REVA UNIVERSITY
Bengaluru, India

School of CSA

B.Sc (Research)
(Computer Science - Cloud Computing and Big Data)

HANDBOOK
2017-2018

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

REVA UNIVERSITY
Bengaluru, India

SCHOOL OF COMPUTER SCIENCE AND APPLICATIONS

Bachelor of Science (Research) Computer Science-Cloud Computing and Big Data

HANDBOOK

2017

Rukmini Knowledge Park,
Kattigenahalli, Yelahanka, Bangalore - 560 064
Phone No: +91-080-66226622, Fax: 080-28478539

Rukmini Educational
Charitable Trust

www.reva.edu.in

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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 27thFebruary, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

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

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

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

and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

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

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

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

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

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

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

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

and the second "REVA Life Time Achievement Award" for the year 2016 has been awarded to Shri. Shekhar Gupta, Renowned Journalist on the occasion of Founder's Day Celebration, 6th January, 2017.

REVA organises various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognised by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga classes everyday to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

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

REVA University Vision

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

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. (R) Computer Science-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 (Research) 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(R) (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(R) (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:

1. Be cloud engineers , data analysts, data scientists and cloud architects
2. be computer Application Developers, Algorithm developers, Computer Programmers
3. Operate various cloud related commercial software tools to solve scientific and business problems
4. Work alongside engineering, medical, ICT professionals and scientists to assist them in setting up a cloud in their area of domain
5. Act as administrators in public, private and government organisations with further training and education
6. Acquire higher degrees to work in colleges, universities as professors or as scientists in research establishments or business administrators
7. Understand environmental, legal, cultural, social, ethical, public safety issues
8. Work as a member of a team and communicate effectively across team members
9. Adopt lifelong learning philosophy for continuous improvement
10. set his/her own enterprise with further training

Program Outcomes for B.Sc (Research) 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 analyse, 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 (PSO)

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 & Applications
B. Sc (Research) Scheme 2017-2021

FIRST SEMESTER

Sl. No	Code	Title	HC/SC/ FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB101	Mathematics	HC	3	1	0	4	5
2	BS17CB102	Programming in C	HC	4	0	0	4	4
3	BS17CB103	Linux Foundation	HC	2	1	1	4	6
4	BS17CB104	Digital Principles and Logic Design	HC	4	0	0	4	4
5	BS17CB105	Environmental Studies	FC	2	0	0	2	2
6	BS17CB106	C Programming Lab	HC	0	0	2	2	4
7	BS17CB107	Logic Design Lab	HC	0	0	2	2	4
Total Credits				**15**	**2**	**5**	**22**	**29**

SECOND SEMESTER

Sl. No	Code	Title	HC /SC FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB201	Probability and Statistics	HC	3	1	0	4	5
2	BS17CB202	Computer Organization and Architecture	HC	4	0	0	4	4
3	BS17CB203	Data Structures using C	HC	4	0	0	4	4
4	BS17CB204	Advanced Linux	HC	4	0	0	4	4
5	BS17CB205	English for Technical Communications	HC	4	0	0	4	4
6	BS17CB206	Constitution of India & Professional Ethics	FC	2	0	0	2	2
7	BS17CB207	Data Structures Lab	HC	0	0	2	2	4
8	BS17CB208	Advanced Linux Lab	HC	0	0	2	2	4
Total Credits				**21**	**1**	**4**	**26**	**31**

THIRD SEMESTER

Sl. No	Code	Title	HC/SC/OE	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB301	Discrete Mathematical Structures with Graph Theory	HC	3	1	0	4	5
2	BS17CB302	Cloud Computing and Virtualization Foundation	HC	3	0	1	4	5
3	BS17CB303	OOP with C++	HC	4	0	0	4	4
4	BS17CB304	Operating Systems	HC	4	0	0	4	4
5	BS17CB305	Data Base Management System	HC	4	0	0	4	4
6	BS17CB306	Numerical Methods	HC	4	0	0	4	4
7	BS17CB307	Programming with C++ Lab	HC	0	0	2	2	4
8	BS17CB308	DBMS Lab	HC	0	0	2	2	4
Total Credits				**22**	**1**	**5**	**28**	**34**

FOURTH SEMESTER

Sl. No	Code	Title	HC/ SC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB401	Operations Research	HC	3	1	0	4	5
2	BS17CB402	Cloud Computing Architecture and Design	HC	3	0	1	4	5
3	BS17CB403	Advanced Java Programming	HC	4	0	0	4	4
4	BS17CB404	Computer Networks	HC	3	0	1	4	5
5	BS17CB405	Design & Analysis of Algorithm	HC	4	0	0	4	4
6	BS17CB406	Data Warehousing & Data Mining	HC	4	0	0	4	4
7	BS17CB407	Design & Analysis of Algorithm Lab	HC	0	0	2	2	4
8	BS17CB408	Advanced Java Programming Lab	HC	0	0	2	2	4
Total Credits				**21**	**1**	**6**	**28**	**35**

FIFTH SEMESTER

Sl. No	Code	Title	HC/ SC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB501	AWS & Azure Public Cloud Platforms	HC	2	1	0	3	4
2	BS17CB502	Big Data Analytics using Hadoop	HC	2	1	1	4	6
3	BS17CB503	Programming with Ruby & Python	HC	2	1	0	3	4
4	BS17CB504	Cloud Databases	HC	3	0	1	4	5
5	BS17CB515	Enterprise Resource Planning	SC	2	1	0	3	4
	BS17CB525	E-Commerce						
6	BS17CB516	Web Programming	SC	2	0	1	3	4
	BS17CB526	C# and .Net						
7	BS17CB505	AWS and Azure Public Cloud lab	HC	0	0	2	2	2
8	BS17CB506	Programming with Ruby & Python lab	HC	0	0	2	2	2
Total Credits				**13**	**4**	**7**	**24**	**31**

SIXTH SEMESTER

Sl. No	Code	Title	HC/ SC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB601	Automation Tools for Cloud Deployment	HC	2	1	1	4	6
2	BS17CB602	Building Private Cloud with Openstack	HC	2	1	0	3	4
3	BS17CB603	Big Data and Hadoop on AWS and Azure	HC	2	1	0	3	4
4	BS17CB604	Software Engineering	HC	4	0	0	4	4
5	BS17CB615	Entrepreneurship and Management	SC	2	1	0	3	4
	BS17CB625	Financial Engineering						
6	BS17CB616	Information Security and Cryptography	SC	2	1	0	3	4
	BS17CB626	Advanced Computer Networks						
7	BS17CB607	Big Data and Hadoop on AWS and Azure lab	HC	0	0	2	2	2
8	BS17CB608	Building Private Cloud with Openstack lab	HC	0	0	2	2	2
Total Credits				**14**	**5**	**5**	**24**	**30**

SEVENTH SEMESTER –MODIFIED SCHEME

Sl. No	Code	Title	HC/ SC/ OE	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB701	Deployment &Management of Private Cloud	HC	2	1	0	3	4
2	BS17CB702/ M18MS1010	Big Data Technologies on Google Cloud	HC	2	1	1	4	6
3	BS17CB703	DevOps	HC	2	1	0	3	4
4	BS17CB704	Project Work – Phase-1	HC	0	2	2	4	8
5	BS17CB715	Software Project Management	SC	2	1	0	3	4
	BS17CB725	Object Oriented Modeling and Design						
	BS17CB735/ M18MS1062	Advanced DBMS						
6		Open Elective	OE	4	0	0	4	4
7	BS17CB707	Deployment &Management of Private Cloud lab		0	0	2	2	2
8	BS17CB708	Devops lab		0	0	2	2	2
Total Credits				**12**	**6**	**7**	**25**	**34**

Open Elective Courses offered to other Schools

Sl. No	Code	Title	HC/ SC/ OE	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB716	Fundamentals of Cloud Computing	OE	4	0	0	4	4
	BS17CB726	Basics of Data Analytics						

EIGHTH SEMESTER – MODIFIED SCHEME

Sl. No	Code	Title	HC/ SC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB811	Cloud Storage using Open Stack Swift	SC	3	1	0	4	5
	BS17CB821/ M18MS2020	Linear Algebra						
2	BS17CB812	Wireless Sensor Networks and Internet of Things	SC	2	1	0	3	4
	BS17CB822/ M18MS2041	System Simulation and Modelling						
3	BS17CB803	Project Work– Phase-2	HC	0	4	4	8	16
Total Credits				**5**	**6**	**4**	**15**	**25**

Credit Summary

Semester	Credits
First	22
Second	26
Third	28
Fourth	28
Fifth	24
Sixth	24
Seventh	25
Eighth	15
Total	192

Credit Distribution

Semester	Hard Core (HC)	Fundamental Core(FC)	Soft Core (SC)	Open Elective (OE)	Total Credits
I	20	2	-	-	22
II	24	2	-	-	26
III	28	-	-	-	28
IV	28	-	-	-	28
V	18	-	6	-	24
VI	18	-	6	-	24
VII	18	-	3	4	25
VIII	08	-	7	-	15
Total Credits for Programme					192

DETAILED SYLLABUS

FIRST SEMESTER

Sl. No	Code	Title	HC/ SC/ FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB101	Mathematics	HC	3	1	0	4	5
2	BS17CB102	Programming in C	HC	4	0	0	4	4
3	BS17CB103	Linux Foundation	HC	2	1	1	4	6
4	BS17CB104	Digital Principles and Logic Design	HC	4	0	0	4	4
5	BS17CB105	Environmental Studies	FC	2	0	0	2	2
6	BS17CB106	C Programming Lab	HC	0	0	2	2	4
7	BS17CB107	Logic Design Lab	HC	0	0	2	2	4
Total Credits				**15**	**2**	**5**	**22**	**29**

BS17CB101	**MATHEMATICS**	**L**	**T**	**P**	**C**
Total Hours: 60		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

- To understand the concepts of Linear algebra and its applications in various fields of engineering and Technology.
- To understand the concepts of differential calculus and its applications.
- To familiarize with partial differentiation and its applications in various fields.
- To understand the concepts of Integral calculus, differential equations and its applications.

COURSE OUTCOMES:

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

- Apply the knowledge of Linear Algebra in Image processing and digital signal processing.

- Apply the knowledge of differential calculus in the field of wave theory and communication systems.
- Apply the knowledge of partial differential equations in the field of signals and systems, control systems, magnetic wave theory.
- Apply the knowledge of Integral calculus differential equations to perform integration and other operations for certain types of functions and carry out the computation fluently

COURSE CONTENT:

UNIT I Linear Algebra **15 Hours**

Rank of matrix, Echelon form, (*reference-Normal form: one example), Solution of a system of linear equations by Gauss elimination (*reference-Gauss –Jordan methods: one example), Gauss seidel iterative method, Rayleigh Power method to find the largest Eigen value and corresponding Eigen vector. LU decomposition, Diagonalization of a matrix,

UNIT II Differential Calculus **15 Hours**

Successive differentiation-nth derivatives (proof and problems), Leibnitz Theorem (without proof) and problems, Taylors series and Maclaurins series expansion for one variable (only problems),

Partial Differentiation: Partial derivatives-Euler's theorem-problems, Total derivative and chain rule.

UNIT III Integral Calculus **15 Hours**

Reduction formulae for the integrals, and evaluation of these integrals with standard limits(direct result) - Problems. Multiple Integrals – Double integrals, change of order of integration (simple problems)

UNITIV Differential Equations **15 Hours**

Exact equation and reducible to exact form (1. Close to expression M or N andfind IF, 2. y f(x) dx+x g(y) dy). **Linear Differential Equations:** Definitions, Complete solution, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding the particular integral Method of variation of parameters(simple problems),

Text Books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43nd edition, 2015
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition, 2013.

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 19th Reprint edition, 2013.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 4th edition, 2014.

BS17CB102	PROGRAMMING IN C	L	T	P	C
Total Hours: 60		4	0	0	4

COURSE OBJECTIVES:

The objective of this course is to:

- Introduce the fundamentals of computer System;
- Provide an understanding of problem solving with computers;
- Introduce C programming language;
- Provide a familiarization with the Unix programming environment;
- Introduce problem solving through authoring and executing C programs.

COURSE OUTCOMES:

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

- Use the basic terminology of computer programming;
- Explain the different Unix commands, their usage and their syntax;
- Write, compile and debug programs in C language;
- Use different data types and operators in a computer program;
- Design programs involving decision structures, loops and functions;
- Use procedure calls by value and by reference;
- Use arrays in applications like sorting and searching;
- Handling strings;
- Apply the C language knowledge to solve variety of problems.

COURSE CONTENT:

UNIT I Introduction to Computer System **15 Hours**

Definition of a Computer, Structure of a computer, Basics of computer hardware and computer software, Types and Functions of operating system, Algorithms and Flowcharts.

Getting started with UNIX: Introduction to Unix Operating System, Introduction Basic Command Format, Using the VI text editor, Basic UNIX commands, Types of computer networks.

UNIT II Fundamentals of Problem Solving and Introduction to C Language 15 Hours

Introduction to C Language –Structure of a C Program, Data type, Variables, Constants, Input / Output, Tips and common programming Errors. **Operators:** Types of Operators, Expressions and Statements. **Branching constructs:** Conditional Branching- if, if-else, else-if ladder, nested if, switch. Unconditional goto, break, continue, and return.

UNIT III Looping Constructs and Arrays 15 Hours

Looping constructs: for, while, do- while, nested-for, Advantages of Looping.**Arrays:** One Dimensional and Two Dimensional Arrays; Searching Techniques, Sorting-bubble sort;

UNIT IV Functions Strings and Pointers 15 Hours

Functions: Inbuilt and User defined Functions, Parameter Passing mechanisms, Call by value and Call by address; **Strings:** String Operations with and without using inbuilt String Functions; **Pointers:** Introduction to Pointers.

Text Books:

1. Herbert Schildt, C: The Complete Reference, 4th Edition, Tata McGraw Hill
2. Kernighan, Dennis Ritchie, The C Programming Language,2nd edition, Englewood Cliffs,NJ: Prentice Hall, 1988
3. Sumitabha Das, UNIX Concepts and Applications, 4th Edition; Tata McGraw Hill
4. B.S. Anami, S.A. Angadi and S. S. Manvi, Computer Concepts and C Programming: AHolistic Approach, PHI, Second Edition, 2008.
5. E. Balaguruswamy, Programming in ANSI C, 4th Edition, Tata McGraw Hill, 2008.

BS17CB103	**LINUX FOUNDATION**	**L**	**T**	**P**	**C**
Total Hours: 60		**2**	**1**	**1**	**4**

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).

COURSE OUTCOMES:

On completion of this course the student will be able 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).

COURSE CONTENT:

UNIT I Introduction to Linux **15 Hours**

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

UNIT II Interacting with shell and desktop **15 Hours**

Introduction, Environment, Introduction to Shell, Shell configuration, Secure shell, GNOME, KDE,

UNIT III Basic Linux Administration **15 Hours**

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 Linux Network, Security and Services configuration **15 Hours**

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 Book, Richard Petersen, McGraw-Hill Education

Reference Book:

1. A Book by Mark G. Sobell A Practical Guide to Fedora and Red Hat Enterprise Linux, Seventh Edition

Lab Experiments:

- Learn installation procedure of Ubuntu and Red hat Linux server.

• Create files and directories
• Change or modify permission on files and directories
• Install and configure nfs server
• Configure nfs client and work on mountpoints
• Work on Linux desktop interface
• Configure DNS server
• Install and configure web server

BS17CB104	DIGITAL PRINCIPLES AND LOGIC DESIGN	L	T	P	C
Total Hours: 60		4	0	0	4

COURSE OBJECTIVES:

- To understand the basics of digital electronics.
- To lay a foundation of building blocks used in digital design.
- To introduce basic postulates of Boolean algebra.
- To introduce the methods for simplifying Boolean expressions.
- To introduce the design of combinational and sequential circuits.

COURSE OUTCOMES:

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

- Construct the K-map from a Boolean expression and to find the minimal SOP/POS forms;
- Design combinational and sequential digital logic circuits;
- Solve real-world problems using Boolean relation between inputs and output;
- Design the operation of basic building blocks, such as different types of latches, flip-flops, registers and counters;
- Implement various types of flip-flops in creating sequential circuits and their uses in synchronous and asynchronous counters;
- Analyze and design Moore and mealy machine with state transition diagrams.

COURSE CONTENT:

UNIT I Basic Gates and Combinational Logic Circuits **15 Hours**

Review of Basic Logic gates, Positive and Negative Logic, Introduction to HDL. Combinational Logic Circuits: Sum-of-Products Method, Truth Table to Karnaugh Map, Pairs Quads, and Octets, Karnaugh

Simplifications, Don't-care Conditions, Product-of-sums Method, Product-of-sums simplifications, Simplification by QuineMcClusky Method, Hazards and Hazard covers, HDL Implementation Models.

UNIT II Data-Processing Circuits **15 Hours**

Multiplexers, De-multiplexers, 1-of-16 Decoder, BCD to Decimal Decoders, Seven Segment Decoders, Encoders, Exclusive-OR Gates, Parity Generators and Checkers, Magnitude Comparator, Programmable Array Logic, Programmable Logic Arrays, HDL Implementation of Data Processing Circuits. Arithmetic Building Blocks, Arithmetic Logic UNIT.

UNIT III Flip-Flops, Registers **15 Hours**

Flip-flops: RS Flip-Flops, Gated Flip-Flops, Edge-triggered RS FLIP-FLOP, Edge-triggered D FLIP-FLOPs, Edge-triggered JK FLIPFLOPs. Flip- Flops: FLIP-FLOP Timing, JK Master-slave FLIP-FLOP, Switch Contact Bounce Circuits, Various Representation of FLIP-FLOPs, HDL Implementation of FLIP-FLOP.

Registers: Types of Registers, Serial In - Serial Out, Serial In - Parallel out, Parallel In - Serial Out, Parallel In - Parallel Out, Universal Shift Register, Applications of Shift Registers, and Register implementation in HDL. Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus

UNIT IV Counters, D/A Conversion and A/D Conversion **15 Hours**

Counters: Asynchronous Counters, Decoding Gates, Synchronous Counters, Changing the Counter Modulus. Decade Counters, Pre-settable Counters, Counter Design as a Synthesis problem, A Digital Clock, Counter Design using HDL**.**

D/A Conversion and A/D Conversion: Variable, Resistor Networks, Binary Ladders, D/A Converters, D/A Accuracy and Resolution, A/D Converter-Simultaneous Conversion, A/D Converter-Counter Method, Continuous A/D Conversion, A/D Techniques, Dual-slope A/D Conversion, A/D Accuracy and Resolution.

Text Books:

1. Donald P Leach, Albert Paul Malvino&GoutamSaha: Digital Principles and Applications, 8th Edition, Tata McGraw Hill, 2015
2. Anil K Maini, Varsha Agarwal: Electronic Devices and Circuits, Wiley, 2012.

Reference Books:

1. Stephen Brown, ZvonkoVranesic: Fundamentals of Digital Logic Design with VHDL, 2nd Edition, Tata McGraw Hill, 2005.
2. R D Sudhaker Samuel: Illustrative Approach to Logic Design, Sanguine-Pearson, 2010. 3. M Morris Mano: Digital Logic and Computer Design, 10 th Edition, Pearson, 2008.

BS17CB105	ENVIRONMENTAL STUDIES	L	T	P	C
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 **15 Hours**

Multidisciplinary nature of environmental studies – Definition -Scope and importance -Need for public awareness.

UNIT II Natural Resources **15 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 **15 Hours**

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

UNIT IV Social Issues and the Environment **15 Hours**

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 environmentand human health - HIV/Aids -Women and child welfare - Case studies.

Text Books:

1. Desai R.G. - Environmental studies, Himalaya Publication House.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.,
4. Jadhav, H &Bhosale, V.M. 1995, Environmental Protection and Laws, Himalaya Pub. House, Delhi.
5. Rao M N. &Datta, A.K. 1987. Waste Water treatment, Oxford & IBH Publ. Co. Pvt. Ltd.

BS17CB106	C PROGRAMMING LAB	L	T	P	C
Total Hours:30		0	0	2	2

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.
9. Write a program to display numbers (transactions) from1 to n.
10. Write a program to find the sum of n natural numbers.
11. Read your ATM Pin Number. Write a program to identify your Pin Number is palindrome or not**.**
12. Read your Landline Number. Write a program to print the reverse of it and also find sum of digits of your Landline Number.

13. Create a Contact list of n friends, Write a program to read and print the Phone number of your friend's.
14. 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.
15. You have joined a startup company of N employees; Write a program is to sort all employee id.
16. 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.
17. 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.
18. In a CCP test you scored less marks compared to your friend, Write a program to swap your marks with your friend.
19. 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.
20. 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.
21. Read your first and last name in two different strings; Write a program to combine these two strings into third string.
22. Assume a person has entered a Password,Write a program so that he can know the length of his password.
23. Read a meaningful word in English, Write a program to identify the word when inversed yields the same or not.

BS17CB107	LOGIC DESIGN LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1 a) Realization of Universal Gates using basic gates.
   b) Design and develop VHDL code to realize Universal gates using basic gates.
2 a) Realization of Half/Full adder and Half/Full Subtractors using logic gates.
   b) Design and develop VHDL code to realize Full adder and Full Subtractors.
3 a) Given a 4-variable logic expression, simplify it using Entered Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
   b) Design and develop the VHDL code for an 8:1 multiplexer. Simulate and verify it's working.
4 a) Realize the working of JK Flip-Flop using SR Flip-Flop.
   b) Design and develop the VHDL code for SR Flip-Flop.Simulate and verify it's working.
5 a) Realize a J-K Master / Slave Flip-Flop using NAND gates and verify its truth table.
   b) Design and develop the Verilog / VHDL code for D Flip-Flop with positive-edge triggering. Simulate and verify it's working.
6 a) Design and implement a mod-n (n<8) synchronous up counter using J-K Flip-Flop ICs and demonstrate its working.
   b) Design and develop the Verilog / VHDL code for mod-8 up counter. Simulate and verify it's working.
7 a) Design and implement a ring counter using 4-bit shift register and demonstrate its working.
   b) Design and develop the Verilog / VHDL code for switched tail counter. Simulate and verify it's working.
8 Design and implement an asynchronous counter using decade counter IC to count up from 0 to n (n<=9) and demonstrate its working.
9 Design and construct a 4-bit R-2R ladder D/A converter using Op-Amp. Determine its accuracy and resolution.

SECOND SEMESTER

Sl. No	Code	Title	HC/SC FC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB201	Probability and Statistics	HC	3	1	0	4	5
2	BS17CB202	Computer Organization and Architecture	HC	4	0	0	4	4
3	BS17CB203	Data Structures using C	HC	4	0	0	4	4
4	BS17CB204	Advanced Linux	HC	4	0	0	4	4
5	BS17CB205	English for Technical Communications	HC	4	0	0	4	4
6	BS17CB206	Constitution of India & Professional Ethics	FC	2	0	0	2	2
7	BS17CB207	Data Structures Lab	HC	0	0	2	2	4
8	BS17CB208	Advanced Linux Lab	HC	0	0	2	2	4
Total Credits				**21**	**1**	**4**	**26**	**31**

BS17CB201	**PROBABILITY AND STATISTICS**	**L**	**T**	**P**	**C**
Total Hours:60		**3**	**1**	**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:

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

- Understand and appreciate descriptive statistics.
- Understand the concepts of probability and random variables.

- Understand and apply statistical theory to analytics field.

COURSE CONTENT:

UNIT I Introduction **15 Hours**

Importance of statistics, concepts of statistical population and a sample -quantitative and qualitative data - collection of primary and secondary data. Designing a questionnaire and a schedule. Classification and tabulation of data. Measurement scales-nominal, ordinal, interval and ratio. Diagrammatic and graphical representation of data. Construction of univariate and bivariate frequency distributions.

UNIT II Univariate data **15 Hours**

Concepts of central tendency, Partition values and dispersion, Measures of inequality-Gini's coefficient and Lorenz curve. Skewness and kurtosis. Their measures based on quartiles and moments.

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 and its applications.

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

Definition, Discrete and continuous random variables, Distribution function probability mass anddensity functions expectation of a random variable and rules of expectation.Moment generating function of a random variable their properties and uses.

Text Books:

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

References Books:

1. Berenson and Levine, Basic Business Statistics, Prentice- Hall India (1996, 6thedition)
2. Daniel and Terrell Business Statistics for Management and Economics, Prentice-Hall India, (1992, 6th edition)
3. Ross Sheldon, A First Course in Probability, Macmillan , (6th edition)

BS17CB202	COMPUTER ORGANIZATION AND ARCHITECTURE	L	T	P	C
Total Hours:60		4	0	0	4

COURSE OBJECTIVES:

- To have a thorough understanding of the basic structure and operation of a digital computer.
- To discuss in detail the operation of the arithmetic UNIT including the algorithms &implem entation of fixed-point and floating-point addition, subtraction, multiplication &division.
- To study the hierarchical memory system including cache memories and virtual memory.
- To study the different ways of communicating with I/O devices and standard I/Ointerfaces.

COURSE OUTCOMES:

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

- Apply the knowledge of basic computer structure to evaluate system performance.
- Compare Different Input Output Organization Schemes.
- Summarize Bus structures used in computer.
- Describe the structure of memory devices used in computer.
- Explain different stages of a complete instruction execution in computer.

COURSE CONTENT:

UNIT I Introduction **15Hours**

Functional UNIT, Basic operational concepts, Bus structures,System Design- Register Level,Processor Level, CPU Organization, Data Representation, Fixed –Point Numbers, Floating Point Numbers.

UNIT II Basic Processing UNIT **15Hours**

Fundamental concepts, Instruction Formats, Instruction Types. Addressing modes, Execution ofcomplete instruction, multiple bus organization, Hardwired control,CPU Control UNIT, Pipeline Control.

UNIT III Memory Organization **15 Hours**

Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

UNIT IV I/O Organization **15 Hours**

Accessing I/O Devices, Interrupts, DMA, Synchronous and Asynchronous bus, Interface circuits, Standard I/O Interfaces.

Text Books:

1. **V**.CarlHamacher, ZvonkoG.Varanesic and SafatG.Zaky, "Computer Organisation", V Edition, Reprint 2012,Tata McGraw-Hill Inc.
2. John P.Hayes, "Computer architecture and Organisation", Tata McGraw-Hill, Third dition, 2012
3. Morris Mano, "Computer System Architecture", Third Edition,Prentice-Hall of India, 2000.

BS17CB203	DATA STRUCTURES USING C	L	T	P	C
Total Hours:60		4	0	0	4

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, Structures, Unions, Pointers and Dynamic Memory Allocation Functions.

UNIT II Linear Data Structures: 15 Hours

Stack: Definition, Stack Operations, Applications of stack (Infix to postfix conversion, evaluation of expression). Queue: Definition, Queue Operations, types of Queues, Applications of Queues. Linked List:

Definition, Types of Linked lists, Linked list operations, Applications of linked list.

UNIT III Searching and Sorting, Hashing, File Structure **15 Hours**

Searching: Linear and Binary Search, **Sorting:** Insertion, Selection, Bubble, Quick, Merge, Heap, Radix sort. **Hashing** Hash Table organizations, Hashing Functions, Static and Dynamic Hashing. **File Operations:** File Attributes, Text Files and Binary Files, Basic File Operations

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

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

Text Books:

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

Reference Books:

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

BS17CB204	ADVANCED LINUX	L	T	P	C
Total Hours:60		4	0	0	4

COURSE OBJECTIVES:

- Understand advanced topics of Linux operating system
- Understand Linux troubleshooting
- Automating Linux common and advanced tasks using scripting

COURSE OUTCOMES:

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

- Ability to understand troubleshooting steps in linux.
- Troubleshooting linux OS issues.
- Ability to write scripts and execute them.

COURSE CONTENT:

UNIT I Configuring Server on Linux **10 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 **20 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: Network Administration Ubuntu and Centos Configure **15 Hours**

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 **15 Hours**

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 initiate 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

BS17CB205	ENGLISH FOR TECHNICAL COMMUNICATIONS	L	T	P	C
Total Hours:60		4	0	0	4

COURSE OBJECTIVES:

- To understand and use spoken English to develop proficiency in theory and communicative skills.
- To communicate orally in English and its usage in formal, semi-formal and official situations.
- To read, write and comprehend texts.
- To understand and use effective writing skills to express ideas and present information.
- To expand the use of English grammar in a stimulating and professional manner.
- Familiarize about adapting their listening, reading and writing for various audiences and contexts they might encounter professionally.

COURSE OUTCOMES:

- The syllabus enables students to use the English language effectively in day to day technical/business communications.
- Familiarize about adapting their listening, reading and writing for various audiences and contexts they might encounter professionally.

COURSE CONTENT:

UNIT I Basics of Technical Communication **15 Hours**

Process of Communication, Language as a Tool, Types of communication(LSRW),levels of Communication, Communication networks, flow of Communication, importance of technical Communication, Barriers to Communication, **Grammar:** Present Tense. **Parts of Speech**: Nouns, Pronouns, verbs Adverbs, **Vocabulary**: word formation, Single word substitutes, Wh-questions,

UNIT II Active Listening and Reading **15 Hours**

Active Listening: Difference between listening and hearing, Types of listening, traits of a good listener. Reading skill: Intensive and extensive reading, skimming and scanning.

Technology in communication: Software for creating messages, software for writing documents, software for presenting documents.**Grammar:** Past Tense **Parts of speech**: Prepositions, Adjectives, Conjunction, Interjection. **Vocabulary:** use of imperatives, use of sequence words

UNIT III Speaking **15 Hours**

Introduction, **Effective Presentation Strategies** ,Defining purpose, analyzing audience and locale, organizing contents, preparing outline, Visual Aids, understanding nuances of delivery, Kinesics, Proxemics, Paralinguistic's: Speaking skills, Phonetics, Stress, Rhythm and Intonation, Practice in speaking skills Chronemics, sample speech, Group Discussion and seminar presentation. **Grammar: Future** Tense. **Vocabulary:** use of abbreviations and acronyms.

UNIT IV Technical Writing **15 Hours**

Introduction to writing skills, Basic rules, Sentence structure, Different Forms of writing, introductory grammar, common errors, Importance of Technical writing. **Reports:** Types, significance, structure, **Technical proposals**: Parts, types, significance, writing of proposal, Technical paper, **Project Dissertation and Thesis** (only Structure). **Types of letters**, Circular, agenda, notice, press release. **Curriculum Vitae**: Bio-Data, Resume,CV, Difference between CV, Bio-Data and Resume. Writing C Vs Cover letters.

Text Books:

1. Technical Communication – Principles and Practices by Meenakshi Raman and Sangeeta Sharma: Oxford University Press, 2007.
2. Improve Your Writing ed. V. N. Arora and Laxmi Chandra, Oxford University Press, 2001, New Delhi.
3. Technical Communication – A Practical Approach by Madhu Rani and SeemaVerma, Acme Learning 2011, New Delhi.

Reference Books:

1. English language Laboratories: A Comprehensive Manual by NiraKonar, PHI
2. Words at Work by David Honer, Peter Strutt, CUP
3. Business Correspondence and Report Writing by R. C. Sharma, Krishna Mohan, Tata McGraw Hill.

BS17CB206	CONSTITUTION OF INDIA & PROFESSIONAL ETHICS	L	T	P	C
Total Hours:30		2	0	0	2

COURSE OBJECTIVES:

- To provide and gain knowledge on Constitution of India
- To know and understand about the Fundamental Rights, Duties and other Rights which is been given byour law.

- To prepare students in the practicality of Constitution perspective and make them face the world as abonafide 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 practise 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 **15 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 **15 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, Electoralprocess, Election Commission.Right to Information (RTI), Consumer and Consumer Protection.

UNIT III Ethics **15 Hours**

Meaning, Definition, Evolution, Need of ethics,Aristotlean Ethics, Utilitarianism, Katianism, Professional Ethics, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees.

UNIT IV Engineering Ethics **15 Hours**

Definition Scope and needs, Ethics in Consumer Protection, Due Care theory, Environmental Ethics,

Ethical Code of Conduct in ethics. Best Ethical Companiesin India and Abroad; Corporate Social Responsibilities, Code of Conduct and Ethical Excellence.

Text Book:

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

BS17CB207	DATA STRUCTURES LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

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.

14. Write a Program to

a) Create AVL Tree

b) Insert element to AVL tree

c) Find the height of the AVL tree

BS17CB208	**ADVANCED LINUX LAB**	**L**	**T**	**P**	**C**
Total Hours:30		**0**	**0**	**2**	**2**

LAB EXPERIMENTS:

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
11. Design, Develop and Implement a Program in C for the following operations on Graph(G) of Cities
    a. Create a Graph of N cities using Adjacency Matrix.
    b. Print all the nodes reachable from a given starting node in a digraph using DFS/BFS method

12. Given a File of N employee records with a set K of Keys(4-digit) which uniquely determine the records in file F. Assume that file F is maintained in memory by a Hash Table(HT) of m memory locations with L as the set of memory addresses (2-digit) of locations in HT.Let the keys in K and addresses in L are Integers. Design and develop a Program in C that uses Hash function H: K à L as H(K)=K mod m (remainder method), and implement hashing technique to map a given key K to the address space L. Resolve the collision (if any) using linear probing.

THIRD SEMESTER

Sl. No	Code	Title	HC/SC/ OE	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB301	Discrete Mathematical Structures with Graph Theory	HC	3	1	0	4	5
2	BS17CB302	Cloud Computing and Virtualization Foundation	HC	3	0	1	4	5
3	BS17CB303	OOP withC++	HC	4	0	0	4	4
4	BS17CB304	Operating Systems	HC	4	0	0	4	4
5	BS17CB305	Data Base Management System	HC	4	0	0	4	4
6	BS17CB306	Numerical Methods	HC	4	0	0	4	4
7	BS17CB307	Programming with C++ Lab	HC	0	0	2	2	4
8	BS17CB308	DBMS Lab	HC	0	0	2	2	4
Total Credits				**22**	**1**	**5**	**28**	**34**

BS17CB301	**DISCRETE MATHEMATICAL STRUCTURES WITH GRAPH THEORY**	**L**	**T**	**P**	**C**
Total Hours:60		**3**	**1**	**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 **18 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 **12 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.

BS17CB302	CLOUD COMPUTING AND VIRTUALIZATION FOUNDATION	L	T	P	C
Total Hours:60		3	0	1	4

COURSE OBJECTIVES:

- Provide storage foundation knowledge on Cloud Computing concepts
- Demystify cloud and virtualization
- Understand multiple Hypervisors/Virtualization technologies used in cloud data center with hands on experience
- Ability to Install and configure Microsoft hyper infrastructure
- Ability to Install and manage Windows server 2016

COURSE OUTCOMES:

On completion of this course the student will be able 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 Virtualizations 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 2012 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 Powershell, Hyper-V Basics , Hyperv-v virtual machine operations, Hyperv Networking, Hyperv storage, Building a Failover Cluster,

Text books:

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

Reference Book:

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

List of Experiments to be conducted

Lab 1 Amazon EC2- Win server 2012 and Redhatlinux (RHEL)

- Launch Windows server 2012 Instance
- connect to the EC2 Windows 2012and RHEL instance
- Terminate the Windows server 2012 and RHEL Instanc

Lab 2 : Amazon Elastic Block Store

- Create Standard Volume
- Create and delete snapshots
- Create Provisioned I/o Volume
- Assign volumes to Windows server 2012 and Ubuntu 14.04 server
- Disassociate and Delete volumes

Lab 3 : Amazon Elastic Load Balancing (ELB)

- **Lab 3.1**
  - 1.Launch Two Ubuntu EC2 Instances- apache web servers with user data
  - Edit HTML files to both the servers
  - Test your web Servers through internet

- **Lab 3.2**
  - 1.Create Elastic Load Balancer
  - Add both the Ubuntu servers to ELB
  - Test your Elastic Load Balancer
  - Delete your Elastic Load Balancer

Lab 5 : AWS s3

- AWS s3- Overview and pricing
- Create Bucket and Folder
- Upload, download, share and delete object
- Delete Bucket

Lab 6 Create ,connect delete Win server 2012 on Microsoft Azure cloud

Lab 7 : create a block storage volume attach to win and linux server of azure cloud

Lab 8 : create a load balancer and attach 2 web servers

Lab 9 : Install windows server 2012/2016

Lab 10 : install hyperv role on windows server

Lab 11 : Create a virtual macinenad install guest operating system

Lab 12 : install iscsi role on win server

Lab 13 : configure failover cluster of two hyperv hosts

Lab 14 : test failover

BS17CB303	OOP With C++	L	T	P	C
Total Hours:60		4	0	0	4

COURSE OBJECTIVES:

- Understand object oriented programming and advanced C++ concepts
- Be able to explain the difference between object oriented programming and→ procedural programming.
- Be able to program using more advanced C++ features such as→ composition of objects, operator overloads, dynamic memory allocation, inheritance and polymorphism, file I/O, exception handling, etc.
- Be able to build C++ classes using appropriate encapsulation and design→ principles.

COURSE OUTCOMES:

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

- Implement classes and objects for a given problem.
- Demonstrate the ability of accessing members in the written programs.
- Use operator overloading and inheritance mechanism for larger modules.
- Identify the usage of virtual functions in programs.
- Write templates for generic classes and also exception handling for error detection and handling.

COURSE CONTENT:

UNIT I Introduction **15 Hours**

Object Oriented paradigm, Structured vs. Object Oriented Paradigm. Elements of Object Oriented Programming: Object, Classes, Encapsulation & data abstraction, Inheritance, Polymorphism etc., C++ Overview, different data types, operators, expressions, const& volatile qualifiers, arrays and strings, reference variables. **Modular Programming with Functions:** Function Components, argument passing, inline functions, function overloading, function templates, recursive functions

UNIT II Classes **15 Hours**

Introduction, Class Specification, Class Objects, access members, defining member functions, data hiding, constructors, destructors, parameterized constructors, static data members, functions, scope resolution operator

Objects: passing objects as arguments, returning objects, friend functions & classes, arrays of objects,

Dynamic objects – Pointers to objects, Class members, Operator overloading using friend functions such as ++, --, [ ] etc. Class templates.

UNIT III Inheritance **15 Hours**

Base Class, Inheritance & protected members, protected base class inheritance, inheriting multiple base classes, Constructors, Destructors & Inheritance. Passing parameters to base Class Constructors, Granting access. **Virtual functions & Polymorphism:** Virtual base classes, Virtual function -Calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, pure virtual functions, abstract classes, using Virtual functions, Early & late binding.

UNIT IV I/O Streams **15 Hours**

IO Stream basics, output operator <<, input >>, additional I/O operators, overloading theoutput operator <<, overloading the input operator >>, file input & output, manipulators. **Exception Handling, STL:**Exception handling fundamentals, Exception handling options, STL: An overview,containers, vectors, lists, maps.

Text Books:

1. Herbert Schildt: C++ The Complete Reference, 4th Edition, Tata McGraw Hill, 2007.

Reference Books:

1. Stephen Prata : C++ Primer Plus, 6th Edition, Person Education
2. Al Stevens: C++ Programming, 7th Edition, Wiley India Publications
3. Stanley B.Lippmann, JoseeLajore: C++Primer, 4th Edition, Addison Wesley, 2005.
4. Object oriented programming with C++, E. Balaguruswamy, TMH.

BS17CB304	OPERATING SYSTEMS	L	T	P	C
Total Hours:60		4	0	0	4

COURSE OBJECTIVES:

- The objectives of this course are to:
- Introduce the history,basics and structure of Operating System
- Describe process concepts and scheduling techniques
- Familiarize with physical and virtual memory management techniques
- Describe UNIX kernel, data structures and internal representation of files in UNIX operating system
- Illustrate Interprocess communication mechanisms

COURSE OUTCOMES:

- On successful completion of this course, student shall be able to:
- Explain the history, basics and structure of operating systems
- Implement various process management and scheduling schemes
- Design and develop memory management techniques
- Demonstrate the internals of UNIX operating system
- Use the computing environment and various services of operating system for development of applications.

COURSE CONTENT:

UNIT I Operating System Principles **15 Hours**

Evolution of Operating Systems, Structural overview, Types of Operating System and operations, Computing environments, Operating System Services, User - Operating System interface, System calls and system programs, Operating System structure, Virtual machines.

UNIT II Process Management **15 Hours**

Process concept, process scheduling, Operations on processes, Inter process communication. Multi-Threaded Programming, Overview, Multithreading models, Thread Libraries, threading issues. Process scheduling: Basic concepts, scheduling criteria, Scheduling algorithms, Multiple Processor scheduling Thread scheduling.

UNIT III Memory Management **15 Hours**

Memory Management Strategies, Swapping, contiguous memory allocation, Paging, structure of page table, Segmentation. Virtual Memory Management: Background, Demand paging, copy-on-write, Page replacement, Allocation methods, Thrashing.

UNIT IV UNIX kernel and its files **15 Hours**

Introduction to Kernel: Architecture of the UNIX operating system, Introduction to system concepts, Kernel data structures, System Administration, Internal representation of Files: Inodes, structure of a regular file, Directories, Conversion of a path Name to an Inode, Super block, Inode assignment to a new file, Allocation of disk blocks, other file types.

Text Books:

1. Abraham Silberschatz,PeterBearGalvin, Greg Gagne,Operating System Principles,Wiley Asia Student Edition 2009.
2. William Stallings, Operating Systems: Internals and Design Principles, Prentice Hall of India, seventh edition 2011.

3. Maurice J. Bach ; The Design of the UNIX Operating System; Pearson Education; Prentice Hall of India, 2004.

References Books :

1. D. M. Dhamdhere;Operating Systems: A Concept-Based Approach; Tata McGraw-Hill,2002.
2. Charles Crowley;Operating System: A Design-oriented Approach; Irwin Publishing,2002.
3. Gary J. Nutt; Operating Systems: A Modern Perspective; Addison-Wesley, 2011.
4. Springer,Springer transaction for advance in Distributed computing and middleware.
5. IEEE,IEEE transaction for Real time operating system.
6. ACM, ACMtransaction for embedded operating system.

BS17CB305	DATA BASE MANAGEMENT SYSTEM	L	T	P	C
Total Hours:60		4	0	0	4

COURSE OBJECTIVES:

- To provide the basic knowledge about the data models and database concepts.
- To describe conceptual data models and ER diagrams.
- To explain theoretical concepts of the relational data model and the relational algebra.
- To describe the use of SQL commands for database operations

COURSE OUTCOMES:

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

- Apply the knowledge to design database schemas.
- Design ER diagrams for given data models.
- Use database concepts and relational models for building database applications.
- Develop database applications for industrial projects.
- Demonstrate skills as a database administrator to control both data and application programs.

COURSE CONTENT:

UNIT I Introduction to databases and Conceptual Modeling **15 Hours**

Introduction, characteristics of the database approach, data models, schemas, instances, database languages and interfaces, Using high-level conceptual data models for database design, a sample database application, entity types, attributes, keys, relationship types, weak entity types, ER diagrams, naming conventions, design issues

.

UNIT II Relational Data Model and Relational algebra **15 Hours**

Relational model concepts, relational model constraints and relational database schemas, update operations, transactions, dealing with constraint violations, unary relational operations, select and project, relational algebra operations from set theory, binary relational operations, join and division, additional relational operations, examples of queries in relational algebra.

UNIT III SQL **15 Hours**

SQL data definition and data types, specifying constraints in SQL, basic retrieval queriesin SQL, insert, delete, update statements in SQL, additional features of SQL, schema change statements in SQL, Retrieving data using the SQL Select Statement, Restricting and sorting data, Using Single row functions, Joins, More complex SQL retrieval queries, views in SQL.

UNIT IV Database Design Theory and Normalization **15 Hours**

Informal design guidelines for relation schemas, Functional dependencies, Normal forms based on primary keys, General definitions of second and third normal forms, Other Normal forms.

Text Books:

1. RaghuRamakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition,McGraw-Hill, 2003.
2. Elmasri and Navathe, Fundamentals of Database Systems, 5th Edition, Pearson Education, 2007.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan: Database System Concepts, 6th Edition,
2. McGraw Hill, 2010.
3. C J Date, Database Design and Relational Theory: Normal Forms and All that Jazz, O 'Reilly, April2012.
4. IEEE, IEEE Transactions on Knowledge and Data Engineering
5. Elsevier, Elsevier Data and Knowledge Engineering
6. ACM, ACM Transactions on Database Systems

BS17CB306	**NUMERICAL METHODS**	**L**	**T**	**P**	**C**
Total Hours:60		**4**	**0**	**0**	**4**

COURSE OBJECTIVES:

At the end of the course, the students would be acquainted with the basic concepts in numerical methods and their uses are summarized as follows:

- The roots of nonlinear (algebraic or transcendental) equations, solutions of large system of linear equations and Eigen value problem of a matrix can be obtained numerically where analytical methods fail to give solution.
- When huge amounts of experimental data are involved, the methods discussed on interpolation will be useful in constructing approximate polynomial to represent the data and to find the intermediate values.

COURSE OUTCOMES:

Students will be able to:

- solve an algebraic or transcendental equation using an appropriate numerical method
- approximate a function using an appropriate numerical method
- solve a differential equation using an appropriate numerical method
- evaluate a derivative at a value using an appropriate numerical method
- solve a linear system of equations using an appropriate numerical method
- perform an error analysis for a given numerical method
- prove results for numerical root finding methods
- calculate a definite integral using an appropriate numerical method
- code a numerical method in a modern computer language

COURSE CONTENT:

UNIT I Solution of Equations and Eigen value Problems **15 Hours**

Solution of equation –Fixed point iteration: Bisection method - Newton's method – Solution of linear system by Gaussian elimination and Gauss-Jordon method– Iterative method - Gauss-Seidel method - Inverse of a matrix by Gauss Jordon method – Eigen value of a matrix by power method and by Jacobi method for symmetric matrix.

UNIT II Interpolation and Approximation **15 Hours**

Lagrangian Polynomials – Divided differences – Interpolating with a cubic spline – Newton's forward and backward difference formulas.

UNIT III Numerical Differentiation and Integration **15 Hours**

Differentiation using interpolation formulae –Numerical integration by trapezoidal and Simpson's1/3 and 3/8 rules – Romberg's method – Two and Three point Gaussian quadrature formulae –Double integrals using trapezoidal and Simpsons's rules.

UNIT IV Initial and Boundary Value Problems for Ordinary Differential Equations 15 Hours

Single step methods: Taylor series method – Euler method for first order equation – Fourth order Runge – Kutta method for solving first and second order equations – Multistep methods: Milne's and Adam's predictor and corrector methods. Finite difference solution of second order ordinary differential equation.

Text Books:

1. Veerarjan, T and Ramachandran, T., "Numerical methods with programming in C",Tata McGraw-HillPublishing.Co.Ltd.
2. Sankara Rao K, "Numerical Methods for Scientisits and Engineers", PrinticeHall of India Private Ltd, New Delhi.

ReferenceBooks:

1. Chapra, S. C and Canale, R. P., "Numerical Methods for Engineers, Tata McGraw-Hill, New Delhi.
2. Gerald, C. F. and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education, Asia, New Delhi.
3. Grewal, B.S. and Grewal,J.S., " Numerical methods in Engineering and Science", Khanna Publishers,New Delhi.

BS17CB307	PROGRAMMING WITH C++ LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. Write a C++ Program to create a class to implement the data structure STACK. Write a constructor to initialize the TOP of the STACK. Write a Member function PUSH() to insert an element and member function POP( ) to delete an element check for overflow and underflow conditions..
2. Write a C.++ program to create a class ARITHMETIC which consists of a FLOAT and an INTEGER variable. Write member functions ADD(),SUB(),MUL(),DIV() to perform addition, subtraction, multiplication, division respectively. Write a member function to get and display values.
3. Write a C++ program to read an integer number and find the sum of all the digits until it reduces to a single digit using constructors. Destructors and inline member functions.
4. Write a C++ program to create a class FLOAT that contains one float data member. Overload all the four Arithmetic operators so that they operate on the object FLOAT.
5. Write a C++ program to create a class STRING. Write a Member Function to initialize get and display strings. Overload the operator ++, and == to concatenate two Strings and to compare two strings respectively.

6. Write a C++ program to create class, which consists of EMPLOYEE Detail like E_ Number, E_ Name, Department, Basic, Salary, Grade. Write a member function to get and display them. Derive a class PAY from the above class and write a member function to calculate DA, HRA and PF depending on the grade.
7. Write a C++ program to create a class SHAPE. which consists of two VIRTUAL FUNCTIONS Calculate_Area() and Calculate__Perimeter() to calculate area and perimeter of various figures. Derive three classes SQUARE. RECTANGLE. TRIANGLE from class Shape and Calculate Area and Perimeter of each class separately and display the result.
8. Write a C++ program to create two classes. Each class consists of two private variables a integer and a float variable. Write member functions to get and display them.
9. Write a friend Function common to both classes, which takes the object of above two classes as arguments and the integer and float values of both objects separately and display the result.
10. Write a C++ program using Function Overloading to read two Matrices of different Data Types such as integers and floating point numbers. Find out the sum of the above two matrices separately and display the sum of these arrays individually.
11. Write a C++ Program to check whether the given string is a palindrome or not using Pointers.
12. Write a C++ Program to create a File and to display the contents of that file with line numbers.
13. Write a C ++ Program to merge two files into a single file.

BS17CB308	**DBMS LAB**	**L**	**T**	**P**	**C**
Total Hours:30		**0**	**0**	**2**	**2**

LAB EXPERIMENTS:

1.Consider the insurance database given below. The primary keys are underlined and the datatypes are specified.

PERSON (driver_id#: String,name: string,address: string)

CAR (Regno: string, model: string, year: int)

ACCIDENT (report_number: int, acc_date: date, location: string)

OWNS(driver_id#: string, Regno: string)

PARICIPATED(driver_id: string, Regno: string, report_number: int, damageamount: int)

(i) create the above tables by properly specifying the primary keys and the foreign keys.

(ii) Enter atleast five tuples for each relation

(iii) Demonstrate how you

a. update the damage amount for the car with a specific Regno in the accident with report number 12 to 25000.

b. Add a new accident to the database.

(iv) find the total number of people who owned cars that were involved in accidents in 2002.

(v) Find the number of accidents in which cars belonging to a generation of suitable reports.

Create suitable front end for querying and displaying the results.

2.Consider the following relations for an order processing database application in a company.

CUSTOMER(cust#:int, cname: string, city: string)

ORDER(order#: int, odate: date, cust#: int, ord_amt: int)

ORDER_ITEM(order#:int, Item#:int,qty:int)

ITEM(item#: int,UNIT_price: int)

SHIPMENT(order#:int, warehouse#:int, ship_date:date)

Warehouse(warehouse#: Int,city: string)

(i) create the above tables by properly specifying the primary keys and the foreign keys.

(ii) Enter at least five tuples for each relation.

(iii) Produce a listing: CUSTNAME, #oforderes, AVG_ORDER_AMT, where the middle column is the total numbers of orders by the customers and the last column is the average order amount for that customer.

(iv) List the order# for orders that were shipped from all the warehouses that the company has in a specific city.

(v) Demonstrate how you delete item# 10 from the ITEM table and make that field null in the ORDER_ITEM table.

(vi) Generation of suitable reports.

Create suitable front end for querying and displaying the results.

3.Consider the following database of student enrollment in courses & books adopted for each course.

STUDENT(regno: string, name: string, major: string, bdate: date)

COURSE(course#: int, cname: string,dept: string)

ENROLL(regno: string, course#: int, sem: int, marks: int)

BOOK_ADOPTION(course#: int, sem: int, book_ISBN: int)

TEXT(book_ISBN: int, book_title: string, publisher: string, author: string)

(i) create the above tables by properly specifying the primary keys and the foreign keys.

(ii) Enter at least five tuples for each relation.

(iii) Demonstrate how you add a new text book to the database and make this book be adopted by some deartment.

(iv) Produce a list of text books(include course #,book_ISBN,book_title)in the alphabetical order for courses offered by the 'CS' department that use more than two books.

(v) List any department that has all its adopted books publishes by a specific publisher.

(vi) Generation of suitable reports.

(vii) Create suitable front end for querying and displaying the results.

4. Consider the following database for a banking enterprise. The primary keys are underlined and the data types are specified.

BRANCH (branch_name:string, branch_city:string, assests:real)

ACCOUNT(accno:int, branch-name:string, balance:real)

DEPOSITOR(customer_name:string, accno:int)

CUSTOMER(customer_name:string, customer_street:string, customer_city:string)

LOAN(loan_number:int, branch_name:string, amount:real)

BORROWER(customer_name:string, loan_number:int)

(i) create the above tables by properly specifying the primary keys and the foreign keys

(ii) Enter at least five tuples for each relation

(iii) Find all the customers who have at least two accounts at the main branch

(iv) Find all the customers who have an account at all the branches located in a specific city.

(v) Generation of suitable reports.

(vi) Create suitable front end for querying and displaying the results.

5.The following tables are maintained by a book dealer.

AUTHOR(author_id:int, name;string, city: string, country:string)

PUBLISHER(publisher_id:int, name:string, city:string, country:string)

CATALOG(book_id:int, title:string, author_id:int, publisher_id:int, category_id:int, year:int, price:int)

CATEGORY(category_id:int, description:string)

ORDER_DETAILS(order_no:int, book_id:int, quantity:int)

(i) Create the above tables by properly specifying the primary keys and the foreign keys.

(ii) Enter at least five tuples for each relation.

(iii) Give the details of the authors who have 2 or more books in the catalog and the price of the books in the catalog and the year of publication is after 2000.

(iv) Find the author of the book which has maximum sales.

(v) Demonstrate how you increase the price of books published by a specific publisher by 10%.

(vi) Generation of suitable reports.

(vii) Create suitable front end for querying and displaying the results.

FOURTH SEMESTER

Sl. No	Code	Title	HC/ SC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB401	Operations Research	HC	3	1	0	4	5
2	BS17CB402	Cloud Computing Architecture and Design	HC	3	0	1	4	5
3	BS17CB403	Advanced Java Programming	HC	4	0	0	4	4
4	BS17CB404	Computer Networks	HC	3	0	1	4	5
5	BS17CB405	Design & Analysis of Algorithm	HC	4	0	0	4	4
6	BS17CB406	Data Warehousing & Data Mining	HC	4	0	0	4	4
7	BS17CB407	Design & Analysis of Algorithm Lab	HC	0	0	2	2	4
8	BS17CB408	Advanced Java Programming Lab	HC	0	0	2	2	4
Total Credits				**21**	**1**	**6**	**28**	**35**

BS17CB401	OPERATIONS RESEARCH	L	T	P	C
Total Hours:60		3	1	0	4

COURSE OBJECTIVES:

- Introduce students to the techniques of operations research in mining operations
- Provide students with basic skills and knowledge of operations research and its application in mineral industry
- Introduce students to practical application of operations research in big mining projects

COURSE OUTCOMES:

- Formulate and solve problems as networks and graphs.
- Develop linear programming (LP) models for shortest path, maximum flow, minimal spanning tree, critical path, minimum cost flow, and transshipment problems.
- Solve the problems using special solution algorithms.
- Use CPM and PERT techniques, to plan, schedule, and control project activities.
- Construct linear integer programming models and discuss the solution techniques.
- Formulate pure, mixed, and binary integer programming models.

COURSE CONTENT:

UNIT I Introduction and Linear Programming Problems (LPP) 14 Hours

Introduction to OR Modeling Approach and Various Real Life Situations, Basic LPP and Applications; Various Components of LP Problem Formulation, Solving LPP: Using Simultaneous Equations and Graphical Method; Simplex Method.

UNIT II Solving Linear Programming Problems and Transportation Problems 16 Hours

Big – M Method.Two-Phase Method, DualityTheory; Transportation Problems and Assignment Problems

UNIT III Network Analysis 15 Hours

Shortest Path: Dijkstra Algorithm; PERT-CPM problems (Cost Analysis, Crashing, Resource Allocation excluded)

UNIT IV Game Theory and Queuing Theory 15 Hours

Introduction ; 2- person Zero – sum Game; Saddle Point ; Mini-Max and Maxi-Min Theorems(statement

only); Games without saddle point ; Graphical Method ; Principle of Dominance. Introduction; Basic Definitions and Notations; Axiomatic Derivation of the Arrival & Departure (Poisson Queue). Poisson Queue Models: M/M/1: ∞/FIFO andM/M/1: N/ FIFO.

Text Book:

1. H.A. Taha, "Operations Research", Fifth Edn. Macmillan Publishing Company,.

ReferenceBooks :

1. V.K.Kapoor – "Operations Research" problem & Solutions, fourth revised edition, Sultan Chand & Sons Educational Publishers, New Delhi.
2. KantiSwaroop – " Operations Research"
3. Hadley G., "Linear Programming" Narosa Publishers, 1987
4. Hillier F. & Liebermann G.J., "Introduction to Operations Research" 7/e , THM
5. Hillier F.& Liebermann G.J., "Operations Research", Holder Day Inc, 1974
6. Mustafi : Operations Research, New Age International
7. Mital : Optimization Methods, New Age International
8. Shenoy : Operations Research for Management , New Age International
9. Mahapatra : Introduction to System Dynamics Modelling, Universities PressRao : Engineering Optimization , New Age International
10. Schaum Outline Series – "Operations Research" ,TMH

BS17CB402	CLOUD COMPUTING ARCHITECTURE AND DESIGN	L	T	P	C
Total Hours:60		3	0	1	4

COURSE OBJECTIVES:

- To get understanding of Cloud Data centre Infrastructure framework.
- To understand components which help achieve cloud infrastructure.

COURSE OUTCOMES:

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

- To differentiate the various components in cloud data centre.
- Understand the importance and relevance of components and inter relation.
- Ability to Install and configure Citrix Xen host clusters and configure High availability for VM.

COURSE CONTENT:

UNIT I Cloud Enabling and Data centre /VMware ESXi Technology 15 Hours

Internet service Providers, technical and business considerations, virtualization, standardization, automation, remote operations and management, High availability, security-aware design ,operation, and Management ,computing hardware, storage hardware, network hardware, virtualization technology, Multi-tenant technology, service technology .VMware ESXi 5.5 or above (Exploring VSphere 5.5, Planning and installing VMware ESXi 5.5 , Install and configure vcentre Server, setup vsphere web application for management, creating and configuring virtual networks, creating and configuring shared storage (iSCSI SAN or NFS) for storing VM's , Configure vsphere high availability and test VM failover, VM snapshots and restore, VM clone.

UNIT II Fundamentals of cloud architecture 15 Hours

Introduction to UML and TOGAF, workload Distribution Architecture, resource pooling architecture, Dynamic scalability architecture, Elastic resource capacity architecture, server load balancing architecture, cloud bursting architecture, elastic disk provisioning architecture, redundant storage architecture, case study example.

UNIT III Advanced cloud architecture and Virtualization with Citrix Xen Server 15 Hours

Hypervisor clustering architecture, load balanced virtual server instances, non-disruptive service relocation architecture, zero downtime architecture, cloud balancing architecture, resource reservation architecture, dynamic failure detection and recovery architecture, bare-metal provisioning architecture, rapid provisioning architecture, storage workload management architecture ,case study example . Citrix xen (Installing and configure Xen Server, install xencentre client, configuring xen server networking, Xen server storage overview and components.)

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

Lab Experiment

• ESXi Hypervisor – Installation and Configure

• vCenter – Installation and Configure

• Virtual Machine (Linux) – Create and Manage on ESXi

• Virtual Machine (Windows) – Create and Manage on ESXi

• Configure Cluster and High Availability of VMware Esxi server

• Xen Server – Installation and Configure

• XenCenter – Installation and Configure

• Virtual Machine (Linux) – Create and Manage on Xen server

• Virtual Machine (Windows) – Create and Manage on Xen Server

• Configure Cluster and High Availability on Xen Server

BS17CB403	ADVANCED JAVA PROGRAMMING	L	T	P	C
Total Hours:60		4	0	0	4

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 HTML **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, GenericServlet, 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
3. https://www.tutorialspoint.com/java/

BS17CB404	COMPUTER NETWORKS	L	T	P	C
Total Hours:60		3	0	1	4

COURSE OBJECTIVES:

The objective of this course is to:

- Understand basics of Networking and VLAN
- Understand basics of router and configuration

COURSE OUTCOMES:

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

- Ability to understand functions of networking, LAN and Ethernet
- Understand and setup basic LAN
- Understand and configure VLAN
- Understand and configure router.

COURSE CONTENT:

UNIT I Network basics **15 Hours**

What are network and physical components of networking, network topologies, OSI and TCP/IP Models, LAN's and Ethernet.

UNIT II Switching foundation **15 Hours**

Understand the need for switches, initial configuration of a switch, Basic switch configuration, verify the switch startups, understand need for VLAN and VLAN tunneling protocol, VTP Models, VLAN creation and port assignment, adds, moves and changes to VLAN.

UNIT III TCP/IP Transport and Internet Layer and IP addressing **15 Hours**

TCP/IP's Internet layer, IP Network addressing, Public and Private IP Address, DHCP, DNS, Understanding binary numbering, Decimal and binary systems, Sub networks, subnet creation, Configuring Hosts for Class A, Class C and Class B, Understand Transport layer, and session multiplexing.

UNIT IV Routing **15 Hours**

Understand functions of routing and routing tables, static routing, dynamic routing, default routes, Packet delivery process, configuring a Cisco router, dynamic routing protocols. Introduction to software defined networking in Linux (open vs. witch and linux bridge)

Text Books:

1. Interconnecting Cisco Network Devices, Part 1 (ICND1) Foundation Learning Guide, 4th Edition,by Anthony Sequeira
2. Routing and Switching Essentials v6 Companion Guide, By Cisco Networking Academy

Lab Experiments

- Create VLAN
- Create subnets
- Configure gateways
- Configure route between subnets
- Install and configure open vs. witch (OVS)
- Create software switches using OVS
- Create GRE tunnel

BS17CB405	DESIGN & ANALYSIS OF ALGORITHM	L	T	P	C
Total Hours:60		4	0	0	4

COURSE OBJECTIVES:

- To analyze the asymptotic performance of algorithms.
- To write rigorous correctness proofs for algorithms.
- To demonstrate a familiarity with major algorithms and data structures.
- To apply important algorithmic design paradigms and methods of analysis.

COURSE OUTCOMES:

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

- Understand the fundamental principles underlying algorithm analysis and design and be able to apply them in specific instances
- Understand Asymptotic notations and apply them to simple methods, including methods that utilize complex loops and recursion;
- Analyze run-time execution of previous learned sorting methods, including selection and merge sort;
- Implement and analyze insertion sort and Quick sort

COURSE CONTENT:

UNIT I Introduction **15 Hours**

Notion of Algorithm; Review of Asymptotic Notations; Mathematical Analysis of Non- Recursive and Recursive Algorithms Brute Force Approaches: Introduction; Selection Sort and Bubble Sort; Sequential Search and Brute Force String Matching

UNIT II Divide and Conquer and the Greedy Method **15 Hours**

Divide and Conquer - General Method; Binary Search; Merge Sort; Quick Sort and its performance; Greedy Method - The General Method; Knapsack Problem; Minimum-Cost Spanning Trees: Prim's Algorithm; Kruskal's Algorithm; Single Source Shortest Paths.

UNIT III Dynamic Programming And Decrease-And-Conquer **15 Hours**

Dynamic Programming - The General Method; Warshall's Algorithm; Floyd's Algorithm for the All-Pairs Shortest Paths Problem; Single-Source Shortest Paths: General Weights; 0/1 Knapsack. Decrease-and-Conquer Approaches - Introduction; Insertion Sort; Depth First Search and Breadth First Search;

Topological Sorting

UNIT IV Space-Time Tradeoffs And Coping With Limitations Of Algorithmic Power 15 Hours

Space-Time Tradeoffs -Introduction; Sorting by Counting; Input Enhancement in String Matching; Decision Trees; P; NP; and NP Complete Problems; coping with limitations of algorithmic power – Backtracking - n - Queens problem; Hamiltonian Circuit Problem; Subset – Sum Problem; Branch-and-Bound - Assignment Problem; Knapsack Problem; Traveling Salesperson Problem

Text Books:

1. Anany Levitin, Introduction to the Design and Analysis of Algorithms, 2nd Edition, Pearson
2. Education, 2007.
3. Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivestand Clifford Stein, Introduction toAlgorithms, 3rd Edition, PHI, 2010.
4. R C T Lee, S S Tseng, R C Chang andY T Tsai, Introduction to the Design and Analysis of Algorithms
5. A Strategic Approach, Tata McGraw Hill, 2005.Jon Kleinbergand E. Tardos, Algorithm Design, Pearson Addison-Wesley, 2004.
6. S. Dasgupta, C. Papadimitriou and U. Vazirani Algorithms, 1st Edition, McGraw-Hill Education, 2006.
7. AV Aho, JE Hopcroft and JD Ullman, The Design and Analysis of Algorithms, Addison-WesleyPublishing Company, 1974.

BS17CB406	**DATA WAREHOUSING & DATA MINING**	**L**	**T**	**P**	**C**
Total Hours:60		**4**	**0**	**0**	**4**

COURSE OBJECTIVES:

- To expose the students to the concepts of data warehousing architecture and OLAP
- To understand data mining principles and techniques and introduce DM applications
- To understand the basic concepts and algorithms of association analysis.
- To understand the concept of classification for the retrieval purposes.

COURSE OUTCOMES:

- To be able to illustrate the issues surrounding the Integration of theory and practice
- To be able to evaluate new and emerging technologies in terms of their suitability for BI and DW software development purposes.
- To be able to apply the association rules for mining the data

- Design and deploy appropriate classification techniques

COURSE CONTENT:

UNIT I Data Warehousing **15 Hours**

Introduction, Operational Data Stores (ODS), Extraction Transformation Loading (ETL), Data Warehouses Design Issues, Guidelines for Data Warehouse Implementation, Data Warehouse Metadata Online Analytical Processing (OLAP): Characteristics of OLAP systems, Multidimensional view and Data cube, Data Cube Implementations, Data Cube operations, Implementation of OLAP and overview on OLAP Software's.

UNIT II Data Mining **15 Hours**

Challenges, Data Mining Tasks, Types of Data, Data Preprocessing, Measures of Similarity and Dissimilarity, Data Mining Applications.

UNIT III Association Analysis: Basic Concepts and Algorithms **15 Hours**

Frequent Item set Generation, Rule Generation, Compact Representation of Frequent Item sets, Alternative methods for generating Frequent Item sets, FP Growth Algorithm, Evaluation of Association Patterns

UNIT IV Classification and Clustering **15 Hours**

Basics, General approach to solve classification problem, Decision Trees, Rule Based Classifiers, and Nearest Neighbor Classifiers. Bayesian Classifiers, Estimating Predictive accuracy of classification methods, improving accuracy of clarification methods. Clustering :Methods, Partitional Methods, Hierarchical Methods, Density Based Methods, Features of Cluster Analysis.

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.

BS17CB407	DESIGN & ANALYSIS OF ALGORITHM LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. Design an algorithm to sort a given set of elements using the Quick sort technique and implement the same to perform Empirical Analysis for different values of n; the number of elements in the list to be sorted and plot a graph of the time taken versus n. The elements must be read from a file OR the student is expected to apply random number generator concept to supply the input to the program.
2. Develop an algorithm for the given Directed Acyclic Graph to achieve the following:
   a. Compute all the nodes that are reachable from source node using BFS method.
   b. Analyze whether a given graph is connected or not using DFS method.
3. Construct a Minimum Cost Spanning Tree for a given undirected graph using Kruskal's and Prim's algorithm and perform the empirical analysis on them. Also compare the order of their growths and prepare a report on the same.
4. Evaluate a given node in a weighted connected graph and find all the shortest paths to other nodes using Dijkstra's algorithm.
5. a. Implement All-Pairs Shortest Paths Problem using Floyd's Algorithm.
   b. Implement 0/1 Knapsack problem using Dynamic Programming algorithm.
6. a. Obtain the Topological ordering of vertices in a given digraph.

b. Compute the transitive closure of a given directed graph using Warshall's algorithm.

7. Deduce an optimal solution for the Traveling Salesperson problem. Also apply error approximation algorithm to determine the error in the instances. The student is free to use either dynamic programming concept OR brute force OR backtracking technique to derive optimal solution.
8. Find a subset of a given set $S = \{s_1;s_2;. . . . . ;s_n\}$ of n positive integers whose sum is equal to a given positive integer d. For example; if S= {1; 2; 5; 6; 8} and d = 9 there are two solutions{1;2;6}and{1;8}. A suitable message is to be displayed if the given problem instance doesn't have a solution.
9. Implement String matching algorithm using brute force; Horspool's Method and Knuth-Morris-Pratt. Perform Empirical Analysis for all the three algorithms for the limited set of Strings and compare their outcomes and document the same.
10. Implement *N* Queen's problem using Back Tracking and display the results in the form of a table showing all possible placements of *N* Queens for some instances of *n*.

BS17CB408	ADVANCED JAVA PROGRAMMING LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

Part-A

1. Demonstrate various I/O streams in java.
2. Demonstrate the Reader/Writer classes in java.
3. Demonstrate the multithreading concept by implementing Runnable interface.
4. Demonstrate the multithreading concept by extending Thread class.
5. Write an applet program and using paint function make some graphics.
6. Write a program to demonstrate the usage of different Layouts in java.
7. Write a java program to demonstrate various GUI components in java (AWT / SWING) with appropriate Event Handling.
8. Creating simple JDBC application
9. Implement java beans and insert into different tools.
10. Simple Application using JDBC API.
11. Develop the application using Servlets and Jsp .
12. EJB Applications which Demonstrate Session Bean, MDB and Persistance.

Part – B

Design a simple windows application using swings and MYSQL by following the constraints listed below

1. Should be a team project with max of two
2. All the layouts should be used in the entire project
3. All the validations are must
4. Packages, interfaces, inheritance and Exception handling concepts must be used

FIFTH SEMESTER

Sl. No	Code	Title	HC/ SC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB501	AWS & Azure Public Cloud Platforms	HC	2	1	0	3	4
2	BS17CB502	Big Data Analytics using Hadoop	HC	2	1	1	4	6
3	BS17CB503	Programming with Ruby & Python	HC	2	1	0	3	4
4	BS17CB504	Cloud Databases	HC	3	0	1	4	5
5	BS17CB515	Enterprise Resource Planning	SC	2	1	0	3	4
	BS17CB525	E-Commerce						
6	BS17CB516	Web Programming	SC	2	0	1	3	4
	BS17CB526	C# and .Net						
7	BS17CB505	AWS and Azure Public Cloud lab	HC	0	0	2	2	2
8	BS17CB506	Programming with Ruby & Python lab	HC	0	0	2	2	2
Total Credits				**13**	**4**	**7**	**24**	**31**

BS17CB501	AWS & AZURE PUBLIC CLOUD PLATFORMS	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

- Have hands on knowledge on Amazon cloud
- Have hands on knowledge on Azure 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 **15 Hours**

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

UNIT III Amazon Web Services Cloud **15 Hours**

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, DynamoDB, 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 SimpleDBPaperback ,**byJamesMurty**
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**

Reference Sites:

1. http://www.amazon.com/Getting-Started-AWS-Amazon-Services-ebook
2. https://docs.microsoft.com/en-us/azure/

BS17CB502	BIG DATA ANALYTICS USING HADOOP	L	T	P	C
Total Hours:60		2	1	1	4

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 /BigData, Hadoop concepts, hdfs, getting started with Hadoop frameworks and HadoopInstallationchecking 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

Map Reduce, 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 Map Reduce **15 Hours**

Developing a Map Reduce program, setting up the development environment, writing a UNIT test with MR UNIT, Map Reduce workflows, How Map Reduce works, Failures ,Map Reduce types and format, Map Reduce features

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

UNIT III Hadoop administration Flume and Sqoop **15 Hours**

Hadoop administration, basics of Hadoop administration, basics of Map Reduce development, Hadoop Input/output, Testing Hadoop Programs. Monitoring Hadoop, Killing a Data node process, killing a task tracker process, killing a job tracker process, killing the name node process, setting up a nodeHadoop cluster, Administering Hadoop. What is Flume, installing Flume, integrating Flume with applications. What is Sqoop, getting Sqoop, Sqoop imports a deeper look, working with imported data in Sqoop

Chapter 10,11,14,15 (Hadoop-The.Definitive.Guide_4.edition_a_Tom.White_April-2015.pdf)

UNIT IV Big Data ecosystem projects Pig,Hive, Spark,HBase, zookeeper **15 Hours**

Introduction to Pig,Installing and running Pig,PigLatin,User defined function in Pig,Data processing operators in Pig, Pig in practice, Introduction to Hive, Installing and configuring Hive, comparison with traditional databases,HiveQL, Tables, querrying data, UDF in Hive. Introduction to Spark, Installing Spark, anatomy of Spark job run, executors and cluster managers. Introduction to HBase,Installation of HBase, using HBase clients, HBasevs RDMS. Introduction to zookeeper, Installing and running zookeeper, building applications with zookeeper, zookeeper in production

Chapter 16,17,19,20,21(Hadoop-The.Definitive.Guide_4.edition_a_Tom.White_April-2015.pdf)

Text Books:

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

Big data analytics using hadoop lab

1. Setup single node hadoop cluster
2. Run hadoop sample jobs
3. Install configure hive perform analytics
4. Install and configure flume and perform analytics
5. Hadoop operations and troubleshooting

BS17CB503	PROGRAMMING WITH RUBY & PYTHON	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 Python **15 Hours**

Introduction to python, the setup, write first python program, comments and pound characteristics, numbers and math, variables and names, strings and text, printing, prompting people, asking questions,

UNIT II **15 Hours**

Prompting and passing, reading and writing files, names ,variables, code ,functions, what if ,and else and if , designing and debugging, modules ,classes and objects. Your first website

UNIT III Writing python scripts **15 Hours**

Write scripts to automate common tasks, write scripts to perform arithmetic operations, write script to connect to Database server and create tables and insert data into database

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

Getting started with Ruby, installing Ruby, Ruby building blocks, develop your first Ruby application, classes ,objects, and modules in Ruby, Objects and libraries, error handling ,debugging and Testing ,Files and Databases, Advanced Ruby features, Developing a larger Ruby application,Ruby Online (Web application frameworks theory : Rails, and Sinatra , Ruby and the internet, GUI-Based Desktop application

development overview, useful ruby Libraries and Gems)

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

Reference Books:

1. Beginning Ruby: From Novice to Professional (Expert's Voice in Open Source) by Peter Cooper
2. Learn Python the hard way 3rd edition

BS17CB504	CLOUD DATABASES	L	T	P	C
Total Hours:60		3	0	1	4

COURSE OBJECTIVES:

The objective of this course is to:

- To classify the latest trends in databases.
- To summarize the features of NoSQL systems.
- To distinguish NoSQL databases with each other and relational systems
- To compare the various NoSQL Data models.
- To acquire knowledge in parallel, distributed databases and its applications.
- To understand the usage of advanced data models.
- To learn emerging databases like MongoDB, HBase etc.

COURSE OUTCOMES:

The student should know and understand:

- Describe NoSQL Databases.
- Compare the four types of NoSQL Databases (Document oriented, Key Value Pairs, Column oriented and Graph).
- Explain the need of NoSQL databases in handling Big data.
- Distinguish between the types of NOSQL databases.
- Demonstrate the data models in these databases.
- Apply appropriate Data model for any application.
- Design and write queries in NOSQL Databases.
- Evaluate NoSQL database development tools and programming languages

- Applythe principles behind Distributed storage models.

COURSE CONTENT:

UNIT I Introduction to NOSQL **15 Hours**

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

UNIT II Postgresql Database **15 Hours**

Install and operate PostgreSQL, Create and delete databases and database users, Produce and delete tables, Use pgcrypto to store passwords safely, Insert, update, and delete data from tables.

Introduction to Key-value stores- Exploring RedisRedis data model Storing Data in and Accessing Data from Apache Redis –Querying in Redis.

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

Introduction to Document stores, Exploring MongoDB, MongoDB data model, Storing Data in and Accessing Data from MongoDB, CRUD operations in MongoDB. Querying in MongoDB using examples, Interact with MongoDB using Language Binding using any one language(PHP/JAVA/PYTHON)

UNIT IV Advanced NOSQL **15 Hours**

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

Text Books:

1. Pramod. J. Sadalge, Martin Fowler, NoSQL distilled, A brief guide to emerging world of Polyglot persistence. Addison-Wesley 2013.

2. Lars GeorgeHBase: A definitive Guide, OReilly publications,2011.

3. Josiah L. Carlson, Redis in Action,Manning Publications, 2013.

4. The Definitive guide to MongoDB, The NoSQL Database for Cloud and Desktop Computing, Apress2010 .

5. Instant PostgreSQLStarter by Daniel K. Lyons

Reference Books:

1. "Professional NOSQL" by Shashank Tiwari, 2011, WROX Press

2. Kristina Chodorow, MongoDB: The Definitive Guide, 2nd Edition, O'Reilly publications,2013

Reference Websites:

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

Cloud Database Laboratory

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

BS17CB515	ENTERPRISE RESOURCE PLANNING	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

To make student able to:

- Build an understanding of the fundamental concepts of ERP systems, their architecture, and working of different modules in ERP.
- learn various components of an application software that help computerize functioning of an enterprise such as sales, materials, production, financial , customer relationship AND supply chain modules.
- Provide a contemporary and forward - looking on the theory and practice of Enterprise Resource Planning Technology.
- Develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
- Prepare the students technological competitive and make them ready to self - upgrade with the higher technical skills.

COURSE OUTCOMES

After completing this course, student will be able to

- Make basic use of Enterprise software, and its role in integrating business functions
- Analyze the strategic options for ERP identification and adoption.
- Design the ERP implementation strategies.
- Create reengineered business processes for successful ERP implementation
- Comprehend the technical aspects of ERP systems.
- Analyze the steps and activities in the ERP life cycle
- Identify the typical functionality in an ERP system;
- Explain the scope of common Enterprise Systems (e.g., MM, SCM, CRM, HRM, procurement)
- Explain the challenges associated with implementing enterprise systems and their impacts on organizations

COURSE CONTENT:

UNIT I Introduction to ERP **15 Hours**

Introduction to ERP - Basic ERP concepts - Risks of ERP- Benefits of ERP.**ERP Technology : E**RP and Related Technologies – Business Intelligence – E-Commerce and E-Business - Business Process Reengineering – Data Warehousing – Data Mining – Supply Chain Management – Customer Relationship Management.(Part I, II)

UNIT II ERP Implementation **15 Hours**

Implementation Challenges - Implementation Strategies - Implementation Life Cycle - Implementation Methodologies – Project Management and Monitoring – Post Implementation activities. (Part III)

UNIT III ERP Business modules & Market **15 Hours**

Business Modules of an ERP Package – Finance - Manufacturing – Human Resource - Quality Management – Marketing – Sales, Distribution and Service.ERP Marketplace and Marketplace Dynamics – SAP AG – Oracle Corporation – PeopleSoft. (Part V & VI)

UNIT IV ERP Present and Future **15 Hours**

Turbo Charge the ERP System – Enterprise Application Integration – ERP, Internet and WWW - ERP II – ERP and Total Quality Management - Future directions and Trends in ERP. (Part VII)

Text Book:

1. Alexis Leon, "ERP Demystified", Tata McGraw Hill, 1999.(Part I to III, V to VII)

Reference Book:

1. Joseph A. Brady, Ellen F. Monk, Bret J. Wangner, "Concepts in Enterprise Resource Planning", Thomson Learning, 2001.
2. Jose Antonio Fernandz, " The SAP R /3 Hand book", Tata McGraw Hill
3. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI
4. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology
5. Mary Summer, "Enterprise Resource Planning"- Pearson Education

BS17CB525	E-COMMERCE	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

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.**E-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.

BS17CB516	WEB PROGRAMMING	L	T	P	C
Total Hours:60		2	0	1	3

COURSE OBJECTIVES:

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 and Tags,

UNIT II HTML 5 **15 Hours**

Detecting HTML5 features – Canvas, Video, Local Storage, Web Workers, Offline Applications, Geolocation, Placeholders and input types, What Does It All Mean–Doctype, Root, Headers, Articles, Dates

and Times, Navigation and Footers. Simple Shapes, Canvas, Paths, Texts, Gradients and Images. 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 ExpressionsJavaScript: 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: UnderstandingjQuery,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.

BS17CB526	**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:

UNIT I .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:

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

.NET FRAMEWORK AND APPLICATIONS LABORATORY

Part – A

1. Design and develop a C# program following constrains

- Room class with 1 abstract method and 1 Virtual Method in it
- Class-Room and Lab classes should inherit Room Class
- Class-Room should override both abstract and virtual method from Room Class
- Lab class Should override only abstract class

Display proper messages in the main class

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

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

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

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

PART – B

Design an ASP.Net website using C# by following the constraints listed below

- Should be a team project with max of two members
- Should use any version control software for version management
- Database with stored procedures is must
- Should have minimum of 3 reports

Following concepts are must

i) Different Master pages for Different Users

ii) Sessions

iii) Login Screen

iv) GridView, ListView

v) Crystal Reports

vi) DLL for all the database processing

vii) DLL for all the validations

viii) Disconnected data modal for filling comboboxs and gridviews

BS17CB505	AWS AND AZURE PUBLIC CLOUD LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1.Amazon EC2- Win server 2012 (Hands on lab by students)

- Launch Windows server (Latest Version)2012 Instance
- Decrypt Password and download RDP shortcut client
- connect to the EC2 Windows 2012 instance
- Terminate the Windows server 2012 Instance

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

- Create Standard Volume
- Create and delete snapshots
- Create Provisioned I/o Volume
- Assign volumes to Windows server 2012 and Ubuntu 14.04 server
- Disassociate and Delete volumes

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

- Lab 3.1
    1. Launch Two Ubuntu EC2 Instances- apache web servers with user data
    2. Edit HTML files to both the servers
    3. Test your web Servers through internet
- Lab 3.2
    1. Create Elastic Load Balancer
    2. Add both the Ubuntu servers to ELB
    3. Test your Elastic Load Balancer
    4. Delete your Elastic Load Balancer

4.AWS Route53

- What is Route53
- Route-53 demo integration with ELB you created (Performed by Instructor only)

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

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

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

- RDS- An overview
- RDS –read replica
- RDS- Multi AZ failover
- RDS snapshots
    1. Lab 1 : Create a RDS instance
    2. Lab 2 : connecting to an RDS instance
    3. Lab 3 : creating a RDS snapshots and restoring snapshot
    4. Lab 4: Deleting RDS snapshots
- Deploy Web application in Amazon Ec2 (media wiki)
- Connect your Media wiki web application with RDS instances securely
- Make media wiki available on public url for user sign up and write knowledge wiki
- Delete Your RDS instance

7.AWS s3 (Hands on lab by students)

- AWS s3- Overview and pricing
- Create Bucket and Folder
- Upload, download, share and delete object
- Delete Bucket

Azure Lab

1. Deploy workloads on Azure Resource Manager (ARM) virtual machines (VMs)
2. Identify workloads that can and cannot be deployed; run workloads, including Microsoft and Linux; create VMs; connect to a Windows/Linux VM
3. Implement Azure storage blobs and Azure files
4. Read data, change data, set metadata on a container, store data using block and page blobs, stream data using blobs, access blobs securely, implement async blob copy, configure a Content Delivery Network (CDN), design blob hierarchies, configure custom domains, scale blob storage

5. Integrate an Azure Active Directory (Azure AD) with existing directories
6. Implement Azure AD Connect and single sign-on with on-premises Windows Server 2012 R2, add custom domains, monitor Azure AD

BS17CB506	PROGRAMMING WITH RUBY & PYTHON LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

Python Lab:

- 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

Ruby Lab:

- Lab 01: Write a Ruby program which accept the user's first and last name and print them in reverse order with a space between them
- Lab 02: Write a Ruby program to create a new string where "if" is added to the front of a given string. If the string already begins with "if", return the string unchanged.
- Lab 03: Write a Ruby program to check a given string contains 'i' characters
- Lab 04: Write a Ruby program that tells you how many minutes there are in a year (do not bother right now about leap years etc.).
- Lab 05: Write a web app using Ruby on Rails with DB connectivity, RDBMS.
- Lab 06: Write a Ruby program that tells you how many minutes there are in a year (do not bother right now about leap years etc.)

SIXTH SEMESTER

Sl. No	Code	Title	HC/ SC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB601	Automation Tools for Cloud Deployment	HC	2	1	1	4	6
2	BS17CB602	Building Private Cloud with Openstack	HC	2	1	0	3	4
3	BS17CB603	Big Data and Hadoop on AWS and Azure	HC	2	1	0	3	4
4	BS17CB604	Software Engineering	HC	4	0	0	4	4
5	BS17CB615	Entrepreneurship and Management	SC	2	1	0	3	4
	BS17CB625	Financial Engineering						
6	BS17CB616	Information Security and Cryptography	SC	2	1	0	3	4
	BS17CB626	Advanced Computer Networks						
7	BS17CB607	Big Data and Hadoop on AWS and Azure lab	HC	0	0	2	2	2
8	BS17CB608	Building Private Cloud with Openstack lab	HC	0	0	2	2	2
Total Credits				**14**	**5**	**5**	**24**	**30**

BS17CB601	**AUTOMATION TOOLS FOR CLOUD DEPLOYMENT**	**L**	**T**	**P**	**C**
Total Hours:60		**2**	**1**	**1**	**4**

COURSE OBJECTIVES:

- Introduce Chef Configuration Management Framework
- Learn the basics of Puppet configuration management framework
- Hands on Knowledge on install and configure Chef and puppet

COURSE OUTCOMES:

- To build chef and puppet server infrastructure to manage nodes
- To write infrastructure deployment code like cookbook(chef) , manifests (puppet)
- To learn the basics of Bootstrap windows server and deploy web servers on them

- To learn the basics of rhel,Ubuntunodesand deploy web servers on them
- 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

UNIT II Develop a Complex Cookbook **15 Hours**

Resource and Providers, HA, Cloud Provisioning with Vagrant and Chef, Troubleshooting . Overview of commUNITy cookbooks of openstack cloud and their usage

UNIT III Puppet Automation tools **15 Hours**

Getting Started with Puppet , Building Hosts with Puppet , Working with Environments , Puppet Scalability , Externalizing Puppet Configuration , Exporting and Storing Configuration,

UNIT IV Puppet Consoles **15 Hours**

Dashboard and The Foreman, Tools and Integration , Reporting with Puppet, Extending Facter and Puppet Marionette Collective , Working with Puppet

Text Books:

1. Automation through Chef Opscode A Hands-on Approach to Chef ,By NavinSabharwal ManakWadhwa
2. Pro Puppet By James Turnbull , Jeffrey McCune
3. Web docs from official puppet (https://puppet.com/) and chef (https://www.chef.io/chef)

Hands on lab

- Chef server- Install and configure
- Install and configure Chef-Workstation on ubuntu
- Install and configure Chef-Workstation on Windows 7
- Create and apply a cookbook for Ubuntu server ,centos7 and win 2016
- Creating dependency cookbook
- Install and configure puppet server and puppet nodes
- Write manifest to automate deployment of web infrastructure on centos7, Ubuntu and windows 2016 server.

BS17CB602	BUILDING PRIVATE CLOUD WITH OPENSTACK	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

- Build Openstack private cloud while leveraging and integrating VMware and Hyperv virtualization technology to spin cloud instances /VM's

COURSE OUTCOMES:

- Ability to deploy openstack multi node
- Prepare VMware virtual infrastructure and integrate with Openstack
- Prepare Hyper-v 2012 or higher version virtual infrastructure and integrate with Openstack

COURSE CONTENT:

UNIT I OpenStack ecosystem introduction and Deploying Single node openstack-KVM :

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 OpenStackMulitnode 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 Lab sessions on Preparing vmware infrastructure and integrate with Openstack:

15 Hours

Preparing vCenter Environment , Configure ESXi Host01 for Openstack integration, configure ESXi Host02 for OpenStack Integration, Install vsphere client , vCenter – Installation and Configure, Add hosts & Create cluster, Create br-int on each host for openstack integration, Enable port for novnc console

UNIT IV Lab sessions on Preparing Hyper-v (Latest version) infrastructure and integrating with Openstack : 15 Hours

Install OpenStack controller, network node and integrate with Microsoft hyper (Latest version) or above Install Windows (Latest version) on Host01, Install Windows (Latest version) on Host02, , Install Hyper-V Role on 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/

BS17CB603	BIG DATA AND HADOOP ON AWS AND AZURE	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

The objective of this course is to:

- Deploy Hadoop /use hadoop on Openstack ,Amazon cloud and Azure cloud

COURSE OUTCOMES:

- Create and Manage HDInsight clusters on Windows Azure
- Discover the different HDInsight services and configuration files
- Develop and run Map Reduce jobs using .NET and PowerShell
- Use Hadoop on Amazon Web services
- Use Hadoop on Openstack
- Troubleshoot common problems

COURSE CONTENT:

UNIT I Hadoop on Amazon Web Service cloud 15 Hours

what is AWS Elastic Map Reduce, 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

UNIT II Hadoop on Microsoft Azure cloud **15 Hours**

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 ,Using Windows Azure HDInsight Emulator, Accessing HDInsight over Hive and ODBC , Consuming HDInsight from Self-Service BI Tools ,Integrating HDInsight with SQL Server Integration Services , Logging in HDInsight , Troubleshooting Cluster Deployment ,Troubleshooting Job Failures

UNIT III Hadoop on OpenStack **15 Hours**

Introducing OpenStack Sahara project (Hadoop-As-Service), rationale,architecture and roadmap of OpenStack Sahara, Sahara installation and configuration, create keystone endpoints and enabled Sahara OpenStack dashboard.

UNIT IV **15 Hours**

Sahara advanced configuration, Getting started and Sahara configuration UI, registering an image and running Hadoop jobs on Sahara project, open stack heat introduction, setup a Hadoop cluster via Open Stack heat.

Text Books:

1. Learning Big Data with Amazon Elastic MapReduce by Amarkant Singh, Vijay Rayapati
2. Pro Microsoft HDInsightHadoop on Windows By Debarchan Sarkar
3. Bigdata on OpenStackhttp://docs.openstack.org.

BS17CB604	SOFTWARE ENGINEERING	L	T	P	C
Total Hours:60		4	0	0	0

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.

COURSE CONTENT:

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:RequirementsAnalysis,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, AbhishekSrivastava–"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.

BS17CB615	ENTREPRENEURSHIP AND MANAGEMENT	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

- Learn the Basics of management
- Understand the entrepreneurial decision making process from business model designto 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 - Departmentation – 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 PublishingHouse, 2011
3. Entrepreneurship Development-Small Business Enterprises– Poornima M. Charantimath, PearsonEducation, 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.

BS17CB625	FINANCIAL ENGINEERING	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

- This course exposes the students to the various concepts of Financial Innovation and Research

COURSE OUTCOMES:

- Provide an introduction to the field of financial engineering
- Develop theoretical foundations of financial engineering
- Study some of the most important products and applications of financial engineering
- Develop practical modeling skills and provides an in-depth study of various issues there under.

COURSE CONTENT:

UNIT I Introduction to Financial Engineering **15 Hours**

Meaning, Scope and Need-Tools of Financial Engineering – Financial Engineering and Financial Analysis

– Factors Contributing to the Growth of Financial Engineering – Financial Engineering Process.

UNIT II Financial Product Development **15 Hours**

Need – Direction – Design – Testing and Introduction –Recent Debt Market Innovations – Zero Coupon Securities – Repo and reverse Market, Junk Bonds, Fixed Vs Floating Rate – Equity and Equity Related Instruments – Equity Options –Warrants – Equity Distribution – The Role of Equity in Corporate Capital Structure – Hybrid

Securities – Meaning – Need and Types of Securities.

UNIT III Financial Engineering Process and Strategies **15 Hours**

Overview – Changing Face of Liquidity Management – Asset Liability Management (ALM) in Banking sector – Hedging – Process of Hedging – Risk Management issues and Instruments – Liquidity Risk Management – Interest Rate Risk Management – Currency Risk Management – Role of GAP – Simulation – Duration Method – Value at Risk (VAR).

UNIT IV Corporate Restructuring **15 Hours**

Mergers and De-mergers – Motives – Acquisitions – Takeover –LBO – Sources of Value in a Leveraged Buy Out– Disinvestments Process – Motives

Reference Book:

1. A Complete Guide to Financial Innovation by John F Marshall and Vipul K. Bansal by John F. MarshallVipul K. Bansal,Publisher Allyn and Bacon, 1992.

BS17CB616	INFORMATION SECURITY AND CRYPTOGRAPHY	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

The objectives of this course are to:

- Introduce the concepts of computer network security covering security architecture and services.
- Describe security encryption algorithms and standards such as DES.
- Provide the knowledge about Public key Cryptographic Principles and Algorithms.
- Explain the features of network security applications
- Gain expertise in electronic mail security systems.

COURSE OUTCOMES:

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

- Explain the concepts of computer network security covering security architecture and services.
- Use security encryption algorithms and standards such as DES for developing applications
- Implement Public key Cryptographic Algorithms and integrate them with secured data transaction based systems.
- Demonstrate the features of network security applications
- Deploy electronic mail security applications in campus/organization networks

COURSE CONTENT:

UNIT I Introduction **15 Hours**

The OSI Security Architecture, Security Attacks, Security Services, mechanisms, A model for network security, standards, symmetric encryption principles, Symmetric Block Encryption Algorithms, Data Encryption Standards, Strength of DES, Triple DES, Advanced Encryption Standard.

UNIT II Public-Key Cryptography and Message Authentication **15 Hours**

Public key Cryptographic Principles, PublicKey Cryptographic Algorithms (RSA, Diffie-Hellman), Approaches to Message Authentication, SecureHash Functions (SHA-512), Message Authentication Codes, Digital Signatures.Overview of Kerberos (Key Exchange),Overview Intrusion Detection.

UNIT III Cloud Security **15 Hours**

Security Concerns, Risk Issues, and Legal Aspects. Cloud Computing: Security,Assessing Your Risk Tolerance in Cloud Computing,Legal and Regulatory Issues, Securing the Cloud: Architecture: Security Requirements for the Architecture, Cloud Security Architecture, Planning Key Strategies for Secure Operation.Securing the Cloud: Data Security :Overview of Data Security in Cloud Computing, Cloud Data Security: Sensitive Data Categorization. Cloud Data Storage, Cloud Lock-in

UNIT IV Electronic Mail Security **15 Hours**

Password Management, Virus and threats, Virus Countermeasures,Firewalls, The Need for Firewalls, Firewall Characteristics, Types of Firewalls.Introduction to Cloud Security.

Text Books:

1. William Stallings, Network Security Essentials Applications and Standards, Fifth edition, Prentice Hall, 2011
2. Behrouz A. Forouzan, Cryptography and Network Security, McGraw Hill,2007.

3. Vic (J.R.) Winkler, Securing The Cloud: Cloud Computing Security Techniques and Tactics ,(Syngress/Elsevier) - 978-1-59749-592-9

Reference Books:

1. William Stallings, Cryptography and Network Security Principles and Practise, Pearson, Sixth edition,2013
2. Joseph MiggaKizza, Guide to Computer Security, Springer Science & Media Inc., Third edition, 2015
3. Andrew S.Tanenbaum, Computer Networks, Pearson, Fifth edition
4. AtulKahate, Cryptography and Network Security, McGraw Hill, 2013.
5. Springer Journal of Cryptographic Engineering , ISSN 2190-8508
6. ACM,ACM- International Journal of Applied Cryptography,ISSN:1753-0563
7. IEEE, IEEE Transactions on Information Forensics and Security.

BS17CB626	ADVANCED COMPUTER NETWORKS	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

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.

COURSE OUTCOMES:

- 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.

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, Subnetting, 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, Functions required for supporting QoS, Traffic Control, Leaky Bucket algorithm, Token Bucket Algorithm, Explicit Congestion Notification (ECN), 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, McGraw Hill Education Pvt Ltd 2013
2. Andrew S Tanenbaim, "Computer Networks", Pearson Education, 5th Edition, Elsevier Inc, 2014.

BS17CB607	BIG DATA AND HADOOP ON AWS AND AZURE LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. Deploy 2 node Hadoop Cluster on Azure Cloud.
2. Install Hive and run sample hive programs.
3. Install Flume and run sample Flume program.
4. Deploy Azure managed Bigdata cluster.
5. Running Flume program kn Azure managed biodata cluster

6. AWS elastic mapreduce cluster deployment.
7. Run sample Hadoop Job on was MapReduce cluster.
8. Run hive scripts on was elastic map reduce.
9. Ingest from cloud born or on premise data, store data in azure data lake, store data in azure BLOB storage, perform routine small writes on continuous basis on azure.
10. Run sample program using Pig.
11. Deploy apache Spark cluster.
12. Twitter analysis

BS17CB608	BUILDING PRIVATE CLOUD WITH OPENSTACK LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. Install and configure OpenStack controllers
2. Install and configure network node
3. Install and configure compute node
4. Install and configure database server
5. Integrate openstack with vmware
6. Integrate openstack with Microsoft hyperv
7. Integrate openstack with kvm
8. Install and configure kvm server

SEVENTH SEMESTER –MODIFIED SCHEME

Sl. No	Code	Title	HC/ SC/ OE	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB701	Deployment &Management of Private Cloud	HC	2	1	0	3	4
2	BS17CB702/ M18MS1010	Big Data Technologies on Google Cloud	HC	2	1	1	4	6
3	BS17CB703	DevOps	HC	2	1	0	3	4
4	BS17CB704	Project Work – Phase-1	HC	0	2	2	4	8
5	BS17CB715	Software Project Management	SC	2	1	0	3	4
	BS17CB725	Object Oriented Modeling and Design						
	BS17CB735/ M18MS1062	**Advanced DBMS**						
6		Open Elective	OE	4	0	0	4	4
7	BS17CB707	Deployment &Management of Private Cloud lab		0	0	2	2	2
8	BS17CB708	Devops lab		0	0	2	2	2
Total Credits				**12**	**6**	**7**	**25**	**34**

Open Elective Courses offered to other Schools

Sl. No	Code	Title	HC/ SC/ OE	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB716	Fundamentals of Cloud Computing	OE	4	0	0	4	4
	BS17CB726	Basics of Data Analytics						

BS17CB701	DEPLOYMENT &MANAGEMENT OF PRIVATE CLOUD	L	T	P	C
Total Hours:60		2	1	0	3

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 2012 server virtualization backend.
- Implement and manage open stack.

COURSE OUTCOMES:

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

- Deploy OpenStack cloud for high availability for controller
- Deploy OpenStack cloud for highavailabilityin a network.
- Deploy and compute nodes for high availability in a compute node

COURSE CONTENT:

UNIT I High availability basics using HA Proxy **15 Hours**

Apache working with modules, improving logging, using content compression,looking beyond apache with Nginx ,apache and php, multi server setups using Nginx and Apache , proxy options in Nginx, Load balancer features and using multiple backend servers

UNIT II Building OpenStack High Availability **15 Hours**

Install two OpenStack controller on different machines , network node on different machines and compute node (kvm) on different machines. Configure OpenStack services on both controllers like Keystone, rabbitmq , nova, cinder ,glance ,horizon , test and validate the HA configure 2 KVM hosts and shared storage and integrate with openStack controllers and , test failover of cloud

UNIT III Microsoft system Centre (Latest Version) or above **15 Hours**

Virtual machine Manager, Introduction to App controller, Configuration Manager, Data Protection Manager

UNIT IV Implementing and Managing **15 Hours**

Introduction to Operations Manager, Introduction to Advisor, Introduction to Service Manager, Introduction to Orchestrator,Introduction to Windows azure pack .

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 2012 Unleashed Paperback – June 11, 2012 by Chris Amaris (Author), Rand Morimoto (Author), Pete Handley (Author), David Ross (Author)

4. Introducing Microsoft System Center 2012 R2 Technical Overview by Mitch Tulloch with SymonPerriman and the System Center Team(http://download.microsoft.com/download/C/8/A/C8A5F520-F31E-4BB4-B972-D2525D17C38/Microsoft_Press_ebook_Introducing_System_Center_2012_PDF.pdf)

5. Pro Linux High Availability Clustering BySander van Vugt

6. Learning OpenStack Networking (Neutron) by James Denton

Reference Books:

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

BS17CB702/ M18MS1010	BIG DATA TECHNOLOGIES ON GOOGLE CLOUD	L	T	P	C
Total Hours:60		2	1	1	4

COURSE OBJECTIVES:

- Discover the Google Cloud Platform
- Learn the various aspects of Google cloud

COURSE OUTCOMES:

- To understand google cloud platform
- To deploy win and linux virtual machines and connect
- To create cloud storage and attach to vm
- To deploy load balancer and add web servers backed to the load balancer
- Use cloud DNS service
- To work on google cloud sqldb service,
- To deploy web application on vm and connect application to db
- Deploy bigdata on google cloud engine.

COURSE CONTENT:

UNIT I GCP Fundamentals **15 Hours**

Identify the purpose and value of Google Cloud Platform products and services, Interact with Google Cloud Platform services, Google App Engine, Google Kubernetes Engine, and Google Compute Engine, Choose among and use Google Cloud Platform storage options: Google Cloud Storage, Google Cloud SQL, Google Cloud Bigtable, and Google Cloud Datastore, BigQuery, Make basic use of Google Stackdriver, Google's monitoring, logging, and diagnostics system, Autoscaling, load balancer

UNIT II Designing data processing systems **15 Hours**

Designing flexible data representations. Considerations include, Designing data pipelines. Considerations include, Designing data processing infrastructure. future advances in data technology , Building and maintaining data structures and databases, Building and maintaining pipelines , Building and maintaining processing infrastructure.

UNIT III Analyzing Data and machine learning **15 Hours**

Analyzing data and enabling machine learning, data collection and labeling, data visualization, dimensionality reduction, data cleaning/normalization, defining success metrics, Modeling business processes for analysis and optimization , Optimizing data representations, data infrastructure performance and cost, Ensuring reliability , Assessing, troubleshooting, and improving data representations and data processing infrastructure.

UNIT IV Visualizing Date and design for security **15 Hours**

Visualizing data and advocating policy, Building (or selecting) data visualization and reporting tools. Considerations include: automation , decision support, data summarization, (e.g, translation up the chain, fidelity, trackability, integrity, Advocating policies and publishing data and reports.,Designing for security and compliance, Designing secure data infrastructure and processes. Considerations include, Identify and Access Management (IAM), data security, penetration testing, Separation of Duties (SoD), security control 7.2 Designing for legal compliance. Considerations include:

Reference Books :

1. Google cloud official documentation
2. https://cloud.google.com
3. https://cloud.google.com/certification/guides/dataengineer/#certificate-exam-guide
4. https://cloud.google.com/training/courses/core-fundamentals

BS17CB703	DEVOPS	L	T	P	C
Total Hours:60		2	1	0	3

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 the big picture **15 Hours**

What is DevOps ? , why DevOps, DevOps and performance, DevOps - culture or technology, DevOps with business ,DevOps tools

UNIT II DevOps – Learning Ansible **15 Hours**

Getting Started with Ansible, Devloping ,testing and releasing playbooks, Taking Ansible to Production,Error Handling ,Rollback, working with custom modules,Provisioning

UNIT III DevOps – containerization **15 Hours**

What is containerization? , Docker ,Docker installation and configuration, building a continuous integration pipeline with Docker, Kubernetes architecture, deploy minkubeKubernetes cluster, POD, deployment, replication controller, Kubernetes volume, auto scaling, ingress controller, rolling updates , Kubernetes authentication and authorization

UNIT IV DevOps- CI/CD **15 Hours**

What is CI/CD?, overview on : Git, GitHub, Jenkins, code analysis tool & artifact storage, build CI/CD pipeline with DevOps tools , demo and hands-on with case study

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 Learning Ansible by MadhurranjanMohaan, 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/

BS17CB704	PROJECT WORK – PHASE-1	L	T	P	C
Total Hours:60		0	2	2	4

COURSE CONTENT:

- 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

Appendix: User Manual with the help of screen shots and text description

BS17CB715	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

- Will be able to understand the fundamental principles of Software Project management & also have a good knowledge of responsibilities of project manager and to handle the various projects.
- Be familiar with the different methods and techniques used for project management.
- By the end of this course student will have good knowledge of the issues and challenges faced while doing the Software project Management.
- Will be able to know the reasons for the software projects failures and how that failure probability can be reduced effectively.
- Will be able to do the Project Scheduling, Tracking, Risk analysis, Quality management.
- Will be able to estimate the Project Cost using different techniques.

COURSE OUTCOMES:

- Identify project goals, constraints, deliverables, performance criteria, control needs, and resource requirements in consultation with stakeholders.
- Carry out an evaluation and selection of projects against strategic, technical and economic criteria and use a variety of cost benefit evaluation techniques for choosing among competing project proposals.
- Approach project planning in an organized step by step manner and select an appropriate process model produce an activity plan for a project.
- Identify project risks, monitor and track project deadlines and produce a work plan and resource schedule.
- Plan the evaluation of a proposal or a product and manage people in software environments.

COURSE CONTENT:

UNIT I Conventional Software Management: 15 Hours

The waterfall model, conventional software Management performance. Evolution of Software Economics: Software Economics, pragmatic software cost estimation.
The old way and the new: The principles of conventional software engineering, principles of modern software management, transitioning to an iterative process.

(TB 1: Chapters – 01, 02 & 04)

UNIT II Life cycle phases **15 Hours**

Engineering and production stages, inception, Elaboration, construction, transition phases. Artifacts of the process: The artifact sets, Management artifacts, Engineering artifacts, programmatic artifacts. Model based software architectures : A Management perspective and technical perspective. (TB 1: Chapters - 05, 06 & 07)

UNIT III Work Flows of the process **15 Hours**

Software process workflows, Iteration workflows. Checkpoints of the Process: Major Mile Stones, Minor Milestones, Periodic status assessments. Iterative Process Planning: Work breakdown structures, Planning guidelines, The Cost and Schedule Estimating Process, The Iteration planning process, Pragmatic planning.Project Organizations and Responsibilities: Line-of-Business Organizations, Project Organizations, Evolution of Organizations. (TB 1: Chapters - 08, 09, 10 & 11)

UNIT IV Process Automation **15 Hours**

Automation Building Blocks, The Project Environment. Project Control and Process instrumentation : The server care Metrics, Management indicators, quality indicators, life cycle expectations pragmatic Software Metrics, Metrics automation.(TB 1: Chapters - 12 & 13)

Text Books:

1. 'Software Project Management- A Unified Frame Work', Walker Royce, Pearson Education, 2013.

Reference Books:

1. 'Software Project Management', Bob Hughes, Mike Cotterell&Rajib Mall, FIFTH Edition, Tata McGraw Hill, 2016.

2. 'Managing Global Projects', Ramesh, Gopalaswamy,Tata McGraw Hill, 2001.

BS17CB725	OBJECT ORIENTED MODELING AND DESIGN	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

- To introduce the concept of Object-oriented design
- Acquire knowledge of Basic UML Concepts, Life Cycle of Object oriented Development, Modeling Concepts
- Produce conceptual models for solving operational problems in software and IT
- environment using UML
- Analyze the development of Object Oriented Software models

COURSE OUTCOMES:

- Develop a working understanding of formal object-oriented analysis and design processes, Ability to abstract object-based views for generic software systems.
- Ability to analyze and model software specifications.
- Ability to abstract object-based views for generic software systems

COURSE CONTENT:

UNIT I Modeling Concepts & Class Modeling **15 Hours**

Introduction to OO development, OO themes; Evidence for usefulness of OO development; OO modeling history. Modeling as Design Technique:Modeling; abstraction; The three models.Object and class concepts; Link and associations concepts; Generalization and inheritance; A sample class model; Navigation of class models; Practical tips.Advanced object and class concepts; Association ends; N-array associations;Aggregation; Abstract classes; Multiple inheritance; Metadata; Reification; Constraints; Derived data; Packages;

UNIT II State Modeling and Interaction Modeling **15 Hours**

State Modeling: Events, States, Transitions and Conditions; State diagrams; State diagram behavior; Practical tips. Advanced State Modeling: Nested state diagrams; Nested states; Signal generalization; Concurrency; A sample state model; Relation of class and state models;Interaction Modeling: Use case models; Sequence models; Activity models. Use case
relationships; Procedural sequence models; Special constructs for activity models

UNIT III System Conception and Analysis **15 Hours**

System Conception: Devising a system concept; elaborating a concept; preparing a problem statement. Overview of analysis; Domain class model; Domain state model; Domain interaction model; Iterating the analysis. Application Analysis: Application interaction model;Application class model; Application state model; adding operations.

UNIT IV System Design and Class Design **15 Hours**

Overview of system design; Estimating performance; Making a reuse plan; Breaking a system in to sub-systems; Identifying concurrency; Allocation of sub-systems; Management of data storage; Handling global resources; Choosing a software control strategy; Handling boundary conditions Class Design: Overview of class design; Bridging the gap; Realizing use cases; Designing algorithms; Recording downwards, Refactoring; Design optimization; Reification of behavior.(15 Hours)

Text Books:

1. Michael Blaha, James Rumbaugh, "Object-Oriented Modeling and Design with UML", 2nd Edition, Pearson Education / PHI, 2005. (Chapters 1 to 9, 11 to 14.10,15.1 to 15.8)

2. Frank Buschmann, RegineMeunier, Hans Rohnert, Peter Sommerlad, Michael Stal, "Pattern-Oriented Software Architecture, A System of Patterns", Volume 1, John Wiley and Sons, 2006. (Chapters 1, 2.4, 3)

Reference Books:

1. Grady Booch et al, "Object-Oriented Analysis and Design with Applications", 3rd Edition, Pearson,2007.

2. Mark Priestley, "Practical Object-Oriented Design with UML", 2nd Edition, Tata McGraw-Hill, 2003.

3. K. Barclay, J. Savage, "Object-Oriented Design with UML and JAVA", Elsevier, 2008.

4. Booch, G., Rumbaugh, J., and Jacobson, I., "The Unified Modeling Language User Guide", 2 ndEdition,Pearson, 2005.

5. E. Gamma, R. Helm, R. Johnson, J. Vlissides, "Design Patterns-Elements of Reusable Object- Oriented Software", Addison-Wesley, 1995.

6. Michael R Blaha, James R Rumbaugh, "Object Oriented Modeling and Design with UML", 2nd Edition,Prentice Hall, 2004.

BS17CB735/ M18MS1062	ADVANCED DBMS	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

The objectives of this course are to:

- learn the modeling and design of databases
- acquire knowledge on parallel and distributed databases and its applications
- study the usage and applications of Object Oriented database
- understand the usage of advanced data models
- acquire inquisitive attitude towards research topics in databases

COURSE OUTCOMES:

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

- Select the appropriate high performance database like parallel and distributed database
- Design a semantic based database to meaningful data access
- Embed the rule set in the database to implement intelligent databases

- Represent the data using XML database for better interoperability
- Model and represent the real world data using object oriented database
- To learn transaction processing and concurrency control.

COURSE CONTENT:

UNIT I Overview of Storage and Indexing **12 Hours**

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

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

18 Hours

The system catalog, Introduction to operator evaluation; Algorithm for relational operations; Introduction to query optimization; When does a DBMS sort data? A simple two-way merge sort; External merge sort, Evaluating Relational Operators The Selection operation; General selection conditions; The Projection operation; The Join operation; The Set operations; Aggregate operations; The impact of buffering.

UNIT III Concurrency Control **18 Hours**

Serializability and Transaction processing: Enforcing, Serializability by Locks, Locking Systems With Several, Lock Modes, Architecture for a Locking Scheduler Managing . **Transaction processing**: Introduction of transaction processing, advantages and disadvantages of transaction processing system, online transaction processing system, resolving deadlock, Transaction management in multi-database system, long duration transaction, high-performance transaction system.

UNIT IV Parallel and Distributed Databases and XML data **12 Hours**

Architectures for parallel databases; Parallel query evaluation; Parallelizing individual operations; Parallel query optimizations; Introduction to distributed databases; Distributed DBMS architectures; Storing data in a Distributed DBMS;

Information retrival and XML data: Colliding Worlds: Databases, IR, and XML, Introduction to Information Retrieval, Indexing for Text Search, Web Search Engines, Managing Text in a DBMS, A Data Model for XML, XQuery: Querying XML Data.

Mobile databases, Multimedia databases, geographic databases, temporal databases, biological databases

Text Books:

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

Reference Books:

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

OPEN ELECTIVE COURSES OFFERED TO OTHER SCHOOLS

BS17CB716	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".

BS17CB726	BASICS OF DATA ANALYTICS	L	T	P	C
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 **15 Hours**

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.

BS17CB707	DEPLOYMENT &MANAGEMENT OF PRIVATE CLOUD LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. Install and configure OpenStack Controllers on three virtual machines in Active/Active mode for High Availability (3 virtual Machines) , configure VIP using existing Load balancer at customer site
2. Setup the three mariadb database in Active/Active mode servers in the form of Virtual machine. Setup Synchronous replication to secondary database (3 x virtual Machines)
3. Install and configure rabbitmq cluster
4. Install and configure openstack service endpoints
5. Configure vxlan network for openstack network addresse
6. Setup up private cloud using Microsoft system centre (latest version)

BS17CB708	DEVOPS LAB	L	T	P	C
Total Hours:30		0	0	2	2

LAB EXPERIMENTS:

1. Github – Create an account and fork your application code
2. Git clone the github code , Use maven to compile and package java source code
3. Deploy .war file manuallyJenkins – Deploy Jenkins on ubuntu server (each student will deploy his Jenkins server)
4. Continuous Integration setup – Jenkins and Github
5. Automation Maven test, Compile and Package (.war) using Jenkins
6. Students to Integrate Jenkins (CI) server with Sonarqube (lab by students)
7. Sonarqube –static code analysis and set quality gates
8. Use freestyle and pipeline job
9. Integrate Jenkins with docker for ci/cd pipeline slave nodes
10. Ansible server installation and configure win 2016, cento7 and Ubuntu node under management
11. Write playbook to deploy web infrastructure on win 2016, cento7 and Ubuntu node under management

EIGHTH SEMESTER – MODIFIED SCHEME

Sl. No	Code	Title	HC/ SC	Credit Pattern			Credits	Working Hrs
				L	T	P		
1	BS17CB811	Cloud Storage using Open Stack Swift	SC	3	1	0	4	5
	BS17CB821/ M18MS2020	Linear Algebra						
2	BS17CB812	Wireless Sensor Networks and Internet of Things	SC	2	1	0	3	4
	BS17CB822/ M18MS2041	System Simulation and Modelling						
3	BS17CB803	Project Work– Phase-2	HC	0	4	4	8	16
Total Credits				**5**	**6**	**4**	**15**	**25**

BS17CB811	**CLOUD STORAGE USING OPEN STACK SWIFT**	**L**	**T**	**P**	**C**
Total Hours:60		**3**	**1**	**0**	**4**

COURSE OBJECTIVES:

- Get students well versed with next generation storage i.e. Object based storage using OpenStack swift

COURSE OUTCOMES:

- Learn Swift's concepts for organizing, distributing, and serving data
- Explore basic and advanced features of the Swift RESTful API
- Delve into Swift's many client libraries, including useful Python features
- Write middleware to customize and simplify your storage system
- Understand requirements for planning a Swift deployment—including your specific use case
- Learn options for coaxing the best performance from your cluster
- Get best practices for daily operations, such as monitoring and planning capacity additions.

COURSE CONTENT:

UNIT I Storage evolution **15 Hours**

The Evolution of Storage, Storage Needs for Today's Data, No One-Size-Fits-All Storage System, Object Storage Compared with Other Storage Types, A New Storage Architecture: Software-Defined Storage, Software-Defined Storage Components ,Why OpenStack Swift? Conclusion

UNIT II Swift Data model and architecture **15 Hours**

Swift Data Model , Swift Architecture , Server Processes , Consistency Processes , Locating the Data , Creating and Updating the Rings , □ Talking to the Cluster: The Swift API , Sending a Request , Authorization and Taking Action, Getting a Response, Communication Tools Example Scenarios

UNIT III Ceph storage concepts **15 Hours**

Planning for Ceph, Deploying Ceph, Bluestore, erasure coding ,developing with Lib Rados

UNIT IV Ceph storage advanced **15 Hours**

Distributed computation with Ceph storage, monitoringCeph, tiering with Ceph, tuning Ceph, troubleshooting

Text Books :

1.Book for swift :Implementing-Cloud-Storage-OpenStack-Swift-by Amar Kapadia, SreedharVarma, Kris Rajan

2.Book for Ceph **:** Mastering Ceph Nick Fisk,May 2017

Lab Programs:

1. Setup swift single node cluster
2. CRUD operation on swift cluster
3. Deploy multi node swift cluster
4. Deploy Opensourcewebapp and integrate with openstack swift
5. Deploy ceph block storage
6. Create volumes and attach to servers
7. Add swift node to cluster
8. Remove swift node from cluster
9. Add storage node to Ceph
10. Remove storage node from ceph
11. Ceph cluster troubleshooting
12. Swift cluster troubleshooting.

BS17CB821/ M18MS2020	LINEAR ALGEBRA	L	T	P	C
Total Hours:60		3	0	1	4

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
- Develop methods of computing and using eigen values and eigenvectors.

COURSE OUTCOMES:

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).

Books for Reference:

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.

BS17CB812	WIRELESS SENSOR NETWORKS AND INTERNET OF THINGS	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

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

COURSE OUTCOMES:

- 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)

Reference Books:

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

BS17CB822/ M18MS2041	SYSTEM SIMULATION AND MODELLING	L	T	P	C
Total Hours:60		2	1	0	3

COURSE OBJECTIVES:

The objectives of this course are:

- Make the students to understand the importance simulation and .modeling in a range of important application areas.
- Explain the event – scheduling, time-advance algorithm in computer networks.
- Introduce discrete event stochastic models and queuing models.
- Learn the benefits of probability, random process verification and validation of the models

COURSE OUTCOMES:

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

- Outline the various applications of simulation.
- Describe the role of important elements of simulation in modeling paradigm.
- Generate Random numbers using different techniques.
- Apply simulation on various layers for Optimization and random number generation.
- Present the Modeling techniques for event systems.

COURSE CONTENT:

UNIT I NTRODUCTION **15 Hours**

Why is Simulation Important? When simulation is the appropriate tool and when it is not appropriate? Areas of application, Systems and system environment; Components of a system, Discrete and continuous systems, Model of a system; Types of Models; Discrete-Event System Simulation. Simulation examples: Simulation of queuing systems; Simulation of inventory systems; other examples of simulation. What is model? Advantages and Disadvantages of Modeling and Simulation, Common Pitfalls of Modeling and Simulation and Rules of Thumb, Overview of M&S tools.

UNIT II GENERAL PRINCIPAL, STATISTICAL & QUEUING MODELS **15 Hours**

Simulation Software: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event scheduling; List processing.

Review of terminology and concepts; Useful statistical models; discrete distributions; Continuous

distributions; Poisson process; Empirical distributions. Characteristics of queuing systems; Queuing notation; Long-run measures of performance of queuing systems; Steady-state behavior of M/G/1 queue; Networks of queues.

UNIT III RANDOM-NUMBER **15 Hours**

Properties of random Numbers; Generation of pseudo-random numbers; Techniques for generating random numbers; Tests for Random Numbers. Random-Variate Generation: Inverse transform technique; Acceptance-Rejection technique; Special properties.

Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Fitting a non-stationary Poisson process; selecting input models without data; Multivariate and Time-Series input models.

UNIT IV VERIFICATION AND VALIDATION OF SIMULATION MODELS **15 Hours**

Model building, verification and validation; Verification of simulation models; Calibration and validation of models. Optimization via Simulation. Modeling and Simulation using Network Simulator: RF Propagation Wired MANE, Network Layer.

Text Books:

1. Jerry Banks , John S. Carson II , Barry L. Nelson , David M. Nicol, ''Discrete-Event System Simulation'', Pearson Education, 5th edition, 2015 (chapters 1-10).
2. Averill M. Law, ''Simulation Modeling and Analysis'', Tata McGraw-Hill, 4th edition, 2007.(chapters 7, 8).
3. Wehrle, Klaus, Günes, Mesut, Gross, James, "Modeling and Tools for Network Simulation", 2010.(chapters 1-5).

Reference Books:

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

BS17CB803	PROJECT WORK– PHASE-2	L	T	P	C
Total Hours:60		0	4	4	8

COURSE CONTENT:

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 Screen
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 Four Year 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**:** L:T:P.

(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 B. Sc in Computer Science with specialization in Cloud Computing and Big Data (Research) degree program are 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.

3. **Courses of Study**

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

a. Core Course:

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

b. Foundation Course (FC):

The foundation Course is a core course which should be completed successfully as a part of graduate degree program irrespective of the branch of study.

c. Hard Core Course (HC):

The **Hard Core Course** is a Core Course in the main branch of study and related branch(es) of study, if any, that the candidates have to complete compulsorily.

d. Soft Core Course (SC):

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

e. O**pen Elective Course (OE):**

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

f. Project Work / Dissertation:

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

3. Scheme, Duration and Medium of Instructions:

3.1 B. Sc in Computer Science with specialization in Cloud Computing and Big Data (Research) degree program is of 8 semesters - 4 years duration. A candidate can avail a maximum of 16 semesters - 8 years as per double duration norm, in one stretch to complete B. Sc in Computer Science with specialization in Cloud Computing and Big Data (Research) degree program 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. Minimum Credits to be Earned

4.1 **A candidate has to earn 192 credits for successful completion of** B. Sc in Computer Science with specialization in Cloud Computing and Big Data (Research) degree program with the distribution of credits for different courses as prescribed by the university. A candidate can enroll for a maximum of 32 credits and a minimum of 20 credits per Semester. However he / she may not successfully earn a maximum of 32 credits per semester. This maximum of 32 credits does not include the credits of courses carried forward by a candidate.

4.2 Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to VIII semester and complete successfully 192 credits in 8 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.

4.3. **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 192 credits for the B. Sc in Computer Science with specialization in Cloud Computing and Big Data (Research) degree program.

4.3.1. Add on Proficiency Diploma:

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 192 credits for the B. Sc in Computer Science with specialization in Cloud Computing and Big Data (Research) degree program.

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

5. Scheme of Assessment and Evaluation

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

i. Internal Assessment (IA); and

ii. Semester End Examination (SEE)

5.2. Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of UG Engineering programs shall carry 40:60 marks respectively (i.e., 40 marks internal assessment; 60 marks semester end examination).

5.3. The 40 marks of internal assessment shall comprise of:

Internal Test	= 30 marks
Assignments / Seminars / Model Making etc.	= 10 marks

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

- 1st test for 15 marks at the end of 6th week of the beginning of the semester;
- 2nd test for 15 marks at the end of 13th week of the beginning of the semester; and
- 3rd test for 15 marks at the end of 16th week of the beginning of the semester.

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

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

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

5.7. There shall be two Assignments / Seminars each carrying 5 marks ; whereas the number of model designs and the marks for each model design shall be decided by the School well in advance and should be announced before commencement of the Semester to avoid ambiguity and confusion among students and faculty members.

5.8. The Semester End Examination for 60 marks shall be held in the 19th and 20th week of the beginning of the semester and the syllabus for the semester end examination shall be entire 4 units.

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

5.10. Summary of Internal Assessment and Evaluation Schedule is provided in the table given below.

Summary of Internal Assessment and Evaluation Schedule

Type of Assessment	Period	Syllabus	Marks	Activity
Allocation of Topics for Assignments / Seminars / Model making*	Beginning of 5th Week	First Unit and Second Unit		Instructional process and Continuous Assessment
First Internal Test	2nd Part of 6th Week	First Unit and 1st half of Second Unit	15	Consolidation of 1st Unit 1st half of 2nd Unit
Submission of Assignments / Conduct of Seminars / Presentation of Model Design*	8th Week	First Unit and Second Unit	5	Instructional process and Continuous Assessment
Second Internal Test	2nd Part of 13th Week	Second half of Second Unit and Third Unit	15	Consolidation of Second half of Second Unit and 3rd Unit
Allocation of Topics for Assignments / Seminars / Model making*	Beginning of 11th Week	Third Unit and Fourth Unit		Instructional process and Continuous Assessment
Submission of Assignments / Conduct of Seminars / Presentation of Model Design*	14th Week	Third Unit and Fourth Unit	5	Instructional process and Continuous Assessment
Third Test	2nd Part of 16th Week	Fourth Unit	15	Consolidation of Fourth Unit
Semester-end Practical Examination	17th & 18th Week	Entire syllabus	60	Conduct of Semester - end Exams
Preparation for Semester-end Theory Exam	17th & 18th Week	Entire Syllabus		Revision and preparation for semester–end exam

Semester End Theory Examination	19th Week & 20th Week	Entire Syllabus	60	Evaluation and Tabulation
	End of 21st Week			Notification of Final Grades

Note: 1. **As per the model making is concerned, the School shall decide about the Marks and the Number of Model Designs and as well the schedule of allocation and presentation of model design(s). If the model design carries 5 marks, there shall be two model designs; and in case of 10 marks, there shall be one model design. However, the decision of the School should be announced in the beginning of the Semester for students to avoid ambiguity and confusion.*

2. Examination and Evaluation shall take place concurrently and Final Grades shall be announced latest by 5 day after completion of the examination.

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

6. Assessment of Performance in Practical's

6.1. 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.

6.2. The 40 marks meant for Internal Assessment (IA) of the performance in carrying out practical shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records	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.	10 marks
	Total	**40 marks**

63. The 60 marks meant for Semester End Examination (SEE), shall be allocated as under:

i	Conduction of semester end practical examination	40 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
	Total	**60 marks**

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

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

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

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

8. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Mid-term Tests and Assignments), 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 respective semester-end examination. The grievance cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the university on the candidate if his/her submission is found to be baseless and unduly motivated. This cell may recommend 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.

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

Only those students who fulfill a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc, as part of the program, as provided in the succeeding sections, shall be eligible to appear for Semester End examination.

10. Requirements to Pass the Semester and to Carry Forward the Failed Subjects / Courses:

10.1 Requirements to Pass a Course

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 40 + SEE = 60) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 25% (15 marks) in Semester End Examination (SEE) which is compulsory.

10.2 Provision to Carry Forward the Failed Subjects / Courses:

The total number of "F" Grades that can be carried forward by a student at the end of any even semester shall not be more than four courses.

10.3.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 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.

11. Attendance Requirement:

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

11.2. 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.

11.3. 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 in 10.3.

11.4. 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 Semester end examination, and subsequently a notification pertaining to the above will be brought out by the Director of the School before the commencement of Semester end examination. A copy of this notification shall

also be sent to the office of the Registrar & Registrar (Evaluation).

11.5.Absence during Internal Test:

In case a student has been absent from a internal tests due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Head of the School, for conducting a separate internal test. The Head of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester end examination of that respective semester. Under no circumstances internal tests shall be held / assignments are accepted after Semester end examination.

12. Grade Card and Grade Point

12.1.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).

12.2. Final Grade Card: Upon successful completion of B. Sc in Computer Science with specialization in Cloud Computing and Big Data (Honors) Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Registrar (Evaluation).

12.3. 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	C
0-40	0	v*0	F
ABSENT			AB

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

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

12.3.1. 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 : **SGPA (Si) = ∑(Ci x Gi) / ∑Ci** where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith course.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

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

Thus, **SGPA = 188 ÷ 24 = 7.83**

Illustration No. 2

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	**4**	**A**	**8**	**4X8=32**
Course 2	**4**	**B+**	**7**	**4X7=28**
Course 3	**3**	**A+**	**9**	**3X9=27**
Course 4	**3**	**B+**	**7**	**3X7=21**
Course 5	**3**	**B**	**6**	**3X6=18**
Course 6	**3**	**C**	**5**	**3X5=15**
Course 7	**2**	**B+**	**7**	**2X7=21**
Course 8	**2**	**O**	**10**	**2X10=20**
	24			**175**

Thus, **SGPA = 175 ÷ 24 = 7.29**

Illustration No.3

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade point)
Course 1	4	O	10	4 x 10 = 40
Course 2	4	A+	9	4 x 9 = 36
Course 3	3	B+	7	3 x 7 = 21
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B+	7	3 x 7 = 21
Course 7	2	A+	9	2 x 9 = 18
Course 8	2	A+	9	2 x 9 = 18
	24			**199**

Thus**, SGPA = 199 ÷ 24 = 8.29**

12.4. Cumulative Grade Point Average (CGPA):

12.4.1. Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (192) for B. Sc in Computer Science with specialization in Cloud Computing and Big Data (Honors) degree program is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e : **$CGPA = \sum(Ci \times Si) / \sum Ci$**

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

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

Illustration:
CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	24	6.83	24 x 6.83 = 163.92
2	24	7.29	24 x 7.29 = 174.96
3	24	8.11	24 x 8.11 = 192.64
4	26	7.40	26 x 7.40 = 192.4
5	26	8.29	26 x 8.29 = 215.54
6	24	8.58	24 x 8.58 = 205.92
7	24	9.12	24 x 9.12 = 218.88
8	24	9.25	24 x 9.25 =222
Cumulative	196		1588.26

Thus, **CGPA** = $\frac{24x6.83+24x7.29+24x8.11+26x7.40+26x8.29+24x8.58+24x9.12+24x9.25}{196}$ = 8.10

12.4.2. 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 8.10 x 10=81.0

12.5. Classification of Results

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

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
9 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass

Overall percentage=10*CGPA

13. **Challenge Valuation:**

a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script(s) of semester end examination 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 semester end examination.**

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.

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

LIST OF FACULTY MEMBERS

Sl.No	Name	Designation	Phone Number	Email ID
1	Dr. S. Senthil	Director	8884750100	dir.csa@reva.edu.in
2	Dr. M Vinayaka Murthy	Professor	9448809443	mvinayakamurthy@reva.edu.in
3	Dr . Rajeev Ranjan	Assoc.Prof	9108898284	rajeevranjan@reva.edu.in
4	Dr. D Revina Rebecca	Assoc.Prof	9886517277	revinarebecca@reva.edu.in
5	Dr. Kavitha	Assoc.Prof	9591704008	kavitha@reva.edu.in
6	Dr.ThirunavukkarasuV	Asst. Prof	9487221719	thirunavukkarasu.v@reva.edu.in
7	Dr. M Jayakameswaraiah	Asst. Prof	9441653580	jayakameswaraiah.m@reva.edu.in
8	Dr.Arul Kumar V	Asst. Prof	8903680533	arulkumar.v@reva.edu.in
9	Prof. K Vijayalakshmi	Assoc.Prof	9740388711	kvijayalakshmi@reva.edu.in
10	Prof. Lokesh C K	Asst. Prof	9448295877	lokeshck@reva.edu.in
11	Prof. Sasikala G	Asst. Prof	7259176911	sasikalag@reva.edu.in
12	Prof. Ravi Dandu	Asst. Prof	9379772672	ravi_d@reva.edu.in
13	Prof. R Pinaka Pani	Asst. Prof	9972254146	pinakapanir@reva.edu.in
14	Prof. Ranganathappa M	Asst. Prof	9035623235	ranganathappam@reva.edu.in
15	Prof. Vijaya Kumar H	Asst. Prof	9663887148	vijayakumarh@reva.edu.in
16	Prof. Vijayalaxmi. P. Chiniwar	Asst. Prof	9611345300	chiniwarvijaya@reva.edu.in
17	Prof. Deepa B G	Asst. Prof	8105095047	deepabg@reva.edu.in
18	Prof. Vidya S	Asst. Prof	9902989134	vidyas@reva.edu.in
19	Prof. Manjushree M	Asst. Prof	9620036036	manjusreem@reva.edu.in
20	Prof. Prasanna Kumar R B	Asst. Prof	9342203018	prasannakumarrb@reva.edu.in
21	Prof. Krishnamurthy R	Asst. Prof	9480050433	krishnamurthyr@reva.edu.in
22	Prof. Varish P V	Asst. Prof	9880279894	varishpv@reva.edu.in
23	Prof. Mohamed Abdul Khader Jailani	Asst. Prof	9790521466	mohamadjilani@reva.edu.in
24	Prof. Shreetha Bhat	Asst. Prof	9743002419	shreethabhat@reva.edu.in
25	Prof. Shobhana Saxena	Asst. Prof	9341261151	shobhanasaxena@reva.edu.in
26	Prof. Sinduja K. M	Asst. Prof	7026999042	sinduja.km@reva.edu.in
27	Prof. P Sree Lakshmi	Asst. Prof	9731068437	p.sreelakshmi@reva.edu.in
28	Prof. Surekha S M	Asst. Prof	9591891989	surekhasmuzumdar@reva.edu.in
29	Prof. Sneha N	Asst. Prof	9538589009	sneha.n@reva.edu.in
30	Prof. Ms. Sushma K V	Asst. Prof	9945145620	sushma.kv@reva.edu.in
32	Prof. Bhargavi V	Asst. Prof	9441631921	bhargavi.v@reva.edu.in
33	Prof.Francis Densil Raj V	Asst. Prof	9443300963	francisdensilrajv@reva.edu.in
34	Prof.A. Amutha	Asst. Prof	9964730295	amutha.a@reva.edu.in