEURSHIP AND MANAGEMENT	L	T	P	C
Total Hours: 60		**3**	**0**	**1**	**4**

COURSE OBJECTIVES:

- Learn the Basics of management
- Understand the entrepreneurial decision making process from business model design to the launch of the new venture.
- Develop a wide range of strategic, financial and human resource planning skills necessary to the new venture planning process
- Provide an atmosphere in which course participants can apply entrepreneurial and teamwork skills in finding, evaluating and beginning the process of implementing new venture concepts
- Sharpen the presentation skills necessary to effectively communicate new venture ideas to potential investors.

COURSE OUTCOMES:

- Describe the basic principles and concepts of management.
- Distinguish different plans and list steps in planning.
- Discuss the concepts of organizing and staffing.
- Interpret the concepts of directing and controlling.
- Demonstrate the meaning, functions, types and roles of an entrepreneur and describe various institutional support.
- Explain in detail about the small scale industries and prepare project report.

COURSE CONTENT:

UNIT I Management   **15 Hours**

Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of Management – Management as a Science, Art or Profession Management & Administration – Roles of Management, Levels of Management, Development of Management Thought – Early Management Approaches –Modern Management Approaches.

Planning: Nature, importance and purpose of planning, process objectives – Types of plans(Meaning only) – Decision making – Importance of planning – steps in planning & planning premises– Hierarchy of plans.

UNIT II Organizing And Staffing   **15 Hours**

Nature and purpose of organization - Principles of organization –Types of organization - Depart mentation – Committees – Centralization Vs decentralization of authority and responsibility – Span of control – MBO and MBE (Meaning only) Nature and importance of Staffing – Process of Selection & Recruitment (in brief).

Directing & Controlling: Meaning and nature of directing-Leadership styles, Motivation Theories, Communication – Meaning and importance – Coordination, meaning and importance and Techniques of Co-ordination. Meaning and steps in controlling – Essentials of a sound control system–Methods of establishing control.

UNIT III Entrepreneur   **15 Hours**

Meaning of Entrepreneur, Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Intrapreneur – an emerging Class. Concept of Entrepreneurship– Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development ; Entrepreneurship in India; Entrepreneurship – its Barriers. **Small Scale Industry**: Definition; Characteristics; Need and rationale: Objectives; Scope;role of SSI in Economic Development. Advantages of SSI, Steps to start an SSI – Government policy towards SSI; Different Policies of S.S.I; Government Support for S.S.I. during 5 year plans, Impact of Liberalization, Privatization, Globalization on S.S.I, Effect of WTO/GATT Supporting Agencies of Government for S.S.I, Meaning ; Nature of Support ; Objectives ; Functions ; Types of Help ;Ancillary Industry and Tiny Industry (Definition only).

UNIT IV Institutional Support   **15 Hours**

Different Schemes: TECKSOK, KIADB, KSSIDC, KSIMC, DIC Single Window Agency: SISI; NSIC; SIDBI; KSFC.

Preparation Of Project: Meaning of project, project Identification, Project Selection, Project Report, Need and Significance of Report, Contents, formulation, Guidelines by Planning Commission for Project report, network Analysis, Errors of Project Report, Project Appraisal. Identification of Business Opportunities – Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.

Text Books:

1. Principles of Management– P.C Tripathi, P.N.Reddy, Tata McGraw Hill, 4thEdition, 2010.
2. Dynamics of Entrepreneurial Development & Management – Vasant Desai, Himalaya Publishing House, 2011
3. Entrepreneurship Development-Small Business Enterprises– Poornima M. Charantimath, Pearson Education, 2006 (2 & 4)

Reference Books:

1. Management Fundamentals– Concepts, Application, Skill Development -Robert Lusier, 5thedition, Thomson Publications, 2011.
2. Entrepreneurship Development– S. S. Khanka, S Chand & Co., 2007.
3. Management – Stephen Robbins, Pearson Education / PHI – 17th Edition, 2003.

B19BS6023	MACHINE LEARNING AND AI ON CLOUD	L	T	P	C
Total Hours: 60		3	0	1	4

COURSE OBJECTIVES:

The objective of this course is to:

- Deploy live chatbot using Google cloud solutions
- Perform image, video, text, speech labs using Amazon cloud ML solutions
- Perform Azure Ml studio labs and forecasting technique using Azure ML and AI solutions

COURSE OUTCOMES:

A student who successfully completes the course will have the ability to:
- Work as Data scientists who can leverage multi machine learning and AI solutions

COURSE CONTENT:

UNIT I Machine Learning and AI on GCP   15 Hours

Vision AI : Overview and Concepts, Analyze images in the cloud or at the edge, Video AI: Overview and Features, Precise video analysis — down to the frame ,AI Platform Notebooks: Overview and Features ,An enterprise notebook service to launch projects in minutes ,AI Platform Deep Learning VM Image :Overview and Features, Preconfigured virtual machines for deep learning applications, Kubeflow: Overview and Features, The machine learning toolkit for Kubernetes ,Cloud TPU : Overview and Features Hardware designed for performance ,Natural Language : Overview and Features Multimedia and multi-language processing ,Translation : Overview and Features : Fast, dynamic translation tailored to your content

UNIT II Machine Learning and AI on GCP   15 Hours

Cloud Speech-to-Text API : Overview and Features: Speech recognition across 120 languages, Cloud Text-to-Speech API : Overview and Features : Lifelike text-to-speech interactions, Dialog flow : Overview and Features : Conversational experiences across devices and platform , AutoML Tables : Overview and Features: Build state-of-the-art ML models on structured data, Cloud Inference API : Overview and Features : Run large-scale correlations over typed time-series datasets, Recommendations AI (beta) : Overview and Features: Deliver highly personalized product recommendations at scale, BigQuery ML : Overview and Feature : Build models with SQL, Cloud AutoML : Overview and Features: Train custom ML models quickly and easily

UNIT-III: Machine Learning and AI on AWS   15 Hours

Overview and features of AWS Sagemaker, AWS Textract, AWS Translate , AWS Transcribe, AWS Recognition, Amazon Comprehend – NLP, AWS Polly ,AWS Personalize, Amazon DeepLens, Amazon Forecast (reinforcement learning) ,Amazon Lex

UNIT-IV: Machine Learning and AI on Azure   **15 Hours**

Azure machine learning overview, Introduction to Azure machine learning studio, Developing and hosting Azure machine learning applications. Building Azure machine learning models with ML Studio (Prepare Azure SQL database, Import data, Visualize data, Train and evaluate a regression model and a classification model using exercise and calories data set) **.** Publish Predictive models as Azure Machine Learning services (Significance of web service, How to publish and test a web service in ML Studio). Building Azure Machine Learning Models with Azure ML Services (Introduction to Azure Machine Learning Services, How to build Azure machine learning models with ML services.)

Lab experiments:

- Lab1 : Implementing an AI Chatbot with Google Dialog flow

- Lab 2 : Detect Labels, Faces, and Landmarks in Images with the Cloud Vision API

- Lab 3: Google Cloud – Deploy Jupyter notebook instance with GPU and run sample pandas or classification example program
- Lab 4 : User vision API to identify text from image sign board (OCR) which is in chinese language and translate the text to english using Google Translate api .
- Lab 5 : Hands on Lab :Building Azure machine learning models with ML services introduction Electricity demand forecast
- Lab 6: Hands on Lab, Publish and test a web service using ML Studio using exercise and calories dataset ,Publishing and consuming a parameterized web service)
- Lab 7: Hands-on lab sessions Lab, Using Exercise and Calories dataset, Explore Azure Machine Learning Studio, Upload datasets, Create Experiments, How to import data from big data sources and define a data workflow in an experiment.
- AWS ML and AI labs

  - Labs : Deploy one click Jupyter notebooks(NB)
  - Labs : run sample Pandas programs on cloud jupyter NB
  - Labs : Extract text from documents
  - Labs – translate content from English to Chinese language
  - Labs – convert speech to text
  - Labs – Object and scene detection
  - Labs – Image Moderation
  - Labs – Facial Analysis
  - Labs – Celebrity recognition
  - Labs – Face comparison
  - Labs – Text in Image
  - Labs – Video Analytics
  - Labs – Analyse unstructured text
  - Labs – Text to Life like speech conversion

B19BS6030		L	T	P	C
	MAJOR PROJECT	0	0	10	10
Total Hours:240					

Guidelines for Project Formulation

Type of Project:

As majority of the students are expected to work out a real life project in some industry/research and development laboratories/educational institutions/software companies, it is suggested that the project is to be chosen which should have some direct relevance in day-to-day activities of the candidates in his/her institution. Students are encouraged to work in the areas listed at the end. However, it is not mandatory for a student to work on a real life project. The student can formulate a project problem with the help of Guide.

Project Proposal (Synopsis)

The project proposal should be prepared in consultation with your guide. The project proposal should clearly state the project objectives and the environment of the proposed project to be undertaken. The project work should compulsorily include the software development. The project proposal should contain complete details in the following form:

1. Title of the Project
2. Introduction and Objectives of the Project
3. Project Category (RDBMS/OOPS/Networking/Multimedia/Artificial Intelligence/Expert Systems etc.)
4. Analysis (DFDs at least up to second level , ER Diagrams/ Class Diagrams/ Database Design etc. as per the project requirements).
5. A complete structure which includes: Number of modules and their description to provide an estimation of the student's effort on the project. Data Structures as per the project requirements for all the modules. Process Logic of each module. Testing process to be used. Reports generation (Mention tentative content of report)
6. Tools / Platform, Hardware and Software Requirement specifications
7. Are you doing this project for any Industry/Client? Mention Yes/No. If Yes, Mention the Name and Address of the Industry or Client
8. Future scope and further enhancement of the project.

Items To Be Included In The Project Report

The following items should be included in the Project Report:

The project report must contain the following:

1. Introduction Objectives
2. Tools/Environment Used
3. Analysis Document (This should include SRS in proper structure based on Software Engineering concepts, E-R diagrams/Class diagrams/any related diagrams (if the former are not applicable), Data flow diagrams/other similar diagrams (if the former is not applicable), Data dictionary).
4. Design Document (Modularization details, Data integrity & constraints including database design, Procedural design, User interface design) Program code (Complete code (well indented)/Detailed specification instead of code*, Comments & Description. The program code should always be developed in such a way that it includes complete error handling, passing of parameters as required, placement of procedure/function statements as needed.)
5. Testing (Test case designs are to be included separately for Unit testing, Integration testing, System testing; Reports of the outcome of Unit testing, Integration testing, System testing are to be included separately. Also, details of debugging and code improvement are to be included.)
6. Input and Output Screens
7. Limitations of the Project
8. Future Application of the Project
9. Bibliography

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:

1. Willingness to learn
2. Self-motivation
3. Team work
4. Communication skills and application of these skills to real scenarios
5. Requirement of gathering, design and analysis, development and testing skills
6. Analytical and Technical skills
7. Computer skills
8. Internet searching skills
9. Information consolidation and presentation skills
10. Role play
11. 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 improves 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 Science is not only knowledge in the subject, but also the skill 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

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 BCA 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 **Courses 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. Open 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 **Open 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 BCA 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 BCA, 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 120 credits for successful completion of Three Year BCA 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 120 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**.

5. **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 120 credits for the Three Year BCA Degree program.

6. **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 120 credits for the Three Year BCA Degree program.

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

7. **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
Presentations / Quizzes / Case studies	=	10 marks

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

- 1st test for 15 marks at the end of 8th week of the beginning of the Semester; and
- 2nd test for 15 marks at the end of the 16th week of the beginning of the Semester; and

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

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

7.6. 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**.

7.7. 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	8th Week	1st and 2nd Units	15	Consolidation of 1st and 2nd Unit
Allocation of Topics for Assignments	-	First Unit and second unit		Instructional process and Continuous Assessment
Submission of Assignments	-	First Unit and second unit	5	Instructional process and Continuous Assessment
Presentations / Quizzes/Case studies	-	First Unit and second unit	5	Instructional process and Continuous Assessment
Second Test	16th Week	Third unit and Fourth unit	15	Consolidation of 3rd and 4th Unit
Allocation of Topic for 2nd Assignment	-	2nd half of second unit and 3rd Unit		Instructional process and Continuous Assessment
Submission of Assignments	-	2nd half of second unit and 3rd Unit	5	Instructional process and Continuous Assessment
Presentations / Quizzes / Case studies	-	2nd half of second unit and 3rd Unit	5	Instructional process and Continuous Assessment
Semester End Practical Examination	17th 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 2nd 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 Practical's 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 practical's 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 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 :

$$\text{SGPA (Si)} = \sum(C_i \times G_i) / \sum C_i$$

where C_i is the number of credits of the ith course and G_i is the grade point scored by the student in the ith course.

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.,

$$\text{CGPA} = \sum(C_i \times S_i) / \sum C_i$$

where S_i is the SGPA of the ith 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.

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	Distinction
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	First Class
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C	Average	Second Class
> 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, 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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