Study & Evaluation Scheme

of

Bachelor of Science (Honours)-Computer Science

[Applicable w. e. f. Academic Session – 2020-21]

[As per CBCS guidelines given by UGC]

TEERTHANKER MAHAVEER UNIVERSITY
N.H.-24, Delhi Road, Moradabad, Uttar Pradesh-244001
Website: www.tmu.ac.in

TEERTHANKER MAHAVEER UNIVERSITY
(Established under Govt. of U.P. Act No. 30, 2008)
Delhi Road, Bagarpur, Moradabad (U.P.)

Study & Evaluation Scheme	
SUMMARY	
Institute Name	*College of Computing Sciences & Information Technology, Teerthanker Mahaveer University, Delhi Road, Moradabad*
Programme	*Bachelor of Science (Honours)-Computer Science*
Duration	*Three Years full time(Six Semesters)*
Medium	*English*
Minimum Required Attendance	*75%*
Credits	
Maximum Credits	*151*
Minimum Credits Required for Degree	*148*

Assessment:					
Evaluation			**Internal**	**External**	**Total**
Theory			40	60	100
Practical/ Dissertations/ Project Reports/ Projects			50	50	100
Class Test-1	**Class Test-2**	**Class Test-3**	**Assignment(s)**	**Attendance & Participation**	**Total**
Best two out of three					
10	10	10	10	10	40
Duration of Examination			**External**	**Internal**	
			3 Hours	1.5 Hours	

To qualify the course a student is required to secure a minimum of 45% marks in aggregate including the semester end examination and teachers continuous evaluation.(i.e. both internal and external). A candidate who secures less than 45% of marks in a course shall be deemed to have failed in that course. The student should have at least 45% marks in aggregate to clear the semester.

Question Paper Structure	
1	*The question paper shall consist of six questions. Out of which first question shall be of short answer type (not exceeding 50 words) and will be compulsory. Question no. 2 to 6 (from Unit-I to V) shall have explanatory answers (approximately 350 to 400 words) along with having an internal choice within each unit.*
2	*Question No. 1 shall contain 8 parts from all units of the syllabus with at least one question from each unit and students shall have to answer any five, each part will carry 2 marks.*
3	*The remaining five questions shall have internal choice within each unit; each question will carry 10 marks.*

IMPORTANT NOTES:	
1	*The purpose of examination should be to assess the Course Learning Outcomes (COs) that will ultimately lead to of attainment of Programme Specific Outcomes (PSOs). A question paper must assess the following aspects of learning: Remember Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy).*
2	*Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.*
3	*There shall be continuous evaluation of the student and there will be a provision of fortnight progress report.*

Program Structure- Bachelor of Science (Honours) Computer Science

A. Introduction:

Bachelor of Science (Honours) Computer Science is a three-year full time undergraduate programme, divided into six semesters, that focuses on the discipline of computer science, computer application and its services. The main aim of this program is to produce quality professionals and research fellows who can work in every sector of the world by implementing the technology of computer systems and software. The programme introduces the various domains of computer science consists of coding, programming languages, computer hardware, computer software, networking, database management system, information technology, mathematics, statistics, internet of things, artificial intelligence, cloud computing and cyber security. The programme run in a regular mode. The basic eligibility for admission in this programme is a minimum aggregate of 60% in 10+2 with Physics, Mathematics and Chemistry / Computer Science.

The college emphasizes on the following courses, ***balanced with core and elective courses****:* The curriculum of Bachelor of Science (Honours) Computer Science programme emphasizes an intensive and flexible computer science education with minimum 148 credits required for the award of Bachelor of Science (Honours) Computer Science Degree out of maximum 151 credits offered in the programme. The programme structure and credits for Bachelor of Science (Honours) Computer Science are finalized based on the stakeholders' requirements and general structure of the programme. Minimum number of classroom contact teaching credits for the Bachelor of Science (Honours) Computer Science program will be 148 credits required for the award of Bachelor of Science (Honours) Computer Science Degree out of maximum 151 credits offered in the programme. However, it is mandatory to earn 83 credits in Core Courses (CC), 19 credits in Ability Enhancement Courses (AEC), 17 credits in Discipline Specific Elective Course (DSC) & Project Courses and to earn 32 credits in the courses such as Skill Enhancement Courses (SEC), Open Elective Courses (OEC) and Generic Elective Courses (GEC).

Course handouts for students will be provided in every course. A course handout is a thorough teaching plan of a faculty taking up a course. It is a blueprint which will guide the students about the pedagogical tools being used at different stages of the syllabus coverage and more specifically the topic-wise complete plan of discourse, that is, how the faculty members treat each and every topic from the syllabus and what they want the student to do, as an extra effort, for creating an effective learning. It may be a case study, a role-play, a classroom exercise, an assignment-home or field, or anything else which is relevant and which can enhance their learning about that particular concept or topic. Due to limited availability of time, most relevant topics will have this kind of method in course handout.

Bachelor of Science (Honours) Computer Science: Three-Year (6-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S.No.	**Type of Course**	**Credits**	**Total Credits**
1	Core Course (CC)	15 Theory Courses of 4 Credit Hrs. each and (Total Credit Hrs. 15X4)=60 Credit Hours (60 Credits)	83
		01 Theory Courses of 3 Credit Hrs. each and (Total Credit Hrs. 1X3)=3 Credit Hours (3 Credits)	
		10 Practical Courses of 4 Credit Hrs. each (Total Credit Hrs. 10X4)=40 Credit Hours (20 Credits)	
2	Ability-Enhancement Compulsory Course (AEC)	06 Courses of 4 Credit Hrs. each (Total Credit Hrs. 6X4)= 24 Credit Hours (19 Credits)	19
3	Skill-Enhancement Elective Course (SEC)	04 Courses of 4 Credit Hrs. each (Total Credit Hrs. 4X4)= 16 Credit Hours (12 Credits)	12
4	Open Elective Course (OEC)	02 Courses of 3 Credit Hrs. each (Total Credit Hrs. 2X3)= 06 Credit Hours (06 Credits)	06
5	Generic Elective Course (GEC)	04 Courses of 4 Credit Hrs. each (Total Credit Hrs. 4X4)= 16 Credit Hours (14 Credits)	14
6	Program/Discipline Specific Elective Course (DSC)	04 Courses of 4 Credit Hrs. each (Total Credit Hrs. 4X4)= 16 Credit Hours (12 Credits)	12
7	Value Added Course (VAC)	4 Courses of 2 Credit Hrs. each (Total Credit Hrs. 4X2)= 08 Credit Hours (0 Credit)	0
		2 Course of 3 Credit Hrs. each (Total Credit Hrs. 2X3)= 06 Credit Hours (0 Credit)	
8	Project and Summer Training Report	1 Course of 6 Credit Hrs. each (Total Credit Hrs. 1X6)= 06 Credit Hours (03 Credits)	5
		1 Course of 0 Credit Hrs. each (Total Credit Hrs. 1X0)= 0 Credit Hours (02 Credit)	
Total Credits			**151**

Contact hours include work related to Lecture, Tutorial and Practical (LTP), where the institution has flexibility to decide course wise requirements.

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our University.

The following is the course module designed for the Bachelor of Science (Honours) Computer Science program:

Core Course (CC): Core courses of Bachelor of Science (Honours) Computer Science program will provide a holistic approach to computer science education, giving students an overview of the field of knowledge, a basis to build and specialize upon. These core courses are the strong foundations to establish the knowledge of computer science and provide broad and multi-disciplined knowledge that can be studied further in depth during the elective phases.

The core courses will provide more practical-based knowledge, case-based lessons and collaborative learning models. It will train the students to develop their ability of remembering, understanding, applying, analyzing, evaluating and creating the things.

A wide range of core courses provides the knowledge of various domains of computer science including coding business logic in various programming languages, computer hardware, computer software, networking, database management system, information technology, mathematics, statistics, internet of things, artificial intelligence, cloud computing and cyber security.

The integrated foundation is important for students because it will not only allow them to build upon existing skills, but they can also explore career options in a range of industries, and expand their understanding of various fields of computer science. We offer core courses in all semesters during the Bachelor of Science (Honours) Computer Science program. There will be 4 credits for each theory core course and 2 credits for each practical core course offered.

Ability Enhancement Course (AEC): The Ability Enhancement Course (AEC) is a course designed to develop the ability of students in communication (especially English) and other related courses where they might find it difficult to communicate at a higher level in their prospective job at a later stage due to lack of practice and exposure in the language, etc. Students are motivated to learn the theories, fundamentals and tools of communication which can help them develop and sustain in the corporate environment and culture. We offer one AEC of 4 credits in semester I and five AECs of 3 credits each in Semester I, II, III and IV of the program.

Skill Enhancement Course (SEC): The Skill Enhancement Course (SEC) is a course designed to develop the field specific skills like aptitude, reasoning, business logic understanding, building, and implementing in an enterprise. The mobile and desktop applications and websites may be created using these skills. We offer two SECs of 4 credits each and two SECs of 2 credits each in semester V and VI.

Generic Elective Course (GEC): Generic Elective Course is an interdisciplinary additional subject that is compulsory in semester III, IV and VI of the program. The score of Generic Elective Course is counted towards overall aggregate marks under Choice Based Credit System (CBCS). We offer three GECs of 4 credits each and one GEC of 2 credits in semester III, IV and VI.

Open Elective Course (OEC): Open Elective Course is an interdisciplinary additional subject that is compulsory in semester V and VI of the program. The score of Open Elective Course is counted towards overall aggregate marks under Choice Based Credit System (CBCS). We offer two OECs of 3 credits each in semester V and VI.

Value Added Course (VAC): A Value Added Course is a non-credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability required for the overall development of a student and at the same time essential for industry/corporate demands and requirements. The student possessing these skills will definitely develop insight to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world. There shall be one course each in Semester I & II and two courses each in Semester III & IV and will carry no credit, however, it will be compulsory for every student to pass these courses with minimum 45% marks to be eligible for the certificate. These marks will not be included in the calculation of CGPI. Students have to be specifically registered in the specific course of the respective semesters.

Discipline Specific Elective Course (DSC): The Discipline Specific Elective Course is chosen to make students specialist or having specialized knowledge of a specific domain like computer application, programming and networking, etc. It will be covered in two semesters (IV & VI) of second year and third year of the program relevant to chosen disciplines of core courses of the program. We offer two DSCs of 4 credits each and two DSCs of 2 credits each in semester IV and VI.

C. Programme Specific Outcomes (PSOs)

The learning and abilities or skills that a student would have developed by the end of three-year **Bachelor of Science (Honours) Computer Science Programme:**

PSO – 1	Understanding the nature and basic concepts of computing, mathematics, and basic sciences that are relevant and appropriate to the domain.
PSO – 2	Applying knowledge of computing, mathematics, and basic sciences that are relevant and appropriate to the domain.
PSO – 3	Designing computer-based system, process, component, or program to meet desired needs of government and society.

The Pedagogy & Unique practices adopted: "Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will emphasize on experiential learning:

***1. Case Based Learning*:** Case based learning enhances student skills at delineating the critical decision dilemmas faced by organizations, helps in applying concepts, principles and analytical skills to solve the delineated problems and develops effective templates for computer science related problem solving. Case method of teaching is used as a critical learning tool for effective learning and we encourage it to the fullest.

2. Role Play & Simulation: Role-play and simulation are forms of experiential learning. Learners take on different roles, assuming a profile of a character or personality, and interact and participate in diverse and complex learning settings. Role-play and simulation function as learning tools for teams and groups or individuals as they "play" online or face-to-face. They alter the power ratios in teaching and learning relationships between students and educators, as students learn through their explorations and the viewpoints of the character or personality they are articulating in the environment. This student-centered space can enable learner-oriented assessment, where the design of the task is created for active student learning. Therefore, role-play& simulation exercises such as virtual share software and hardware simulation etc. are promoted for the practical-based experiential learning of our students.

3. Video Based Learning (VBL) & Learning through Movies (LTM): These days technology has taken a front seat and classrooms are well equipped with equipment and gadgets. Video-based learning has become an indispensable part of learning. Similarly, students can learn various concepts through movies. In fact, many teachers give examples from movies during their discourses. Making students learn few important theoretical concepts through VBL & LTM is a good idea and method. The learning becomes really interesting and easy as videos add life to concepts and make the learning engaging and effective. Therefore, our college promotes VBL & LTM wherever possible.

***4. Field / Live Projects*:** The students, who take up experiential projects in companies, where senior executives with a stake in teaching, guide them and drive the learning. All students are encouraged to do some live project other than their regular classes/projects.

5. Industrial Visits: Industrial visit are essential to give students hands-on exposure and experience of how things and processes work in industries. Our college organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

6. MOOCs: Students may earn credits by passing Massive Open Online Courses (MOOCs) like NPTEL, Swayam, etc. as decided by the college from time to time. Graduate level programs may award Honours degree, provided, students earn pre-requisite credits through MOOCs. It is recommended to cover 20% contents in online mode.

7. Special Guest Lectures (SGL) & Extra Mural Lectures (EML): Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry, time to time, to deliver their vital inputs and insights.

8. Student Development Programs (SDP): Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, SAP, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

9. Industry Focused Programmes: Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice based insights to the students.

10. Special Assistance Programme for Slow Learners & Fast Learners: After the first class test (CT-1), we identify the slow learners and the fast learners on the basis of their performance in the class and test. We counsel the slow learners to assess the knowledge gap and provide them special assistance in terms of tutorial programmes in learning the subjects or topics. We motivate the fast learners to go through the various journals and references available in library and online. We encourage fast learners to write the research papers with the help of their supervisors and present in conferences. We organise at least one international conference in each semester.

11. Orientation Programme: We organise Orientation Programme of 15 days for the students to make them well aware of the rules and regulations of college and university, including anti ragging policies. We cover the elementary topics of Mathematics, English, Soft Skills, Science and Reasoning during orientation programme.

12. Mentoring Scheme: Every Student shall be provided with a faculty mentor to help him /her in their personal and academic issues. The mentor maintains a register of all his/her mentees with complete personal details. It is desirable to meet twice in a month but one meeting is mandatory. The mentor records the discussions held, advice given, efforts and improvements made, by the mentee and to the mentee. This register of the mentor must be counter signed by the HOD once a month and by the Principal once a semester.

13. Career & Personal Counseling: We have Training and Placement Cell for Career & Personal Counseling of the students. The cell organizes activities according to the requirement time to time or as per demand of students and companies.

14. Capability Enhancement Program: We provide various subject experts for enhancing the capability of individual, to qualify any competitive exam. The student may also approach the faculty mentor to invite the subject expert or for external help.

15. Extracurricular Activities: We organize various extracurricular activities to help students develop confidence & face audience with care. It brings out their leadership qualities, planning and organizing skills. Students undertake various cultural, sports and other competitive activities within and outside the campus. This helps them build their wholesome personality.

16. Participation in Workshops, Seminars and Writing & Presenting Papers: We motivate our students to write research paper, of the idea they generated from their regular studies, implementing a new concept in their favorite programming language and present their paper in international or national conferences, held across the country. e-Journals are available in the library for catering their requirement of research writing.

17. Formation of Student Clubs, Membership and Organising & Participating the Events: We find the interest of student and based upon that they are asked to join an existing club or found a new club. We have various clubs and various events take place among these clubs. The clubs organize events and participation depends on the nature of event.

18. Capability Enhancement and Development Schemes: A student may have a wide spectrum of capabilities hidden inside. We explore the capability of student with the help of various events throughout the year and find the students with the caliber in a specific field or skill. We then shape the students by mentoring and providing resources and guide which is required to make him an Ace of their field.

19. Library Visit and Utilization of E-Learning Resources: Some student may be interested in different topic which is not the part of their curriculum, such student ask for resources or guide through her mentee. If the student say that "I require XYZ book", we order that book through library and make available to him. We also motivate students to go through vide catalogue of our library and ask them to give requisition.

Bachelor of Science (Honours) Computer Science Curriculum

B.Sc. (Honours) CS : Semester I

S. No.	Category	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	AEC I	TMU 101	Environmental Studies	2	1	0	3	40	60	100
2	CC I	CSC111	Computer Fundamentals & C Programming	3	1	0	4	40	60	100
3	AEC II	CSC 112	Human Values & Professional Ethics	3	1	0	4	40	60	100
4	CC II	CSC 113	Digital Logic & Basics of Computer Organization	3	1	0	4	40	60	100
5	AEC III	TMUGE101	English Communication I	2	0	2	3	40	60	100
6	CC III	CSC156	Programming In C: Lab	0	0	4	2	50	50	100
7	CC IV	CSC157	Computer Fundamentals & Digital Electronics Lab	0	0	4	2	50	50	100
			Total	**13**	**4**	**10**	**22**	**300**	**400**	**700**

Value Added Course / Semester- I

Value added course is an audit course which will be compulsory to pass with 45% marks. However, it will not be added towards overall result.

S. No.	Category name	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	VAC-1	TMUGA-101	Foundation in Quantitative Aptitude	2	1	0	0	40	60	100

B.Sc. (Honours) CS : Semester II

S. No.	Category	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC V	CSC213	Operating System Concepts	3	1	0	4	40	60	100
2	CC VI	CSC 214	Introduction to Web Design	3	1	0	4	40	60	100
3	CC VII	CSC 215	Data Structures Using C++	3	1	0	4	40	60	100
4	CC VIII	CSC216	Discrete Mathematics	3	1	0	4	40	60	100
5	AEC IV	TMUGE201	English Communication II	2	0	2	3	40	60	100
6	CC IX	CSC 255	Introduction to Web Design Lab	0	0	4	2	50	50	100
7	CC X	CSC 256	Data Structures Using C++ Lab	0	0	4	2	50	50	100
		Total		**14**	**4**	**10**	**23**	**300**	**400**	**700**

Value Added Course / Semester - II

Value added course is an audit course which will be compulsory to pass with 45% marks. However, it will not be added towards overall result.

S. No.	Category name	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	VAC-2	TMUGA-201	Analytical Reasoning	2	1	0	0	40	60	100

B.Sc. (Honours) CS : Semester III

S. No.	Category	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC XI	CSC301	Software Engineering and UML	3	1	0	4	40	60	100
2	**GEC I**	**Select one out of the list Generic Elective I**		3	1	0	4	40	60	100
3	CC XII	CSC315	Object-Oriented Programming Concepts Using Java	3	1	0	4	40	60	100
4	CC XIII	CSC316	Computer Network	3	1	0	4	40	60	100
5	AEC V	TMUGE301	English Communication III	2	0	2	3	40	60	100
6	CC XIV	CSC357	Object-Oriented Programming Concepts Using Java LAB	0	0	4	2	50	50	100
7	**GEC II**	**Select one out of the list Generic Elective II**		0	0	4	2	50	50	100
		Total		**14**	**4**	**10**	**23**	**300**	**400**	**700**

Value Added Course / Semester - III

Value added course is an audit course which will be compulsory to pass with 45% marks. However, it will not be added towards overall result.

S. No.	Category name	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	VAC-3	TMUGA-302	Modern Algebra and Data Management	2	1	0	0	40	60	100
2	VAC-4	TMUGS-301	Managing Self	2	1	0	0	50	50	100

B.Sc. (Honours) CS : Semester IV

S. No.	Category	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC XV	CSC403	Algorithm Design	3	1	0	4	40	60	100
2	CC XVI	CSC411	Data Base Management System	3	1	0	4	40	60	100
3	CC XVII	CSC 413	Introduction to R Programming	3	0	0	3	40	60	100
4	**DSC I**	**Select one out of the list Discipline Specific Elective Course I**		3	1	0	4	40	60	100
5	AEC VI	TMUGE401	English Communication IV	2	0	2	3	40	60	100
6	CC XVIII	CSC456	Data Base Management System LAB	0	0	4	2	50	50	100
7	**DSC II**	**Select one out of the list Discipline Specific Elective Course II**		0	0	4	2	50	50	100
8	CC XIX	CSC461	R Programming Lab	0	0	4	2	50	50	100
		Total		**14**	**3**	**14**	**24**	**350**	**450**	**800**

Industrial Training

S. No.	Category	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1.	Project I	CSC557	Industrial Training*	0	0	0	2	50	50	100

*Industrial Training to be undertaken at the end of IV semester and to be evaluated at the start of V semester

Value Added Course / Semester - IV

Value added course is an audit course which will be compulsory to pass with 45% marks. However, it will not be added towards overall result.

S. No.	Category name	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	VAC-5	TMUGA-402	Advance Algebra and Geometry	2	1	0	0	40	60	100
2	VAC-6	TMUGS-401	Managing Work and Others	2	1	0	0	50	50	100

B.Sc. (Honours) CS : Semester V

S. No.	Category	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	CC XX	CSC515	Dot Net Framework with C#	3	1	0	4	40	60	100
2	CC XXI	CSC516	Theory of Computation	3	1	0	4	40	60	100
3	CC XXII	CSC517	Python Programming & Introduction to Data Science	3	1	0	4	40	60	100
4	**SEC I**	**Select one out of the list Skill Enhancement Course I**		3	1	0	4	40	60	100
5	**GEC III**	**Select one out of the list Generic Elective III**		3	1	0	4	40	60	100
6	**SEC II**	**Select one out of the list Skill Enhancement Course II**		0	0	4	2	50	50	100
7	CC XXIII	CSC560	Python Programming & Introduction to Data Science Lab	0	0	4	2	50	50	100
8	CC XXIV	CSC 561	Dot Net Framework with C# Lab	0	0	4	2	50	50	100
9	OEC I	Open Elective I		3	0	0	3	40	60	100
		Total		**18**	**5**	**12**	**31***	**440***	**560***	**1000***

* including Industrial Training (to be undertaken at the end of IV semester, listed in IV semester evaluation scheme)

B.Sc. (Honours) CS : Semester VI

S. No.	Category	Course Code	Course Name	Periods			Credit	Evaluation Scheme		
				L	T	P		Internal	External	Total
1	**SEC III**	**Select one out of the list Skill Enhancement Course III**		3	1	0	4	40	60	100
2	CC XXV	CSC 618	Machine Learning using Python	3	1	0	4	40	60	100
3	**GEC IV**	**Select one out of the list Generic Elective IV**		3	1	0	4	40	60	100
4	**DSC III**	**Select one out of the list Discipline Specific Elective Course III**		3	1	0	4	40	60	100
5	Project II	CSC662	Project LAB	0	0	6*	3	50	50	100
6	**SEC IV**	**Select one out of the list Skill Enhancement Course IV**		0	0	4	2	50	50	100
7	**DSC IV**	**Select one out of the following list Discipline Specific Elective Course IV**		0	0	4	2	50	50	100
8	CC XXVI	CSC661	Machine Learning using Python LAB	0	0	4	2	50	50	100
9	OEC II	Open Elective II		3	0	0	3	40	60	100
		Total		15	4	18	28	400	500	900

* 2 hours will be supervisor interaction and 4 hours will be lab hours

List of Discipline Specific Courses

Semester-IV

Discipline Specific Elective Course I (DSC I)

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
DSE I	CSC 414	Concepts of IoT	3	1	0	4	40	60	100
	CSC 415	Computer Security and Privacy							
	CSC 416	Ethical Hacking Fundamentals							

Semester-IV

Discipline Specific Elective Course II (DSC II)

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
DSE II	CSC 458	Concepts of IoT LAB	0	0	4	2	50	50	100
	CSC 459	Computer Security and Privacy LAB							
	CSC460	Ethical Hacking Fundamentals LAB							

Semester-VI

Discipline Specific Elective Course III (DSC III)

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
DSE III	CSC 621	Mobile Computing& Mobile Device Architecture	3	1	0	4	40	60	100
	CSC622	Big Data Analytics							
	CSC623	NoSQL							

Semester-VI

Discipline Specific Elective Courses IV (DSC IV)

Choose relevant lab based on DSC III

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
DSE IV	CSC658	Concepts of Mobile Computing LAB	0	0	4	2	50	50	100
	CSC659	Big Data Analytics LAB							
	CSC660	NoSQL LAB							

List of Generic Elective Courses

Semester III

Generic Elective Course I (GEC I)

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
GE I	CSC 312	Computer Based Numerical & Statistical Techniques	3	1	0	4	40	60	100
	CSC313	Computer Based Optimization Techniques							
	CSC314	Scientific Computing							

Semester III

Generic Elective Course II (GEC II)

Choose relevant lab based on GEC I

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
GE II	CSC 358	Computer Based Numerical & Statistical Techniques LAB	0	0	4	2	50	50	100
	CSC 359	Computer Based Optimization Techniques LAB							
	CSC360	Scientific Computing LAB							

Semester-V
Generic Elective Course III (GEC III)

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
GE III	**CSC512**	Entrepreneurship	3	1	0	4	40	60	100
	CSC513	Industrial Psychology							
	CSC520	Management Concepts & Organizational Behavior							

Semester-VI
Generic Elective Course IV (GEC IV)
Choose relevant lab based on GEC III

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
GE IV	CSC619	Cloud Computing	3	1	0	4	40	60	100
	CSC620	Introduction to Human Computer Interaction							

List of Skill Enhancement Courses

Semester-V
Skill Enhancement Course I (SEC I)

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
SEC I	CSC518	Mobile Application Development using Android	3	1	0	4	40	60	100
	CSC519	Advance Java							

Semester-V
Skill Enhancement Course II(SEC II)
Choose relevant lab based on SEC I

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
SEC II	CSC558	Android LAB	0	0	4	2	50	50	100
	CSC559	Advance Java LAB							

Semester-VI

Skill Enhancement Course III(SEC III)

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
SEC III	CSC616	Programming in PHP and MySQL	3	1	0	4	40	60	100
	CSC617	ASP.Net with MVC Architecture							

Semester-VI

Skill Enhancement Course IV(SEC IV)
Choose relevant lab based on SEC III

Select one out of the following

Category	Course Code	Course	Periods			Credit	Evaluation Scheme		
			L	T	P		Internal	External	Total
SEC IV	CSC656	ASP.Net with MVC Architecture LAB	0	0	4	2	50	50	100
	CSC657	Programming in PHP and MySQL LAB							

Course Code: TMU101	**Ability Enhancement Course - I** **B.Sc. (Honours) Computer Science – Semester I** **Environmental Studies**	**L-2** **T-1** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Understanding** environmental problems arising due to constructional and developmental activities.	
CO2.	**Understanding** the natural resources and suitable methods for conservation of resources for sustainable development.	
CO3.	**Understanding** the importance of ecosystem and biodiversity and its conservation for maintaining ecological balance.	
CO4.	**Understanding** the types and adverse effects of various environmental pollutants and their abatement devices.	
CO5.	**Understanding** Greenhouse effect, various Environmental laws, impact of human population explosion, environment protection movements, different disasters and their management.	
Course Content:		
Unit-1:	Definition and Scope of environmental studies, multidisciplinary nature of environmental studies, Concept of sustainability & sustainable development. **Ecology and Environment**: Concept of an Ecosystem-its structure and functions, Energy Flow in an Ecosystem, Food Chain, Food Web, Ecological Pyramid& Ecological succession, Study of following ecosystems: Forest Ecosystem, Grass land Ecosystem & Aquatic Ecosystem & Desert Ecosystem.	**6 Hours**
Unit-2:	**Natural Resources:** Renewable & Non-Renewable resources; Land resources and land use change;Land degradation, Soil erosion & desertification. **Deforestation**: Causes & impacts due to mining, Dam building on forest biodiversity & tribal population. **Energy Resources**: Renewable & Non-Renewable resources, Energy scenario & use of alternate energy sources, Case studies. **Biodiversity:** Hot Spots of Biodiversity in India and World, Conservation,ImportanceandFactors Responsible for Loss of Biodiversity, Biogeographical Classification of India.	**6 Hours**
Unit-3:	**Environmental Pollutions:** Types, Causes, Effects & control; Air, Water, soil & noise pollution, Nuclear hazards & human health risks, Solid waste Management; Control measures of urban & industrial wastes, pollution case studies.	**6 Hours**

Unit-4:	**Environmental policies & practices: Climate change & Global** Warming (GreenhouseEffect),Ozone Layer -Its Depletion and Control Measures, Photo chemical Smog, Acid Rain Environmental laws: Environment protection Act; air prevention & control of pollution act, Water Prevention & Control of Pollution Act, Wild Life Protection Act, Forest Conservation Acts, International Acts; Montreal & Kyoto Protocols & Convention on biological diversity, Nature reserves, tribal population & Rights & human wild life conflicts in Indian context.	**6 Hours**
Unit-5:	**Human Communities & Environment:** Human population growth; impacts on environment, human health & welfare, Resettlement & rehabilitation of projects affected person: A case study, Disaster Management; Earthquake, Floods & Droughts, Cyclones & Landslides, Environmental Movements; Chipko, Silent Valley, Vishnoi's of Rajasthan, Environmental Ethics; Role of Indian & other regions & culture in environmental conservation, Environmental communication & public awareness; Case studies.	**6 Hours**
Text Books:	1. "Environmental Chemistry", De, A. K., New AgePublishersPvt.Ltd.	
Reference Books:	1. "Introduction to Environmental Engineeringand Science", Masters, G. M., PrenticeHall India Pvt. Ltd. 2. "Fundamentals of Ecology",Odem, E. P., W. B. Sannders Co. 3. BiodiversityandConservation",Bryant, P. J., Hypertext Book 4. "Textbook of Environment Studies", Tewari, Khulbe&Tewari,I.K. Publication	
Additional Electronic Reference Material:	1. https://www.tutorialspoint.com/environmental_studies/	

Course Code: CSC111	**Core Course - I** **B.Sc. (Honours) Computer Science – Semester I** **Computer Fundamentals & C Programming**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic structure of a computer along with hardware, software and memory associated with it.	
CO2.	Understanding various terminologies and functions used in C programming language.	
CO3.	Applying programming concepts to write compile and debug programs in C language.	
CO4.	Analyzing programming concepts by using loops, arrays, pointers, structures etc.	
CO5.	Design programs for general purposes	
Course Content:		
Unit-1:	Introduction to computers, characteristics and limitations of computer, Block diagram of computer, types of computers, uses of computers, computer generations. Input and output devices: Keyboard and mouse, inputting data in other ways, Types of Software: system software, Application software, commercial, open source, domain and free ware software, Memories: primary, secondary and cache memory.	**8 Hours**
Unit-2:	Introduction to C: Introduction – Structure of C Program – Writing the first C Program – File used in C Program – Compiling and Executing C Programs – Using Comments – Keywords – Identifiers – Basic Data Types in C – Variables – Constants – I/O Statements in C- Operators in C- Programming Examples – Type Conversion and Type Casting.	**8 Hours**
Unit-3:	Decision Control and Looping Statements: Introduction to Decision Control Statements – Conditional Branching Statements – Iterative Statements – Nested Loops – Break and Continue Statement – Goto Statement Functions: Introduction – using functions – Function declaration/ prototype – Function definition – function call – return statement – Passing parameters – Scope of variables – Storage Classes – Recursive function	**8 Hours**
Unit-4:	Arrays: Introduction – Declaration of Arrays – Accessing elements of the	**8 Hours**

	Array – Storing Values in Array – Calculating the length of the Array – Operations on Array – one dimensional array for inter-function communication – Two dimensional Arrays –Operations on Two Dimensional Arrays Strings: Introduction String and Character functions	
Unit-5:	Pointers: Understanding Computer Memory – Introduction to Pointers – declaring Pointer Variables – Pointer Expressions and Pointer Arithmetic – Null Pointers – Generic Pointers - Passing Arguments to Functions using Pointer – Pointer and Arrays – Passing Array to Function – Structure, Union, and Enumerated Data Types: Introduction – Nested Structures – Arrays of Structures – Structures and Functions - Unions – Enumerated Data Types, Command line arguments	**8 Hours**
Text Books:	1. Sinha P.K., Computer Fundamentals, BPB Publishing.	
Reference Books:	1. O'Leary Timothy, O'Leary Linda , Microsoft Office ,TMH Publication 2. BalaguruswamyE., *Programming in ANSI C*, TMU 3. KanitkarYashwant, *Let Us C*, BPB 4. Leon A. & Leon M., Introductions to Computers, Vikas Publication. 5. Norton Peter, Introductions to Computers, TMH Publication. Price Michael, Office in Easy Steps ,TMH Publication. 6. Behrouz A. Forouzan and Richard F. Gilberg, "Computer Science A Structured Programming Approach Using C", PHI, 3rd Ed., 7. Jeri R. Hanly and Elliot B. Koffman, "Problem Solving and Programming in C", Pearson, 8. Rama N. Reddy and Carol A. Ziegler, "C Programming for Scientist and Engineers with Applications", Jones and Bartlet	
Additional Electronic Reference Material:	1. https://www.javatpoint.com/computer-fundamentals-tutorial	

Course Code: CSC112	**Ability Enhancement Course - II** **B.Sc. (Honours) Computer Science – Semester I** **Human Values & Professional Ethics**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of Morals, Values, Ethics and Value education.	
CO2.	Understanding the concept of work ethics and find out the difference between profession, ethics and happiness.	
CO3.	Analyzing the concept of trust, spiritualism, and focus on problems related to stress.	
CO4.	Understanding the concept and meaning of Intellectual Property Rights, Cybercrime, Plagiarism and misconduct	
CO5.	Understanding about e-waste and creating a balance between computer ethics and corporate social responsibility.	
Course Content:		
Unit-1:	**Introduction to Value Education:** Understanding of Morals, Values and Ethics; Need, Content and Process for Value Education. Attributes of A Good Character- Integrity, Work Ethic, Respect For Others, Living Peacefully, Cooperation, Commitment, Empathy etc. Spirituality: Introduction to Yoga and Meditation for Professional Excellence and Stress Management. Understanding Harmony in the Family and Society.	**8 Hours**
Unit-2:	**Ethics & Technology:** Impact of Technological Growth on Society and Value System; Reports of Club of Rome, Appropriate Technology Movement of Schumacher, Problems of Technology Transfer, Technology Assessment Impact Analysis, Human Operator in Engineering Projects & Industries, Problems of Man-Machine Interaction, Human Centered Technology, Safety and Risk Analysis.	**8 Hours**
Unit-3:	**Ethics of Profession:** Ethical Issues in Engineering Practice, Conflicts of Interest: Conflicts between Business Demands and Professional Ethics. Social and Ethical Responsibilities of Technologists. Ethical Issues at Workplace: Discrimination, Cybercrime, Plagiarism, Sexual Misconduct, Fraudulent Use of Institutional Resources. Intellectual Property Rights and its uses.Whistle blowing and beyond, Case studies**.**	**8 Hours**

Unit-4:	**Profession and Human Values:** Values Crisis in Contemporary Society; Value Spectrum of Good Life; Integrated Personality. Modern Search for a Good Society: Justice, Democracy, Secularism, Rule of Law. Values in Indian Constitution. Canons of ethics: Ethics of Virtue; Ethics of Duty; Ethics of Responsibility.	**8 Hours**
Unit-5:	**Global Issues & Professional Ethics:** MNCs & Morality; Case Study: Bhopal Gas Tragedy. Environmental Ethics: Disposal of Plastic Waste, e-Waste, Industrial. Computer Ethics: Problems in Computer Ethics. Weapons Development: Impact on Society & Humanity. Moral Leadership; Corporate Social Responsibility. Engineering Council of India.	**8 Hours**
Text Books:	1. RS Naagarazan, A Text Book on Professional Ethics & Human Values, New Age International Publishers	
Reference Books:	1. Deborah Johnson, Ethical Issues in Engineering, Prentice Hall, Englewood Cliffs, New Jersey 2. Stephen H Unger, Controlling Technology: Ethics and the Responsible Engineers, John Wiley & Sons, New Yor 3. A N Tripathi, Human values in the Engineering Profession, Monograph published by IIM, Calcutta 4. Sathya Sai Education in Human Values, UK Newsletter, 2/2003 www.sathyasaiehv.org.uk	
Additional Electronic Reference Material:		

Course Code: CSC113	**Core Course - II** **B.Sc. (Honours) Computer Science – Semester I** **Digital Logic & Basics of Computer Organization**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the operations of logic gates, boolean algebra and karnaugh map.	
CO2.	Understanding the working of combinational and sequential circuits.	
CO3.	Understanding the working of register organization and stack organization.	
CO4.	Understanding the concept of Input-Output Organization and memory organization.	
CO5.	Applying the concepts of combinational and sequential circuits to design the desired circuit.	
Course Content:		
Unit-1:	**Introduction to Number Systems**-Types-Decimal, Binary, Octal, Hexadecimal; Conversion from one number system to other; Binary arithmetic operations; Representation of Negative Numbers;1's complement and 2's complement, Complement arithmetic, weighted and Non Weighted Codes **Logic Gates:** Basic Gates, Universal Gates and realization of other gates using universal gates	**8 Hours**
Unit-2:	**Boolean Algebra:** Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canaonical representation of Boolean expressions, Minimization Techniques for Boolean Expressions using Karnaugh Map (three, four and five variable) **Combinational Circuits**- Introduction to combinational Circuits, Adders- Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor, BCD adder, BCD Subtractor.	**8 Hours**
Unit-3:	**Combinational Circuits:** Multiplexer, Demultiplexer, Encoder, Priority Encoder, Decoder, BCD to Seven segment Display Decoder, Comparators.	**8 Hours**

	Sequential Circuits: Introduction to Sequential Circuits, Flip-Flops, Types of Flip Flops: R-S, T, D, J-K, Race around condition, Master-Salve JK flip flop, Realization of flip flops. **Shift Registers:** Introduction to shift registers, 4 bit shift register	
Unit-4:	**Processor Organization:** General register organization, Stack organization, Reverse Polish Notation, Instruction Format, Addressing mode, Instruction type.	**8 Hours**
Unit-5:	**Input-Output Organization:** Peripheral Devices, Strobe control, Hand Shaking, DMA, Interrupts & Interrupt handling, Direct Memory access: DMA Controller and DMA Transfer. **Memory Organization:** Memory Hierarchy, Main Memory: RAM & ROM chips.	**8 Hours**
Text Books:	1. Mano M., Computer System Architecture, Prentice Hall of India. 2. Mano Morris, Digital Logic, Prentice Hall of India.	
Reference Books:	1. Stallings, Computer Organization, Prentice Hall of India. 2. Vravice, Zaky&Hamacher, Computer Organization, Tata Mc Graw Hill 3. Tannenbaum, Structured Computer Organization, Prentice Hall of India. 4. Hayes John P., Computer Organization, McGraw Hill	
Additional Electronic Reference Material:	1. https://www.electronics-tutorials.ws/logic/logic_1.html	

Course Code: TMUGE101	**Ability Enhancement Course - III** **B.Sc. (Honours) Computer Science – Semester I** **English Communication I**	**L-2** **T-0** **P-2** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering and understanding** of the basic of English grammar and vocabulary.	
CO2.	**Understanding** of the basic Communication process.	
CO3.	**Applying** correct vocabulary and tenses in sentences construction.	
CO4.	**Analyzing** communication needs and developing communication strategies using both verbal & non-verbal method.	
CO5.	**Drafting** applications in correct format for common issues.	
CO6.	**Developing** self-confidence.	
Course Content:		
Unit-1:	**I Introductory Sessions** • Self-Introduction • Building Self Confidence: Identifying strengths and weakness, reasons of Fear of Failure, strategies to overcome Fear of Failure • Importance of English Language in present scenario (*Practice: Self-introduction session*	**8 Hours**
Unit-2:	**Basics of Grammar** Parts of Speech • Tense • Subject and Predicate • Vocabulary: Synonym and Antonym *(Practice: Conversation Practice)*	**8 Hours**
Unit-3:	**Basics of Communication** • Communication : Process, Types, 7Cs of Communication, Importance & Barrier	**8 Hours**

	• Language as a tool of communication • Non-verbal communication: Body Language • Etiquette & Manners • Basic Problem Sounds *(Practice :Pronunciation drill and building positive body language)*	
Unit-4:	**Application writing** Format & Style of Application Writing • Practice of Application writing on common issues.	**8 Hours**
Unit-5:	**Value based text reading:** Short Story (Non- detailed study) • The Gift of the Magi – O. Henry	**8 Hours**
Text Books:	1. Singh R.P., An Anthology of Short stories, O.U.P. New Delhi	
Reference Books:	1. Kumar, Sanjay. &PushpLata. "*Communication Skills"* New Delhi: Oxford University Press. 2. Carnegie Dale. "*How to win Friends and Influence People*" New York: Simon & Schuster. 3. Harris, Thomas. A. "*I am ok, You are ok*" New York: Harper and Row. 4. Goleman, Daniel. "*Emotional Intelligence*" Bantam Book	
Additional Electronic Reference Material:		

Evaluation Scheme

Internal Evaluation			External Evaluation		Total Marks
40 Marks			60 Marks		100
20 Marks (Best 2 out of Three CTs) ***(From Unit- II, IV & V)***	10 Marks (Oral Assignments) ***(From Unit I & III)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(From Unit II, IV & V)***	20 Marks (External Viva)* ***(From Unit -1 & III)***	

*Parameters of External Viva

Content	Body Language	Confidence	Question Responsiveness	TOTAL
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note: External Viva will be conducted by 2-member committee comprising

a) One Faculty teaching the class

b) One examiner nominated by University Examination cell.

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: CSC156	**Core Course - III** **B.Sc. (Honours) Computer Science – Semester I** **Programming in C: Lab**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding problem-solving techniques.	
CO2.	Applying sorting algorithms	
CO3.	Applying function on programs for reusability	
CO4.	Applying concepts such as arrays, structures etc to write different programs in C language.	
CO5.	Design general purpose programs using C	
Course Content:		
	1. Programs based on data Types 2. Programs to calculate factorial, Fibonacci series. 3. Programs on Arrays – Maximum, Minimum, Sum of the elements, etc 4. Basic Sorting Algorithms 5. Function based programs 6. Returning from Functions 7. Static data handling examples 8. Pointers based address manipulations programs 9. Programs to handle data through the use of structures. 10. Filing based programs – create, read, append etc	**20 Hours**

Course Code: CSC157	**Core Course - IV** **B.Sc. (Honours) Computer Science – Semester I** **Computer Fundamentals & Digital Electronics Lab**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basics of MS office.	
CO2.	Understanding the working of basic of sequential circuits.	
CO3.	Understanding the working of basic gates.	
CO4.	Applying concepts of MS-WORD, MS-EXCEL, POWERPOINT and MS-ACCESS	
CO5.	Applying concepts of logic gate and boolean algebra to design combinational circuits.	
CO6.	Designing sequential circuits with flipflops and registers.	
Course Content:		
	MS Office: **MS-WORD** Creating, Editing, Formatting: Font name, size, color, alignment, changing, paragraph settings, change case, spell checker, Mail Merge, Creating Tables, editing tables, alignment settings in tables **MS-EXCEL** Creating, Editing, Formatting: font name, size, color, alignment, changing, entering data, Sorting Data, Inserting, renaming and deleting Sheet, Inserting row, column, cell ,picture, background, graph, symbol, hyperlink ,object, diagram. **MS-POWERPOINT** Creating, Editing, Formatting: font name, size, color, alignment, changing, Inserting table, picture, background, graph, symbol, hyperlink, object, diagram. **MS-ACCESS** Creating database and editing data base 1. Design proper logic circuits to verify the truth table of basic gates	**20 Hours**

	2. Implement the following Boolean expression using basic 3. Design proper logic circuits to prove that NAND gate is a universal gate. 4. Design proper logic circuits to prove that NOR is gate a universal gate. 5. Design an X-OR gate using NAND gate only. 6. Design half subtractor using NOR gate 7. Design Half Adder using NAND gate 8. Design Full Adder using Basic logic gates 9. Design Full Subtractor using Basic logic gates 10. Design a 4*1 multiplexer using basic logic gates and create IC. 11. Design a 8*1 multiplexer using basic logic gates and cerate IC. 12. Realize the following Boolean function using suitable MUX:- f(A,B,C)=Π(0,1,3, 5) 13. Design a half adder using suitable MUX 14. Design a full adder using suitable MUX. 15. Design a half subtractor using suitable MUX. 16. Design a full subtractor using suitable MUX.	

Course Code: TMUGA-101	**B.Sc. (Honours) Computer Science – Semester I** **Value Added Course (VAC-1)** **Foundation in Quantitative Aptitude**	**L-2 T-1 P-0 C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Solving complex problems using Criss cross method, base method and square techniques.	
CO2.	Applying the arithmetical concepts of Average, Mixture and Allegation.	
CO3.	Evaluating the different possibilities of various reasoning based problems in series, Blood relation and Direction.	
CO4.	Operationalizing the inter-related concept of Percentage in Profit Loss and Discount, Si/CI and Mixture/Allegation.	
Course Content:		
Unit-1:	**Speed calculations** Squares till 1000,square root, multiplications: base 100, 200 300 etc., 11-19, crisscross method for 2X2, 3X3, 4X4, 2X3, 2X4 etc., cubes, cube root	**3 Hours**
Unit-2:	**Percentages** Basic calculation, ratio equivalent, base, change of base, multiplying factor, percentage change, increment, decrement, successive percentages, word problems	**5 Hours**
Unit-3:	**Profit Loss Discount** Basic definition, formula, concept of mark up, discount, relation with successive change, faulty weights	**5 Hours**
Unit-4:	**SI and CI** Simple Interest, finding time and rate, Compound Interest, difference between SI and CI, Installments	**4 Hours**
Unit-5:	**Averages** Basic Averages, Concept of Distribution, Weighted Average, equations	**3 Hours**
Unit-6:	**Mixtures and allegations** Mixtures of 2 components, mixtures of 3 components, Replacements	**5 Hours**
Unit-7:	**Blood relations** Indicating type, operator type, family tree type	**3 Hours**
Unit-8:	**Direction sense** Simple statements, shadow type	**2 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com • R6:-Logical Reasoning by Nishith K Sinha	

	• R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Course Code: CSC213	**Core Course - V** **B.Sc. (Honours) Computer Science – Semester II** **Operating System Concepts**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding various operating systems, Process Management, Process states, Process Synchronization, CPU Scheduling, Memory Management & Directory Structure.	
CO2.	Understanding concepts of detailed operation deadlock and deadlock characterization.	
CO3.	Understanding and comparing different CPU Scheduling Algorithms & Memory management techniques.	
CO4.	Understanding Disc access, management and scheduling.	
CO5.	Analyzing deadlocks and memory.	
Course Content:		
Unit-1:	**Operating System:** History, Types: Batch System, Time Sharing System, Real Time System, Multiprogramming, Distributed System; Functions; Services; System calls; System programs; Virtual machines.	**6 Hours**
Unit-2:	**Process Management:** Concept, States, Control Block, Scheduling; CPU, Criteria, Algorithms, Preemptive& Non Preemptive	**6 Hours**
Unit-3:	**Process Synchronization:** Critical Section, Race Condition, Synchronization Hardware, Semaphores, Classical Problems of Synchronization. **Deadlocks:** Characterization, Avoidance, Detection & Recovery.	**6 Hours**
Unit-4:	**Memory Management:** Contiguous Allocation, External and Internal Fragmentation, Paging &Segmentation.	**6 Hours**
Unit-5:	**File Management:** Directory Structure, Allocation Methods; Contiguous; Linked; Indexed: Free Space Management; Disk: Structure, Scheduling Algorithms, Management.	**6 Hours**
Text Books:	1. Silbershatz, A. and Galvin, P., *Operating System Concept*, Addison-Wesley.	

	2. Nutt, G., *Operating Systems*, Addison-Wesley. 3. God bole, A., *Operating System*, Prentice Hall of India.	
Reference Books:	**1.** Flynn, M., *Understanding Operating System*, Thomson Press. **2.** Tannenbaum, O., *Operating System Concept*, Addison-Wesley. **3.** Joshi, R.C., and Tapaswi, S., *Operating Systems*, Wiley-Dreamtech.	

Course Code: CSC214	**Core Course - VI** **B.Sc. (Honours) Computer Science – Semester II** **Introduction to Web Design**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basics of web technologies, HTML, Linking of HTML files.	
CO2.	Understanding the concept of Image alignment text alignment in HTML.	
CO3.	Understanding the concept of web page working, creating forms using of buttons.	
CO4.	Understanding various operations on cascading style sheet (CSS).	
CO5.	Understanding the bootstrap framework with its features and layout.	
Course Content:		
Unit-1:	HTML – URI, LIST, Hyperlinks: History of HTML, Introduction to URI: Fragment Identifier & Relative Uniform Resource indicator, Standard Generalized Markup Language, Structure of HTML document, Switching between your Editor and Browser, Structuring Web Page, Paragraph and Line Break Tags, Adding Comments, Formatting your Text; Creating Lists: Ordered List Tags, Unordered List Tag & Nesting Lists: Controlling How Ordered Lists are displayed, Creating a Multilevel Outline, Using Start and Value Attributes in an Ordered List, Controlling the Display of Unordered List, Creating Definition List; Creating Hyper Text Links, Linking to a File or Data Object, Linking to NON-WWW Files, Linking to a Place in the Same HTML File, Linking to a Place in Another HTML File, Creating Link Lists, Creating a Simple Link List	**8 Hours**
Unit-2:	HTML – Images, Links, Rules, Address Tag and Text: Inserting Images: Using the Align Attribute in Inline Graphics, Setting the Height and Width of an Inline Image; Creating Image Links; Horizontal Rules: Changing the Height of a Horizontal Rule, Changing between Shaded and Un-shaded Horizontal Rule, Changing the Width of a Horizontal Rule, Setting the Alignment of a Horizontal Rule; Address Tag; Working with Text: Text Alignment, Changing Font Sizes and Colors: Setting Font Sizes, Setting the Base Font, Using the Small and Big tags, Changing the Font Color; Using a Background Image; Marquee Tag	**8 Hours**
Unit-3:	Web Page Authoring using HTML: Tables: Creating Columns and Rows, Adding a Border, Adding Column Headings, Adding Spacing and Padding, Adding a Caption, Setting the Table Width and Height, Aligning Cell Contents, Setting Column Width, Centering a Table, Inserting an Image, Spanning Columns & Spanning Rows, Setting Font Size and Colors,	**8 Hours**

	Assigning Background Colors; Frames: Percentage dimensions, Relative dimensions, Creating two rows Frames, Creating two columns frames, Creating two rows and the second row containing two columns; Forms: What is Form?, Form Tag, Method, Action, Input Tag, Type Attribute: Check box, Hidden, Image, Radio, Reset, Submit, Text Cascading Style Sheets (CSS): Properties Table: Using the style Attribute, Creating Classes and IDs, Generating External Style Sheets, Typography, Consistency, Types of styles, Specifying class within HTML document, Style placement: Inline style, Span & div tags, header styles, Text and font attributes: Font Vs CSS, changing fonts, text attributes, Advance CSS properties: Backgrounds, Box properties and Positioning	
Unit-4:	Bootstrap Framework , History of Bootstrap , Advantages of Bootstrap Framework, What is Responsive web page, Major Features of Bootstrap, What is Mobile-First Strategy, How to apply Bootstrap to Applications, Bootstrap Grid , Advantages of Bootstrap Grid, Display responsive Images, use readymade themes. Bootstrap Tables, Bootstrap Form Layout.	**8 Hours**
Text Books:	1. Burdman, Collaborative Web Development , Addison Wesley.	**8 Hours**
Reference Books:	1. Bayross Ivan, Web Technologies Part II , BPB Publications. 2. HTML and CSS: Design and Build Websites By Jon Duckett 3. Bootstrap Quick Start by Jake Spurlock. Publisher: O'Reilly Media, Inc 4. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition, Pearson Education. 5. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education. 6. Marty Hall and Larry Brown,"Core Web Programming" Second Edition, Volume I and II, Pearson Education. 7. Bates, "Developing Web Applications", Wiley.	
Additional Electronic Reference Material:	1. https://www.creativebloq.com/web-design/10-design-concepts-web-developers-need-know-11135255	

Course Code: CSC215	**Core Course - VII** **B.Sc. (Honours) Computer Science – Semester II** **Data Structures Using C++**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concepts of C++ Programming to solve computing problems.	
CO2.	Understanding the basic concepts of object and classes in C++ and different function statements for transforming a problem solution into programs.	
CO3.	Understanding the basic concepts of data structure, arrays and recursion.	
CO4.	Understanding the stack, linked list and queue data structure using C++ class concepts.	
CO5.	Understanding the basic concepts of sorting and searching with different algorithms.	
CO6.	Understanding the basic concepts of tree and file structure.	
Course Content:		
Unit-1:	**C++ Programming Basics:** Variables, data type, features of object oriented programming, Functions, Call by Reference, Call by Address, Call by Value, Function Overloading, Inline Function, Enumerations. **Object & Classes:** Access Specifies, Constructors. Default, Copy Constructor, destructor, Object as Function Arguments, Returning Object from Function. Static Data Members, Static Member Functions, Abstract class, Const Data and Classes. Friend Functions, memory allocation in C++.	**8 Hours**
Unit-2:	**Introduction:** Basic Terminology, Elementary Data Organization, Data Structure operations, Algorithm Complexity and Time Space trade off. **Arrays:** Array Definition, Representation and Analysis, Single and Multidimensional Arrays, address calculation, application of arrays, string and its operations, Array as Parameters, Array & pointers.	**8 Hours**
Unit-3:	**Stack:** Array Representation and Implementation of stack, Operations on Stacks: Push &Pop, Linked Representation of Stack, Applications of stack, Conversion of Infix to Prefix and Postfix Expressions, Evaluation of postfix expression using stack. **Queues:** Array representation and implementation of queues, Operations on Queue, Circular queue, Priority Queue.	**8 Hours**

	Linked List: Representation and Implementation: Singly Linked List, Doubly Linked List, Circular Linked List, Circular Doubly Linked List, Header Linked List. Operations on Linked List: Insert, Delete, Searching, Traversal. Array and Queue Implementation using Linked List, Polynomial representation and addition.	
Unit-4:	Sort, Practical consideration for Internal Sorting. **Searching and Hashing:** Sequential search, binary search, Hash Table, Hash Functions, Collision Resolution Strategies, Hash Table Implementation.	**8 Hours**
Unit-5:	**Trees:** Basic terminology, Binary Trees, Binary tree representation, algebraic Expressions, Complete Binary Tree, Extended Binary Trees, Array and Linked Representation of Binary trees, Traversing Binary trees, Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST, Complexity of Search Algorithm, Path Length, AVL Trees. **Graphs:** Definitions and concepts, representation using Adjacency matrix, Adjacency lists.	**8 Hours**
Text Books:	1. S. Lipschutz, Data Structures , TMH.	
Reference Books:	1. Horowitz and Sahani, "Fundamentals of data Structures", Galgotia 2. T. H .Cormen "Introduction to Algorithms " PHI 3. K Loudon, "Mastering Algorithms With C", Shroff Publisher & Distributors 4. A M Tenenbaum, "Data Structure using C", Pearson 5. YashwantKanitkar "Data Structure using C" 6. R. S. Salaria, "Data Structures & Algorithms Using C"	
Additional Electronic Reference Material:	1. https://towardsdatascience.com/data-structures-in-c-part-1-b64613b0138d 2. http://www.cplusplus.com/doc/tutorial/structures/	

Course Code: CSC216	**Core Course - VIII** **B.Sc. (Honours) Computer Science – Semester II** **Discrete Mathematics**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of propositional calculus, mathematical techniques and counting principles.	
CO2.	Understanding the concepts of graph and tree in discrete structures.	
CO3.	Understanding the concepts of recurrence relations and generating functions in combinatory.	
CO4.	Applying the various counting principles for solution of a real life problem.	
CO5.	Analyzing the mathematical problems based on graph and trees.	
Course Content:		
Unit-1:	**Propositional Calculus:** Propositions, Truth tables, Logical Equivalence, Logical implications, Algebra of propositions, Conditional propositions, Bi-conditional statements, Negation of Compound statements, Tautologies and Contradiction, Normal Form, Arguments, Fallacies.	**6 Hours**
Unit-2:	**Graphs:** Introduction to Graphs, Finite and Infinite Graphs, Incidence and Degree, Isolated Vertex, Pendant Vertex, and Null graph, Regular graph, Complete Graph, Bipartite Graph, Isomorphic and Homeomorphisms of Graphs, Sub graph, Connected and Disconnected graphs, Operations on Graphs, Euler graph, Hamiltonian graph, Chinese Postman Problem and Travelling-Salesman problem.	**8 Hours**
Unit-3:	**Trees:** Definition, Properties of trees, Center and Distance of trees, eccentricity of a tree, Spanning tree, Minimal Spanning tree, Kruskal's and Prim's Algorithms to find Minimal Spanning tree.	**8 Hours**
Unit-4:	**Counting Theory:** Pigeon Hole Principle, Permutations and Combinations, Recurrence Relation, Generating Function, Solution of Recurrence Relation using Generating Function.	**8 Hours**
Unit-5:	**Probability:** Introduction, Random experiment, Sample Space, Probability Axioms, Compound Event, Conditional Probability, Baye'sTheorem, Binomial and Poisson distributions	**8 Hours**
Text Books:	1. Swapan Kumar Sarkar "Discrete Mathematics", - S Chand	**8 Hours**

Reference Books:	1. Liu C.L., "Elements of Discrete Mathematics" 2. Neville Dean, "Essence of Discrete Mathematics Prentice Hall" 3. Seymour Lipschutz and Marc Lipson, "Discrete Mathematics", SchaumOutlineseries – TataMcGraw Hill 4. NarsinghDeo, "Graph Theory with Applications to Engineering and Computer Science",Prentice Hall of India.	
Additional Electronic Reference Material:	1. http://discrete.openmathbooks.org/dmoi2/sec_intro-intro.html	

Course Code: TMUGE201	**Ability Enhancement Course - IV** **B.Sc. (Honours) Computer Science – Semester II** **English Communication II**	**L-2** **T-0** **P-2** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	**Remembering & understanding** the basics of English Grammar and Vocabulary	
CO2.	**Understanding** the basics of Listening, Speaking & Writing Skills	
CO3.	**Understanding** principles of letter drafting and various types of formats.	
CO4.	**Applying** correct vocabulary and grammar in sentence construction while writing and delivering presentations	
CO5.	**Analyzing** different types of listening, role of Audience & Locale in presentation	
Course Content:		
Unit-1:	**Functional Grammar** • Prefix, suffix and One words substitution • Modals • Concord	**6 Hours**
Unit-2:	**Listening Skills** • Difference between listening & hearing, Process and Types of Listening • Importance and Barriers to listening	**6 Hours**
Unit-3:	**Writing Skills** • Official letter and email writing • Essentials of a paragraph, • Developing a paragraph: Structure and methods • Paragraph writing (100-120 words)	**6 Hours**
Unit-4:	**Strategies & Structure of Oral Presentation** • Purpose, Organizing content, Audience & Locale, Audio-	**6 Hours**

	visual aids, Body language • Voice dynamics: Five P's - Pace, Power, Pronunciation, Pause, and Pitch. Modes of speech delivery and 5 W's of presentation	
Unit-5:	**Value based text reading:** Short Essay (Non- detailed study) • How should one Read a book? – Virginia Woolf	**6 Hours**
Text Books:	1. Singh R.P., An Anthology of English Essay, O.U.P. New Delhi.	
Reference Books:	1. Nesfield J.C. "*English Grammar Composition & Usage*" Macmillan Publishers 2. Sood Madan "*The Business letters"* Goodwill Publishing House, New Delhi 3. Kumar Sanjay &Pushplata "*Communication Skills*" Oxford University Press, New Delhi.	
Additional Electronic Reference Material:		

Evaluation Scheme

Internal Evaluation			External Evaluation		Total Marks
40 Marks			60 Marks		100
20 Marks (Best 2 out of Three CTs)	10 Marks (Oral Assignments)	10 Marks (Attendance)	40 Marks (External Written Examination)	20 Marks (External Viva)*	
(From Unit-I, III & V)	***(From Unit-II &IV)***		***(From Unit-1, III & V)***	***(From Unit- II & IV)***	

*Parameters of External Viva

Content	Body Language	Communication skills	Confidence	TOTAL
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

***Note**: External Viva will be conducted by 2-member committee comprising*
***a)** One Faculty teaching the class*
***b)** One examiner nominated by University Examination cell.*

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: CSC255	**Core Course - IX** **B.Sc. (Honours) Computer Science – Semester II** **Introduction to Web Design Lab**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying concepts to create simple web pages using various HTML tags and attributes.	
CO2.	Applying concepts of CSS to design the layout of web pages.	
CO3.	Applying concepts of Java script to design dynamic web pages.	
CO4.	Applying concepts of dynamic and auto responsive web pages using Java Script and Bootstrap Framework.	
CO5.	Designing dynamic and auto responsive web pages using Java Script and Bootstrap Framework.	
Course Content:		
	1. Create a simple HTML document about yourself or a topic of your choice using the basic tags learned in the first lesson. 2. Add bold and italic words to your document, save and view. 3. Add a header to your document, save and view. 4. Add paragraph and break tags to your document, save and view. 5. Add a horizontal rule where appropriate, save and view. 6. Add an unordered list to your document, save and view. 7. Add an ordered list to your document, save and view. 8. Add a definition list to your document, save and view. 9. Create a new file called *yournamefile2.htm* (it can be very basic). 10. Create a link to Yahoo (*http://www.yahoo.com*). 11. Create a link from *yournamefile2.htm* to *yournamefile1.htm*. 12. Create a page that shows the different types of heading available	**20 Hours**

and show each in the same page.

13. Open one of your HTML files in your editor.
14. Add an image to your document using the tag, <IMG SRC="image.gif"> (Note**: image.gif** is a generic name. Your image may be **horse.gif** or **scenery.gif**. *Also, the image must be placed in the same directory or folder as your HTML file*. Although the image *can* be in another directory, the way to reference that image in your image tag isn't a part of this exercise). Save and view.
15. Align a short description to the bottom of your image, save and view.
16. Align the description to the top of the image, save and view.
17. Add a simple table to *yournamefile1.htm* without borders. Make the table with 2 rows and columns, save and view.
18. Add border value of 1, save and view.
19. Add a border value of 5, save and view.
20. Make the top row a table header, save and view.
21. Align all data elements to the middle of their cells, save and view.
22. Center one of your headers in *yournamefile1.htm*, save and view.
23. Center your image, save and view.
24. Align the image to the right, save and view.
25. Put a border around the image with a value of 1; save and view each.
26. Add a horizontal rule that is aligned to the left, is 50% of the width of the page and has a size value of 5, save and view.
27. Give some text (non-header) a font size value of +3, save and view.
28. Put a background color and text color on your page. In order to do this you must obtain the hexadecimal value for the color you want to use. The hex values are at the top of each color swatch (a 6 digit alpha-numeric number). Just plug the value in at the appropriate place in your **Body** tag.
29. Add title and footer to each page you have created till now.

30. Draw a home page of the 'TeerthankarMahaveer University' (with tables).

31. Design a website that displays the information about the total courses offered by the university. The website should show the information about each Course in a well formatted manner. Use proper images and colors in the website.

32. Create the gallery page of the "TeerthankarMahaveer University". In this page the different thumbnails of the pictures should be there and on the click the big picture should be seen in a new window.

33. Create a contact page of the university. The different types of controls should be seen there.

Program related to CSS

1. Create a page that will show the inline style of css.
2. Create a page that will show the embedding style of css.
3. Create a page that will show the different types of selectors
4. Create a page that will be done by the file style of CSS.
5. Create a page that will show the different types of property in CSS.
6. Create a page that will display the user information. The formatting will be done by the inline cascading style sheet.
7. Create a web page that will display the different style on a single page using the single style sheet with the help of DIV Tag.
8. Create a web page that will display the different ten properties of style sheet like margin, align, float etc.

Program related to JavaScript

1. Write a JavaScript program which contain a Textbox and a submit button. To perform the operation of calculate the sum of its digits as per click on the submit button.
2. If a five digit number input through the keyboard in the textbox, to perform logic of reverse the number as per click on submit button.
3. If a five digit number is input through the keyboard, write a JavaScript program to print a new number by adding one of each of its digit which will be input in the Textbox. For example if the number that is input 12391 then the output should be displayed as 23402 as per click on submit button.

4. According to the Gregorian calendar, it was Monday on the date 01/01/1990. If any year is input through the keyboard write a JavaScript program to find out what is the day on 1st January of this year.

5. A library charges a fine for every book returned late. For first 5 day the fine is 50 paise, for 6-10 days fine is one rupee and above 10 days fine is 5 rupees. If you return the book after 30 days your membership will be cancelled. Write a JavaScript program to accept the number of days the member is late to return the book and display the fine or the appropriate message as per click on the submit button.

6. If the three sides of a triangle are entered through the keyboard in three textbox, write a program to check whether the triangle is isosceles, equilateral, scalene or right—angled triangle as per click on the submit button.

7. Write a JavaScript program that performs the logic of prime number finding between 1 to 300. But condition is that it will print all the number in reversing order.

8. Write a JavaScript program that performs the logic of Fibonacci series as per given range. But condition is that it will reverse order.

9. Write a menu driven program which has following option:

    a. Factorial of a number

    b. Armstrong or not

    c. Odd or even

    d. Magic number or not

    e. Perfect number or not

10. Write a javascript general—purpose function to convert any given year into the textbox. The following table shows the roman equivalents of decimal numbers:

Decimal	**Roman**	**Decimal**	**Roman**
1	i	100	c
5	v	500	d

10	x	1000	m
50	L		

Example:

Roman equivalent of 1988 is mdcccclxxxviii

Roman equivalent of 1525 is mdxxv

11. A positive number entered through the keyboard. Write a JavaScript function to obtain the prime factors of this number. For example, prime factors of 24 are 2,2,2 and 3, whereas prime factor of 35 are 5 and 7.
12. Write a JavaScript program in which 25 numbers are entered from the keyboard into an array. Write a program to find out how many of them are positive, how many are negative, how many are even and how many are odd.
13. Implement the selection sort, bubble sort and insertion sort algorithm on a set of 25 number using JavaScript.
14. Write a JavaScript program to interchange the odd and even components of an array.
15. Create a JavaScript Program which count how many character are placed in the text area. This application contain two Button one for Total Count and another for showing the content and counting character.
16. Write a JavaScript program in which contain 3 Textbox which contain day, month, year from user and a button, onclick on that button you will find the days of week.
17. Write a JavaScript program in which browser contains a textbox and a button. Perform sum the digit from 1 to range of digit which u have enter in the textbox and show the sum of the digit as per given range in the alert massage with word conversion.
18. Write a JavaScript Stopwatch program in which browser contains two Textbox and a button: one Textbox contain predetermine time and another Textbox contain Times as per decreasing order according to First Textbox when clicking on button when the time

is 00:00:00 then you will get a alert massage.

19. Write a JavaScript program in which browser contains a textbox and a button. Perform the following validation when hit on the Button

    a. The textbox field would not be Blank

    b. Check the length of the input string in to the Textbox it would not be less than 3 and greater than 10. If the range is less than 3 and greater than 10, than perform a alert massage with the range of string.

20. Write a JavaScript Stopwatch program in which browser contains two Textbox and a button: one Textbox contain predetermine time and another Textbox contain Times as per increasing order start from 00:00 the clock will raise an alert message when the time will same as the time on first Textbox.

21. Write a JavaScript Program that will find out how many days left in this month.

22. Write a JavaScript Program that will contain a input box that will show the visitor how long they have been on your page. Time is running in increment operation.

23. When someone visits your web page, JavaScript will start the clock. When the leave that page, they will be alerted with the time they have been viewing the page.

24. Perform the Checkbox Validation using JavaScript.

25. Perform Phone Number Validation using JavaScript.

26. Perform Date Validation sing JavaScript.

27. Perform Email address Validation using JavaScript.

28. Write a JavaScript Program that will validate credit card entry.

29. Write a JavaScript program in which browser contains three textbox and a button. Perform the following operation and validation as per First textbox contain FirstName and Second Textbox contain Lastname in Proper Case. The Third Textbox contains UserId as per this rule when u hit on the Submit Button. The rule is userId contain 6 Character from the starting of Last Name and 1 character of the firstname from starting after

	concatenate show this string as a userId in the third Textbox. If the Last Name has not 6 Character than collect all the character from the Last name and swap remaining blank from – and concatenate first character of First Name. Example:- First Name Ram Last Name Laxman UserID LaxmanR But If First Name Ram Last Name Laxm UserID Laxm—R • Only Characters are Allowed in text Box • Blank Text Box Not Allowed • Locked UserID Text Box Mean no one can Change the Content.	

Course Code: **CSC256**	**Core Course - X** **B.Sc. (Honours) Computer Science – Semester II** **Data Structures Using C++ Lab**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying concepts of data types, class and object by writing C++ program.	
CO2.	Applying concepts of stack, linked list and queue by writing C++ Program.	
CO3.	Applying concepts of different searching and sorting algorithms by writing C++ Program.	
CO4.	Applying basic concepts of tree by writing C++ Program.	
CO5.	Developing various programs for utility in C++	
Course Content:		
	Implement the concepts of C++ classes, objects and various instances. 1. Implement the features of array arguments and friend function. 2. To write programs implementing Sorting programs: Bubble sort, Merge sort, Insertion sort, Selection sort, and Quick sort. 3. To write programs implementing Searching programs: Linear Search, Binary Search. 4. To write programs Array implementation of Stack, Queue, Circular Queue, Linked List. 5. To write programs implementing Stack, Queue, Circular Queue, Linked List using dynamic memory allocation. 6. To write program implementing Binary tree. 7. To write programs implementing Tree Traversals (pre-order, in-order, post-order). 8. To write program to represent graph.	**20 Hours**

Course Code: TMUGA-201	**B.Sc. (Honours) Computer Science – Semester II** **Value Added Course (VAC-2)** **Analytical Reasoning**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying the arithmetical concepts in Ratio Proportion Variation.	
CO2.	Employing the techniques of Percentage; Ratios and Average in inter related concepts of Time and Work, Time Speed and Distance.	
CO3.	Identifying different possibilities of reasoning based problems of Syllogisms and Venn diagram.	
CO4.	Examining the optimized approach to solve logs and Surds.	
Course Content:		
Unit-1:	**Ratio, proportions and variations** Concept of ratios, proportions, variations, properties and their applications	**5 Hours**
Unit-2:	**Time and Work** Same efficiency, different efficiency, alternate work, application in Pipes and Cisterns	**6 Hours**
Unit-3:	**Time Speed Distance** Average speed, proportionalities in Time, Distance, trains, boats, races, circular tracks	**6 Hours**
Unit-4:	**Logs and Surds** Concept and properties of logs, surds and indices	**4 Hours**
Unit-5:	**Coding and decoding** Sequential coding, reverse coding, abstract coding	**3 Hours**
Unit-6:	**Syllogisms** Two statements, three statements	**4 Hours**
Unit-7:	**Venn diagram** Basic concept and applications	**2 Hours**
Reference Books:	• R1:-Arun Shrama:- How to Prepare for Quantitative Aptitude • R2:-Quantitative Aptitude by R.S. Agrawal • R3:-M Tyra: Quicker Maths • R4:-Nishith K Sinha:- Quantitative Aptitude for CAT • R5:-Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com • R6:-Logical Reasoning by Nishith K Sinha • R7:-Verbal and Non Verbal Reasoning by R.S. Agrawal *** Latest editions of all the suggested books are recommended.**	

Course Code: CSC301	**Core Course - XI** **B.Sc. (Honours) Computer Science – Semester III** **Software Engineering and UML**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of life cycle models to choose the appropriate model	
CO2.	Understanding the software based on the industry standards	
CO3.	Understanding and Designing test cases	
CO4.	Understanding the UML notation.	
CO5.	Applying the requirements and design the software.	
Course Content:		
Unit-1:	**Introduction:** Software Engineering approach, SDLC, Software Crisis, Software Process, Process models (Waterfall, Prototype, Iterative, Evolutionary and Spiral model). Overview of Quality Standards like ISO 9001, SEI – CMM.	**6 Hours**
Unit-2:	**Software Requirement:** Analysis and Specifications DFDs, Software Requirement Specifications, steps for constructing good SRS. Software Project Planning: Size Estimation like lines of Code & Function Count, Cost Estimation Models, Static single& Multivariable Models, COCOMO	**6 Hours**
Unit-3:	**Software Design:** Design Concepts & Principle, Cohesion & Coupling, Function Oriented Design, Object Oriented Design. Coding Structured programming, Programming style, Software Testing Software Metrics: Software measurements: What & Why, Token Count, Halstead Software Science Measures, Design Metrics, Data Structure Metrics, Information Flow Metrics.	**6 Hours**
Unit-4:	**Software Maintenance:** Software Maintenance Process and its types, Introduction to Reverse Engineering, Software Reliability & Quality Assurance, Software Reliability issues, Software quality measurement	**6 Hours**
Unit-5:	**UML :**What is UML, What is Modeling, UML Diagrams, Use Case Diagram, Class Diagram, Activity Diagram, Package Diagram, State-Transition Diagram, Sequence Diagram, Collaboration Diagram Component Diagram.	**6 Hours**

Text Books:	1. Jalote P., An Integrated approach to Software Engineering, Narosa.	
Reference Books:	1. Mall Rajib, Software Engineering, Prentice Hall of India. 2. Pressman R.S., Software Engineering – A Practitioner's Approach, McGraw Hill Int.Ed.. 3. Sommerville Ian, Software Engineering, Pearson Education. 4. Agrawal K.K. &Yogesh Singh, Software Engineering, New Age Publication. 5. Waman S. Jawadekar,Software Engineering-Principles and Practice, McGraw Hill. 6. "Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and the Unified Process" by Craig Larman (ISBN-13: 978-0130925695).	
Additional Electronic Reference Material:	1. https://www.geeksforgeeks.org/unified-modeling-language-uml-introduction/	

Course Code: CSC312	Generic Elective – I B.Sc. (Honours) Computer Science – Semester III **Computer Based Numerical & Statistical Techniques**	L-3 T-1 P-0 C-4
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding numerical methods to find our solution of algebraic linear equations using different methods under different conditions, and numerical solution of system of algebraic linear equations.	
CO2.	Understanding numerical methods to find our solution of non linear equations using different methods under different conditions, and numerical solution of system of non linear equations. Also work out numerical differentiation and integration whenever and wherever routine methods are not applicable.	
CO3.	Understanding various interpolation methods and finite difference concepts.	
CO4.	Understanding the importance of curve fitting, regression and its applications to solve problems.	
CO5.	Understanding the importance of time series and forecasting models, and Testing of Hypothesis to apply various test and its applications to solve problems.	
Course Content:		
Unit-1:	**Linear Equations**: Gauss Jordan, Gauss Elimination Methods, Gauss Jacobi, Gauss Seidel methods, pivoting. **Non-Linear Equations:** Bisection Method, Regula-Falsi Method, Newton-Raphson Method, Rate of Convergence	**8 Hours**
Unit-2:	**Numerical Integration**: Trapezoidal, Simpson's 1/3 rule, Simpson's 3/8 rule and it's derivatives from Newton's Forward polynomial. Finite Difference, missing value and factorial notation	**8 Hours**
Unit-3:	Newton's Forward and Backward Interpolation Formulae, Gauss Forward and Backward Difference Formulae; Newton's Divided Difference Formula, Lagrange's Interpolation Formula.	**8 Hours**

Unit-4:	Curve Fitting; Method of Least Squares, Fitting of Straight Lines, Polynomials and Exponential Curves. **Regression analysis:** Linear and Non-linear, Multiple Regression.	**8 Hours**
Unit-5:	**Time Series:** Moving Averages; Smoothening of curves. **Forecasting:**; Forecasting Models and Methods **Testing of Hypothesis:** Test of Significance; Chi-square Test; T-Test	**8 Hours**
Text Books:	1. Raman, R., *Computer Oriented Numerical Methods*, Prentice Hall of India. 2. Grewal, B. S., *Numerical Methods in Engineering and Science*, Khanna Publishers. 3. Gupta, S. P., *Statistical Methods*, Sultan and Sons.	
Reference Books:	1. Veerarajan, T. Ramachandran, T., *Theory and Problems in Numerical Method*, Tata McGraw Hill. 2. Niyogi, P., *Numerical Analysis and Algorithms*, Tata McGraw Hill. 3. Scheld, F., *Numerical Analysis*, Tata McGraw Hill. 4. Balaguruswamy, E., *Numerical methods*, Tata McGraw Hill.	
Additional Electronic Reference Material:	1. http://library.abes.ac.in/E-Books/CBNST%20Notes.pdf	

Course Code: CSC313	**Generic Elective – I** **B.Sc. (Honours) Computer Science – Semester III** **Computer Based Optimization Techniques**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the importance of Transportation Problems and Integer Linear Programming and its applications to solve problems.	
CO2.	Understanding the importance of Non Linear Programming and Dynamic Programming and its applications to solve problems.	
CO3.	Understanding the importance of Inventory Models and Replacement problems and its applications to solve problems.	
CO4.	Applying problems defining, understanding and classification	
CO5.	Applying Linear Programming problem and similar such problems into appropriate forms and problem solving.	
Course Content:		
Unit-1:	**Linear Programming Problems (LPP):** Definition of LPP, Graphical Solutions of Linear Programming Problems, Simplex Method, and Artificial Variable Method, Two Phase Method, Charnes' Big-M Method, Duality, Dual Simplex Method.	**8 Hours**
Unit-2:	**Transportation Problems:** Introduction to Transportation Model, Matrix Form of TP, Applications of TP Models, Basic Feasible Solution of a TP, Degeneracy in TP, Formation of Loops in TP, Solution Techniques of TP, Different Methods for Obtaining Initial Basic Feasible Solutions viz. Matrix Minima Method, Row Minima Method, Column Minima Methods, Vogel's Approximation Method, Techniques for Obtaining Optimal Basic Feasible Solution. **Assignment Problems:** Definition, Hungarian Method for AP.	**8 Hours**
Unit-3:	**Integer Linear Programming Problems:** Integer Linear Programming Problems, Mixed Integer Linear Programming Problems, Cutting Plane Method, Branch and Bound Method, 0-1 integer linear programming problem	**8 Hours**
Unit-4:	**Introduction to NLP:** Definition of NLP, Convex Programming Problems, Quadratic Programming Problems, Wolfe's Method for Quadratic Programming, Kuhn-Tucker Conditions, Geometrical Interpretation of KT-Conditions, KT-Points etc.	**8 Hours**

	Dynamic Programming: Bellman's Principle of optimality of Dynamic Programming, Multistage decision problem and its solution by Dynamic Programming with finite number of stages, Solution of linear programming problems as a Dynamic Programming problem	
Unit-5:	**Inventory Models and Replacement problems:** Inventory models –various costs-deterministic inventory models, Single period inventory model with shortest cost, stochastic models, Application of inventory models, Economic lot sizes-price breaks, Replacement problems-capital equipment-discounting costs-replacement in anticipation of failure- group replacement-stochastic nature underlying the failure phenomenon.	**8 Hours**
Text Books:	1. SwarupK , "Operation Research", S. Chand New Delhi.	
Reference Books:	1. Hadley, G.,"Linear Programming, and Massachusetts", Addison-Wesley 2. Taha, H.A, "Operations Research – An Introduction", Macmillian 3. Hiller, F.S., G.J. Lieberman, " Introduction to Operations Research", Holden-Day. 4. Harvey M. Wagner, "Principles of Operations R esearch with Applications to Managerial	
Additional Electronic Reference Material:	https://www.bing.com/search?q=operations+research+pdf&qs=n&form=QBRE&sp=-1&pq=operations+research+pdf&sc=4-23&sk=&cvid=FBDF25A087344122B2E21208145C72E2	

Course Code: CSC314	**Generic Elective – I** **B.Sc. (Honours) Computer Science – Semester III** **Scientific Computing**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the confluence of scientific computing, ways of learn, technology, interventions and computing.	
CO2.	Understanding the computing and parts of digital, numerical solutions technique. That is beneficial for student's in future competitive exams.	
CO3.	Understanding to solve the competitive exams questions in a very less time.	
CO4.	Understanding for solving the problem of Euler's. Euler's equations.	
CO5.	Applying methods for scientific computing and numerical solutions technique.	
Course Content:		
Unit-1:	**Number System:** Binary, Octal, Hexadecimal and Decimal, Floating Point Numbers. Binary Arithmetic: Basic Rules of Binary Addition, Subtraction, multiplication and division. Floating point format, Finite precision, round-off, machine epsilon, Error propagation and catastrophic cancellation.	**8 Hours**
Unit-2:	**Solving Set of Linear Equations:** Gauss elimination method (with row pivoting) and Gauss-Jordan method, Iterative methods: Jacobi and Gauss-Seidel iterative methods. **Root finding:** Bisection method, Regula-Falsi, and Newton-Raphson method.	**8 Hours**
Unit-3:	**Numerical integration:** Newton-Cotes Method, Trapezoid rule, Simpson's one-third and Simpson's three-eight rule. **Optimization:** Search by section, Newton's method, steepest descent, Conjugate gradient, Simulated annealing.	**8 Hours**
Unit-4:	**Solving Ordinary Differential Equations:** Picard's method, Euler's method, Euler's modify method, Runge-Kutta second and fourth order methods.	**8 Hours**

Unit-5:	**Partial differential equations:** Hyperbolic and parabolic equations, Elliptic equations.	**8 Hours**
Text Books:	1. W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery. *Numerical Recipes in C: The Art of Scientific Computing*. Cambridge University Press.	
Reference Books:	1. W. H. Press, S. A. Teukolsky, W. T. Vetterling, and B. P. Flannery. *Numerical Recipes in Fortran: The Art of Scientific Computing, volume 1-2*. Cambridge University Press. 2. J. Stoer and R. Bulirsch. *Introduction to Numerical Analysis*. Springer Verlag, 3. *MATLAB/OCTAVE documentation*. Online reference. http://www.mathworks.com/. 4. D. J. Hingham and P. J. Hingham. *MATLAB/OCTAVE guide*. Society of IndustrialandAppliedMathematics 5. C. F. van Loan. *Introduction to Scientific Computing: A Matrix-Vector Approach using MATLAB/OCTAVE*. Prentice Hall	
Additional Electronic Reference Material:	1. https://www.scicomp.uni-kl.de/about/scientific-computing/	

Course Code: CSC315	**Core Course - XII** **B.Sc. (Honours) Computer Science – Semester III** **Object-Oriented Programming Concepts Using Java**	**L-3 T-1 P-0 C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the detail concept of java in real life.	
CO2.	Understanding java with some modules.	
CO3.	Understanding how the java is different and easy from other programming Languages.	
CO4.	Applying the relationship between java and Data Analysis.	
CO5.	Analyzing how the data is predicted in java.	
Course Content:		
Unit-1:	**Core Java:** Overview, Data types, Variables, Operators, Arrays, Control Statements, Class and object, Methods, Inheritance, Package and Interface, Exception Handling, Multithreaded programming, I/O, Java Applet, String handling, Networking, Event handling. **Abstract Window Toolkit (AWT):** Controls, Layout managers, Menus, Images, Graphics.	**8 Hours**
Unit-2:	**Java Swing**-Swing Overview, Swing Components: JApplet, Icons, Labels, Text Fields, Buttons, Check Boxes, Radio Buttons, Toggle buttons, Lists, Combo Boxes, Toolbars, Tabbed Panes, Layered Panes, Scroll Panes, Split Panes, Trees, menus, Swing and the Model- View- Controller Design Pattern, Dialog Boxes, Pluggable Look and feel,. Layouts, Windows, Dialog Boxes, Inner frame.	**8 Hours**
Unit-3:	**Java Database Connectivity**- JDBC vs ODBC, Two – Tier and Three – Tier Model, JDBC Package and Drivers, Driver Interface and Driver Manager Class, Connection Interface-Statement Interface, Prepared Statement,ResultSet , Meta Data Interface, Database URL, Making the Connection, Executing sql Commands, Managing Connections Statement, Populating a Database, Scrollable and Updateable ResultSet, RowSets,JDBC/ODBC Bridge, java.sql package, Connectivity to remote database, navigating through multiple rows retrieved from a database.	**8 Hours**
Unit-4:	**Java Beans:** Application Builder tools, Bean developer kit (BDK), Introspection, Developing a simple bean, Using Bound properties, Java	**8 Hours**

	Beans API. **Generic Programming**-Basic Concepts of Generic class, Generic methods. **Utilities-** JAR Files, Java's Documentation Comments.	
Unit-5:	**Java Servlet-** Servlet Overview, Servlet API, Life cycle, Running, Debugging,Servlet Interface, Generic Servlet, HTTP Servlet, Servlet Life Cycle, Working with Apache Tomcat Server, Step to create Servlet in Tomcat, Handling Client HTTP Request & Server HTTP Response, Introduction to Thread-safe Servlet and Cookies.	**8 Hours**
Text Books:	1. Patrick Naughton& Herbert Schildt, *The Complete Reference JAVA2*, Tata McGraw Hill	
Reference Books:	1. Balagurusamy E., *Programming in JAVA*, Tata McGraw Hill 2. Steven Holzner, *Java2 Black Book*, Dreamtech.	
Additional Electronic Reference Material:	1. https://www.javatpoint.com/java-tutorial	

Course Code: **CSC316**	**Core Course - XIII** **B.Sc. (Honours) Computer Science – Semester III** **Computer Network**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concept of computer network and its applications, network topology, network architecture, OSI reference model, TCP/IP protocol, physical layer transmission.	
CO2.	Understanding concept of medium access sublayer, error detection and correction algorithms, LAN protocols, CSMA with collision detection, ethernet, Wireless LANs.	
CO3.	Understanding concept of network layer, internetworking devices, routing algorithms, IP address, subnetting, supernetting, IPV4 and IPV6.	
CO4.	Understanding concept of transport layer, P2P delivery, UDP, SCTP, congestion control and quality of services.	
CO5.	Understanding concept of application layer, DNS, FTP,HTTP, cryptography and network security.	
Course Content:		
Unit-1:	Introductory Concepts: Goals and Applications of Networks, networks topology, Network structure and architecture, the OSI reference model, TCP/IP protocol suite ,Physical Layer- transmission, guided and unguided media, performance.	**8 Hours**
Unit-2:	Medium access sub layer: Error correction & detection algorithms, Framing, Channel allocations, LAN protocols-ALOHA Protocols, Carrier Sense Multiple Access Protocols, CSMA with Collision Detection, switching Methods, Ethernet, Introduction of wireless LANs, connecting devices.	**8 Hours**
Unit-3:	Network Layer: Networking and Internetworking devices, routing algorithms, Internetwork Protocol, IP addresses, Subnetting, supernetting, Other protocols in network layer, IPv4 and IPV6 Packet Format .	**8 Hours**
Unit-4:	Transport Layer: Process to process delivery connection management, User Datagram protocol (UDP), Transmission Control Protocol. (TCP), SCTP, Congestion control and quality of services.	**8 Hours**
Unit-5:	Application Layer: Domain Name System, Electronic mail, File Transfer Protocol, WWW and Hyper Text Transfer Protocol, Introduction to	**8 Hours**

	Cryptography and Network Security ,Firewalls.	
Text Books:	1. Computer Network By Andrew S Tanenbaum Pearson Education	
Reference Books:	1. Computer Networking With Internet Protocols By William Stallings Pearson Publication 2. Data and Computer Communication by W. Stallings, Macmillan Press 3. Computer Networks & Internet with Internet Applications by Comer Pearson Education 4. Internetworking with TCP/IP by PHI 5. Data Communication and Networking by Forouzan TMH 6. Computer Networks with Internet Protocols by W Stallings, Pearson Education 7. Local and Metropolitan Area Networks by W Stallings, Pearson Education	
Additional Electronic Reference Material:	1. ACM Digital Library for Computer Network 2. https://www.geeksforgeeks.org/basics-computer-networking/	

Course Code: TMUGE301	**Ability Enhancement Course - V** **B.Sc. (Honours) Computer Science – Semester III** **English Communication III**	**L-2** **T-0** **P-2** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Remembering and understanding the English grammar and vocabulary.	
CO2.	Understanding the art of public speaking and strategies of reading comprehension.	
CO3.	Applying correct vocabulary and sentence construction during public speaking or professional writing.	
CO4.	Aanalyzing different types of sentences like simple, compound and complex.	
CO5.	Drafting notice, agenda and minutes of the meeting.	
CO6.	Demonstrating speaking skills during common conversation and power point presentation.	
Course Content:		
Unit-1:	**English Grammar & Vocabulary** • Correction of Common Errors (with recap of English Grammar with its usage in practical context.) • Synthesis : Simple , complex and compound sentence • Commonly used Idioms & phrases (Progressive learning whole semester)	**6 Hours**
Unit-2:	**Speaking Skills** • Art of public speaking • Common coversation • Extempore • Power Point Presentation (PPt) Skills**:** Nuances of presenting PPTs	**6 Hours**
Unit-3:	**Comprehension Skills**	**6 Hours**

	• Strategies of Reading comprehension: Four S's • How to solve a Comprehension (Short unseen passage: 150-200 words)	
Unit-4:	**Professional Writing** • Preparing Notice,Agenda& Minutes of the Meeting	**6 Hours**
Unit-5:	**Value based text reading:** Short story • The Barber's Trade Union – Mulk Raj Anand	**6 Hours**
Text Books:	1. Singh R.P., An Anthology of Short stories, O.U.P. New Delhi	
Reference Books:	1. Allen, W. *"Living English Structure*" Pearson Education, New Delhi. 2. Joseph, Dr C.J. & Myall E.G. "*A Comprehensive Grammar of Current English*" Inter University Press, Delhi 3. Wren & Martin "*High School English Grammar and Composition*" S.Chand&Co.Ltd., New Delhi. 4. Norman Lewis "*Word Power Made Easy*" Goyal Publications & Distributers, New Delhi. 5. Chaudhary, Sarla "Basic Concept of Professional Communication" Dhanpat Rai Publication, New Delhi. 6. Kumar Sanjay &Pushplata "*Communication Skills*" Oxford University Press, New Delhi. 7. Agrawal, Malti "*Professional Communication*" KrishanaPrakashan Media (P) Ltd. Meerut	
Additional Electronic Reference Material:		

Evaluation Scheme

Internal Evaluation			External Evaluation		Total Marks
40 Marks			60 Marks		
20 Marks (Best 2 out of Three CTs) ***(From Unit- I, III,IV & V)***	10 Marks (Oral Assignments) ***(Unit –II)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(From Unit- I, III,IV & V)***	20 Marks (External Viva)* ***(Unit –II)***	**100**

*Parameters of External Viva

Content	Body Language	Communication skills	Confidence	TOTAL
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note*:External Viva will be conducted by 2-member committee comprising*

- ***a)*** *One Faculty teaching the class*
- ***b)*** *One examiner nominated by University Examination cell.*

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: CSC357	**Core Course - XIV** **B.Sc. (Honours) Computer Science – Semester III** **Object-Oriented Programming Concepts Using Java LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the execution of java In real life.	
CO2.	Applying the different modules to predict data.	
CO3.	Applying different functions to search pattern in the files.	
CO4.	Analyzing the data from different datasets with different modules.	
CO5.	Develop applets in Java	
Course Content:		
	1. Developing simple console application in Java. 2. Programs based on loops, arrays, operators and big numbers. 3. Programs based on Classes and Objects. 4. Programs based on Method Overloading, Constructors 5. Simple application based on static keyword. 6. Programs based on Inheritance. 7. Programs based on Method Overriding, Dynamic Method Dispatch, Abstract Classes. 8. Programs based on Object Wrappers and Autoboxing. 9. Programs based on String Handling. 10. Programs based on Networking. 11. Simple application to demonstrate the working of Packages. 12. Developing a Simple Applet. 13. An applet to demonstrate the working of Mouse Events. 14. Programs based on the usage of all AWT controls. 15. A simple application to demonstrate the working of Frames.	**20 Hours**

	16. A simple swing application. 17. Programs to demonstrate event handling on various swing components. 18. Programs based on applets and multithreading. 19. A simple application to retrieve and insert records in MS-Access database. 20. A simple application to retrieve and insert records in My-SQL database.	

Course Code: **CSC358**	**Generic Elective – II** **B.Sc. (Honours) Computer Science – Semester III** **Computer Based Numerical & Statistical Techniques LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding floating point arithmetic operations and deduce errors involved in polynomial interpolation.	
CO2.	Understanding Algebraic and transcendental equation.	
CO3.	Applying formulae by Bessel's, Newton, Sterling, and Lagrange's.	
CO4.	Applying method of least square and showing frequency chart, regression analyst.	
CO5.	Applying numerical integration and differentiations.	
Course Content:		
	1. To write a program implementing floating point arithmetic operations i.e., addition, subtraction, multiplication and division. 2. To write a program to deduce errors involved in polynomial interpolation. 3. To write programs implementing Algebraic and transcendental equations using Bisection, Newton-Raphson 4. Iterative, method of false position, rate of conversions of roots in tabular form for each of thesemethods. 5. To write a program implementing formulae by Bessel's, Newton, Sterling, and Lagrange's. 6. To write a program implementing method of least square curve fitting. 7. To write a program implementing numerical differentiation. 8. To write a program implementing numerical integration using Simpson's 1/3 and 3/8 rules,trapezoidal rule. 9. To write a program showing frequency chart, regression analysis, Linear square fit, and polynomial fit.	**20 Hours**

Course Code: **CSC359**	**Generic Elective – II** **B.Sc. (Honours) Computer Science – Semester III** **Computer Based Optimization Techniques LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the importance of optimization of industrial process management.	
CO2.	Understanding the concepts of mathematics for making optimization problem.	
CO3.	Understanding the performance measurement for various optimization problems.	
CO4.	Applying basic concepts of mathematics to formulate an optimization problem.	
CO5.	Analyzing and appreciating variety of performance measures for various optimization problems.	
Course Content:		
	1. Matrix operations in Matlab/Octave 2. Simplex algorithm in Matlab/Octave 3. Two Phase algorithm in Matlab/Octave 4. Big-M method in Matlab/Octave 5. Various Transportation methods like Row Minima/CoulmnMininma/Vogels method in Matlab/Octave 6. Hungarian Method in Matlab/Octave. 7. Implement various Integer Programming algorithm in Matlab/Octave 8. Implement various NLP algorithm in Matlab/Octave 9. Implement various Dynamic Programming algorithm in Matlab/Octave 10. Implement various Inventory Models in Matlab/Octave	**20 Hours**

Course Code: CSC360	**Generic Elective – II** **B.Sc. (Honours) Computer Science – Semester III** **Scientific Computing LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the range of mathematical problems, model and / or solve them using an appropriate method.	
CO2.	Understanding the solutions using one or more of the commonly-used programming environments.	
CO3.	Applying computer code so that others can understand it more easily	
CO4.	Applying and preparing reports on the results obtained.	
CO5.	Analyzing reports with given terms and conditions.	
Course Content:		
	Q1. Create a matrix A of size 4*4. Perform the following operations using built-in functions: a) Find upper triangular part. b) Find lower triangular part. c) Find the diagonal elements. d) Multiply each element of A by a scalar value. Q2. Plot multiple line plots on the same axes. Set line color to be always black and line style order to cycle through solid, dash-dot, dash-dash, and dotted line styles. Q3. Write a function file to compute the factorial value of a single scalar argument and call the function “sfactorial”. Q4. Write a script to fill the lower triangular part of a square matrix with 1s and the rest with 0s. Q5. Write a script that calculates the greatest common divisor (GCD) of two positive integers. Q6. Generate an overlay plot for plotting three lines	**20 Hours**

Y1=sin t

Y2=t

Y3= t-t^3⁄3+t^5⁄5-t^7⁄7

$0 \leq t \leq 2\pi$

a) The plot command.

b) The hold command.

c) The line command.

Q7. Write a script that calculates the smallest positive integer, n, such that an >= b for some real numbers a and b. (Meaning, find the smallest power of a that is at least b.)

Q8. Create two column vectors and perform the following element-by-element functions:

a) Multiplication.

b) 'to the power of' operation.

c) Division

d) Sum

e) Difference

Q9. Create a m-file to declare two matrices and compute A'.B

Q10. Write a function file to compute the roots of the quadratic equation.

Q11. Use functions for plotting x-y data for the following functions.

a) f(t)=t cost, $0 \leq t \leq 10\pi$

b) $x=e^t$

$y=100 + e^{3t}$, $0 \leq t \leq 2\pi$.

Q12. Write a script that does the same thing as the linspace function. It should start at some value, xstart, stop at xstop and create a vector that contains N values evenly spaced from xstart to xstop.

Q13. Create m-file to calculate a^b *c

Q14. Write a function mymax. It takes five numbers as argument and

returns the maximum of the numbers.

Q15. Write a script to fill the upper triangular part of a square matrix with 1s and the rest with 0s.

Q16. Plotting 3D data

$Z=\cos x.\ \cos y\ .e^{-\sqrt{x2}}+y^{2/5}$

$|x| \leq 7, |y| \leq 7.$

Q17. Plot multiple line plots on the same axes. Set line color to be always black and line style order to cycle through solid, dash-dot, dash-dash, and dotted line styles.

Q18. Write a script that calculates the smallest positive integer, n, such that an >= b for some real numbers a and b. (Meaning, find the smallest power of a that is at least b.)

Q19. Create a matrix A of size 4X4. Perform the following operations using built-in functions:

a) Find upper triangular part.

b) Find lower triangular part.

c) Find the diagonal elements.

d) Multiply each element of A by a scalar value.

Q20:

(a). To perform complex arithmetic.

(b)Generate and plot signals and complex valued functions.

©Confidently develop M-files and save results of computations from a session.

Q21. Write program implementing floating point arithmetic operations i.e., addition, subtraction, multiplication and division.

Q22. Write program to deduce errors involved in polynomial interpolation..

Q23. Write program of Matrix Addition.

Q24. Write program of Matrix Multiplication.

Q25. Write program of Bisection Method.

	Q26. Write program of Regula false position method. Q27. Write program of Newton Raphson's Method. Q28. Write program of Newton Forward formula. Q29. Write program of Newton Backward Formula. Q30. Write program of Gauss Forward Formula. Q31. Write program of Gauss Backward Formula. Q32. Write program of Lagrange's Interpolation method. Q33. Write program of Trapezoidal Method. Q34. Write program of Simpson's one third rule. Q35. Write program of Simpson's three eight rule. Q36. Write program to implement numerical differentiation. Q37. Write program to draw straight line from the given data. Q38. Write program to draw equation of second degree polynomial from the given data	

Course Code: TMUGA-302	**Value Added Course - III** **BSC- Semester-III** **Modern Algebra and Data Management**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.	
CO2.	Applying the concepts of modern mathematics Divisibility rule, Remainder Theorem, HCF /LCM in Number System.	
CO3.	Applying the rules of permutation and combination, Fundamental Principle of Counting to find the probability.	
CO4.	Applying calculative and arithmetical concepts of ratio, Average and Percentage to analyze and interpret data.	
CO5.	Analyzing the various arithmetic concepts to check sufficiency of data	
Course Content:		
Unit-1:	**Number theory** Classification of Numbers, Divisibility Rules, HCF and LCM, Factors, Cyclicity(Unit Digit and Last Two digit), Remainder Theorem, Highest Power of a Number in a Factorial, Number of trailing zeroes	**10 Hours**
Unit-2:	**Data interpretation** Data Interpretation Basics, Bar Chart, Line Chart, Tabular Chart, Pie Chart, DI tables with missing values	**6 Hours**
Unit-3:	**Data Sufficiency** Introduction of Data Sufficiency, different topics based DS	**5 Hours**
Unit-4:	**Permutations and combinations** Fundamental counting, and or, arrangements of digits, letters, people in row, identical objects, rank, geometrical arrangements, combination: - basic, handshakes, committee, selection of any number of objects, identical and distinct, grouping and distribution, de-arrangements	**6 Hours**
Unit-5:	**Probability** Introduction, Probability based on Dice and Coins, Conditional Probability, Bayes Theorem	**3 Hours**
Text Books:		
Reference Books:	1. Arun Shrama:- How to Prepare for Quantitative Aptitude 2. Quantitative Aptitude by R.S. Agrawal 3. M Tyra: Quicker Maths 4. Nishith K Sinha:- Quantitative Aptitude for CAT 5. Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com	
Additional Electronic Reference Material:		

Course Code: TMUGS-301	**Value Added Course - IV** **BSc - Semester-III** **Managing Self**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Utilizing effective verbal and non-verbal communication techniques in formal and informal settings	
CO2.	Understanding and analyzing self and devising a strategy for self growth and development.	
CO3.	Adapting a positive mindset conducive for growth through optimism and constructive thinking.	
CO4.	Utilizing time in the most effective manner and avoiding procrastination.	
CO5.	Making appropriate and responsible decisions through various techniques like SWOT, Simulation and Decision Tree.	
CO6.	Formulating strategies of avoiding time wasters and preparing to-do list to manage priorities and achieve SMART goals.	
Course Content:		
Unit-1:	**Personal Development:** Personal growth and improvement in personality Perception Positive attitude Values and Morals High self motivation and confidence Grooming	**10 Hours**
Unit-2:	**Professional Development:** Goal setting and action planning Effective and assertive communication Decision making Time management Presentation Skills Happiness, risk taking and facing unknown	**8 Hours**
Unit-3:	**Career Development:** Resume Building Occupational Research Group discussion (GD) and Personal Interviews	**12 Hours**
Text Books:		
Reference Books:	1. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika,	

	Organizational Behaviour (2018), 18th ed., Pearson Education 2. Tracy, Brian, Time Management (2018), Manjul Publishing House 3. Hill, Napolean, Think and grow rich (2014), Amazing Reads 4. Scott, S.J., SMART goals made simple (2014), Createspace Independent Pub 5. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan 6. Burne, Eric, Games People Play (2010), Penguin UK	
Additional Electronic Reference Material:	1. https://www.indeed.com/career-advice/interviewing/job-interview-tips-how-to-make-a-great-impression 2. https://www.hloom.com/resumes/creative-templates/ 3. https://www.mbauniverse.com/group-discussion/topic.php	

Course Code: CSC403	**Core Course - XV** **B.Sc. (Honours) Computer Science – Semester IV** **Algorithm Design**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding of algorithms using inductive proof.	
CO2.	Understanding best, worst and average -case running times of algorithms using asymptotic analysis.	
CO3.	Understanding the divide-and-conquer paradigm and explain when an algorithmic design.	
CO4.	Applying algorithms that employ divide-and-conquer paradigm.	
CO5.	Applying divide-and-conquer algorithms. Derive and solve recurrences describing the performance of divide-and-conquer algorithms.	
Course Content:		
Unit-1:	**Algorithms:** Design paradigms, Motivation, Concept of algorithmic efficiency, Run Time Analysis Asymptotic Notations, Divide and conquer, Structure of divide-and-conquer algorithms, Binary search, Quick sort, Analysis of divide and conquer	**8 Hours**
Unit-2:	**Greedy Method:** Paradigms; Exact optimization solution (minimum cost spanning tree), approximate solution (Knapsack problem), Single source shortest paths	**8 Hours**
Unit-3:	**Dynamic Programming:** Concepts, Dynamic programming vs. divide and conquer, Applications, Shortest path in graph, Matrix multiplication, Traveling salesman Problem (TSP), Longest Common sequence(LCS).	**8 Hours**
Unit-4:	**Graph searching and Traversal:** Methods (Depth First search (DFS) and Breadth First Search (BFS)),back tracking, 8-Queen problem, Knapsack problem.	**8 Hours**
Unit-5:	**Brach and Bound:** LC searching Bounding, FIFO branch and bound, LC, Applications, 0/1Knapsack problem, Traveling Salesman Problem. **Computational Complexity:** Complexity Measures, Polynomial vs. Non-polynomial Time complexity, NP-hard and NP-complete classes, Examples.	**8 Hours**

Text Books:	1. Coremen, L.,*Introduction to Algorithms*, Prentice Hall of India.	
Reference Books:	1. Sahani, S.,*Fundamentals of Computer Algorithms*, Galgotia 2. Bratley, B., *Fundamental of Algorithms*, Prentice Hall of India. 3. Goodrich, M.T., *Algorithms Design*, John Wiley. 4. Aho, A.V., *The Design and analysis of Algorithms*, Pearson Education.	
Additional Electronic Reference Material:	1. http://www.cs.sjtu.edu.cn/~jiangli/teaching/CS222/files/materials/Algorithm%20Design.pdf	

Course Code: CSC411	**Core Course - XVI** **B.Sc. (Honours) Computer Science – Semester IV** **Data Base Management System**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basics of database concepts including Characteristics, design of data models, database architecture and database languages.	
CO2.	Understanding the performance of data models using entity relationship model and relational model with the help of E-R diagram, extended E-R diagram, key concepts and integrity constraints.	
CO3.	Understanding and analyzing the relational tables and evaluate the results with DDL, DML and DCL queries and operations like sub queries, join, union and intersection using SQL.	
CO4.	Understanding and remembering the concept of functional dependency and normalization upto 3NF and BCNF on relational tables with transaction processing, serializability and recovery.	
CO5.	Applying the concept of concurrency control protocols and locking on database transactions with recovery techniques and database security	
Course Content:		
Unit-1:	**Introduction:** An overview of database management system, Database System Vs File System, Database system concepts and architecture, data models schema and instances, data independence and data base language and interfaces, Data definitions language, DML, Overall Database Structure.	**8 Hours**
Unit-2:	**Data modeling using the Entity Relationship Model:** ER model concepts, notation for ER diagram, mapping constraints, keys, Concepts of Super Key, candidate key, primary key, Generalization, aggregation, reduction of an ER diagrams to tables, extended ER model. **Relational data Model and Language:** Relational data model concepts, integrity constraints: entity integrity, referential integrity, Keys constraints, Domain constraints, relational algebra.	**8 Hours**
Unit-3:	**SQL:** Characteristics of SQL, Advantages of SQL, SQL data types and literals, Insert, update and delete operations ,sub queries, Aggregate functions, Joins, Unions, Intersection, Minus operations. Roles and	**8 Hours**

	Privileges.	
Unit-4:	**Data Normalization:** Functional dependencies, Normal form up to 3rd normal form & BCNF **Transaction Processing Concepts:** Transaction system, testing of serializability, Serializability of schedules, conflict & view serializable schedule, recoverability, Recovery from transaction failures.	**8 Hours**
Unit-5:	**Concurrency Control Techniques:** Concurrency control, locking Techniques for concurrency control, Time stamping protocols for concurrency control, validation based protocol, multiple granularity. Overview of recovery techniques and Database Security.	**8 Hours**
Text Books:	1. Silberschatz Abraham, Korth Henry &Sudarshan S., Database Systems Concepts, McGraw Hill, 1997.	
Reference Books:	1. Elmarsi R. &Navathe S.B., Fundamentals of Database Systems, Addison Wesley, 2004 2. Date C.J., An Introduction to Database Systems, Addition Wiley. 3. Melton Jim& Simon Alan, Understanding the New SQL: A Complete Guide, Morgan Kaufmann Publishers, 1993. 4. Majumdar A. K. &Battacharya P., Data Base Management Systems, Tata McGraw Hill, 1996. 5. Bipin Desai, An Introduction to Database Systems, Galgotia Publications, 1991	
Additional Electronic Reference Material:	1. https://www.guru99.com/what-is-dbms.html	

Course Code: **CSC413**	**Core Course - XVII** **B.Sc. (Honours) Computer Science – Semester IV** **Introduction to R Programming**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic of R programming, data types, operators, R vectors, R matrix, Categorical and continuous variables, understanding about Data frames, lists, sorting and merger of data frames.	
CO2.	Understanding basic programming structure in R, conditions, loops, understanding import data from CSV, Excel, SPSS, STATA, SAS files, export data to various file format. Understanding aggregate function.	
CO3.	Understanding data visualization, elementary statistics, Sampling distributions, Hypothesis testing, Linear Regression, Multiple Linear Regression, Linear Model selection.	
CO4.	Understanding grammar of graphics, graph plotting, understanding debugging tools traceback(), debug().	
CO5.	Understanding Clustering in R, K-Means and k-medoids clustering, Analyzing Time Series, understanding reading, plotting and decomposing time series data, understanding ARIMA models, Text mining using R.	
Course Content:		
Unit-1:	Introduction: R programming language, R data types, Arithmetic and logical operators. R Vectors, R Matrix: Create, print, add column, slice. Factor in R: Categorical and continuous variables. Data Preparation: R data frames: create, append, select, subset. List in R, R sort a data frame, merge data frames in R.	**8 Hours**
Unit-2:	Programming: Control structure: if, else, else if, for loop, nested for loop, repeat loop, while loop,next, break. Functions, Loop Functions: apply(), lapply(), sapply(), tapply(),split(),mapply(),vectorizing a functions. Import data in R: read CSV, Excel, SPSS, STATA, SAS file. Replacing missing value in R. R exporting data to excel : CSV, SAS, STATA, Text File . R aggregate function.	**8 Hours**
Unit-3:	Statistics and Probability: Elementary statistics; Basic Data Visualization; Probability; Common Probability distribution. Statistical Testing and Modeling: Sampling distributions; Hypothesis	**8 Hours**

	testing; Analysis of Variance; Simple Linear Regression; Multiple Linear Regression; Linear Model selection**.**	
Unit-4:	Advanced Graphs: Advanced Plot Customization; Grammar of Graphics; Defining color and Plotting in Higher dimension; Interactive 3D plots. Debugging: Tools in R, using traceback(), using debug(), using recover()	**8 Hours**
Unit-5:	Clustering using R: K-Means and k-medoids clustering; Case study; Hierarchical clustering procedures. Time Series Analysis: Reading, plotting and decomposing time series data; Forcasting using exponential smoothing; ARIMA models; Text mining using R.	**8 Hours**
Text Books:	1. Sandeep Rakshit,R Programming for Beginners.	
Reference Books:	1. Norman Matloff, The Art of R Programming". 2. R Programming for Data Science, 3. Hadley Wickham, R for Data Science.	
Additional Electronic Reference Material:	1. https://www.r-project.org/about.html	

Course Code: CSC414	**Discipline Specific Course - I** **B.Sc. (Honours) Computer Science – Semester IV** **Concepts of IoT**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of Internet of Things	
CO2.	Understanding basic protocols in wireless sensor network	
CO3.	Understanding IoT applications in different domain and be able to analyze their performance.	
CO4.	Applying methods for verifying wireless sensor network.	
CO5.	Applying basic IoT applications on embedded platform	
Course Content:		
Unit-1:	**Introduction to IoT** Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs	**8 Hours**
Unit-2:	**IoT& M2M** Machine to Machine, Difference between IoT and M2M, Software define Network	**8 Hours**
Unit-3:	**Network & Communication aspects** Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination	**8 Hours**
Unit-4:	**Challenges in IoT** Design challenges, Development challenges, Security challenges, Other challenges **Domain specific applications of IoT** Home automation, Industry applications, Surveillance applications, OtherIoT applications	**8 Hours**

Unit-5:	**Developing IoTs** Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python	**8 Hours**
Text Books:	1. Vijay Madisetti, ArshdeepBahga, "Internet of Things: A Hands-On Approach"	
Reference Books:	1. WaltenegusDargie,ChristianPoellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"	
Additional Electronic Reference Material:	1. https://www.globenewswire.com/news-release/2020/09/10/2091930/0/en/Global-Physical-and-Digital-Asset-Tracking-GPS-RFID-IoT-and-Blockchain-Markets-2020-2025.html	

Course Code: CSC415	**Discipline Specific Course - I** **B.Sc. (Honours) Computer Science – Semester IV** **Computer Security and Privacy**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the concepts of confidentiality, availability, and integrity in context of Information Assurance.	
CO2.	Understanding types of attackers as well as various types of attacks and their solutions.	
CO3.	Understanding various authentication mechanisms on email security and cryptographic methods for data security.	
CO4.	Understanding various network and port scanning tools.	
CO5.	Understanding legal and ethical issues in computer security.	
Course Content:		
Unit-1:	**Introduction**: What Is Computer Security-Values of Assets, The Vulnerability–Threat–Control Paradigm, Threats-confidentiality, integrity, availability, types of threats, types of attackers, Harm-Risk and Common Sense, Method–Opportunity–Motive, Vulnerabilities, Controls.	**8 Hours**
Unit-2:	**Toolbox: Authentication, Access Control, and Cryptography:**-Authentication, Identification Versus Authentication, Multifactor Authentication, Secure Authentication, Access Control-Access Policies Implementing Access Control Procedure, Oriented Access Control, Role-Based Access Control, Cryptography.	**8 Hours**
Unit-3:	**Networks:-** Network Concepts-Network Transmission Media ,Protocol Layers ,Addressing and Routing Threats to Network Communications-Interception: Eavesdropping and Wiretapping, Modification, Fabrication: Data Corruption, Interruption: Loss of Service, Port Scanning, and Vulnerability Summary. Wireless Network Security-WiFi Background, Vulnerabilities in Wireless Networks, Failed Countermeasure: WEP (Wired Equivalent Privacy), Stronger Protocol Suite: WPA (WiFi Protected Access)	**8 Hours**
Unit-4:	**Privacy:-**Privacy Concepts-Aspects of Information Privacy, Computer-Related Privacy Problems, Privacy Principles and Policies, Authentication and Privacy, Privacy on the Web, Email Security, Privacy Impacts of Emerging Technologies.	**8 Hours**

Unit-5:	**Legal Issues and Ethics:-** Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Redress for Software Failures, Computer Crime, Ethical Issues in Computer Security, Incident Analysis with Ethics	**8 Hours**
Text Books:	1. "Introduction to Computer Security", by M. Goodrich and R. Tamassia, Addison Wesley	
Reference Books:	1. Security in Computing, Fifth Edition by: Charles P. Pfleeger; Shari Lawrence Pfleeger; Jonathan Margulies, Prentice Hall	
Additional Electronic Reference Material:	1. https://www.sciencedirect.com/topics/computer-science/security-and-privacy	

Course Code: CSC416	**Discipline Specific Course - I** **B.Sc. (Honours) Computer Science – Semester IV** **Ethical Hacking Fundamentals**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding basic terminology and the fundamentals associated with Hacking in good or bad perspective.	
CO2.	Understanding to commiserate with different ways and methodology of Hacking.	
CO3.	Understanding the nature, class and platforms to tackle for web and network-based Hacking.	
CO4.	Understanding to plan tracking and a vulnerability assessment for web-based applications.	
CO5.	Understanding to express the basic understanding of ethical hacking laws and tests.	
Course Content:		
Unit-1:	**Introduction to Ethical Hacking:** Hacking Methodology, Process of Malicious Hacking, Foot printing and Scanning: Foot printing, Scanning. Enumeration: Enumeration. System Hacking and Trojans: System Hacking, Trojans and Black Box Vs White Box Techniques	**8 Hours**
Unit-2:	**Hacking Methodology:** Denial of Service, Sniffers, Session Hijacking and Hacking Web Servers: Session Hijacking, Hacking Web Servers. Web Application Vulnerabilities and Web Techniques Based Password Cracking: Web Application Vulnerabilities, Web Based Password Cracking Techniques	**8 Hours**
Unit-3:	**Web and Network Hacking :** SQL Injection, Hacking Wireless Networking, Viruses, Worms and Physical Security: Viruses and Worms, Physical Security. Linux Hacking: Linux Hacking. Evading IDS and Firewalls: Evading IDS and Firewalls.	**8 Hours**
Unit-4:	**Report writing & Mitigation:** Introduction to Report Writing & Mitigation, requirements for low level reporting & high level reporting of Penetration testing results, Demonstration of vulnerabilities and Mitigation of issues identified including tracking.	**8 Hours**

Unit-5:	**Ethical Hacking Laws and Tests :** An introduction to the particular legal, professional and ethical issues likely to face the domain of ethical hacking, ethical responsibilities, professional integrity and making appropriate use of the tools and techniques associated with ethical hacking – Social Engineering, Host Reconnaissance.	**8 Hours**
Text Books:	1. Michael T. Simpson, Kent Backman, James E. "Corley, Hands-On Ethical Hacking and Nework Defense", Second Edition, CENGAGE Course.	
Reference Books:	1. Steven DeFino, Barry Kaufman, Nick Valenteen, "Official Certified Ethical Hacker Review Guide", CENGAGE Course. 2. Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made Easy", Syngress Basics Series – Elsevier. 3. Whitaker & Newman, " Penetration Testing and Network Defense" , Cisco Press, Indianapolis.	
Additional Electronic Reference Material:	1. https://www.eccouncil.org/ethical-hacking/	

Course Code: TMUGE401	**Ability Enhancement Course - VI** **B.Sc. (Honours) Computer Science – Semester IV** **English Communication IV**	**L-2** **T-0** **P-2** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Remembering and understanding the English grammar and vocabulary.	
CO2.	Understanding the essentials of effective listening and speaking.	
CO3.	Understanding the corporate expectations and professional ethics.	
CO4.	Applying correct vocabulary and sentence construction during professional writing or job interviews.	
CO5.	Analyzing different types of interviews.	
CO6.	Drafting resume, C.V. or cover letter.	
Course Content:		
Unit-1:	**Vocabulary & Grammar** • Homophones and Homonyms • Correction of Common Errors (with recap of English Grammar with its usage in practical context.) • Transformation of sentences	**6 Hours**
Unit-2:	**Essence of Effective listening & speaking** • Listening short conversation/ recording (TED talks / Speeches by eminent personalities) *Critical Review of these abovementioned* • Impromptu	**6 Hours**
Unit-3:	**Professional Writing**	**6 Hours**

	• Proposal: Significance, Types, Structure & AIDA • Report Writing: Significance ,Types, Structure& Steps towards Report writing	
Unit-4:	**Job Oriented Skills** • Cover Letter • Preparing Rèsumè and Curriculum-Vitae • Interview: Types of Interview, Tips for preparing for Interview and Mock Interview • Corporate Expectation & Professional ethics: Skills expected in corporate world	**6 Hours**
Unit-5:	**Value based text reading:** Short story • A Bookish Topic – R.K. Narayan	**6 Hours**
Text Books:	1. Singh R.P., An Anthology of Short stories, O.U.P. New Delhi.	
Reference Books:	1. Raman Meenakshi& Sharma Sangeeta, *"Technical Communication-Principles & Practice"* Oxford University Press, New Delhi. 2. Mohan K. & Sharma R.C., "*Business Correspondence of Report Writing",*TMH, New Delhi. 3. Chaudhary, Sarla "Basic Concept of Professional Communication" Dhanpat Rai Publication, New Delhi. 4. Kumar Sanjay &Pushplata "*Communication Skills*" Oxford University Press, New Delhi. 5. Agrawal, Malti "*Professional Communication*" KrishanaPrakashan Media (P) Ltd. Meerut.	
Additional Electronic Reference Material:		


TMU

Evaluation Scheme

Internal Evaluation			External Evaluation		Total Marks
40 Marks			60 Marks		
20 Marks (Best 2 out of Three CTs) ***(Unit –I, III,IV & V)***	10 Marks (Oral Assignments) ***(Unit –II& IV)***	10 Marks (Attendance)	40 Marks (External Written Examination) ***(Unit –I, III,IV & V)***	20 Marks (External Viva)* ***(Unit –II& IV)***	**100**

*Parameters of External Viva

Content	Body Language	Communication skills	Confidence	TOTAL
05 Marks	05 Marks	05 Marks	05 Marks	20 Marks

Note*:External Viva will be conducted by 2-member committee comprising*

a) *One Faculty teaching the class*
b) *One examiner nominated by University Examination cell.*

Each member will evaluate on a scale of 20 marks and the average of two would be the 20 marks obtained by the students.

Course Code: CSC456	**Core Course - XVIII** **B.Sc. (Honours) Computer Science – Semester IV** **Database Management System LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the Oracle installation to perform DDL queries like Create, Alter, Drop, Truncate and Rename on relational database tables.	
CO2.	Understanding and applying DML queries like Select, Insert, Update and Delete on relational database tables.	
CO3.	Understanding and applying DCL queries like Grant and Revoke on relational database tables with the mechanism to take the backup of our database	
CO4.	Applying and evaluating aggregate functions with Group By and Having Clauses.	
CO5.	Analyzing queries for different types of joins and set operations with the creation of nested sub queries and views. Also learn to design a database with at least 2-NF conformity.	
Course Content:		
	1. Introduction various DBMS – Oracle 9i, MySQL Server, MS-SQL Server. 2. Implementing the following on any one of the above servers. Description of Data Types. 3. Using Select queries , where clause, order by clause, distinct keywords etc on a sample database. 4. Create a sample Relational Database. 5. Using DDL to create Tables, Alter Tables, Drop Tables. 6. Using DML to update tables and insert data. 7. Use constraints to define Primary Keys, Foreign Keys, Cascade Operations and check Constraints. 8. Using DCL to grant & revoke permissions to users. 9. Taking backup on Hard Drive. 10. Design a Complete Database for a Bank with at least 2-NF conformity.	**20 Hours**

Course Code: **CSC458**	**Discipline Specific Course - II** **B.Sc. (Honours) Computer Science – Semester IV** **Concepts of IoT LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding a variety of emerging devices and technologies such as smart sensing, pervasive connectivity, virtual interfaces & ubiquitous computing and their potential applications in consumer, retail, healthcare and industrial contexts.	
CO2.	Understanding on research with industry partners to address significant and complex challenges surrounding IoT technologies and applications.	
CO3.	Applying methods on a platform for conducting consultancy work required by government/Private organizations in around Coimbatore.	
CO4.	Applying faculty learning, research and hands-on experimentation to discover and demonstrate the promise of the Internet of Things.	
CO5.	Analyzing the students unique interdisciplinary learning and innovation experiences with IoT technologies	
Course Content:		
	1. Experiment to ON LED light on pin 13 2. Experiment to ON/OFF LED light on pin 13 3. Experiment to Blink LED light on pin 13 4. Experiment to perform the alternate task on bell ringer and LED 5. Experiment to Blink alternate LEDs light(Hint use 4 LEDs) 6. Experiment to measure distance of an object using IR OBSTACLE SENSOR 7. Experiment to detect Leakage of as using GAS SENSOR 8. Experiment to detect fire of as using FIRE SENSOR 9. Experiment to demonstrate controlling of relay shield from serial monitor (Arduino IDE) 10. Experiment to ON/OFF LED light based on light intensity	**20 Hours**

	11. Experiment to demonstrate the use of BLUETOOTH RELAY SHIELD 12. Experiment to demonstrate the use of LCD AND KEYPAD-SCREW SHIELD 13. Experiment to demonstrate the use of HEART BEAT SENSOR 14. Experiment to demonstrate the use of GSM 15. Experiment to demonstrate the use of GPS	

Course Code: **CSC459**	**Discipline Specific Course - II** **B.Sc. (Honours) Computer Science – Semester IV** **Computer Security and Privacy LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying various cryptographic methods for data security.	
CO2.	Applying expertise in configuring host and network level technical security controls.	
CO3.	Applying the various network and port scanning tools for data and network security.	
CO4.	Analyzing analytical skills in identifying and troubleshooting networking, security, and performance issues.	
CO5.	Analyzing network working with configure host and controls.	
Course Content:		
	1. Understanding various types of attacks and their solutions 2. Implement cryptographic methods for data security 3. Implement various access controls 4. Implement various network scanning tools 5. Implement various port scanning tools 6. Learn about various attack on wireless network 7. Learn about various authentication mechanism on email security 8. Prepare a case study regarding the ethical issues in computer security.	**20 Hours**

Course Code: CSC460	**Discipline Specific Course - II** **B.Sc. (Honours) Computer Science – Semester IV** **Ethical Hacking Fundamentals LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding skills of Scanning, Foot-printing & Reconnaissance.	
CO2.	Applying skills over enumeration tools, social engineering, and simulation of system hacking.	
CO3.	Applying demonstrating application / network-level Session Hijacking.	
CO4.	Analyzing different attacks and backdoor plantation.	
CO5.	Creating different network application demonstrated on network levels.	
Course Content:		
	1. Identifying Live System 2. Performing a Check for Open Ports 3. Implementing Scanning Techniques 4. OS Fingerprinting 5. Banner Grabbing 6. Performing Malware Attacks 7. Implementing Application-level Session Hijacking 8. Hacking Web Applications 9. Planting a Backdoor 10. Using Enumeration Tools 11. Implementing Network-level Session Hijacking 12. Conduct Social Engineering Attack	**20 Hours**

Course Code: CSC461	**Core Course - XIX** **B.Sc. (Honours) Computer Science – Semester IV** **R Programming Lab**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Applying real world problems using R, adding vectors, finding mean, min, max of vectors.	
CO2.	Applying searching and sorting based programs, recursion and basic mathematics based applications.	
CO3.	Analyzing application which taking input from user, creating programs to generate random number.	
CO4.	Analyzing data science tools and their implementations.	
CO5.	Creating list based application, plotting graph using R.	
Course Content:		
	Basic Questions in R 1. R "Hello Word " program. 2. R program to add two vectors. 3. Find sum, mean and product of vector in R programming. 4. Program to take input from user. 5. Program to generate random numbers from standard distributions. 6. Program to sample from a population. 7. R program to find min and max. 8. R program to sort a vector. 9. R program to find the factorial of a number. 10. R program for multiplication table. 11. R program to check prime number. 12. R program to check Armstrong number. 13. R program to print the Fibonacci series. 14. R program for leap year. 15. R program to find odd or even number. 16. R program to check number +ve ,-ve or zero.	**20 Hours**

	17. R program to find sum of natural numbers. 18. R program to convert decimal to binary using recursion. 19. R program to find factorial of a number using recursion. 20. R program to find factor of a number. 21. Fibonacci series using recursion in R. 22. R program to find HCF or GCD. 23. R program to find LCM. 24. R program to make a simple calculator. 25. R program for list implementation. 26. R program for data frames. 27. R programming Bar plot. 28. R programming histogram. 29. R programming pie chart. 30. R box plot. 31. R strip chart. **R programming for data science** 1. Identifying types of variables in R. 2. Univariate statistics implementation in R. 3. Implementation of probability in R.	

Course Code: TMUGA-402	Value Added Course - V BSC- Semester-IV **Advance Algebra and Geometry**	L-2 T-1 P-0 C-0
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Implementing the rules of different geometrical concepts in Lines and Angles, Triangles, Area and volumes of different figures.	
CO2.	Recognizing the rules of Crypt-arithmetic and relate them to find out the solutions.	
CO3.	Illustrating the different Algebraic expressions in Quadratics, progressions etc.	
CO4.	Employing the concept of higher level reasoning in Clocks, Calendars and Puzzle Problems.	
CO5.	Correlating the various arithmetic and reasoning concepts in checking sufficiency of data.	
Course Content:		
Unit-1:	**Geometry and Mensuration** Lines and Angles, Triangles – Areas, Similar Triangles, Circles, Polygons, 2D Mensuration , 3D Mensuration	**3 Hours**
Unit-2:	**Functions** Introduction to Functions, Even and Odd Functions, Recursive	**2 Hours**
Unit-3:	**Crypt Arithmetic** Introduction of Crypt Arithmetic, Mathematical operations using Crypt Arithmetic, Company Specific Pattern	**4 Hours**
Unit-4:	**Quadratics** Introduction of Quadratic Equation, Relationship between equations, Maxima and Minima of Quadratic Equations, Range	**2 Hours**
Unit-5:	**Heights and Distance** Basic concept, Word problems	**2 Hours**
Unit-6:	**Progressions and special series** Introduction to AP, GP and HP, Common terms in Progressions, Arithmetic Geometric Progression, Sum of convergent series	**3 Hours**
Unit-7:	**Set theory** Introduction , Venn Diagrams basics, Venn Diagram – 3 sets, 4-Group Venn Diagrams	**2 Hours**
Unit-8:	**Data Sufficiency** Introduction, Blood relation based, direction based, ranking based	**4 Hours**
Unit-9:	**Problem Solving** Introduction, Puzzle based on 3 variable, Puzzle based on 4 variable	**4 Hours**
Unit-10:	**Clocks and calendars** Introduction , Angle based , faulty Clock, Interchange of hands, Introduction of Calendars, Leap Year , Ordinary Year	**4 Hours**

Text Books		
Reference Books:	1. Arun Shrama:- How to Prepare for Quantitative Aptitude 2. Quantitative Aptitude by R.S. Agrawal 3. M Tyra: Quicker Maths 4. Nishith K Sinha:- Quantitative Aptitude for CAT 5. Reference website:- Lofoya.com, gmatclub.com, cracku.in, handakafunda.com, tathagat.mba, Indiabix.com 6. Logical Reasoning by Nishith K Sinha 7. Verbal and Non Verbal Reasoning by R.S. Agrawal	
Additional Electronic Reference Material:		

Course Code: TMUGS-401	**Value Added Course - VI** **BSc- Semester-IV** **Managing Work and Others**	**L-2** **T-1** **P-0** **C-0**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Communicating effectively in a variety of public and interpersonal settings.	
CO2.	Applying concepts of change management for growth and development by understanding inertia of change and mastering the Laws of Change.	
CO3.	Analyzing scenarios, synthesizing alternatives and thinking critically to negotiate, resolve conflicts and develop cordial interpersonal relationships.	
CO4.	Functioning in a team and enabling other people to act while encouraging growth and creating mutual respect and trust.	
CO5.	Handling difficult situations with grace, style, and professionalism.	
Course Content:		
Unit-1:	**Intrapersonal Skills:** Creativity and Innovation Understanding self and others (Johari window) Stress Management Managing Change for competitive success Handling feedback and criticism	**8 Hours**
Unit-2:	**Interpersonal Skills:** Conflict management Development of cordial interpersonal relations at all levels Negotiation Importance of working in teams in modern organisations Manners, etiquette and net etiquette	**12 Hours**
Unit-3:	**Interview Techniques:** Job Seeking Group discussion (GD) Personal Interview	**10 Hours**
Text Books:		
Reference Books:	1. Robbins, Stephen P., Judge, Timothy A., Vohra, Neharika, Organizational Behaviour (2018), 18th ed., Pearson Education 2. Burne, Eric, Games People Play (2010), Penguin UK 3. Carnegie, Dale, How to win friends and influence people (2004),	

	RHUK 4. Rathgeber, Holger, Kotter, John, Our Iceberg is melting (2017), Macmillan 5. Steinburg, Scott, Nettiquette Essentials (2013), Lulu.com	
Additional Electronic Reference Material:	1. https://www.hloom.com/resumes/creative-templates/ 2. https://www.mbauniverse.com/group-discussion/topic.php 3. https://www.indeed.com/career-advice/interviewing/job-interview-tips-how-to-make-a-great-impression	

Course Code: CSC515	**Core Course - XX** **B.Sc. (Honours) Computer Science – Semester V** **Dot Net Framework with C#**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basics of Dot Net Framework with C#.	
CO2.	Classifying hands-on use of Dot Net Framework with C# applications in Web, Window and Console Application. Completion of the assignments will result Dot Net Framework with C# applications knowledge and skills.	
CO3.	Identifying categories of programs, Web, Window and Console Application. Organize and work with many projects.	
CO4.	Recognizing when to use each of the Dot Net Framework with C# programs to create professional, academic, business and many software projects.	
CO5.	Applying skills and concepts for basic use of computer hardware, software, networks and the Internet in the workplace and in future coursework as identified by the internationally accepted Internet and Microsoft Core .Net standards	
Course Content:		
Unit-1:	Review of OOP Concepts - Overview of .NET Framework - Basic Elements of C# - Program Structure and simple Input and Output Operations – Operators and Expressions – Statements – Arrays and Structures.	**8 Hours**
Unit-2:	Inheritance - Namespace – Polymorphism – Interface and Overloading – Multiple Inheritance – Property – Indexes – Delegates – Publish/Subscribe Design Patterns- Operator overloading-Method Overloading.	**8 Hours**
Unit-3:	C# Concepts for creating Data Structures - File Operation – File Management systems – Stream Oriented Operations- Multitasking – Multithreading – Thread Operation – Synchronization.	**8 Hours**
Unit-4:	Working with XML – Techniques for Reading and Writing XML Data - Using XPath and Search XML - ADO.NETArchitecture – ADO.NET Connected and Disconnected Models – XML and ADO.NET – Simple and Complex Data Binding– Data Grid View Class.	**8 Hours**

Unit-5:	Application Domains – Remoting – Leasing and Sponsorship - . NET Coding Design Guidelines –Assemblies – Security – Application Development – Web Services - Building an XML Web Service - Web Service Client – WSDL and SOAP – Web Service with Complex Data Types – Web Service Performance.	**8 Hours**
Text Books:	1. S. ThamaraiSelvi and R. Murugesan "A Textbook on C# ", Pearson Education.	
Reference Books:	1. Stephen C. Perry " Core C# and .NET", Pearson Education. 2. Jesse Liberty, "Programming C#", Second Edition, O'Reilly Press. 3. Robinson et al, "Professional C#", Fifth Edition, Wrox Press. 4. Herbert Schildt, "The Complete Reference: C#", Tata McGraw Hill. 5. Andrew Troelsen, "C# and the .NET Platform", A! Press, 200UNIT III 6. Thaana Thai and Hoang Q. Lam, ". NET Framework Essentials", Second Edition, O'Reilly.	
Additional Electronic Reference Material:	1. https://docs.microsoft.com/en-us/dotnet/csharp/tutorials/	

Course Code: CSC516	**Core Course - XXI** **B.Sc. (Honours) Computer Science – Semester V** **Theory of Computation**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understanding the basic concept of computer automation, finite state system, DFA, NFA, comparison of DFA and NFA, limitations and applications of finite automata.	
CO2.	Understanding concept of finite automata with epsilon transitions, kleen's theorem, minimization of DFA, Moore and Mealy machine, closure properties of regular sets.	
CO3.	Understanding concept of regular language in finite machine, converting DFA's to regular expression, applications of regular expressions, pumping lemma of regular language, Chomsky classification of grammars, right linear and left linear grammar, construction of CFG, derivation trees, sentential forms .	
CO4.	Understanding concept of context free grammar, ambiguity in CFG and removing this, reduced grammar, CNF and GNF, closure properties of CFL, pumping lemma for CFL.	
CO5.	Understanding concept of PDA, acceptance of CFL, CFL and PDA equivalence, DCFL and DPDA.	
Course Content:		
Unit-1:	Fundamentals: Basic Mathematical Notation and techniques, Strings, Alphabet, Language, Operations, Introduction to Finite State System, Finite automaton model, Deterministic Finite Automata (DFA) -Formal definition, Nondeterministic Finite Automata (NFA)- Definition of NFA, language recognizer, Designing of DFA and NDFA : state transition diagram, transition table, language of a DFA, Extended Transition Function, NFA to DFA conversion, Equivalence of DFA and NFA, Limitations and Applications of Finite Automata.	**8 Hours**
Unit-2:	Finite Automata: Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Kleene's Theorem, Properties and Limitations of FSM, Minimization of Deterministic Finite Automata, Equivalence between two FSM`s, Myhill-Nerode Theorem, Finite automata with output :Moore and	**8 Hours**

	Mealy machines and Inter conversion, Closure Properties of Regular Sets.	
Unit-3:	Regular Languages: Regular sets and expressions, Identity rules, Converting DFA's to Regular Expressions: Arden's Theorem and vice versa, applications of Regular Expressions. Proving languages to be non-regular -Pumping lemma. Grammar: Definition, Chomsky Classification of Grammars, right linear and left linear grammars, Equivalence between regular linear grammar and FA, Construction of Context Free Grammar, Derivation Trees, Sentential forms.	**8 Hours**
Unit-4:	Context Free Grammars : Ambiguity and its removal, Reduced Grammar-Elimination of Useless symbols - Unit productions - Null productions.CNF and GNF, Closure properties of CFL, Pumping Lemma for CFL.	**8 Hours**
Unit-5:	PDA: Push down automata, Definition, Model, Acceptance of CFL, Acceptance by final state and acceptance by empty state and its equivalence, CFL and PDA equivalence, Introduction to DCFL and DPDA.	**8 Hours**
Text Books:	1. John C. Martin, "Introduction to Languages and Theory of Computation", McGraw Hill.	
Reference Books:	1. Peter Linz, An introduction to formal language & automata, Jones &Bartlete publications 2. Hopcroft,J.E.&Ullman,J.D. Formal languages and their relation to Automata, Pearson Education. 3. Lewis, H.R. &Papadimitrious, C.H. Elements of the theory of computation. PHI 4. Krithivasan K. & Rama R.,"Introduction to Formal Languages, Automata Theory and Computation", Pearson Education, 2009. 5. Michael Sipser, "Introduction to the Theory of Computation", Cengage Learning.	
Additional Electronic Reference Material:	1. https://www.geeksforgeeks.org/introduction-of-theory-of-computation/	

Course Code: **CSC517**	**Core Course - XXII** **B.Sc. (Honours) Computer Science – Semester V** **Python Programming & Introduction to Data Science**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand programming skills in core Python.	
CO2.	Understand Object Oriented Skills in Python	
CO3.	Understand important aspects related with string, lists and dictionary in python.	
CO4.	Apply the skill of designing user defined functions in python.	
CO5.	Develop the ability to work on database applications.	
Course Content:		
Unit-1:	Introduction History, Features, Setting up path, Working with Python, Basic Syntax ,Variable and Data Types , Operator Conditional Statements If ,If- else ,Nested if-else Looping For, While ,Nested loops Control Statements Break, Continue ,Pass	**8 Hours**
Unit-2:	String Manipulation Accessing Strings ,Basic Operations ,String slices ,Function and Methods Lists Introduction ,Accessing list ,Operations ,Working with lists ,Function and Methods Tuple Introduction ,Accessing tuples ,Operations ,Working ,Functions and Methods	**8 Hours**
Unit-3:	Dictionaries Introduction, Accessing values in dictionaries ,Working with dictionaries ,Properties ,Functions Functions Defining a function , Calling a function, Types of functions ,Function Arguments ,Anonymous functions ,Global and local variables	**8 Hours**
Unit-4:	Modules Importing module ,Math module ,Random module ,Packages ,Composition Input-Output Printing on screen ,Reading data from keyboard ,Opening and closing file ,Reading and writing files ,Functions. **Database**- connectivity, Transactions using MYSQL.	**8 Hours**
Unit-5:	Exception Handling Exception ,Exception Handling ,Except clause ,Try ? finally clause ,User Defined Exceptions, OOPs concept Class and object, Attributes ,Inheritance ,Overloading fuction and operator ,Overriding ,Data hiding , Scientific libraries in Python – NumPy,	**8 Hours**

	SciPy, Matplotlib and Pandas	
Text Book:	1. Learning Python by Mark Lutz, David Ascher Shop O'Reilly - O'Reilly Media	
Reference Books:	1. "Learn Python the Hard Way" by Zed A. Shaw 2. "Python Essential Reference" by David M. Beazley, Addison Wesley 3. "Python in a Nutshell" by Alex Martelli, Oreilly Publication. 4. "Think Python" by Allen Downey, Green Tea Press 5. "Core Python Programming" by Wesley J. Chun, Pearson Education 6. "An Introduction to Python by Guido Van Russom, Fred L.Drake, Network Theory Limited. 7. "Beginning Python: From Novice To Professional By Magnus Lie Hetland, Second Edition Apress 8. "Programming in Python" by Mark Summerfield, Pearson Education	
Additional Electronic Reference Material:	1. https://www.python.org/about/gettingstarted/ 2. https://www.programiz.com/python-programming	

Course Code: **CSC518**	**Skill Enhancement Course - I** **B.Sc. (Honours) Computer Science – Semester V** **Mobile Application Development using Android**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the android framework, Android Software Development Kit, Android application Architecture, various predefine classes and interfaces which are helpful in application development	
CO2.	Understand the various application components, Activities and its various methods, necessary directory structure for application development.	
CO3.	Understand view and viewgroup objects, basic layout designing using xml, understanding android virtual device, understanding screen orientation, understanding various UI controls	
CO4.	Understand custom views, fragments, event handling, styling of components, understanding the different pixel density for images.	
CO5.	Analyze different methods of content provider class for data sharing between applications, Understanding preference file and its various methods for storing application preferences.	
Course Content:		
Unit-1:	**Introduction** Android , Android Versions , Features of Android , Architecture of Android Obtaining the Required Tools , Android SDK , Installing the Android SDK Tools Configuring the Android SDK Manager – Eclipse , Android Development Tools (ADT) , Creating Android Virtual Devices (AVDs) , Creating Your First Android Application – Types of Android Application , Anatomy of an Android Application.	**8 Hours**
Unit-2:	**Activities, Fragments and Intents** Understanding Activities , Creating Activities , Linking Activities Using Intents, Resolving Intent Filter Collision , Returning Results from an Intent , Passing Data Using an Intent Object , Fragments , Adding Fragments Dynamically , Life Cycle of a Fragment , Interactions between Fragments , Calling Built-In Applications Using Intents , Understanding the Intent Object , Using Intent Filters – Adding Categories , Displaying Notifications.	**8 Hours**
Unit-3:	**Android User Interface** Understanding the Components of a Screen , Adapting to Display Orientation Managing Changes to Screen Orientation	**8 Hours**

	, Utilizing the Action Bar , Creating the User Interface Programmatically , Listening for UI Notifications , Designing Your User Interface With Views , Using Basic Views , Using Picker Views , Using List Views to Display Long Lists , Understanding Specialized Fragments – Displaying Pictures And Menus With Views , Using Image Views to Display Pictures – Using Menus with Views , Additional Views.	
Unit-4:	**Databases, Content Providers and Messaging** Saving and Loading User Preferences , Persisting Data to Files , Creating and Using Databases , Content Providers , Sharing Data in Android , Using a Content Provider , Creating Your Own Content Providers , Using the Content Provider – Messaging , SMS Messaging , Sending E,mail.	**8 Hours**
Unit-5:	**Location Based Services, Networking and Android Services** Location Based Services , Displaying Maps, Getting Location Data, Monitoring a Location ,Project — Building a Location Tracker ,Networking ,Consuming Web Services Using HTTP , Consuming JSON Services , Sockets Programming Developing. Android Services, Creating Your Own Services, Establishing Communication between a Service and an Activity, Binding Activities to Services, Understanding Threading, Publishing Android Applications , Preparing for Publishing, Deploying APK Files.	**8 Hours**
Text Books:	1. Wei - Meng Lee, "Beginning Android 4 Application Development" , John Wiley &Sons, Inc.	
Reference Books:	1. Reto Meier, "Professional Android 4 Application Development" , John Wiley & Sons,Inc. 2. ZigurdMednieks, Laird Dornin, Blake Meike G, and Masumi Nakamura, "Programming Android", O'Reilly.	
Additional Electronic Reference Material:	1. https://www.android.com/intl/en_in/	

Course Code: CSC519	**Skill Enhancement Course - I** **B.Sc. (Honours) Computer Science – Semester V** **Advance Java**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the detail concept of java In real life.	
CO2.	Understand how java is different and easy from other programming Languages.	
CO3.	Understand java with some modules	
CO4.	Understand how the data is predicted in java.	
CO5.	Analyzing the relationship between java and Data Analysis.	
Course Content:		
Unit-1:	JDBC – JAVA Database Connectivity, Servlets: Servlet Class hierarchy and life cycle methods, creating the servlet, implementing a servlet application, servlet API, Running a servlet on Apache Tomcat Server.	**8 Hours**
Unit-2:	Managing Sessions and Handling Errors: Session Management in servlets, handling errors and exceptions in servlets, Inter servlet communication, Thread-safe servlets.	**8 Hours**
Unit-3:	EJB Architecture & Design, EJB Container and its services, Enterprise Java Beans – Session beans(State, stateful and stateless session Beans), Entity Beans, Container Managed and Bean Managed persistence.	**8 Hours**
Unit-4:	Java Server Pages - Understanding the working of Server side Scripting, JSP Components, Java beans and JSP concepts, JDBC and JSP, Configuring JSP Server (Apache Tomcat) , Implicit objects, JSP Actions, JSP and MVC,JSTL. Introduction to Struts2 Framework, Interceptors and Validation.Struts2 and AJAX	**8 Hours**
Unit-5:	Hibernate: Introduction, comparing JDBC to Hibernate, Mapping System, Hibernate configuration, HQL Introduction, Introduction to Spring framework.	**8 Hours**
Text Books:	1. Jim Farley, William Crawford, O'Reilly and Associates, "Java Enterprise in a Nutshell".	

Reference Books:	1. Brett McLaughlin, O'Reilly, "Java and XML, Latest Edition. 2. Elliott Rusty Harold and W. Scott Means, O'Reilly, "XML in a Nutshell". 3. James Cooper, "Java Design Pattersn: A Tutorial", Addison Wesley. 4. GovindSesadri, "Enterprise java Computing: Application and Architectures", CambridgeUniversity Publications, 1999. 5. Pure JSP – James Goodwill – SAMS Techmedia	
Additional Electronic Reference Material:	1. https://www.edureka.co/blog/advanced-java-tutorial	

Course Code: CSC512	**Generic Elective – III** **B.Sc. (Honours) Computer Science – Semester V** **Entrepreneurship**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the concepts and factors of Entrepreneur	
CO2.	Understand the Development and objectives of Entrepreneurship.	
CO3.	Understand the classification of the characteristics for the growth of business.	
CO4.	Understand the need and support of Financing and Accounting.	
CO5.	Apply the skills for becoming the enterpreneur	
Course Content:		
Unit-1:	**Entrepreneurship:** Entrepreneur – Types of Entrepreneurs – Difference between Entrepreneur and Intrapreneur Entrepreneurship in Economic Growth, Factors Affecting Entrepreneurial Growth.	**8 Hours**
Unit-2:	**Motivation:** Major Motives Influencing an Entrepreneur – Achievement Motivation Training, Self-Rating, Business Games, Thematic Apperception Test – Stress Management, Entrepreneurship Development Programs – Need, Objectives.	**8 Hours**
Unit-3:	**Business:** Small Enterprises – Definition, Classification – Characteristics, Ownership Structures – Project Formulation – Steps involved in setting up a Business – identifying, selecting a Good Business opportunity, Market Survey and Research, Techno Economic Feasibility Assessment – Preparation of Preliminary Project Reports – Project Appraisal – Sources of Information – Classification of Needs and Agencies.	**8 Hours**
Unit-4:	**Financing and Accounting:** Need – Sources of Finance, Term Loans, Capital Structure, Financial Institution, Management of working Capital, Costing, Break Even Analysis, Taxation – Income Tax, Excise Duty – Sales Tax.	**8 Hours**

Unit-5:	**Support to Entrepreneurs:** Sickness in small Business – Concept, Magnitude, Causes and Consequences, Corrective Measures – Business Incubators – Government Policy for Small Scale Enterprises – Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Sub Contracting.	**8 Hours**
Text Books:	1. Khanka. S.S., "Entrepreneurial Development" S. Chand & Co. Ltd., Ram Nagar, New Delhi.	
Reference Books:	1. Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", Cengage Learning. 2. Hisrich R D, Peters M P, "Entrepreneurship" 8th Edition, Tata McGraw-Hill. 3. Mathew J Manimala, "Entrepreneurship theory at cross roads: paradigms and praxis" 2nd Edition Dream tech. 4. Rajeev Roy, 'Entrepreneurship', Oxford University Press. 5. EDII "Faulty and External Experts – A Hand Book for New Entrepreneurs Publishers: Entrepreneurship Development", Institute of India, Ahmadabad.	
Additional Electronic Reference Material:		

Course Code: CSC513	**Generic Elective – III** **B.Sc. (Honours) Computer Science – Semester V** **Industrial Psychology**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the concept of Sociology, social structure, social values and its impact on business.	
CO2.	Understand the Work and Social change: modern societies, industrial capitalism, globalization, service sector.	
CO3.	Understand the Work experience in Industry: Technology & work experience, Social background, Stress & anxiety of workers.	
CO4.	Understand the Ethics and the professions, significance of professional ethics for engineers, applied ethics.	
CO5.	Understand the significance of ethical leadership, corporate culture and reputation management, corporate social responsibility.	
Course Content:		
Unit-1:	**Sociology in the industrial Perspective:** Concept of Sociology, Sociology as a Science, Sociology of work & industry, Perspectives for sociological analysis of work, Class- Conflict in Industry, Social impact of industrialization, Corporate skills in the fast growing multinational set up.	**8 Hours**
Unit-2:	**Work and Social change:** Nature of modern societies, emergence of industrial capitalism, Technology & Social change, the information society after the industrial society, post-modernity, globalization & Convergence, Significance of the service sector today, work restructuring and corporate management.	**8 Hours**
Unit-3:	**Work experience in Industry:** The concept of alienation, Work satisfaction, Technology & work experience, and Social background of workers, Work orientations, Stress & anxiety of the worker, Work & Leisure, Unemployment, Conflicts in the work place.	**8 Hours**
Unit-4:	**General and Applied Ethics**- Ethics and the professions – Standard of right and wrong, problems of Ethical Certainty, Significance of professional Ethics for Engineers, New Technology and Ethics, Applied Ethics - Cases in professional Engineering Practice, Principles of business ethics, Individual in the organization.	**8 Hours**

Unit-5:	**Ethical Leadership:** Decision making, corporate culture and reputation management, corporate social responsibility and social reporting.	**8 Hours**
Text Books:	1. Sheth N.R., *Social Frame Work of Indian Factory*, O.U.P. Bombay.	
Reference Books:	1. Gisbert P., *Fundamentals of Industrial Sociology*, O.U.P. New Delhi. 2. Watson Tony J., *Sociology: Work & Industry*, New York. Routledge. 3. Schinzinger, Roland & Mike W. Martin, *Introduction to Engineering Ethics*- Boston, McGraw Hill. 4. Fleddermann Charles, *Engineering Ethics*, Upper Saddle River-N.J. Prentice Hall. 5. Miller & Form, *Industrial Sociology*, London Harper & Row. 6. Parsons Richard D., *The Ethics of Professional Practice*-Allyn& Bacon, London. 7. Govindarajan- *Engineering Ethics*- Prentice Hall (India) New Delhi. 8. Bhatia S.K. - *Business Ethics & Management Values*- Deep & Deep Publication. N. Delhi	
Additional Electronic Reference Material:	1. https://www.talentlyft.com/en/resources/what-is-industrial-psychology	

Course Code: CSC520	**Generic Elective – III** **B.Sc. (Honours) Computer Science – Semester V** **Management Concepts & Organizational Behavior**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the Concepts, functions and importance of management with its applicability.	
CO2.	Understand the meaning of organizational behavior and its concepts.	
CO3.	Understand the Theories of motivation and leadership and its importance, applicability into business	
CO4.	Understand the Perception and Thinking process of individual, personality traits and its importance	
CO5.	Analyzing the behavior of individuals to make it productive in organization.	
Course Content:		
Unit-1:	Introduction to Management: Meaning, nature and importance of management; Management functions; Managerial Skills. Planning: Introduction, Importance of Planning, Types of Plans, Planning & Decision Making Process.	**8 Hours**
Unit-2:	Organizing and staffing: Meaning, Importance & Process of Organizing, Organisational Structure & its types, Delegation of Authority, Staffing: Meaning & importance. Directing: Importance & Functions, Controlling: Importance and Process, Measures for Effective Control & Control Techniques.	**8 Hours**
Unit-3:	Organizational Behaviour (OB): Concept, Characteristics, Key Elements of OB, Models of OB. Perception: Concept, Process & Importance. Attitudes & Job Satisfaction. Personality: Concept, Types & Theories, Learning: Concept & Theories of Learning.	**8 Hours**
Unit-4:	Motivation: Concepts, Principles, Theories. Leadership: Concept, Function & Style. Group Dynamics: Definition, Stages of Group Development, Types & Group Decision Making. Power and Politics: Concept, Sources,	**8 Hours**

	Approaches to Power, Political Implications of Power.	
Unit-5:	Organizational Change: Concept, Resistance to change & its Management, Implementation of Change. Conflict: Concept, Sources, Types and Resolution of Conflict, Stress: Meaning, Causes, Consequences & Managing Stress. Culture: Concept, Characteristics, Elements of Culture.	**8 Hours**
Text Books:	1. Prasad L.M., Principles and Practice of Management, Sultan Chand	
Reference Books:	1. Murugan and Shaktivel, Management Principles and Practices, New Age. 2. W Newstrom John, Organizational Behavior: Human Behavior at Work, Tata McGraw Hill 3. Fred, Luthans, Organizational Behaviour, Tata McGraw Hill 4. Shane L Mc. Steven, Glinow Mary Ann Von & Sharma Radha R., "Organizational Behavior" Tata McGraw Hill 5. Robbins Stephen P., Organizational Behavior Pearson Education 6. Koontz, Harold, Cyril 'O' Donnell, And Heinz Weihrich, Essentials of Management, Fourth Edition, McGraw-Hill, Singapore 7. Srivastava &Chunawalla, Management Principles and Practices, Macmillan 8. Koontz, Principles of Management, Tata McGraw Hill.	
Additional Electronic Reference Material:		

Course Code: CSC558	**Skill Enhancement Course - II** **B.Sc. (Honours) Computer Science – Semester V** **Android LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand Activity, analyzing various lifecycle callback methods of Activity class, creating some basic layouts using predefine widgets.	
CO2.	Understand view system, Adapter based views, analyzing various classes of adapter based views, creating basic list using List view, understanding Base Adapter and its various methods.	
CO3.	Understand menu and its types, creating basic screens using menus, buttons and Text views.	
CO4.	Understand the web services, creating application that's consume web services using Network calling, creating application related to content sharing.	
CO5.	Understand map based activity, understanding Geo coding, creating application that's shows Maps and current location	
Course Content:		
	1. Creating Applications with Multiple Activities and a Simple Menu using ListView 2. Creating Activities For Menu Items and Parsing XML Files 3. Writing Multi-Threaded Applications 4. Using WebView and Using the Network 5. Graphics Support in Android 6. Preferences and Content Providers 7. Location Services and Google Maps in Android	**20 Hours**

Course Code: CSC559	**Skill Enhancement Course - II** **B.Sc. (Honours) Computer Science – Semester V** **Advance Java LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the execution of java In real life.	
CO2.	Apply the different modules to predict data.	
CO3.	Apply different functions to search pattern in the files.	
CO4.	Analyze the data from different datasets with different modules.	
CO5.	Develop applications for the use of society	
Course Content:		
	1. Installation of JDK 1.8 2. Installation of NetBeans 7.1 3. Using Netbeans 4. Programs based on JDBC with backend as MySql/Oracle 10g. 5. Window based application development with back end support. 6. Programs based on web based application development. 7. Business Logic development using servlets. 8. Designing page using JSP,customtags,JSTL. 9. Development of EJB Component. 10. Programs based on JSP and AJAX. 11. Programs to implements MVC Architecture.	**20 Hours**

Course Code: **CSC560**	**Core Course - XXIII** **B.Sc. (Honours) Computer Science – Semester V** **Python Programming & Introduction to Data Science Lab**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Apply core python programming like loop, if statement and other concept.	
CO2.	Apply different collections - list, tupple, dictionaries.	
CO3.	Apply functions.	
CO4.	Apply class, inheritance and operator overloading.	
CO5.	Develop Database application in python.	
Course Content:		
	1. Implement some calculative programs in Python. 2. Implement control structures. 3. Implement the concept of list, Built-in List Functions & Methods. 4. Implement tuples, Dictionaries, and data type conversion function. 5. Implements different loops. 6. Implement user defined functions, Pass by reference vs value, variable length argument. 7. Implement of module import, The from...import Statement. 8. Implement exception handling in program. 9. Implementation of classes and objects. 10. Implementation of inheritance in programs. 11. Implementation of File and Text I/O Operations. 12. Implementation of Strings and Regular Expression. 13. Implementation of Overloading and Overriding. 14. Implementation of Built—in functions.	**20 Hours**

Course Code: CSC561	**Core Course - XXIV** **B.Sc. (Honours) Computer Science – Semester V** **Dot Net Framework with C# Lab**	**L-3** **T-0** **P-0** **C-3**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand how to design, code, compile, and execute business-oriented programs using the C# programming language commands.	
CO2.	Apply programming logic for business-oriented programs using appropriate tools such as TOE (Task, Object and Event) charts, hierarchy charts, flowcharts, and pseudo code	
CO3.	Analyze the characteristics unique to object-oriented programming vs. structured programming.	
CO4.	Analyze program-generated output for correctness.	
CO5.	Develop code that validates input data.	
Course Content:		
	1. Installing Visual Studio 2013 2. Creating a C# project within Visual Studio 3. Basic Programs to demonstrate the working of basic data types. 4. Programs to implement the use of Objects. 5. Programs to implement multithreading 6. Programs to implements String handling 7. Programs to implement file handling 8. Using ADO.Net to handle data, connecting to a database, firing queries to display data 9. Using XML Libraries to export data from a database to an XML file 10. Developing windows forms 11. Using various controls on Windows forms.	**20 Hours**

Course Code: **CSC616**	**Skill Enhancement Course – III** **B.Sc. (Honours) Computer Science - Semester VI** **Programming in PHP and MySQL**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the concept of web servers, server side and client side scripts on web development.	
CO2.	Understand the basics of PHP language, its syntax, Wordpress and CakePHP framework, AJAX,.	
CO3.	Understand the basics of MySQL, creating database and database connectivity in PHP with MySQL.	
CO4.	Apply concepts of PHP language using XML and AJAX to create more interactive web applications.	
CO5.	Apply MySQL with PHP to create dynamic content that interact with database.	
Course Content:		
Unit-1:	Web Servers: Introduction to web server. Installation and Configuration of WAMP ,LAMP and XAMPP. An Introduction to server side scripts. Role of client side script and serer side scripts on web development. Difference of PHP with other server side languages.	**8 Hours**
Unit-2:	PHP-Introduction to PHP, History, Web Server, WAMP, Installation and Configuration files, Syntax, Operators, Variables, Constants, Control, Structure, Language construct and functions, Function – Syntax, Arguments, Variables, References, Returns and Variable Scope.	**8 Hours**
Unit-3:	Arrays and its types, Date and Time functions, OOP's – Installation, Modifiers, Inheritance, Interfaces, Exceptions, Static Methods and Properties, String functions. Web Features- Sessions, Forms, GET and POST data, Cookies.	**8 Hours**
Unit-4:	Introduction to MySQL, Putting password on root. Creating users on MySQL. Creating database In MySQL. Creating table and using sql queries in MySQL .Database connectivity in PHP with mysql_connect and PDO and using, insertion, deletion, updating and retrieval of data from database using PHP.	**8 Hours**

Unit-5:	Introduction to AJAX, AJAX and its applications, working of AJAX, Introduction to web services, advantages of web services, web services platform elements, Using XML in PHP. Understanding the WordPress and CakePHP framework of PHP.	**8 Hours**
Text Books:	1. Ivan Bayross, HTML, DHTML, JavaScript, CSS, PHP, BPB Publications.	
Reference Books:	1. Ivan Bayross, PHP 5, BPB Publications. 2. Andrew Curioso, Ronald Bradford, Patrick Galbraith, Expert PHP and Mysql, Wiley Publishing. 3. Professional PHP Programming ,JesusCastagnetto ,Harish Rawat, Sascha Schumann, Chris Scollo,DeepakVeliath - Wrox Publications. 4. Beginning PHP and MySQL 5,W. Jason Gilmore,Apress Publication. 5. PHP 5 Advanced, Larry Ullman, Peachpit Press.	
Additional Electronic Reference Material:	1. https://www.w3schools.com/php/php_mysql_intro.asp	

Course Code: CSC617	**Skill Enhancement Course - III** **B.Sc. (Honours) Computer Science - Semester VI** **ASP.Net with MVC Architecture**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the basics of ASP.Net with MVC Architecture.	
CO2.	Understand the meaning and basic components of a ASP.Net with MVC Architecture.	
CO3.	Understand categories of programs, Web, Window and Console Application. Organize and work with many projects.	
CO4.	Apply ASP.Net with MVC Architecture applications in Web, Window and Console Application. Completion of the assignments will result ASP.Net with MVC Architecture applications knowledge and skills.	
CO5.	Analyze when to use each of the ASP.Net with MVC Architecture programs to create professional, academic, business and many software projects.	
Course Content:		
Unit-1:	**Conceptual Overview of ASP.NET Framework** ASP.NET Introduction, ASP.NET Architecture, ASP.NET Life Cycle, Auto Postback Property, Event Handler Parameters, Dynamically intializing Controls, IsPostBack property of Page class, Comparison between HtmlControls and WebControls, Master page Concept : ContentPlaceHolder and Content tags, Accessing controls of MasterPage in ContentPage, URL's in MasterPages. Redirecting User to Another Page : Redirecting Options, Response.Redirect, Server.Transfer, Cross Page Postback. All Standard Controls, Validation Controls, Navigation Controls, Rich Web Controls. Creating and Implementing User and Custom Controls.	**8 Hours**
Unit-2:	**ASP.NET Configuration, Data Controls and Web Services** ASP.NET State Management- Static Members, View State, Query String, HttpContext, Cookies-HttpCookie, Sessions-HttpSessionState, Application-HttpApplicationState , Caching, Security Authentication and Authorization, Localization and Globalization, Exception Handling.	**8 Hours**

	Basics of ADO.NET: SQL Managed Data Providers- Data adapters, Dataset, DataReader, ExecuteReader, ExecuteScalar, ExecuteNonQuery, DataTable, DataRow, DataColumn. Stored Procedure Concept. Web Service: Need of Web Services, role of XML, UDDI, WSDL, HTTP and SOAP Protocol, Web Service Vs WCF (Windows Communication Foundation).	
Unit-3:	**AJAX , LINQ and ASP.NET MVC Introduction** Introduction to AJAX Concept, Script Manager, UpdatePanel, Update Progress, Timer, AJAX Control Toolkit. Basics of LINQ: Enviornment Setup, Query Operators, LINQ-SQL, LINQ-Objects, LINQ-Datset, LINQ-XML, LINQ-Entities, LINQ-Lambda Expressions. Understanding ASP.NET MVC Architecture, Understanding Model, View and Controller, Advantages of MVC based Web Application, Features of ASP.NET MVC Framework. Exploring Controller's: Exploring Controllers and ControllerBase class, Passing data from Controller to View using ViewData/ViewBag, Types of Action Methods, Action Method Parameters, Action Selector and Filter, Asynchronous Controllers.	**8 Hours**
Unit-4:	**Rajor View, Model Binding, Annotations and State Management** Exploring Razor Views: Types of Views, Razor Syntax Fundamentals, Enum Support, Layout view Razor (Master Pages), Significance of _ViewStart.cshtml, Working with Sections and Partial View. Digging into HTML Helpers: Helper Methods, Binding Html Helper to Model, Custom Helper method. Understanding Model Binders: Default model Binder, Complex Type Model Binding, FormCollection Model Binding, Http Posted File Model Binding, Bind Attribute, Annotations and Validations, State Management Techniques.	**8 Hours**
Unit-5:	**Web Caching, CRUD Operation using Entity Framework and Authentication** Web Caching, MVC and EF Crud Operations, MVC and EF Crud Operation Using BO Class, MVC and EF Crud Operations Using Generic BO Class. Windows Authentication, Forms Authentication, Role Based Authentication, Anti Forgery Token, Working with Areas, Bundling and Minification, Web API.	**8 Hours**
Text Books:	1. Nitin Pandey with NIIT, "Microsoft ASP.NET fast & easy Web Development", Prentice Hall of India.	
Reference Books:	1. G. Andrew Duthic, "Microsoft ASP.Net Step by Step" Prentice hall of India Private Ltd, 2006. 2. Dominic Selly, Andrew Troelsen and Tom Barnaby, "Expert	

	ASP.NET 2.0 Advanced Application Design", APress Media. 3. Hank Meyne, Scoot Davis, "developing Web Applications with ASP.NET and C#", John Wiley & Sons, Inc. 4. Jess Chadwick, Todd Snyder &Hrusikesh Panda, "Programming ASP.NET MVC 4", O'Reilly Media Inc. 5. Matthew MacDonald "Beginning ASP.NET 4 in C# 2010", APress Media	
Additional Electronic Reference Material:	1. https://dotnet.microsoft.com/apps/aspnet/mvc	

Course Code: CSC618	**Core Course - XXV** **B.Sc. (Honours) Computer Science – Semester VI** **Machine Learning using Python**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand how the human intelligence works and takes decision by using experience.	
CO2.	Understand how to make a machine intelligent to take decisions like human and how to give experience to machine.	
CO3.	Understand the importance of ecosystem and conserving it for maintaining ecological balance using machines that takes their own decisions.	
CO4.	Apply various techniques and algorithms for regression, classification and clustering with python, the widely used language having most sophisticated machine learning libraries.	
CO5.	Analyze the efficiency of algorithms using confusion matrix for classification algorithms and R^2 Adjusted for regression algorithms.	
Course Content:		
Unit-1:	**Introduction to Machine Learning:** Introduction; History, Advantages, Scope and Applications; Learning Algorithms: Supervised Learning; Unsupervised Learning; Semi-Supervised Learning; Reinforcement Learning. **Decision Trees:** Introduction, Scope, Advantages; Hunt's algorithm for learning a decision tree; Details of tree induction;	**8 Hours**
Unit-2:	**KNNs, SVMs and Naïve Bayes:** Examples of few text classification problems; Naïve Bayes for text classification; Introduction to KNN algorithm; Decision boundary KNN Vs Decision tree; What is the best K; KNN Problems; Feature selection using KNNs; Linear Classifiers; Learning non-linear patterns.	**8 Hours**
Unit-3:	**ANN and Regression:** Motivation for Artificial Neural Network; Perceptron Algorithm; Decision Boundary for a single Neuron; Introduction to Linear Regression; ***R*^2**: Coefficient of Determination; Logistic regression vs Linear Regression; Can we use Regression Mechanism for Classification?; Logistic Regression – Deriving the Formula; Logistic Regression for Multi-class Classification; Logistic Regression Decision Boundary.	**8 Hours**

Unit-4:	**Feature Selection:** Introduction tofeature selection: what, why, how and where?; Feature selection vs feature extraction; Feature subset selection using Filter based methods; Wrapper Methods; Wrapper Methods vs Filter Methods; Model based machine learning with regularization; Regularization using L2 and L1.	**8 Hours**
Unit-5:	**Sequence Labeling, Clustering:**Introduction to Sequence Learning; Sequence Labeling as Classification; Probabilistic Sequence Models; Hidden Markov Model; Three Problems of an HMM. Basics of Clustering; Applications of Clustering; Understanding Distance based Clustering; K-means Algorithm; Hierarchical (Agglomerative) clustering; Evaluation of cluster quality.	**8 Hours**
Text Books:	1. Brian, O, *Management Information System*, Tata McGraw Hill.	
Reference Books:	1. Gordon, B. D. and Margrethe H. O., *Management Information System*, Tata McGraw Hill. 2. Brian, O., *Introduction to Information System*, McGraw Hill. 3. Jawadekar, W., *Management Information System*, Tata McGraw Hill. 4. Jain, S., *Management Information System*, Tata McGraw Hill.	
Additional Electronic Reference Material:	1. https://www.greatlearning.in/great-lakes-artificial-intelligence-and-machine-learning	

Course Code: CSC619	**Generic Elective – IV** **B.Sc. (Honours) Computer Science – Semester VI** **Cloud Computing**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the concepts, characteristics, delivery models and benefits of cloud computing	
CO2.	Understand the key security and compliance challenges of cloud computing	
CO3.	Understand the key technical and organizational challenges	
CO4.	Understand the different characteristics of public, private and hybrid cloud deployment models	
CO5.	Apply certain methods for fulfilling the challenges of cloud computing.	
Course Content:		
Unit-1:	**Fundamentals:** Cloud Computing definition, Essential characteristics, principals, Usage, private, public and hybrid cloud. Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, role of virtualization in enabling the cloud; Business Agility: Benefits and challenges to Cloud architecture. Application availability, performance, security and disaster recovery	**8 Hours**
Unit-2:	**Cloud Storage, Security and Design:** Virtualized Data Center Architecture, concept, planning and design, disaster recovery principles, Managing VDC environments and infrastructures, Storage strategy and governance; security and regulations, Designing secure solutions, Securing storage in virtualized and cloud environments, Monitoring and management; security auditing and SIEM	**8 Hours**
Unit-3:	**Cloud Services and Economics:** Introduction to cloud services, Reliability, availability and security of services deployed, performance and scalability of services, tools and technologies used to manage cloud services deployment; Cloud Economics : Availability of infrastructure, choosing a Cloud platform for an organization, application requirements, economic constraints & business needs	**8 Hours**
Unit-4:	**Application & Development:** Web services development, deployment & management, tools, processes, Deploying a web service from inside and	**8 Hours**

	outside a cloud architecture, advantages and disadvantages, Service creation environments, Use different Development environments for service development like Amazon, Azure, Google App etc.	
Unit-5:	**Migrating to Cloud:** Introduction, Available services and offerings, tools and best practices, Analyzing the Services, Open Source and Commercial Clouds, Cloud Simulator, Fog Computing, Case Studies :Amazon's cloud services (AWS)	**8 Hours**
Text Books:	1. David, E.Y. Sarna, Implementing and Developing Cloud Computing Applications, CRC Press.	
Reference Books:	1. Dimitris, N. Chorafas, Cloud Computing Strategies, CRC Press. 2. RajkumarBuyya, James Broberg, Andrzej M. Goscinsk, Cloud Computing: Principles 3. Greg Schulz, "Cloud and Virtual Data Storage Networking", Auerbach Publications [ISBN: 978-1439851739], 2011andParadigms, Wiley Publications 4. Mather, T., Cloud Security and Privacy: An Enterprise Perspective On Risks And Compliance, O'Relly 5. Volker Herminghaus, Albrecht Scriba, "Storage Management in Data Centers" Springer; editioN[ISBN: 978-3540850229]. 2009. 6. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 1 edition, [ISBN: 978-0521137355], 2010. 7. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; 1 edition [ISBN: 0071626948], 2009. 8. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 1 edition [ISBN: 1439834539],2010	
Additional Electronic Reference Material:	1. https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-about-the-cloud/	

Course Code: CSC620	**Generic Elective – IV** **B.Sc. (Honours) Computer Science – Semester VI** **Introduction to Human Computer Interaction**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand about human computer interaction.	
CO2.	Understand the interaction design theory as well as elements of cognitive psychology when designing, critiquing or talking about software and/or hardware.	
CO3.	Apply certain methods for working on software and hardware.	
CO4.	Apply mock-ups and carry out user and expert evaluation of interfaces.	
CO5.	Analyze general ways in which to test hypotheses about human computer interaction.	
Course Content:		
Unit-1:	**Introduction :** Importance of user Interface – definition, importance of 8 good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.	**8 Hours**
Unit-2:	**Design process:** Human interaction with computers, importance of 8 human characteristics human consideration, Human interaction speeds, understanding business junctions.	**8 Hours**
Unit-3:	**Screen Designing :** Design goals – Screen planning and purpose, 8 organizing screen elements, ordering of screen data and content – screen navigation and flow – Visually pleasing composition – amount of information – focus and emphasis – presentation information simply and meaningfully – information retrieval on web – statistical graphics – Technological consideration in interface design.	**8 Hours**
Unit-4:	**Windows:** New and Navigation schemes selection of window, 8 selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colours.	**8 Hours**
Unit-5:	**Software tools:** Specification methods, interface – Building Tools. 8 Interaction Devices – Keyboard and function keys – pointing devices – speech recognition digitization and generation – image and video displays	**8 Hours**

	– drivers.	
Text Books:	1. Silberschatz, Korth and Sudershan, Database System Concept', Mc Graw Hill	
Reference Books:	1. Ramakrishna and Gehrke,' Database Management System, Mc Graw Hill. 2. Garcia-Molina, Ullman,Widom,' Database System Implementation' Pearson Education 3. Ceei and Pelagatti,'Distributed Database', TMH 4. Singhal and Shivratri, 'Advance Concepts in Operating Systems' MC Graw Hill	
Additional Electronic Reference Material:	1. https://www.interaction-design.org/literature/topics/human-computer-interaction	

Course Code: CSC621	**Discipline Specific Course - III** **B.Sc. (Honours) Computer Science - Semester VI** **Mobile Computing& Mobile Device Architecture**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the basics of wireless &mobile telecommunication system.	
CO2.	Understand the required functionality of each layer of Mobile Internet Protocol	
CO3.	Understand and identifying the GSM, GPRS and Bluetooth software model for mobile Computing.	
CO4.	Understand the design of Ad-Hoc Networks.	
CO5.	Understand different mobile platform and outline the various mobile applications.	
Course Content:		
Unit-1:	**INTRODUCTION** Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.	**8 Hours**
Unit-2:	**MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER** Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.	**8 Hours**
Unit-3:	**MOBILE TELECOMMUNICATION SYSTEM** Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).	**8 Hours**
Unit-4:	**MOBILE AD-HOC NETWORKS** Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET	**8 Hours**

	– Security.	
Unit-5:	**MOBILE PLATFORMS AND APPLICATIONS** Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.	**8 Hours**
Text Books:	1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI Learning Pvt. Ltd, New Delhi – 2012.	
Reference Books:	1. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, New Delhi, 2007. 2. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005. 3. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003. 4. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,Tata Mc Graw Hill Edition ,2006. 5. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education, 2002.	
Additional Electronic Reference Material:	1. Android Developers : http://developer.android.com/index.html 2. Apple Developer : https://developer.apple.com/ 3. Windows Phone Dev Center: http://developer.windowsphone.com 4. BlackBerry Developer: http://developer.blackberry.com/	

Course Code: CSC622	**Discipline Specific Course - III** **B.Sc. (Honours) Computer Science - Semester-VI** **Big Data Analytics**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the unstructured-nature, reason, drivers and applications of data i.e. big data.	
CO2.	Understand new way processing & paradigm of "divide and conquer" approach i.e. map-reduce algorithm and its applications.	
CO3.	Understand the concepts of Non-relational databases and querying tools.	
CO4.	Understand the fundaments of Hadoop, Hadoop- Architecture, Eco-system, data-formats, big data processing.	
CO5.	Apply big data processing on Hadoop	
Course Content:		
Unit-1:	**INTRODUCTION TO BIG DATA:** Introduction – What is big data, why big data, convergence of key trends, unstructured data, industry examples of big data, web analytics, big data in marketing,big data in medicine, ,big data technologies, ,cloud and big data mobile business intelligence, Crowd sourcing analytics , Four Vs, Drivers for Big data.	**8 Hours**
Unit-2:	Introduction to NoSQL , aggregate data models ,aggregates ,key-value and document data models, relationships, graph databases, schema less databases ,materialized views, distribution models , shading , master slave replication , peer-peer replication , shading and replication , consistency , relaxing consistency , version stamps , map reduce , partitioning and combining , composing map-reduce calculations, Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.	**8 Hours**
Unit-3:	**INTRODUCTION HADOOP:** BASICS OF HADOOP Data format , analyzing data with Hadoop , scaling out , Hadoop streaming , Hadoop pipes , design of Hadoop distributed file system (HDFS) , HDFS concepts , Java interface , data flow ,Hadoop I/O , data integrity , compression , serialization. **HADOOP ARCHITECTURE:** Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., Name Node, Secondary Name Node, and Data Node, Hadoop Map	**8 Hours**

	Reduce paradigm, Map and Reduce tasks, Job, Task trackers.	
Unit-4:	**HADOOP RELATED TOOLS**: Hbase, data model and implementations, Hbase clients, Hbase examples – praxis. Cassandra ,cassandra data model , cassandra examples , cassandra clients , Hadoop integration. Pig , Grunt , pig data model , Pig Latin , developing and testing Pig Latin scripts. Hive , data types and file formats , HiveQL data definition , HiveQL data manipulation – HiveQL queries	**8 Hours**
Unit-5:	**MAP REDUCE APPLICATIONS:** Map Reduce workflows , unit tests with MRUnit , test data and local tests – anatomy of Map Reduce job run , classic Map-reduce , YARN , failures in classic Map-reduce and YARN , job scheduling , shuffle and sort , task execution , Map Reduce types , input formats , output formats	**8 Hours**
Text Books:	1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions",Wiley, ISBN: 9788126551071, 2015.	
Reference Books:	1. Chris Eaton, Dirk deroos et al. , "Understanding Big data ", McGraw Hill. 2. Tom White, "HADOOP: The definitive Guide" , O Reilly . 3. VigneshPrajapati, "Big Data Analytics with R and Haoop", Packet Publishing . 4. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press. 5. JyLiebowitz, "Big Data and Business analytics",CRC press. 6. Chris Eaton, Dirk Deroos, Tom Deutsch et al., "Understanding Big Data", McGrawHIll.	
Additional Electronic Reference Material:	1. https://www.sas.com/en_us/insights/analytics/big-data-analytics.html	

Course Code: CSC623	**Discipline Specific Course - III** **B.Sc. (Honours) Computer Science - Semester VI** **NoSQL**	**L-3** **T-1** **P-0** **C-4**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the basic concepts of NOSQL including its four types of databases, MongoDB, Cassandra, HBASE, Neo4j and aggregate oriented databases.	
CO2.	Understand, and analyzing Replication and sharding, Map Reduce on databases. Distribution Models, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics.	
CO3.	Understand Column-oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra and Architecture of HBASE.	
CO4.	Understand NoSQL Key/Value databases using Riak, Key-Value Databases, Preferences, Shopping Cart Data, Multioperation Transactions, Query by Data, Operations by Sets.	
CO5.	Understand Graph NoSQL databases using Neo4,NoSQL database development tools and programming languages, Graph Databases, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services with Recommended Engines,	
Course Content:		
Unit-1:	Introduction: Overview,and History of NoSQL Databases Definition of the Four Types of NoSQL Database, The Value of Relational Databases, Getting at Persistent Data, Concurrency, Integration, Impedance Mismatch, Application and Integration Databases, Attack of the Clusters, The Emergence of NoSQL, Key Points. Comparison of relational databases to new NoSQL stores, MongoDB, Cassandra, HBASE, Neo4j use and deployment, Application, RDBMS approach, Challenges NoSQL approach, Key-Value and Document Data Models, Column-Family Stores, Aggregate-Oriented Databases.	**8 Hours**
Unit-2:	Replication and sharding, MapReduce on databases. Distribution Models, Single Server, Sharding, Master-Slave Replication, Peer-to-Peer Replication, Combining Sharding and Replication. NoSQL Key/Value databases using MongoDB, Document Databases, What Is a Document	**8 Hours**

	Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Web Analytics or Real-Time Analytics, E-Commerce Applications, When Not to Use, Complex Transactions Spanning Different Operations, Queries against Varying Aggregate Structure.	
Unit-3:	Column- oriented NoSQL databases using Apache HBASE, Column-oriented NoSQL databases using Apache Cassandra, Architecture of HBASE, What Is a Column-Family Data Store? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Event Logging, Content Management Systems, Blogging Platforms, Counters, Expiring Usage, When Not to Use.	**8 Hours**
Unit-4:	NoSQL Key/Value databases using Riak, Key-Value Databases, What Is a Key-Value Store, Key-Value Store Features, Consistency, Transactions, Query Features, Structure of Data, Scaling, Suitable Use Cases, Storing Session Information, User Profiles, Preferences, Shopping Cart Data, When Not to Use, Relationships among Data, Multioperation Transactions, Query by Data, Operations by Sets.	**8 Hours**
Unit-5:	Graph NoSQL databases using Neo4,NoSQL database development tools and programming languages, Graph Databases, What Is a Graph Database? Features, Consistency, Transactions, Availability, Query Features, Scaling, Suitable Use Cases, Connected Data, Routing, Dispatch, and Location-Based Services, Recommendation Engines, When Not to Use.	**8 Hours**
Text Books:	1. NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence , Author: Sadalage, P. & Fowler, Publication: Pearson Education	
Reference Books:	1. Redmond, E. &Wilson ,Seven Databases in Seven Weeks: A Guide to Modern Databases and the NoSQL Movement.	
Additional Electronic Reference Material:	1. https://www.mongodb.com/nosql-explained	

Course Code: **CSC657**	**Skill Enhancement Course - IV** **B.Sc. (Honours) Computer Science - Semester VI** **Programming in PHP and MySQL LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the working of basic programming in PHP and MySQL Lab.	
CO2.	Understand and designing the working of PHP and MySQL Lab.	
CO3.	Understand and designing the working of PHP and MySQL Lab.	
CO4.	Apply the arithmetic expressions using programming in PHP and MySQL Lab.	
CO5.	Apply the designing procedures to design basic project in programming in PHP and MySQL Lab	
Course Content:		
	1. Basic program related to looping, control statement and functions. 2. Program related to array. 3. Program related to string. 4. Program related to Global Variables. 5. Form Validation in PHP a. Write a HTML file to create a simple form with 5 input fieldsviz: Name, Password, b. Email, Pincode, Phone No. and a Submit button. c. Write a PHP program to demonstrate required field validations to validate that allinput fields are required. d. Write a PHP program to validate Name, Email and Password. e. Write a PHP program to display error messages if the above validations do not hold. f. Create a form for your college library entering student details for each student in the college. Validate the form	**20 Hours**

using PHP validators and display error messages.

6. File Handling in PHP

   a. Create a PHP program to demonstrate opening and closing a file.

   b. Create a PHP program to demonstrate reading a file.

   c. Create a PHP program to demonstrate writing in a file.

   d. Create a PHP program to read the following text from a file nitkkr.txt "National Institute of Technology, Kurukshetra (or NIT Kurukshetra), is a public engineering university located in Kurukshetra. In December 2008, it was accredited with the status of Institute of National Importance (INI)"And write to another file Coursephp.txt.

   e. Write a program in PHP to print the count of word the as an independent word in text file STORY.TXT. For example, if the content of the file STORY.TXT is "There was a monkey in the zoo. The monkey was very naughty." Then the output of the program should be 2.

7. Database in PHP

   a. Assume four users user1, user2, user3 and user4 having the passwords pwd1, pwd2, pwd3 and pwd4 respectively. Use PHP script for programs 1 and 2.

   b. Create a Cookie and add these four user ID"s and passwords to this Cookie.

   c. Read the User id and Passwords entered in the Login form and authenticate with the values (UserId and Passwords) available in the cookies. If he is a valid user (i.e., UserName and Password match) you should welcome him by name (UserName) else you should display "You are not an authenticated user".

   d. Write a PHP which does the following job: Insert the details of the 3 or 4 users who register with the web site by using registration form. Authenticate the user when he submits the login form using the UserName and Password from the database (instead of cookies).

   e. Create tables in the database which contain the details of items (books in our case like Book name, Price, Quantity, Amount) of each category. Modify your catalogue page in

	such a way that you should connect to the database and extract data from the tables and display them in the catalogue page using PHP. f. Create and delete MYSQL database using PHP. 8. Session Tracking in PHP a. Write a PHP program to start a PHP Session. b. Write a PHP program to destroy a PHP Session. c. WAP to create a PHP Session without cookies. d. Write a PHP program to store current date-time in a COOKIE and display the "Last visited on date-time on the web page upon reopening of the same page. e. Write a PHP program to store page views count in SESSION, to increment the count on each refresh, and to show the count on web page. 9. Program related to AJAX	

Course Code: **CSC656**	**Skill Enhancement Course - IV** **B.Sc. (Honours) Computer Science - Semester VI** **ASP.Net with MVC Architecture LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the concept of MVC framework with ASP.Net to create simple web applications.	
CO2.	Apply the concept of MVC framework with ASP.Net to create simple web applications.	
CO3.	Apply ASP.Net with Ajax to create web applications.	
CO4.	Apply ASP.Net with Ajax to create window applications.	
CO5.	Develop Desktop and Web Applications.	
Course Content:		
	1. The use of sequence, conditional and iteration construct. 2. Various operators like logical, arithmetical, relational, etc. 3. Overloading of various operators. 4. Use of Static Member functions, optional arguments. 5. Use of destructor and various types of constructor. 6. Various forms of Inheritance. 7. Use of Interface in multiple inheritance, virtual and override concept, delegates. 8. File operation. 9. Create windows based application with connected and disconnected architecture. 10. Simple web application using ASP Net. 11. Use of Active X controls. 12. Create web application using ASP.Net with Ajax and Ajax Control Toolkits provided by 13. Microsoft. 14. Create Window application using ASP.Net with Ajax and Ajax Control Toolkits provided by Microsoft. **Note: Students are advised to develop a small project based on MVC illustrating the handling of database and screens in order to fully understand the C#.**	**20 Hours**

Course Code: CSC658	**Discipline Specific Elective Course - IV** **B.Sc. (Honours) Computer Science - Semester VI** **Concepts of Mobile Computing LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand and Designing mobile and pervasive computing applications and services.	
CO2.	Understand contemporary development environment and languages (WML and J2ME) to develop mobile applications.	
CO3.	Understand role as a member of a team to complete a large programming project.	
CO4.	Apply Authentication and encryption technique used in GSM	
CO5.	Design typical functionalities of modern smartphones e.g. personal phone book containing the name, phone no., address, e-mail,etc	
Course Content:		
	1. Study of WML and J2ME simulators 2. Design of simple Calculator having +,,,* and / using WML/J2ME 3. Design of Calendar for any given month and year using WML/J2ME 4. Design a Timer to System Time using WML/J2ME 5. Design of simple game using WML/J2ME 6. Animate an image using WML/J2ME 7. Design a personal phone book containing the name, phone no., address, e-mail,etc. 8. Simulation of Authentication and encryption technique used in GSM 9. Browsing the Internet using Mobile phone simulator 10. Study of GlomoSim Simulator	**20 Hours**

Course Code: CSC659	**Discipline Specific Elective Course - IV** **B.Sc. (Honours) Computer Science - Semester VI** **Big Data Analytics LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand and using generic platform i.e. linux for tools like Hadoop.	
CO2.	Understand how to use hadoop cluster for big data processing and analytics	
CO3.	Apply known applications of map-reduce algorithms over hadoop and analyze the same.	
CO4.	Apply aided tools of eco-system of big data processor to maintain and administer the cluster.	
CO5.	Design applications on Hadoop	
Course Content:		
	1. Basic commands of linux. 2. Basic commands of HDFS. 3. Introduction, use and assessment of most recent advancements in Big Data technology along with their usage and implementation with relevant tools and technologies. 4. Map Reduce application for word counting on Hadoop cluster. 5. Unstructured data into NoSQL data and do all operations such as NoSQL query with API. 6. Getting maximum temp from temp data using map reduce. 7. Page Rank Computation. 8. Use Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data Analytics	**20 Hours**

Course Code: CSC660	**Discipline Specific Elective Course - IV** **B.Sc. (Honours) Computer Science - Semester VI** **NoSQL LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand the concept of MongoDB and its Installation on Windows &Linux.	
CO2.	Understanding AND/OR operations, Limit Records and Sort Records, Indexing, Advanced Indexing, Aggregation and Map Reducein MongoDB	
CO3.	Apply and creating database and show database using MongoDB shell.	
CO4.	Apply Queries related to Insert Update, Delete, Projection and Where Clause equivalent using MongoDB.	
CO5.	Analyze document oriented and column oriented databases study, queries and practices	
Course Content:		
	Experiments based on the following topics: 1. Introduction and Getting Started 2. Creating and Inserting Documents 3. Updating and Deleting Documents 4. Querying 5. Indexing 6. Aggregation – Aggregation Framework 7. Aggregation – MapReduce 8. Sharding	**20 Hours**

Course Code: CSC661	**Core Course - XXVI** **B.Sc. (Honours) Computer Science – Semester VI** **Machine Learning using Python LAB**	**L-0** **T-0** **P-4** **C-2**
Course Outcomes:	**On completion of the course, the students will be :**	
CO1.	Understand how to import data, clean data and prepare training, testing and validation data in python.	
CO2.	Apply python to train an algorithm to make a machine intelligent to take decisions like human	
CO3.	Apply various techniques and algorithms for regression, classification and clustering with python, the widely used language having most sophisticated machine learning libraries.	
CO4.	Analyze the efficiency of model after implementation in python.	
CO5.	Develop ecosystem by preparing a model that uses other models and used by other models in machine learning ecosystem	
Course Content:		
	1. Apply EM algorithm to cluster a set of data stored in a .CSV file. 2. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. 3. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. 4. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. 5. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task.	**20 Hours**