

# **KONGU ENGINEERING COLLEGE**

(Autonomous Institution Affiliated to Anna University, Chennai)

**PERUNDURAI ERODE – 638 060**

**TAMILNADU INDIA**



## **REGULATIONS, CURRICULUM & SYLLABI - 2020**

**(CHOICE BASED CREDIT SYSTEM)**

**(For the students admitted during 2020 - 2021 and onwards)**

### **MASTER OF SCIENCE IN SOFTWARE SYSTEMS**

**DEPARTMENT OF COMPUTER TECHNOLOGY-PG**





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**KONGU ENGINEERING COLLEGE  
PERUNDURAI ERODE – 638 060  
(Autonomous)**

**INSTITUTE VISION**

To be a centre of excellence for development and dissemination of knowledge in Applied Sciences, Technology, Engineering and Management for the Nation and beyond.

**INSTITUTE MISSION**

We are committed to value based Education, Research and Consultancy in Engineering and Management and to bring out technically competent, ethically strong and quality professionals to keep our Nation ahead in the competitive knowledge intensive world.

**QUALITY POLICY**

We are committed to

- Provide value based quality education for developing the student as a competent and responsible citizen.
- Contribute to the nation and beyond through the state-of-the-art technology.
- Continuously improve our services.

**DEPARTMENT OF COMPUTER TECHNOLOGY-PG**

**VISION**

To become a technically competent centre in the domain of Computer Science to meet the changing needs of nation and beyond.

**MISSION**

Department of Computer Technology – PG is committed to:

- M1: Inculcate conceptual knowledge with profound practical and real time industry exposure to the students.
- M2: Nourish a learning ambience to enhance innovations, problem solving skills, leadership qualities, team-spirit and ethical responsibilities.
- M3: Vitalize the students to acquire entrepreneurial skills to become global leaders.

**PROGRAM EDUCATIONAL OBJECTIVES (PEOs)**

Graduate of Software Systems will:

- PEO1: Work productively as high competent software professionals with strong domain knowledge to develop smart solutions for the upliftment of society.
- PEO2: Emerge successful entrepreneurs with the strong business managerial skills.
- PEO3: Exhibit eternal improvement to enhance knowledge and skills through life-long learning appreciating human values and ethics.

**MAPPING OF MISSION STATEMENTS (M) WITH PEOs**

<b>M\PEO</b>	<b>PEO1</b>	<b>PEO2</b>	<b>PEO3</b>
<b>M1</b>	3	2	2
<b>M2</b>	3	2	2
<b>M3</b>	2	3	1

1 – Slight, 2 – Moderate, 3 – Substantial

**PROGRAM OUTCOMES (POs)**

Graduates of Software Systems will:

- PO1 Computational knowledge:** Apply knowledge of mathematics and computing to the abstraction and conceptualization of computing models from defined problems and requirements.
- PO2 Problem analysis:** Identify, formulate and solve complex computing problems reaching substantiated conclusions using fundamental principles of mathematics and computer science.
- PO3 Design/development of solutions:** Design solutions for well defined computing problems and design systems components or processes that meet the specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations
- PO4 Conduct investigations of complex computing problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
- PO5 Modern tool usage:** Create, select and apply appropriate techniques, resources, and computing technologies necessary for computing practices.
- PO6 Professional Ethics:** Understand and practice professional ethics in multidisciplinary environments
- PO7 Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.
- PO8 Project management and finance:** Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team, to manage projects in multidisciplinary environments.
- PO9 Communication Efficacy:** Communicate effectively on broadly defined computing community and with society by being able to comprehend and write effective reports, design documentation and make effective presentations.
- PO10 Societal and Environmental Concern:** Understand and assess societal, environmental, health, safety, legal and cultural issues within local and global contexts and the consequential responsibilities relevant to professional computing practice.
- PO11 Individual and team work:** Function effectively as an individual and as a member or leader in diverse technical teams.
- PO12 Innovation and Entrepreneurship:** Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth to succeed as an employee or an entrepreneur.

**PROGRAM SPECIFIC OUTCOMES (PSOs)**

Graduates of Software Systems will:	
<b>PSO1</b>	Apply knowledge in diverse areas of computer science and experience an environment conducive in cultivating skills for successful career and entrepreneurship extend relate.
<b>PSO2</b>	Identify the suitable mathematical solution and computing skills required to provide reliable solutions for the real world problems.

**MAPPING OF PEOs WITH POs AND PSOs**

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>PEO1</b>	3	2	1	1	-	-	-	1	3	3	1	-	3	2
<b>PEO2</b>	3	3	2	2	1	1	-	3	3	1	3	3	-	3
<b>PEO3</b>	3	3	2	2	1	3	3	-	-	3	1	1	1	2

1 – Slight, 2 – Moderate, 3 – Substantial



**KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060**

**(An Autonomous Institution Affiliated to Anna University)**

**REGULATIONS 2020**

**CHOICE BASED CREDIT SYSTEM AND OUTCOME BASED EDUCATION**

**MASTER OF SCIENCE (MSc) DEGREE PROGRAMME – 5 YEARS**

**These regulations are applicable to all candidates admitted into MSc Degree programmes from the academic year 2020 – 2021 onwards.**

**1. DEFINITIONS AND NOMENCLATURE**

In these Regulations, unless otherwise specified:

- i. “University” means ANNA UNIVERSITY, Chennai.
- ii. “College” means KONGU ENGINEERING COLLEGE.
- iii. “Programme” means Master of Science (MSc) Degree programme
- iv. “Branch” means specialization or discipline of MSc Degree Programme, like Software Systems, etc.
- v. “Course” means a Theory / Theory cum Practical / Practical course that is normally studied in a semester like Computer Architecture, Data structures etc.
- vi. “Credit” means a numerical value allocated to each course to describe the candidate’s workload required per week.
- vii. “Grade” means the letter grade assigned to each course based on the marks range specified.
- viii. “Grade point” means a numerical value (0 to 10) allocated based on the grade assigned to each course.
- ix. “Principal” means Chairman, Academic Council of the College.
- x. “Controller of Examinations” means authorized person who is responsible for all examination related activities of the College.
- xi. “Head of the Department” means Head of the Department concerned of the College.



## 2. PROGRAMME AND BRANCH OF STUDY

The MSc programme in Software Systems approved by Anna University, Chennai is offered by the college.

## 3. ADMISSION REQUIREMENTS

Candidates for admission to the first semester of the MSc Programme shall be required to have passed the Higher Secondary Examination (academic / vocational) of the (10+2) curriculum prescribed by the appropriate authority of Govt. of Tamil Nadu or any examination of any other authority accepted by the Anna University, Chennai as equivalent thereto.

## 4. STRUCTURE OF PROGRAMMES

### 4.1 Categorisation of Courses

The MSc programme shall have a curriculum with syllabi comprising of theory, theory cum practical, practical courses in each semester, professional skills training/industrial training, project work, internship, etc that have been approved by the respective Board of Studies and Academic Council of the College. All the programmes have well defined Programme Outcomes (PO), Programme Specific Outcomes (PSO) and Programme Educational Objectives (PEOs) as per Outcome Based Education (OBE). The content of each course is designed based on the Course Outcomes (CO). The courses shall be categorized as follows:

- i. Humanities and Social Sciences (HS) including Management Courses
- ii. Basic Science (BS) Courses
- iii. Engineering Science (ES) Courses
- iv. Professional Core (PC) Courses
- v. Professional Elective (PE) Courses
- vi. Employability Enhancement Courses (EC) like Mini Project, Project work, Professional Skills Training, Industrial Training, Entrepreneurships/Start ups and Internship in Industry or elsewhere
- vii. Audit Courses (AC)
- viii. Mandatory Courses (MC) like Student Induction Program and Universal Human Values.

### 4.2 Credit Assignment

#### 4.2.1. Credit Assignment

Each course is assigned certain number of credits as follows:

Contact period per week	Credits
1 Lecture / Tutorial Period	1
2 Practical Periods	1
2 Project Work Periods	1
40 Training / Internship Periods	1

The minimum number of credits to complete the MSc programme is 205.



### 4.3 Employability Enhancement Courses

A candidate shall be offered with the employability enhancement courses like project work, internship, professional skills training/ industrial training, internship and entrepreneurs/start ups during the programme to gain/exhibit the knowledge/skills.

#### 4.3.1 Professional Skills Training/Industrial Training/ Entrepreneurs/Start Ups

A candidate may be offered with appropriate training courses imparting programming skills, communication skills, problem solving skills, aptitude skills etc. It is offered in two phases as phase-I in fifth semester and phase-II in sixth semester including vacation periods and each phase can carry two credits.

(OR)

A candidate may be allowed to go for training at research organizations or industries for a required number of hours in sixth semester vacation period. Such candidate can earn two credits for this training course in place of Professional Skills Training Phase-II in sixth semester. He/She shall attend Professional Skills Training Phase-I in fifth semester and can earn two credits.

(OR)

A candidate may be allowed to set up a start up and working part-time for the start ups by applying his/her innovations and can become a student entrepreneur during MSc programme. Candidates can set up their start up from fifth semester onwards either inside or outside of the college. Such student entrepreneurs may earn a maximum of 2 credits per semester for two semesters each in place of either Professional Skills Training-I / II or Industrial Training-I/ II respectively. The area in which the candidate wants to initiate a start up may be interdisciplinary or multidisciplinary. The progress of the startup shall be evaluated by a panel of members constituted by the Principal through periodic reviews.

#### 4.3.2 Internships

The curriculum enables a candidate to go for full time projects through internship during entire seventh semester and/or entire final semester and can earn credits through it for his/her academics vide clause 7.6 and 7.11.

A candidate is permitted to go for full time projects through internship in seventh semester with the following condition: The candidate shall complete a part of the seventh semester courses with a total credit of about 50% of the total credits of seventh semester including Project Work-I in the first two months from the commencement of the seventh semester under fast track mode. The balance credits required to complete the seventh semester shall be earned by the candidate through either approved Value Added Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

A candidate is permitted to go for full time projects through internship during final semester. Such candidate shall earn the minimum number of credits required to complete final semester other than project through either approved Value Added Courses /Online courses / Self Study Courses or Add/Drop courses as per clause 4.4 and clause 4.5 respectively.

Assessment procedure is to be followed as specified in the guidelines approved by the Academic Council.



#### **4.4 Value Added Courses / Online Courses / Self Study Courses**

The candidates may optionally undergo Value Added Courses / Online Courses / Self Study Courses as elective courses.

**4.4.1 Value Added Courses:** Value Added courses each with One / Two credits shall be offered by the college with the prior approval from the respective Board of Studies. A candidate can earn a maximum of six credits through value added courses during the entire duration of the programme.

**4.4.2 Online Courses:** Candidates may be permitted to earn credits for online courses, offered by NPTEL / SWAYAM / a University / Other Agencies, approved by the respective Board of Studies.

**4.4.3 Self Study Courses:** The Department may offer an elective course as a self study course. The syllabus of the course shall be approved by the respective Board of Studies. However, mode of assessment for a self study course will be the same as that used for other courses. The candidates shall study such courses on their own under the guidance of member of the faculty. Self study course is limited to one per semester.

**4.4.4** The elective courses in the ninth semester may be exempted if a candidate earns the required credits vide clause 4.4.1, 4.4.2 and 4.4.3 by registering the required number of courses in advance.

**4.4.5** A candidate can earn a maximum of 35 credits through all value added courses, online courses and self study courses.

#### **4.5 Flexibility to Add or Drop Courses**

**4.5.1** A candidate has to earn the total number of credits specified in the curriculum of the respective programme of study in order to be eligible to obtain the degree. However, if the candidate wishes, then the candidate is permitted to earn more than the total number of credits prescribed in the curriculum of the candidate's programme.

**4.5.2** From the fifth to ninth semesters the candidates have the option of registering for additional elective courses or dropping of already registered additional elective courses within two weeks from the start of the semester. Add / Drop is only an option given to the candidates. Total number of credits of such courses during the entire programme of study cannot exceed six.

**4.6** Maximum number of credits the candidate can enroll in a particular semester cannot exceed 30 credits.

**4.7** The blend of different courses shall be so designed that the candidate at the end of the programme would have been trained not only in his / her relevant professional field but also would have developed to become a socially conscious human being.

**4.8** The medium of instruction, examinations and project report shall be English.



## **5. DURATION OF THE PROGRAMME**

- 5.1** A candidate is normally expected to complete the MSc Degree programme in 10 consecutive semesters (5 Years), but in any case not more than 16 semesters (8 Years).
- 5.2** Each semester shall consist of a minimum of 90 working days including continuous assessment test period. The Head of the Department shall ensure that every teacher imparts instruction as per the number of periods specified in the syllabus for the course being taught.
- 5.3** The total duration for completion of the programme reckoned from the commencement of the first semester to which the candidate was admitted shall not exceed the maximum duration specified in clause 5.1 irrespective of the period of break of study (vide clause 11) or prevention (vide clause 9) in order that the candidate may be eligible for the award of the degree (vide clause 16). Extension beyond the prescribed period shall not be permitted.

## **6. COURSE REGISTRATION FOR THE EXAMINATION**

- 6.1** Registration for the end semester examination is mandatory for courses in the current semester as well as for the arrear courses failing which the candidate will not be permitted to move on to the higher semester. This will not be applicable for the courses which do not have an end semester examination.
- 6.2** The candidates who need to reappear for the courses which have only continuous assessment shall enroll for the same in the subsequent semester, when offered next, and repeat the course. In this case, the candidate shall attend the classes, satisfy the attendance requirements (vide clause 8), earn continuous assessment marks. This will be considered as an attempt for the purpose of classification.
- 6.3** If a candidate is prevented from writing end semester examination of a course due to lack of attendance, the candidate has to attend the classes, when offered next, and fulfill the attendance requirements as per clause 8 and earn continuous assessment marks. If the course, in which the candidate has a lack of attendance, is an elective, the candidate may register for the same or any other elective course in the subsequent semesters and that will be considered as an attempt for the purpose of classification.



## 7. ASSESSMENT AND EXAMINATION PROCEDURE FOR AWARDING MARKS

**7.1** The MSc programme consist of Theory Courses, Theory cum Practical courses, Practical courses, Mini Project, Project Work, Professional Skills Training/ Industrial Training, Internship and Entrepreneurships/ Start ups. Performance in each course of study shall be evaluated based on (i) Continuous Assessments (CA) throughout the semester and (ii) End Semester Examination (ESE) at the end of the semester except for the courses which are evaluated based on continuous assessment only. Each course shall be evaluated for a maximum of 100 marks as shown below:

Sl. No.	Category of Course	Continuous Assessment Marks	End Semester Examination
1.	Theory / Practical	50	50
2.	Theory cum Practical	The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components respectively.	
3.	Professional Skills Training / Industrial Training / Entrepreneurships / Start ups / Mandatory Course	100	---
4.	Mini Project/Project Work-I/ Project Work-II / Internships	50	50
5.	Value Added Course	The distribution of marks shall be decided based on the credit weightage assigned	
6.	All other Courses		

**7.2** Examiners for setting end semester examination question papers for theory courses, theory cum practical courses and practical courses and evaluating end semester examination answer scripts, project works, internships and entrepreneurships/start ups shall be appointed by the Controller of Examinations after obtaining approval from the Principal.

### 7.3 Theory Courses

For all theory courses out of 100 marks, the continuous assessment shall be 50 marks and the end semester examination shall be for 50 marks. However, the end semester examinations shall be conducted for 100 marks and the marks obtained shall be reduced to 50. The continuous assessment tests shall be conducted as per the schedule laid down in the academic schedule. Three tests shall be conducted for 50 marks each and reduced to 30 marks each. The total of the continuous assessment marks and the end semester examination marks shall be rounded off to the nearest integer.

**7.3.1** The assessment pattern for awarding continuous assessment marks shall be as follows:



Sl. No.	Type	Max. Marks	Remarks
1.	Test – I	30	Average of best two
	Test – II	30	
	Test - III	30	
2.	Tutorial	15	Should be of Open Book/Objective Type. Average of best 4 (or more, depending on the nature of the course, as may be approved by Principal)
3.	Assignment / Paper Presentation in Conference / Seminar / Comprehension / Activity based learning / Class notes	05	To be assessed by the Course Teacher based on any one type.
Total		50	Rounded off to the one decimal place

However, the assessment pattern for awarding the continuous assessment marks may be changed based on the nature of the course and is to be approved by the Principal.

**7.3.2** A reassessment test or tutorial covering the respective test or tutorial portions may be conducted for those candidates who were absent with valid reasons (Sports or any other reason approved by the Principal).

**7.3.3** The end semester examination for theory courses shall be for a duration of three hours and shall be conducted between November and January during odd semesters and between April and June during even semesters every year.

#### **7.4 Theory cum Practical Courses**

For courses involving theory and practical components, the evaluation pattern as per the clause 7.1 shall be followed. Depending on the nature of the course, the end semester examination shall be conducted for theory and the practical components. The apportionment of continuous assessment and end semester examination marks shall be decided based on the credit weightage assigned to theory and practical components approved by Principal.

#### **7.5 Practical Courses**

For all practical courses out of 100 marks, the continuous assessment shall be for 50 marks and the end semester examination shall be for 50 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidate's records shall be maintained.

**7.5.1** The assessment pattern for awarding continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course, and shall be based on rubrics for each experiment.

**7.6 Project Work-I/Project Work-II**

**7.6.1** Project work shall be carried out individually. The project work is mandatory for all the candidates.

**7.6.2** The Head of the Department shall constitute review committee for project work. There shall be two assessments by the review committee during the semester. The candidate shall make presentation on the progress made by him/her before the committee.

**7.6.3** The continuous assessment and end semester examination marks for Project Work and the Viva-Voce Examination shall be distributed as below.

Continuous Assessment (Max. 50 Marks)						End Semester Examination (Max. 50 Marks)			
Review I (Max.. 10 Marks)		Review II (Max.. 20 Marks)		Review III (Max. 20 Marks)		Report Evaluation (Max. 20 Marks)	Viva -Voce (Max. 30 Marks)		
Rv. Com	Guide	Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide	Ext. Exr.	Guide	Exr.1	Exr.2
5	5	10	10	10	10	20	10	10	10

**7.6.4** The Project Report prepared according to approved guidelines and duly signed by the Supervisor shall be submitted to Head of the Department. The candidate(s) must submit the project report within the specified date as per the academic schedule of the semester. If the project report is not submitted within the specified date then the candidate is deemed to have failed in the Project Work and redo it in the subsequent semester.

**7.6.5** If a candidate fails to secure 50% of the continuous assessment marks in the project work, he / she shall not be permitted to submit the report for that particular semester and shall have to redo it in the subsequent semester and satisfy attendance requirements.

**7.6.6** Every candidate shall, based on his/her Project Work-II, publish a paper in a reputed journal or reputed conference in which full papers are published after usual review. A copy of the full paper accepted and proof for that shall be produced at the time of evaluation.

**7.6.7** The project work shall be evaluated based on the project report submitted by the candidate in the respective semester and viva-voce examination by a committee consisting of two examiners and guide of the project work.

**7.6.8** If a candidate fails to secure 50 % of the end semester examination marks in the project work, he / she shall be required to resubmit the project report within 30 days from the date of declaration of the results and a fresh viva-voce examination shall be conducted as per clause 7.6.7.

**7.6.9** A copy of the approved project report after the successful completion of viva-voce examination shall be kept in the department library.



**7.7 Mini Project**

The evaluation method shall be same as that of the Project Work-I as per clause 7.6 excluding clause 7.6.6.

**7.8 Industrial Training**

After completion of Industrial training, the candidate shall submit a brief report on the training undergone and a certificate obtained from the organization concerned. The evaluation will be made based on this report and a Viva-Voce Examination. A copy of the certificate (issued by the Organization) submitted by the candidate shall be attached to the mark list and sent to Controller of Examinations by the respective Head of the Department.

Continuous Assessment (Max. 100 Marks)		
Report Evaluation (Max. 40 Marks)	Viva - Voce (Max. 60 Marks)	
Review Committee	Guide	Review Committee
40	20	40

**7.9 Professional Skills Training**

Phase-I training shall be conducted for minimum 80 hours in 4<sup>th</sup> semester vacation and during 5<sup>th</sup> semester. Phase-II training shall be conducted for minimum 80 hours in 5<sup>th</sup> semester vacation and during 6<sup>th</sup> semester. The evaluation procedure shall be approved by Principal.

**7.10 Entrepreneurships/ Start ups**

A start up/business model may be started by a candidate individually or by a group of maximum of three candidates during the programme vide clause 4.3.1. The head of the department concerned shall assign a faculty member as a mentor for each start up.

A review committee shall be formed by the Principal for reviewing the progress of the Start-ups / Business models, innovativeness, etc. The review committee can recommend the appropriate grades for academic performance for the candidate(s) involved in the start ups. This course shall carry a maximum of two credits in fifth semester and two credits in sixth semester respectively and shall be evaluated through continuous assessments for a maximum of 100 marks vide clause 7.1. A report about the start ups is to be submitted to the review committee for evaluation for each start up and the marks will be given to Controller of Examinations after getting approval from Principal.

**7.11 Projects through Internships**

Each candidate shall submit a brief report about the project through internship undergone and a certificate issued from the organization concerned at the time of Viva-voce examination to the review committee. The evaluation method shall be same as that of the Project Work-II as per clause 7.6 excluding 7.6.6.

**7.12 Value Added Course**

Minimum of two assessments shall be conducted during the value added course duration by the offering department concerned.

**7.13 Online Course**

The Board of Studies will provide methodology for the evaluation of the online courses. The Board can decide whether to evaluate the online courses through continuous assessment and end semester examination or through end semester examination only. In



case of credits earned through online mode from NPTEL / SWAYAM / a University / Other Agencies approved by Chairman, Academic Council, the credits may be transferred and grades shall be assigned accordingly.

#### **7.14 Self Study Course**

The member of faculty approved by the Head of the Department shall be responsible for periodic monitoring and evaluation of the course. The course shall be evaluated through continuous assessment and end semester examination. The evaluation methodology shall be the same as that of a theory course.

#### **7.15 Audit Course**

A candidate may be permitted to register for specific course not listed in his/her programme curriculum and without undergoing the rigors of getting a 'good' grade, as an Audit course, subject to the following conditions.

The candidate can register only one Audit course in a semester starting from second semester subject to a maximum of two courses during the entire programme of study. Such courses shall be indicated as 'Audit' during the time of Registration itself. Only courses currently offered for credit to the candidates of other branches can be audited.

A course appearing in the curriculum of a candidate cannot be considered as an audit course. However, if a candidate has already met the Professional Elective and Open Elective credit requirements as stipulated in the curriculum, then, a Professional Elective or an Open Elective course listed in the curriculum and not taken by the candidate for credit can be considered as an audit course.

Candidates registering for an audit course shall meet all the assessment and examination requirements (vide clause 7.3) applicable for a credit candidate of that course. Only if the candidate obtains a performance grade, the course will be listed in the semester Grade Sheet and in the Consolidated Grade Sheet along with the grade SF (Satisfactory). Performance grade will not be shown for the audit course.

Since an audit course has no grade points assigned, it will not be counted for the purpose of GPA and CGPA calculations.

#### **7.16 Mandatory Course**

A candidate shall attend and complete the induction training program of duration three weeks at the beginning of the first semester. It is mandatory for all candidates who have joined in MSc programme. No credits shall be given for such courses and shall be evaluated through continuous assessment tests only vide clause 7.1 for a maximum of 100 marks each. Since these courses have no grade points assigned, these courses will not be counted for the purpose of GPA and CGPA calculations.

### **8. REQUIREMENTS FOR COMPLETION OF A SEMESTER**

**8.1** A candidate who has fulfilled the following conditions shall be deemed to have satisfied the requirements for completion of a semester and permitted to appear for the examinations of that semester.

**8.1.1** Ideally, every candidate is expected to attend all classes and secure 100 % attendance. However, a candidate shall secure not less than 80 % (after rounding off to the nearest integer) of the overall attendance taking into account the total number of working days in a semester.



**8.1.2** A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to medical reasons (hospitalization / accident / specific illness) but has secured not less than 70 % in the current semester may be permitted to appear for the current semester examinations with the approval of the Principal on payment of a condonation fee as may be fixed by the authorities from time to time. The medical certificate needs to be submitted along with the leave application. A candidate can avail this provision only twice during the entire duration of the degree programme.

A candidate who could not satisfy the attendance requirements as per clause 8.1.1 due to his/her entrepreneurs/ start ups activities, but has secured not less than 60 % in the current semester can be permitted to appear for the current semester examinations with the recommendation of review committee and approval from the Principal.

**8.1.3** In addition to clause 8.1.1 or 8.1.2, a candidate shall secure not less than 60 % attendance in each course.

**8.1.4** A candidate shall be deemed to have completed the requirements of study of any semester only if he/she has satisfied the attendance requirements (vide clause 8.1.1 to 8.1.3) and has registered for examination by paying the prescribed fee.

**8.1.5** Candidate's progress is satisfactory.

**8.1.6** Candidate's conduct is satisfactory and he/she was not involved in any indisciplined activities in the current semester.

**8.2.** The candidates who do not complete the semester as per clauses from 8.1.1 to 8.1.6 except 8.1.3 shall not be permitted to appear for the examinations at the end of the semester and not be permitted to go to the next semester. They have to repeat the incomplete semester in next academic year.

**8.3** The candidates who satisfy the clause 8.1.1 or 8.1.2 but do not complete the course as per clause 8.1.3 shall not be permitted to appear for the end semester examination of that course alone. They have to repeat the incomplete course in the subsequent semester when it is offered next.

## **9. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION**

**9.1** A candidate shall normally be permitted to appear for end semester examination of the current semester if he/she has satisfied the semester completion requirements as per clause 8, and has registered for examination in all courses of that semester. Registration is mandatory for current semester examinations as well as for arrear examinations failing which the candidate shall not be permitted to move on to the higher semester.

**9.2** When a candidate is deputed for a National / International Sports event during End Semester examination period, supplementary examination shall be conducted for such a candidate on return after participating in the event within a reasonable period of time. Such appearance shall be considered as first appearance.

**9.3** A candidate who has already appeared for a course in a semester and passed the examination is not entitled to reappear in the same course for improvement of letter grades / marks.



## **10. PROVISION FOR WITHDRAWAL FROM EXAMINATIONS**

- 10.1** A candidate may, for valid reasons, be granted permission to withdraw from appearing for the examination in any regular course or all regular courses registered in a particular semester. Application for withdrawal is permitted only once during the entire duration of the degree programme.
- 10.2** The withdrawal application shall be valid only if the candidate is otherwise eligible to write the examination (vide clause 9) and has applied to the Principal for permission prior to the last examination of that semester after duly recommended by the Head of the Department.
- 10.3** The withdrawal shall not be considered as an appearance for deciding the eligibility of a candidate for First Class with Distinction/First Class.
- 10.4** If a candidate withdraws a course or courses from writing end semester examinations, he/she shall register the same in the subsequent semester and write the end semester examinations. A final semester candidate who has withdrawn shall be permitted to appear for supplementary examination to be conducted within reasonable time as per clause 14.
- 10.5** The final semester candidate who has withdrawn from appearing for project viva-voce for genuine reasons shall be permitted to appear for supplementary viva-voce examination within reasonable time with proper application to Controller of Examinations and on payment of prescribed fee.

## **11. PROVISION FOR BREAK OF STUDY**

- 11.1** A candidate is normally permitted to avail the authorised break of study under valid reasons (such as accident or hospitalization due to prolonged ill health or any other valid reasons) and to rejoin the programme in a later semester. He/She shall apply in advance to the Principal, through the Head of the Department, stating the reasons therefore, in any case, not later than the last date for registering for that semester examination. A candidate is permitted to avail the authorised break of study only once during the entire period of study for a maximum period of one year. However, in extraordinary situation the candidate may apply for additional break of study not exceeding another one year by paying prescribed fee for the break of study.
- 11.2** The candidates permitted to rejoin the programme after break of study / prevention due to lack of attendance shall be governed by the rules and regulations in force at the time of rejoining.
- 11.3** The candidates rejoining in new Regulations shall apply to the Principal in the prescribed format through Head of the Department at the beginning of the readmitted semester itself for prescribing additional/equivalent courses, if any, from any semester of the regulations in-force, so as to bridge the curriculum in-force and the old curriculum.
- 11.4** The total period of completion of the programme reckoned from the commencement of the semester to which the candidate was admitted shall not exceed the maximum period specified in clause 5 irrespective of the period of break of study in order to qualify for the award of the degree.



- 11.5** If any candidate is prevented for want of required attendance, the period of prevention shall not be considered as authorized break of study.
- 11.6** If a candidate has not reported to the college for a period of two consecutive semesters without any intimation, the name of the candidate shall be deleted permanently from the college enrollment. Such candidates are not entitled to seek readmission under any circumstances.

## **12. PASSING REQUIREMENTS**

- 12.1** A candidate who secures not less than 50 % of total marks (continuous assessment and end semester examination put together) prescribed for the course with a minimum of 50 % of the marks prescribed for the end semester examination in all category of courses vide clause 7.1 except for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course in the examination.
- 12.2** A candidate who secures not less than 50 % in continuous assessment marks prescribed for the courses which are evaluated based on continuous assessment only shall be declared to have successfully passed the course. If a candidate secures less than 50% in the continuous assessment marks, he / she shall have to re-enroll for the same in the subsequent semester and satisfy the attendance requirements.
- 12.3** For a candidate who does not satisfy the clause 12.1, the continuous assessment marks secured by the candidate in the first attempt shall be retained and considered valid for subsequent attempts. However, from the fourth attempt onwards the marks scored in the end semester examinations alone shall be considered, in which case the candidate shall secure minimum 50 % marks in the end semester examinations to satisfy the passing requirements.

## **13. REVALUATION OF ANSWER SCRIPTS**

A candidate shall apply for a photocopy of his / her semester examination answer script within a reasonable time from the declaration of results, on payment of a prescribed fee by submitting the proper application to the Controller of Examinations. The answer script shall be pursued and justified jointly by a faculty member who has handled the course and the course coordinator and recommended for revaluation. Based on the recommendation, the candidate can register for revaluation through proper application to the Controller of Examinations. The Controller of Examinations will arrange for revaluation and the results will be intimated to the candidate concerned. Revaluation is permitted only for Theory courses and Theory cum Practical courses where end semester examination is involved.

## **14. SUPPLEMENTARY EXAMINATION**

If a candidate fails to clear all courses in the final semester after the announcement of final end semester examination results, he/she shall be allowed to take up supplementary examinations to be conducted within a reasonable time for the courses of final semester alone, so that he/she gets a chance to complete the programme.

## 15. AWARD OF LETTER GRADES

Range of % of Total Marks	Letter Grade	Grade Point
91 to 100	O (Outstanding)	10
81 to 90	A+ (Excellent)	9
71 to 80	A (Very Good)	8
61 to 70	B+ (Good)	7
50 to 60	B (Average)	6
Less than 50	RA (Reappear)	0
Satisfactory	SF	0
Withdrawal	W	-
Absent	AB	-
Shortage of Attendance in a course	SA	-

The Grade Point Average (GPA) is calculated using the formula:

$$\text{GPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in the specific semester}}{\sum(\text{course credits}) \text{ for all courses in the specific semester}}$$

The Cumulative Grade Point Average (CGPA) is calculated from first semester (third semester for lateral entry candidates) to final semester using the formula

$$\text{CGPA} = \frac{\sum[(\text{course credits}) \times (\text{grade points})] \text{ for all courses in all the semesters so far}}{\sum(\text{course credits}) \text{ for all courses in all the semesters so far}}$$

The GPA and CGPA are computed only for the candidates with a pass in all the courses.

The GPA and CGPA indicate the academic performance of a candidate at the end of a semester and at the end of successive semesters respectively.

A grade sheet for each semester shall be issued containing Grade obtained in each course, GPA and CGPA.

A duplicate copy, if required can be obtained on payment of a prescribed fee and satisfying other procedure requirements.

**Withholding of Grades:** The grades of a candidate may be withheld if he/she has not cleared his/her dues or if there is a disciplinary case pending against him/her or for any other reason.

## 16. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be declared to be eligible for the award of the MSc Degree provided the candidate has

- Successfully completed all the courses under the different categories, as specified in the regulations.



- ii. Successfully gained the required number of total credits as specified in the curriculum corresponding to the candidate's programme within the stipulated time (vide clause 5).
- iii. Successfully passed any additional courses prescribed by the Board of Studies whenever readmitted under regulations other than R-2020 (vide clause 11.3)
- iv. No disciplinary action pending against him / her.

## 17. CLASSIFICATION OF THE DEGREE AWARDED

### 17.1 First Class with Distinction:

**17.1.1** A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the ten semesters in the **First Appearance** within ten consecutive semesters excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 8.50

(OR)

**17.1.2** A candidate who joins from other institutions on transfer or a candidate who gets readmitted and has to move from one regulations to another regulations and who qualifies for the award of the degree (vide clause 16) and satisfies the following conditions shall be declared to have passed the examination in First class with Distinction:

- Should have passed the examination in all the courses of all the ten semesters in the **First Appearance** within ten consecutive semesters excluding the authorized break of study (vide clause 11) after the commencement of his / her study.
- Submission of equivalent course list approved by the Board of studies.
- Withdrawal from examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 9.00

### 17.2 First Class:

A candidate who qualifies for the award of the degree (vide clause 16) and who satisfies the following conditions shall be declared to have passed the examination in First class:

- Should have passed the examination in all the courses of all ten semesters within twelve consecutive semesters excluding authorized break of study (vide clause 11) after the commencement of his / her study.
- Withdrawal from the examination (vide clause 10) shall not be considered as an appearance.
- Should have secured a CGPA of not less than 7.00



### **17.3 Second Class:**

All other candidates (not covered in clauses 17.1 and 17.2) who qualify for the award of the degree (vide clause 16) shall be declared to have passed the examination in Second Class.

**17.4** A candidate who is absent for end semester examination in a course / project work after having registered for the same shall be considered to have appeared for that examination for the purpose of classification.

## **18. MALPRACTICES IN TESTS AND EXAMINATIONS**

If a candidate indulges in malpractice in any of the tests or end semester examinations, he/she shall be liable for punitive action as per the examination rules prescribed by the college from time to time.

## **19. AMENDMENTS**

Notwithstanding anything contained in this manual, the Kongu Engineering College through the Academic council of the Kongu Engineering College, reserves the right to modify/amend without notice, the Regulations, Curricula, Syllabi, Scheme of Examinations, procedures, requirements, and rules pertaining to its MSc programme.

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**CURRICULUM BREAKDOWN STRUCTURE****Summary of Credit Distribution**

Category	Semester										Total Credits	Curriculum Content (% of total number of credits of the program)
	I	II	III	IV	V	VI	VII	VIII	IX	X		
HS	4	4									8	3.9%
BS	4	4									8	3.9%
ES	4	5									9	4.4%
PC	9	9	23	23	17	16		14			111	54.1%
PE					4	3		9	17		33	16.1%
EC					2	4	15			15	36	17.6%
<b>Semester wise Total</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>23</b>	<b>23</b>	<b>23</b>	<b>15</b>	<b>23</b>	<b>17</b>	<b>15</b>	<b>205</b>	<b>100.00</b>

Category	Abbreviation
Lecture hours per week	L
Tutorial hours per week	T
Practical, Project work, Internship, Professional Skill Training, Industrial Training hours per week	P
Credits	C

**CATEGORISATION OF COURSES****HUMANITIES AND SOCIAL SCIENCE INCLUDING MANAGEMENT (HS)**

Sl.No.	Course Code	Course Name	L	T	P	C	Sem	
1	20IST11	Communicative English – I	3	0	0	3	I	
2	20ISL11	Communicative English - I Laboratory	0	0	2	1	I	
3	20IST21	Communicative English – II	3	0	0	3	II	
4	20ISL21	Communicative English - II Laboratory	0	0	2	1	II	
<b>Total Credits to be earned</b>							8	

**BASIC SCIENCE (BS)**

Sl.No.	Course Code	Course Name	L	T	P	C	Sem	
1	20IST12	Applied Mathematics	3	1	0	4	I	
2	20IST22	Operations Research	3	1	0	4	II	
<b>Total Credits to be earned</b>							8	

**ENGINEERING SCIENCE (ES)**

Sl.No.	Course Code	Course Name	L	T	P	C	Sem	
1	20IST14	Digital Principles and Logic Design	3	0	0	3	I	
2	20ISL13	Digital Principles and Logic Design Laboratory	0	0	2	1	I	
3	20IST24	Basics of Electrical and Electronics Engineering	3	0	0	3	II	
4	20ISL23	Basics of Electrical and Electronics Engineering Laboratory	0	0	4	2	II	
<b>Total Credits to be earned</b>							9	

**PROFESSIONAL CORE**

Sl.No.	Course Code	Course Name	L	T	P	C	Sem	Domain/Stream
1	20IST13	Programming in C	3	0	0	3	I	Prg
2	20IST15	Fundamentals of Computer Science	3	1	0	4	I	CS
3	20ISL12	Programming in C Laboratory	0	0	4	2	I	Prg
4	20IST23	Programming and Linear Data Structures	3	0	0	3	II	Prg
5	20IST25	Computer Organization	3	1	0	4	II	CS
6	20ISL22	Programming and Linear Data Structures Laboratory	0	0	4	2	II	Prg
7	20IST31	Object Oriented Programming with C++	3	0	0	3	III	Prg
8	20IST32	Data Structures	3	0	0	3	III	Alg
9	20IST33	Operating Systems	3	0	0	3	III	CS
10	20IST34	Computer Networks	3	1	0	4	III	NW
11	20IST35	Software Engineering	3	1	0	4	III	SE
12	20ISL31	Object Oriented Programming with C++ Laboratory	0	0	4	2	III	Prg
13	20ISL32	Data Structures Laboratory	0	0	4	2	III	Alg
14	20ISL33	Operating Systems Laboratory	0	0	4	2	III	CS
15	20IST41	Java Programming	3	0	0	3	IV	Prg
16	20IST42	Database Management Systems	3	0	0	3	IV	DB
17	20IST43	Design and Analysis of Algorithms	3	0	0	3	IV	Alg
18	20IST44	Software Testing	3	1	0	4	IV	SE
19	20IST45	Object Oriented System Design	3	1	0	4	IV	SE
20	20ISL41	Java Programming Laboratory	0	0	4	2	IV	Prg
21	20ISL42	Database Management Systems Laboratory	0	0	4	2	IV	DB
22	20ISL43	Design and Analysis of Algorithms Laboratory	0	0	4	2	IV	Alg
23	20IST51	Python Programming and Frameworks	3	0	0	3	V	Prg
24	20IST52	Data Mining and Data Warehousing	3	0	0	3	V	DM
25	20IST53	Web Technology	3	0	0	3	V	WT
26	20IST54	Cryptography and Network Security	3	0	0	3	V	NW
27	20ISL51	Python Programming and Frameworks Laboratory	0	0	4	2	V	Prg
28	20ISL52	Data Mining Laboratory	0	0	4	2	V	DM



29	20ISL53	Web Technology Laboratory	0	0	2	1	V	WT
30	20IST61	Front End Technologies	3	0	0	3	VI	Prg
31	20IST62	Open Source Software	3	1	0	4	VI	Prg
32	20IST63	Machine Learning	3	0	0	3	VI	Alg
33	20IST64	Software Project Management	3	1	0	4	VI	SE
34	20ISL61	Front End Technologies Laboratory	0	0	4	2	VI	Prg
35	20IST81	User Interface Design	3	0	0	3	VIII	SE
36	20IST82	Agile Software Engineering	3	1	0	4	VIII	SE
37	20IST83	Cloud Computing	3	0	0	3	VIII	NW
38	20ISL81	User Interface Design Laboratory	0	0	4	2	VIII	SE
39	20ISL82	Software Application Development Laboratory	0	0	4	2	VIII	SE
<b>Total Credits to be earned</b>							111	

NW – Networks, WT – Web Technology, SE – Software Engineering, DB – Database, Prg – Programming, Alg – Algorithms, CG – Computer Graphics, CS – Computer Science, DM – Data mining

### PROFESSIONAL ELECTIVE

Sl.No.	Course Code	Course Name	L	T	P	C	Sem	Domain/Stream
Elective – 1								
1	20ISE01	Advanced Java Programming	3	0	2	4	V	Prg
2	20ISE02	Advanced Database Technologies	3	1	0	4	V	DB
3	20ISE03	Artificial Intelligence	3	1	0	4	V	AI
Elective – 2								
4	20ISE04	Mobile Communications	3	0	0	3	VI	NW
5	20ISE05	Blockchain Technology	3	0	0	3	VI	NW
6	20ISE06	Computer Graphics	3	0	0	3	VI	CG
Elective – 3								
7	20ISE07	Deep Learning	3	0	0	3	VIII	AI
8	20ISE08	Software Quality Assurance	3	0	0	3	VIII	SE
9	20ISE09	Principles of Management	3	0	0	3	VIII	Mgt
Elective – 4								
10	20ISE10	Introduction to Data Science	3	0	0	3	VIII	DM
11	20ISE11	Building Enterprise Applications	3	0	0	3	VIII	CS
12	20ISE12	Distributed and Parallel Computing	3	0	0	3	VIII	NW
Elective – 5								
13	20ISE13	Principles of Compiler Design	3	0	0	3	VIII	CS
14	20ISE14	Design Thinking	3	0	0	3	VIII	CS
15	20ISE15	Information Security	3	0	0	3	VIII	NW
Elective – 6								
16	20ISE16	Big Data Analytics	3	0	0	3	IX	DB
17	20ISE17	AD HOC and Sensor Networks	3	0	0	3	IX	NW
18	20ISE18	E-Technologies	3	0	0	3	IX	CS
Elective – 7								
19	20ISE19	Customer Relationship Management	3	0	0	3	IX	Mgt
20	20ISE20	Software Maintenance	3	0	0	3	IX	SE



21	20ISE21	Innovation, Entrepreneurship and Venture Development	3	0	0	3	IX	Mgt
22	20ISE28	Service Oriented Architecture	3	1	0	4	IX	CS
		Elective – 8						
23	20ISE22	Human Resource Management	3	0	0	3	IX	Mgt
24	20ISE23	Green Computing	3	0	0	3	IX	CS
25	20ISE24	Cyber Forensics	3	0	0	3	IX	NW
		Elective – 9						
26	20ISE25	Business Intelligence	3	1	0	4	IX	CS
27	20ISE26	Social Network Analysis	3	1	0	4	IX	DM
28	20ISE27	Agile Project Management	3	1	0	4	IX	SE
		Elective – 10						
29	20ISE29	Internet of Things	3	0	2	4	IX	CS
30	20ISE30	Multimedia Systems	3	0	2	4	IX	CG
31	20ISE31	Mobile Application Development	3	0	2	4	IX	Prg
<b>Total Credits to be earned</b>							33	

NW – Networks, WT – Web Technology, SE – Software Engineering, DB – Database, Prg – Programming, Alg – Algorithms, CG – Computer Graphics, CS – Computer Science, DM – Data Mining, AI – Artificial Intelligence

#### EMPLOYABILITY ENHANCEMENT COURSES (EC)

Sl.No.	Course Code	Course Name	L	T	P	C	Sem	
1	20GEL51	Professional Skills Training - I	0	0	80	2	V	
2	20GEL61	Professional Skills Training - II	0	0	80	2	VI	
3	20ISP61	Mini Project	0	0	4	2	VI	
4	20ISP71	Project Work - I	0	0	30	15	VII	
5	20ISP01	Project Work - II	0	0	30	15	X	
<b>Total Credits to be earned</b>							36	

#### MANDATORY NON CREDIT COURSES (MC)

Sl.No.	Course Code	Course Name	L	T	P	C	Sem	
1	20MNT13	Student Induction Program	2	0	0	0	I	
<b>Total Credits to be earned</b>							0	

**SCHEDULING OF COURSES – MSc (SOFTWARE SYSTEMS)****Total Credit: 205**

Sem.	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7	Course 8	Course 9	Credits
I	20IST11 Communicative English-I (HS-3-0-0-3)	20IST12 Applied Mathematics (BS-3-1-0-4)	20IST13 Programming in C (PC-3-0-0-3)	20IST14 Digital Principles and Logic Design (ES-3-0-0-3)	20IST15 Fundamentals of Computer Science (PC-3-1-0-4)	20ISL11 Communicative English-I Laboratory (HS-0-0-2-1)	20ISL12 Programming in C Laboratory (PC-0-0-4-2)	20ISL13 Digital Principles and Logic Design Laboratory (ES-0-0-2-1)	20MNT13 Student Induction Program (MC-2-0-0-0)	21
II	20IST21 Communicative English-II (HS-3-0-0-3)	20IST22 Operations Research (BS-3-1-0-4)	20IST23 Programming and Linear Data Structures (PC-3-0-0-3)	20IST24 Basics of Electrical and Electronics Engineering (ES-3-0-0-3)	20IST25 Computer Organization (PC-3-1-0-4)	20ISL21 Communicative English-II Laboratory (HS-0-0-2-1)	20ISL22 Programming and Linear Data Structures Laboratory (PC-0-0-4-2)	20ISL23 Basics of Electrical and Electronics Engineering Laboratory (ES-0-0-4-2)		22
III	20IST31 Object Oriented Programming with C++ (PC-3-0-0-3)	20IST32 Data Structures (PC-3-0-0-3)	20IST33 Operating Systems (PC-3-0-0-3)	20IST34 Computer Networks (PC-3-1-0-4)	20IST35 Software Engineering (PC-3-1-0-4)	20ISL31 Object Oriented Programming with C++ Laboratory (PC-0-0-4-2)	20ISL32 Data Structures Laboratory (PC-0-0-4-2)	20ISL33 Operating Systems Laboratory (PC-0-0-4-2)		23
IV	20IST41 Java Programming (PC-3-0-0-3)	20IST42 Database Management Systems (PC-3-0-0-3)	20IST43 Design and Analysis of Algorithms (PC-3-0-0-3)	20IST44 Software Testing (PC-3-1-0-4)	20IST45 Object Oriented System Design (PC-3-1-0-4)	20ISL41 Java Programming Laboratory (PC-0-0-4-2)	20ISL42 Database Management Systems Laboratory (PC-0-0-4-2)	20ISL43 Design and Analysis of Algorithms Laboratory (PC-0-0-4-2)		23
V	20IST51 Python Programming and Frameworks (PC-3-0-0-3)	20IST52 Data Mining and Data Warehousing (PC-3-0-0-3)	20IST53 Web Technology (PC-3-0-0-3)	20IST54 Cryptography and Network Security (PC-3-0-0-3)	Elective - 1 (PE-3-1-0-4)	20ISL51 Python Programming and Frameworks Laboratory (PC-0-0-4-2)	20ISL52 Data Mining Laboratory (PC-0-0-4-2)	20ISL53 Web Technology Laboratory (PC-0-0-2-1)	20GEL51 Professional Skills Training - I (EC-0-0-80-2)	23
VI	20IST61 Front End Technologies (PC-3-0-0-3)	20IST62 Open Source Software (PC-3-1-0-4)	20IST63 Machine Learning (PC-3-0-0-3)	20IST64 Software Project Management (PC-3-1-0-4)	Elective - 2 (PE-3-0-0-3)	20ISL61 Front End Technologies Laboratory (PC-0-0-4-2)	20ISP61 Mini Project (EC-0-0-4-2)	20GEL61 Professional Skills Training - II (EC-0-0-80-2)		23
VII	20ISP71 Project Work - I (EC-0-0-30-15)									15
VIII	20IST81 User Interface Design (PC-3-0-0-3)	20IST82 Agile Software Engineering (PC-3-1-0-4)	20IST83 Cloud Computing (PC-3-0-0-3)	Elective - 3 (PE-3-0-0-3)	Elective - 4 (PE-3-0-0-3)	Elective - 5 (PE-3-0-0-3)	20ISL81 User Interface Design Laboratory (PC-0-0-4-2)	20ISL82 Software Application Development Laboratory (PC-0-0-4-2)		23
IX	Elective - 6 (PE-3-0-0-3)	Elective - 7 (PE-3-0-0-3)	Elective - 8 (PE-3-0-0-3)	Elective - 9 (PE-3-1-0-4)	Elective - 10 (PE-3-1-0-4)					17
X	20ISP01 Project Work - II (EC-0-0-30-15)									15



**MAPPING OF COURSES WITH PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES**

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
I	20IST11	Communicative English - I				√		√		√	√	√		√	√	√
	20IST12	Applied Mathematics	√	√	√	√	√								√	√
	20IST13	Programming in C	√	√	√	√									√	√
	20IST14	Digital Principles and Logic Design	√	√	√	√	√								√	√
	20IST15	Fundamentals of Computer Science	√	√	√	√									√	√
	20ISL11	Communicative English - I Laboratory				√		√		√	√	√		√	√	√
	20ISL12	Programming in C Laboratory	√	√	√	√									√	√
	20ISL13	Digital Principles and Logic Design Laboratory	√	√	√	√									√	√
20MNT13	Student Induction Program							√		√				√	√	√
II	20IST21	Communicative English - II				√		√		√	√	√		√	√	√
	20IST22	Operations Research	√	√	√	√	√								√	√
	20IST23	Programming and Linear Data Structures	√	√	√	√									√	√
	20IST24	Basics of Electrical and Electronics Engineering	√	√	√	√	√								√	√
	20IST25	Computer Organization	√	√	√	√									√	√
	20ISL21	Communicative English - II Laboratory				√		√		√	√	√		√	√	√
	20ISL22	Programming and Linear Data Structures Laboratory	√	√	√	√									√	√
20ISL23	Basics of Electrical and Electronics Engineering Laboratory	√	√	√	√	√								√	√	
III	20IST31	Object Oriented Programming with C++	√	√	√	√									√	√
	20IST32	Data Structures	√	√	√	√									√	√
	20IST33	Operating Systems	√	√	√	√									√	√
	20IST34	Computer Networks	√	√	√	√									√	√
	20IST35	Software Engineering	√	√	√	√									√	√
	20ISL31	Object Oriented Programming with C++ Laboratory	√	√	√	√									√	√
	20ISL32	Data Structures Laboratory	√	√	√	√									√	√
20ISL33	Operating Systems Laboratory	√	√	√	√									√	√	



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
IV	20IST41	Java Programming	√	√	√	√									√	√	
	20IST42	Database Management Systems	√	√	√	√									√	√	
	20IST43	Design and Analysis of Algorithms	√	√	√	√									√	√	
	20IST44	Software Testing	√	√	√	√									√	√	
	20IST45	Object Oriented System Design	√	√	√	√									√	√	
	20ISL41	Java Programming Laboratory	√	√	√	√									√	√	
	20ISL42	Database Management Systems Laboratory	√	√	√	√									√	√	
	20ISL43	Design and Analysis of Algorithms Laboratory	√	√	√	√									√	√	
V	20IST51	Python Programming and Frameworks	√	√	√	√									√	√	
	20IST52	Data Mining and Data Warehousing	√	√	√	√									√	√	
	20IST53	Web Technology	√	√	√	√									√	√	
	20IST54	Cryptography and Network Security	√	√	√	√									√	√	
	20ISL51	Python Programming and Frameworks Laboratory	√	√	√	√									√	√	
	20ISL52	Data Mining Laboratory	√	√	√	√									√	√	
	20ISL53	Web Technology Laboratory	√	√	√	√									√	√	
	20GEL51	Professional Skills Training - I	√	√					√	√		√		√	√	√	√
VI	20IST61	Front End Technologies	√	√	√	√									√	√	
	20IST62	Open Source Software	√	√	√	√									√	√	
	20IST63	Machine Learning	√	√	√	√									√	√	
	20IST64	Software Project Management	√	√	√	√									√	√	
	20ISL61	Front End Technologies Laboratory	√	√	√	√									√	√	
	20GEL61	Professional Skills Training - II	√	√					√	√		√		√	√	√	√
	20ISP61	Mini Project	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
VII	20ISP71	Project Work - I	√	√	√	√	√	√	√	√	√	√	√	√	√	√	
VIII	20IST81	User Interface Design	√	√	√	√									√	√	
	20IST82	Agile Software Engineering	√	√	√	√									√	√	
	20IST83	Cloud Computing	√	√	√	√									√	√	
	20ISL81	User Interface Design Laboratory	√	√	√	√									√	√	
	20ISL82	Software Application Development Laboratory	√	√	√	√									√	√	
X	20ISP01	Project Work - II	√	√	√	√	√	√	√	√	√	√	√	√	√	√	



Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
<b>Professional Elective</b>																
V	20ISE01	Advanced Java Programming	√	√	√	√									√	√
V	20ISE02	Advanced Database Technologies	√	√	√	√									√	√
V	20ISE03	Artificial Intelligence	√	√	√	√									√	√
VI	20ISE04	Mobile Communications	√	√	√	√									√	√
VI	20ISE05	Blockchain Technology	√	√	√	√									√	√
VI	20ISE06	Computer Graphics	√	√	√	√									√	√
VIII	20ISE07	Deep Learning	√	√	√	√									√	√
VIII	20ISE08	Software Quality Assurance	√	√	√	√									√	√
VIII	20ISE09	Principles of Management						√		√	√	√	√	√	√	√
VIII	20ISE10	Introduction to Data Science	√	√	√	√									√	√
VIII	20ISE11	Building Enterprise Applications	√	√	√	√									√	√
VIII	20ISE12	Distributed and Parallel Computing	√	√	√	√									√	√
VIII	20ISE13	Principles of Compiler Design	√	√	√	√									√	√
VIII	20ISE14	Design Thinking	√	√	√	√									√	√
VIII	20ISE15	Information Security	√	√	√	√									√	√
IX	20ISE16	Big Data Analytics	√	√	√	√									√	√
IX	20ISE17	AD HOC and Sensor Networks	√	√	√	√									√	√
IX	20ISE18	E-Technologies	√	√	√	√									√	√
IX	20ISE19	Customer Relationship Management						√		√	√	√	√	√	√	√
IX	20ISE20	Software Maintenance	√	√	√	√									√	√
IX	20ISE21	Innovation, Entrepreneurship and Venture Development	√	√	√		√	√	√	√	√	√		√	√	√
IX	20ISE28	Service Oriented Architecture	√	√	√	√									√	√
IX	20ISE22	Human Resource Management									√	√	√	√	√	√
IX	20ISE23	Green Computing	√	√	√	√									√	√
IX	20ISE24	Cyber Forensics	√	√	√	√									√	√
IX	20ISE25	Business Intelligence	√	√	√	√									√	√
IX	20ISE26	Social Network Analysis	√	√	√	√									√	√
IX	20ISE27	Agile Project Management	√	√	√	√									√	√
IX	20ISE29	Internet of Things	√	√	√	√									√	√
IX	20ISE30	Multimedia Systems	√	√	√	√									√	√
IX	20ISE31	Mobile Application Development	√	√	√	√	√								√	√



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
(For the students admitted in the academic year 2020-21)

<b>SEMESTER – I</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST11	Communicative English - I	3	0	0	3	50	50	100	HS
20IST12	Applied Mathematics	3	1	0	4	50	50	100	BS
20IST13	Programming in C	3	0	0	3	50	50	100	PC
20IST14	Digital Principles and Logic Design	3	0	0	3	50	50	100	ES
20IST15	Fundamentals of Computer Science	3	1	0	4	50	50	100	PC
<b>Practical / Employability Enhancement</b>									
20ISL11	Communicative English - I Laboratory	0	0	2	1	50	50	100	HS
20ISL12	Programming in C Laboratory	0	0	4	2	50	50	100	PC
20ISL13	Digital Principles and Logic Design Laboratory	0	0	2	1	50	50	100	ES
<b>Mandatory Non Credit Courses</b>									
20MNT13	Student Induction Program	2	0	0	0	100	0	100	MC
<b>Total Credits to be earned</b>					21				

<b>SEMESTER – II</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST21	Communicative English - II	3	0	0	3	50	50	100	HS
20IST22	Operations Research	3	1	0	4	50	50	100	BS
20IST23	Programming and Linear Data Structures	3	0	0	3	50	50	100	PC
20IST24	Basics of Electrical and Electronics Engineering	3	0	0	3	50	50	100	ES
20IST25	Computer Organization	3	1	0	4	50	50	100	PC
<b>Practical / Employability Enhancement</b>									
20ISL21	Communicative English - II Laboratory	0	0	2	1	50	50	100	HS
20ISL22	Programming and Linear Data Structures Laboratory	0	0	4	2	50	50	100	PC
20ISL23	Basics of Electrical and Electronics Engineering Laboratory	0	0	4	2	50	50	100	ES
<b>Total Credits to be earned</b>					22				



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
(For the students admitted in the academic year 2020-21)

<b>SEMESTER – III</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST31	Object Oriented Programming with C++	3	0	0	3	50	50	100	PC
20IST32	Data Structures	3	0	0	3	50	50	100	PC
20IST33	Operating Systems	3	0	0	3	50	50	100	PC
20IST34	Computer Networks	3	1	0	4	50	50	100	PC
20IST35	Software Engineering	3	1	0	4	50	50	100	PC
<b>Practical / Employability Enhancement</b>									
20ISL31	Object Oriented Programming with C++ Laboratory	0	0	4	2	50	50	100	PC
20ISL32	Data Structures Laboratory	0	0	4	2	50	50	100	PC
20ISL33	Operating Systems Laboratory	0	0	4	2	50	50	100	PC
<b>Total Credits to be earned</b>					23				

<b>SEMESTER – IV</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST41	Java Programming	3	0	0	3	50	50	100	PC
20IST42	Database Management Systems	3	0	0	3	50	50	100	PC
20IST43	Design and Analysis of Algorithms	3	0	0	3	50	50	100	PC
20IST44	Software Testing	3	1	0	4	50	50	100	PC
20IST45	Object Oriented System Design	3	1	0	4	50	50	100	PC
<b>Practical / Employability Enhancement</b>									
20ISL41	Java Programming Laboratory	0	0	4	2	50	50	100	PC
20ISL42	Database Management Systems Laboratory	0	0	4	2	50	50	100	PC
20ISL43	Design and Analysis of Algorithms Laboratory	0	0	4	2	50	50	100	PC
<b>Total Credits to be earned</b>					23				



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
(For the students admitted in the academic year 2020-21)

<b>SEMESTER – V</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST51	Python Programming and Frameworks	3	0	0	3	100	0	100	PC
20IST52	Data Mining and Data Warehousing	3	0	0	3	50	50	100	PC
20IST53	Web Technology	3	0	0	3	50	50	100	PC
20IST54	Cryptography and Network Security	3	0	0	3	50	50	100	PC
	Elective - 1	3	1	0	4	50	50	100	PE
<b>Practical / Employability Enhancement</b>									
20ISL51	Python Programming and Frameworks Laboratory	0	0	4	2	100	0	100	PC
20ISL52	Data Mining Laboratory	0	0	4	2	50	50	100	PC
20ISL53	Web Technology Laboratory	0	0	2	1	50	50	100	PC
20GEL51	Professional Skills Training - I	0	0	80	2	100	0	100	EC
<b>Total Credits to be earned</b>					23				

<b>SEMESTER – VI</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST61	Front End Technologies	3	0	0	3	50	50	100	PC
20IST62	Open Source Software	3	1	0	4	50	50	100	PC
20IST63	Machine Learning	3	0	0	3	50	50	100	PC
20IST64	Software Project Management	3	1	0	4	50	50	100	PC
	Elective - 2	3	0	0	3	50	50	100	PE
<b>Practical / Employability Enhancement</b>									
20ISL61	Front End Technologies Laboratory	0	0	4	2	50	50	100	PC
20ISP61	Mini Project	0	0	4	2	50	50	100	EC
<b>Total Credits to be earned</b>					21				



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
(For the students admitted in the academic year 2020-21)

<b>SEMESTER – VII</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Practical / Employability Enhancement</b>									
20GEL61	Professional Skills Training - II	0	0	80	2	100	0	100	EC
20ISP71	Project Work - I	0	0	30	15	50	50	100	EC
<b>Total Credits to be earned</b>					17				

<b>SEMESTER – VIII</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST81	User Interface Design	3	0	0	3	50	50	100	PC
20IST82	Agile Software Engineering	3	1	0	4	50	50	100	PC
20IST83	Cloud Computing	3	0	0	3	50	50	100	PC
	Elective - 3	3	0	0	3	50	50	100	PE
	Elective - 4	3	0	0	3	50	50	100	PE
	Elective - 5	3	0	0	3	50	50	100	PE
<b>Practical / Employability Enhancement</b>									
20ISL81	User Interface Design Laboratory	0	0	4	2	50	50	100	PC
20ISL82	Software Application Development Laboratory	0	0	4	2	50	50	100	PC
<b>Total Credits to be earned</b>					23				



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
(For the students admitted in the academic year 2020-21)

<b>SEMESTER – IX</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
	Elective - 6	3	0	0	3	50	50	100	PE
	Elective - 7	3	0	0	3	50	50	100	PE
	Elective - 8	3	0	0	3	50	50	100	PE
	Elective - 9	3	1	0	4	50	50	100	PE
	Elective - 10	3	1	0	4	50	50	100	PE
<b>Total Credits to be earned</b>					17				

<b>SEMESTER – X</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Practical / Employability Enhancement</b>									
20ISP01	Project Work - II	0	0	30	15	50	50	100	EC
<b>Total Credits to be earned</b>					15				

**Total Credits: 205**



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
**(For the students admitted in the academic year 2021-22)**

<b>SEMESTER – I</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST11	Communicative English - I	3	0	0	3	40	60	100	HS
20IST12	Applied Mathematics	3	1	0	4	40	60	100	BS
20IST13	Programming in C	3	0	0	3	40	60	100	PC
20IST14	Digital Principles and Logic Design	3	0	0	3	40	60	100	ES
20IST15	Fundamentals of Computer Science	3	1	0	4	40	60	100	PC
<b>Practical / Employability Enhancement</b>									
20ISL11	Communicative English - I Laboratory	0	0	2	1	60	40	100	HS
20ISL12	Programming in C Laboratory	0	0	4	2	60	40	100	PC
20ISL13	Digital Principles and Logic Design Laboratory	0	0	2	1	60	40	100	ES
<b>Mandatory Non Credit Courses</b>									
20MNT13	Student Induction Program	2	0	0	0	100	0	100	MC
<b>Total Credits to be earned</b>					21				

<b>SEMESTER – II</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST21	Communicative English - II	3	0	0	3	40	60	100	HS
20IST22	Operations Research	3	1	0	4	40	60	100	BS
20IST23	Programming and Linear Data Structures	3	0	0	3	40	60	100	PC
20IST24	Basics of Electrical and Electronics Engineering	3	0	0	3	40	60	100	ES
20IST25	Computer Organization	3	1	0	4	40	60	100	PC
<b>Practical / Employability Enhancement</b>									
20ISL21	Communicative English - II Laboratory	0	0	2	1	60	40	100	HS
20ISL22	Programming and Linear Data Structures Laboratory	0	0	4	2	60	40	100	PC
20ISL23	Basics of Electrical and Electronics Engineering Laboratory	0	0	4	2	60	40	100	ES
<b>Total Credits to be earned</b>					22				



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
**(For the students admitted in the academic year 2021-22)**

<b>SEMESTER – III</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST31	Object Oriented Programming with C++	3	0	0	3	40	60	100	PC
20IST32	Data Structures	3	0	0	3	40	60	100	PC
20IST33	Operating Systems	3	0	0	3	40	60	100	PC
20IST34	Computer Networks	3	1	0	4	40	60	100	PC
20IST35	Software Engineering	3	1	0	4	40	60	100	PC
<b>Practical / Employability Enhancement</b>									
20ISL31	Object Oriented Programming with C++ Laboratory	0	0	4	2	100	0	100	PC
20ISL32	Data Structures Laboratory	0	0	4	2	60	40	100	PC
20ISL33	Operating Systems Laboratory	0	0	4	2	60	40	100	PC
<b>Total Credits to be earned</b>					23				

<b>SEMESTER – IV</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST41	Java Programming	3	0	0	3	40	60	100	PC
20IST42	Database Management Systems	3	0	0	3	40	60	100	PC
20IST43	Design and Analysis of Algorithms	3	0	0	3	40	60	100	PC
20IST44	Software Testing	3	1	0	4	40	60	100	PC
20IST45	Object Oriented System Design	3	1	0	4	40	60	100	PC
<b>Practical / Employability Enhancement</b>									
20ISL41	Java Programming Laboratory	0	0	4	2	60	40	100	PC
20ISL42	Database Management Systems Laboratory	0	0	4	2	60	40	100	PC
20ISL43	Design and Analysis of Algorithms Laboratory	0	0	4	2	60	40	100	PC
<b>Total Credits to be earned</b>					23				



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
**(For the students admitted in the academic year 2021-22)**

<b>SEMESTER – V</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST51	Python Programming and Frameworks	3	0	0	3	100	0	100	PC
20IST52	Data Mining and Data Warehousing	3	0	0	3	40	60	100	PC
20IST53	Web Technology	3	0	0	3	40	60	100	PC
20IST54	Cryptography and Network Security	3	0	0	3	40	60	100	PC
	Elective - 1	3	1	0	4	40	60	100	PE
<b>Practical / Employability Enhancement</b>									
20ISL51	Python Programming and Frameworks Laboratory	0	0	4	2	100	0	100	PC
20ISL52	Data Mining Laboratory	0	0	4	2	60	40	100	PC
20ISL53	Web Technology Laboratory	0	0	2	1	60	40	100	PC
20GEL51	Professional Skills Training – I *	0	0	80	2	100	0	100	EC
<b>Total Credits to be earned</b>					23				

\*80 hours of training

<b>SEMESTER – VI</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST61	Front End Technologies	3	0	0	3	40	60	100	PC
20IST62	Open Source Software	3	1	0	4	40	60	100	PC
20IST63	Machine Learning	3	0	0	3	40	60	100	PC
20IST64	Software Project Management	3	1	0	4	40	60	100	PC
	Elective - 2	3	0	0	3	40	60	100	PE
<b>Practical / Employability Enhancement</b>									
20ISL61	Front End Technologies Laboratory	0	0	4	2	60	40	100	PC
20ISP61	Mini Project	0	0	4	2	60	40	100	EC
<b>Total Credits to be earned</b>					21				

\*80 hours of training



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
**(For the students admitted in the academic year 2021-22)**

<b>SEMESTER – VII</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Practical / Employability Enhancement</b>									
20GEL61	Professional Skills Training – II *	0	0	80	2	100	0	100	EC
20ISP71	Project Work - I	0	0	30	15	50	50	100	EC
<b>Total Credits to be earned</b>					17				

<b>SEMESTER – VIII</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
20IST81	User Interface Design	3	0	0	3	40	60	100	PC
20IST82	Agile Software Engineering	3	1	0	4	40	60	100	PC
20IST83	Cloud Computing	3	0	0	3	40	60	100	PC
	Elective - 3	3	0	0	3	40	60	100	PE
	Elective - 4	3	0	0	3	40	60	100	PE
	Elective - 5	3	0	0	3	40	60	100	PE
<b>Practical / Employability Enhancement</b>									
20ISL81	User Interface Design Laboratory	0	0	4	2	60	40	100	PC
20ISL82	Software Application Development Laboratory	0	0	4	2	60	40	100	PC
<b>Total Credits to be earned</b>					23				



**MSc SOFTWARE SYSTEMS CURRICULUM – R2020**  
**(For the students admitted in the academic year 2021-22)**

<b>SEMESTER – IX</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Theory/Theory with Practical</b>									
	Elective - 6	3	0	0	3	40	60	100	PE
	Elective - 7	3	0	0	3	40	60	100	PE
	Elective - 8	3	0	0	3	40	60	100	PE
	Elective - 9	3	1	0	4	40	60	100	PE
	Elective - 10	3	1	0	4	40	60	100	PE
<b>Total Credits to be earned</b>					17				

<b>SEMESTER – X</b>									
Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
<b>Practical / Employability Enhancement</b>									
20ISP01	Project Work - II	0	0	30	15	50	50	100	EC
<b>Total Credits to be earned</b>					15				

**Total Credits: 205**

**PROFESSIONAL ELECTIVE**

Sl.No.	Course Code	Course Name	L	T	P	C	Sem	Domain/Stream
		Elective – 1						
1	20ISE01	Advanced Java Programming	3	0	2	4	V	Prg
2	20ISE02	Advanced Database Technologies	3	1	0	4	V	DB
3	20ISE03	Artificial Intelligence	3	1	0	4	V	AI
		Elective – 2						
4	20ISE04	Mobile Communications	3	0	0	3	VI	NW
5	20ISE05	Blockchain Technology	3	0	0	3	VI	NW
6	20ISE06	Computer Graphics	3	0	0	3	VI	CG
		Elective – 3						
7	20ISE07	Deep Learning	3	0	0	3	VIII	AI
8	20ISE08	Software Quality Assurance	3	0	0	3	VIII	SE
9	20ISE09	Principles of Management	3	0	0	3	VIII	Mgt
		Elective – 4						
10	20ISE10	Introduction to Data Science	3	0	0	3	VIII	DM
11	20ISE11	Building Enterprise Applications	3	0	0	3	VIII	CS
12	20ISE12	Distributed and Parallel Computing	3	0	0	3	VIII	NW
		Elective – 5						
13	20ISE13	Principles of Compiler Design	3	0	0	3	VIII	CS
14	20ISE14	Design Thinking	3	0	0	3	VIII	CS
15	20ISE15	Information Security	3	0	0	3	VIII	NW
		Elective – 6						
16	20ISE16	Big Data Analytics	3	0	0	3	IX	DB
17	20ISE17	AD HOC and Sensor Networks	3	0	0	3	IX	NW
18	20ISE18	E-Technologies	3	0	0	3	IX	CS
		Elective – 7						
19	20ISE19	Customer Relationship Management	3	0	0	3	IX	Mgt
20	20ISE20	Software Maintenance	3	0	0	3	IX	SE
21	20ISE21	Innovation, Entrepreneurship and Venture Development	3	0	0	3	IX	Mgt
22	20ISE28	Service Oriented Architecture	3	1	0	4	IX	CS
		Elective – 8						
23	20ISE22	Human Resource Management	3	0	0	3	IX	Mgt
24	20ISE23	Green Computing	3	0	0	3	IX	CS
25	20ISE24	Cyber Forensics	3	0	0	3	IX	NW



Elective – 9								
26	20ISE25	Business Intelligence	3	1	0	4	IX	CS
27	20ISE26	Social Network Analysis	3	1	0	4	IX	DM
28	20ISE27	Agile Project Management	3	1	0	4	IX	SE
Elective – 10								
29	20ISE29	Internet of Things	3	0	2	4	IX	CS
30	20ISE30	Multimedia Systems	3	0	2	4	IX	CG
31	20ISE31	Mobile Application Development	3	0	2	4	IX	Prg
<b>Total Credits to be earned</b>						33		

NW – Networks, WT – Web Technology, SE – Software Engineering, DB – Database, Prg – Programming, Alg – Algorithms, CG – Computer Graphics, CS – Computer Science, DM – Data Mining, AI – Artificial Intelligence

**20IST11 – COMMUNICATIVE ENGLISH - I**

Programme & Branch	MSc - SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	HS	3	0	0	3

<b>Preamble</b>	To employ techniques of active reading, effective speaking and integrate ideas through writing skills. Learners can gain confidence to communicate in formal forum effectively and write long passages independently.
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<b>Unit – I</b>	<b>Grammar &amp; Vocabulary:</b>	<b>9</b>
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Identifying and Changing Parts of Speech - Verbs: Main and Auxiliary, Regular and Irregular, Finite and Non-Finite – Reading: Prediction and Surveying – Writing: Filling an Application Form – Essays – Activities: Listening: Types of Listening – Speaking: Talking About Oneself, One's Family, Friends and Favorite Persons.

<b>Unit – II</b>	<b>Grammar &amp; Vocabulary:</b>	<b>9</b>
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Tenses – Prefixes and Suffixes – Synonyms and Antonyms – Reading: Types: Skimming, Scanning, Word-by-Word and Speed – Writing: Describing Persons, Places and Products and Processes – Activities: Listening: Process of Listening – Speaking: Presentation.

<b>Unit – III</b>	<b>Grammar &amp; Vocabulary:</b>	<b>9</b>
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Active and Passive Voice – Impersonal Passive – Reported Speech – Reading: Reading Comprehension – Paraphrasing – Writing: Warnings and Instructions – Activities: Listening: Effective Listening Strategies – Speaking: TED Talk.

<b>Unit – IV</b>	<b>Grammar &amp; Vocabulary:</b>	<b>9</b>
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Abbreviations and Acronyms – Structure of Captions/Slogans – Prepositions – Reading: Intensive Reading and Note-making – Writing: Informal and Formal Letters: Enquiry and Placing Order – Activities: Listening: Gap Filling Activity while Listening – Speaking: Narration of an Event – Description of a Product.

<b>Unit – V</b>	<b>Grammar &amp; Vocabulary:</b>	<b>9</b>
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Connectives and Discourse Markers and Text Organization – Sentence Patterns in English – Punctuations – Reading: Tongue Twisters – Rearranging Jumbled Sentences – Writing: E-mails – Preparing the Transcript for a Speech – Activities: Listening: Listening to a Lecture and Taking Notes – Speaking: Describing a Picture.

**Total: 45****TEXT BOOK:**

- |    |   |
|----|---|
| 1. | Sanjay Kumar and Pushp Lata, "Communication Skills", 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2015. |
|----|---|

**REFERENCES:**

- |    |   |
|----|---|
| 1. | Raymond Murphy, "Essential English Grammar: Reference and Practice for South Asian Students", 2 <sup>nd</sup> Edition, Cambridge: Cambridge University Press, 2012. |
| 2. | Glennis Pye, "Vocabulary in Practice, Parts 1 and 2", 1 <sup>st</sup> Edition, Cambridge: Cambridge University Press, 2011.   |



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify and use content words which carry more meaning	Understanding (K2)
CO2	construct sentences in English	Applying (K3)
CO3	read short, simple messages and texts with complete understanding	Understanding (K2)
CO4	write at the sentence and paragraph level and beyond	Creating (K6)
CO5	speak in a given context	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				1		2		1	2	3		3	1	1
CO2				1		2		1	2	3		3	1	1
CO3				1		2		1	3	3		3	1	1
CO4				1		2		1	3	3		3	1	1
CO5				1		2		1	3	3		3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	50			30	100
CAT2	10	10	50			30	100
CAT3	10	10	50			30	100
ESE	10	10	50			30	100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST12 – APPLIED MATHEMATICS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>BS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	The course aims to deal with mathematical logic, counting techniques, finding best fitting curve to the given data, and to solve equations of certain types, interpolate polynomials for given data and perform integration and differentiation of numerical data.
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<b>Unit – I</b>	<b>Mathematical Logic:</b>	<b>9+3</b>
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Logic – Propositional Calculus – Truth Table – Tautology and Contradiction – Equivalences and Implications – Normal Forms – Proofs in Propositional Calculus – Predicates and Quantifiers – Nested Quantifiers – Proofs in Predicate Calculus.

<b>Unit – II</b>	<b>Counting Techniques:</b>	<b>9+3</b>
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Principle of Inclusion and Exclusion – Recurrence Relations – Formation – Solution of Non-Homogeneous Linear Recurrence Relations when the RHS is a Constant, a Linear Polynomial, an Exponential Function – Generating Functions – Solution of Recurrence Relations by using Generating Functions.

<b>Unit – III</b>	<b>Curve Fitting:</b>	<b>9+3</b>
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Method of Least Squares: Fitting of Straight Line of the Form  $y = ax + b$ - Fitting a Parabola of the Form  $y = ax^2 + bx + c$  – Fitting of an Exponential Curve of the Form  $y = ax^b$ ,  $y = ae^{bx}$ ,  $y = ab^x$  – Calculation of the Sum of Squares of Residuals in the Cases of Straight Line Fit and Parabola Fit.

<b>Unit – IV</b>	<b>Solution of Algebraic and Transcendental Equations:</b>	<b>9+3</b>
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Bisection Method – Newton-Raphson Method – Regula-Falsi Method – Fixed Point Iterative Method – Solution of Simultaneous Linear Equations: Gauss Elimination Method – Gauss Jordan Method – Inverse of a Matrix – Gauss-Jacobi and Gauss-Seidel Iterative Methods..

<b>Unit – V</b>	<b>Interpolation:</b>	<b>9+3</b>
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Newton – Gregory Forward Interpolation Formula – Newton – Gregory Backward Interpolation Formula for Equally Distributed Data – Newton’s Divided Difference Method for Unequally Distributed Data – Lagrange Interpolation Formula – Numerical Differentiation and Integration: Numerical Differentiation using Newton’s Forward and Backward Difference Formula – Numerical Integration using Simpson’s 1/3rd Rule – Simpson’s 3/8th Rule – Trapezoidal Rule.

**Lecture: 45, Tutorial: 15, Total: 60**

**TEXT BOOK:**

1a.	Veerarajan T., “Discrete Mathematics with Graph Theory and Combinatorics”, 18 <sup>th</sup> Reprint, Tata McGraw Hill, New Delhi, 2017. For Unit I & II.
1b.	Kandasamy P., Thilagavathy K. and Gunavathi K., “Numerical Methods”, 2 <sup>nd</sup> Edition, S.Chand & Company, Reprint, Tamil Nadu, 2013. For Unit III, IV & V.

**REFERENCES:**

1.	Kenneth H. Rosen, “Discrete Mathematics and its Applications”, 7 <sup>th</sup> Edition, Tata McGraw - Hill Pub. Co. Ltd., New Delhi, 2017.
2.	Sastry S.S., “Introductory Methods of Numerical Analysis”, 5 <sup>th</sup> Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	derive the inferences from Propositions and Predicates.	Analyzing (K4)
CO2	make use of the counting techniques to some situations.	Applying (K3)
CO3	determine the best fitting curve to the given data.	Applying (K3)
CO4	solve the algebraic and transcendental equations and simultaneous linear equations.	Applying (K3)
CO5	perform interpolation, extrapolation, numerical differentiation and numerical integration.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1								3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	12	12	43	33			100
CAT2	12	12	76				100
CAT3	12	12	76				100
ESE	4	4	75	17			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20IST13 – PROGRAMMING IN C

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Preamble** To focus on developing programming skills using C language.

**Unit – I** **Introduction to Programming and C:** **9**

Introduction to Computer Software – Classification of Computer Software – Programming Languages – Generation of Programming Languages – Introduction to C: Structure of a C program – Compiling and Executing C program – C Tokens – Character Set – Keywords – Identifiers – Data Types – Variables – Constants – Input/Output Statements – Operators – Type Conversion and Typecasting.

**Unit – II** **Decision Control and Looping Statements:** **9**

Introduction to Decision Control Statements – Conditional Branching Statements – Iterative Statements – Nested Loops – Break and Continue Statement – goto statement

**Unit – III** **Arrays and Strings:** **9**

Declaring, Initializing and Accessing Arrays – Operations – Two-dimensional Arrays – Operations on Two-dimensional Arrays – Multidimensional Arrays – Sparse Matrices – Applications of Arrays Strings: Introduction – Operations on Strings – Arrays of Strings.

**Unit – IV** **Functions:** **9**

Introduction – Function Declaration/Function Prototype – Function Definition – Function Call – Return Statement – Passing Parameters to Functions – Scope of Variables – Storage Classes – Recursive Functions – Types of Recursion – Passing One-dimensional Arrays and Two-dimensional Arrays to Functions.

**Unit – V** **Pointers:** **9**

Introduction – Declaring Pointer Variables – Pointer Expressions and Pointer Arithmetic – Null Pointers – Generic Pointers – Passing Arguments to Function Using Pointers – Pointers and Arrays – Passing an Array to a Function – Pointers and Strings – Arrays of Pointers – Pointers and 2D Arrays – Function Pointers – Array of Function Pointers – Pointers to Pointers – Drawbacks of Pointers.

**Total: 45**

**TEXT BOOK:**

1. Reema Thareja., "Programming in C ", 2<sup>nd</sup> Edition, Oxford University Press, New Delhi, 2018

**REFERENCES:**

1. Sumitabha Das, "Computer Fundamentals and C Programming", 1<sup>st</sup> Edition, McGraw Hill Education (India) Private Limited, 2018
2. Yashavant Kanetkar, "Let us C", 16<sup>th</sup> Edition, BPB publications, New Delhi, 2018.
3. Balagurusamy. E., "Programming in ANSI C", 7<sup>th</sup> edition, McGraw Hill Education (India) Private Limited, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline the basics of programming and C language.	Understanding (K2)
CO2	identify the appropriate decision control and looping statements in C and develop applications using these statements.	Applying (K3)
CO3	develop simple C programs using the concepts of arrays and strings.	Applying (K3)
CO4	implement modular programming in C language.	Applying (K3)
CO5	recall the concepts of pointers and develop C programs using pointers.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	25	35	40				100
CAT3	20	30	50				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST14 – DIGITAL PRINCIPLES AND LOGIC DESIGN**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>ES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To emphasize the fundamental concepts and overview of Electrical and Electronics Engineering for beginners.						
<b>Unit – I</b>	<b>Binary Systems and Logic Gates:</b>						<b>9</b>
Digital Systems – Binary Numbers – Number Base Conversions – Octal Numbers – Hexadecimal Numbers – Complements (1's Complement and 2's Complement) – Binary Codes – Binary Storage and Registers – Binary Logic – Digital Logic Gates.							
<b>Unit – II</b>	<b>Minimization and Boolean Algebra:</b>						<b>9</b>
Basic Theorems and Properties of Boolean Algebra – Boolean Functions – Canonical and Standard Forms – K-Map Method: Two-Variables - Three-Variables - Four-Variables – Don't Care Conditions – NAND and NOR Implementation.							
<b>Unit – III</b>	<b>Combinational Logic:</b>						<b>9</b>
Combinational Circuits – Analysis Procedure – Design Procedure – Binary Adder: Half Adder – Full Adder – Binary Subtractor: Half Subtractor – Full Subtractor – Decoders – Encoders – Multiplexers.							
<b>Unit – IV</b>	<b>Synchronous Sequential Logic:</b>						<b>9</b>
Sequential Circuits – Latches: SR, D Latches – Flip-Flops: D Flip-Flop – JK Flip-Flop – T Flip-Flop – Characteristic Table – Characteristic Equation – Analysis of Clocked Sequential Circuits: Analysis of D Flip-Flops – Analysis of T Flip-Flops.							
<b>Unit – V</b>	<b>Registers and Counters:</b>						<b>9</b>
Registers – Types of Shift Registers: SISO – SIPO – PISO – PIPO – Universal Shift Registers – Ripple Counters: Binary Ripple Counters – BCD Ripple Counters – Ring Counters – Johnson Counter.							

**Total: 45****TEXT BOOK:**

1.	Morris R. Mano M., Michael D. Ciletti., "Digital Design: With an Introduction to the Verilog HDL, VHDL, and System Verilog", 6 <sup>th</sup> Edition, Pearson, United States, 2018
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**REFERENCES:**

1.	Ghoshal Subrata, "Digital Electronics", 2 <sup>nd</sup> Edition, Cengage Learning, New Delhi, 2018
2.	Alam Mansaf, Alam Bashir Abhijit., Debnath Sudipta., "Digital Logic Design", 1 <sup>st</sup> Edition, PHI Learning Pvt. Ltd., New Delhi, 2016.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	solve problems related to number base conversions and binary codes.	Applying (K3)
CO2	apply the concept of Boolean Algebra and implement minimization techniques.	Applying (K3)
CO3	design the basic combinational circuits.	Applying (K3)
CO4	analyze the functions of basic flip-flops.	Analyzing (K4)
CO5	interpret the concepts of registers and counters.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	3	2	2	1								3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	25	55				100
CAT2	15	30	55				100
CAT3	20	40	15	25			100
ESE	15	20	50	15			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20IST15 – FUNDAMENTALS OF COMPUTER SCIENCE

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Preamble** To provide basic knowledge on fundamentals of computers and problem solving techniques.

**Unit – I** **Introduction to Computer and Problem Solving:** **9+3**

Overview of Computers – Characteristics of Computers – Basic Computer Organization – Applications of Computer – Problem Solving – Problem Solving Techniques - Structuring the Logic – Top Down Design.

**Unit – II** **Case Study on Problem Solving:** **9+3**

Algorithm, Flowchart and Pseudocode for the Problems: Exchanging the Values of Two Variables – Finding the Biggest Number – Counting – Summation of Numbers – Factorial Computation – Generation of Fibonacci Sequence – Summation of Series – Base Conversion – Reversing the Digits of a Number.

**Unit – III** **Memory and I/O Devices:** **9+3**

Computer Memory: Introduction – Representation – Hierarchy – CPU Registers – Cache Memory – Primary and Secondary Memory – Access Types – Magnetic Storage – Optical Storage – Using the Computer Memory – Input and Output Devices: Introduction – I/O Unit – Data Entry Devices – Output Devices – I/O Port – Working of I/O system.

**Unit – IV** **Computer Software and Network Fundamentals:** **9+3**

Interaction of User and Computer: Introduction – Types of Software – System and Application Software – Software Acquisition – Data Communication and Computer Network: Introduction – Importance – Transmission Media – Data Transmission and Data Networking – Computer Network – Wireless Networking.

**Unit – V** **Internet Services and Information Systems:** **9+3**

Internet and Internet Services: Introduction – History – Protocol – Architecture – Managing and Connecting to the Internet – Connections – Address – Services – Uses – Information Systems: Introduction – Data, Information and Knowledge – Characteristics – Information System – Computer based Information System – Need – Categories – Operations Systems Support – Management Support System – Specialized Information System – Careers.

**Lecture: 45, Tutorial: 15, Total: 60**

**TEXT BOOK:**

- Anita Goel, "Computer Fundamentals", 1<sup>st</sup> Edition, Pearson India Education Services Pvt. Ltd, New Delhi, 2010.

**REFERENCES:**

- Sinha K.Pradeep, Sinha Priti, "Computer Fundamentals", 6<sup>th</sup> Edition, BPB Publications, New Delhi, 2011.
- Balagurusamy E., "Fundamentals of Computers", 1<sup>st</sup> Edition, Tata McGraw Hill Ltd, New Delhi, 2009.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand the basics of computer and employ the problem solving techniques for the given simple problems.	Applying (K3)
CO2	compute the solution for the given real world problems in terms of algorithm, flowchart and pseudocode.	Applying (K3)
CO3	explain the features of memory unit and input-output devices.	Understanding (K2)
CO4	interpret the functioning of software and computer networks.	Understanding (K2)
CO5	outline the concepts of services provided by the internet and information systems.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	2	1											2	3
CO4	2	1											2	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	45	40				100
CAT2	15	65	20				100
CAT3	30	70					100
ESE	15	50	35				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISL11 – COMMUNICATIVE ENGLISH I LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>HS</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	To communicate in formal forum effectively and write long passages independently.						

**List of Exercises / Experiments:**

	<b>Listening/ DVD, podcasts and Authentic Videos</b>	<b>Speaking</b>
1	People saying 'hello' and giving personal information; BBC programme about people around the world	Self-introduction, giving personal information and talking about important people in one's life
2	Listening to celebrity talk	Talking about role models, leaders, thinkers, musicians, singers, actors and people in the news
3	Listening to talks related to leisure, hobbies, travel and life in a country; travel shows	Talking about places one has visited and would like to go
4	Listening to discussions of current topics and social issues; people living on the edge	Presentation on a topic of social relevance
5	Listening to models of welcome address, introduction of guests and proposing vote of thanks in a function	Giving welcome address / introduction / vote of thanks for a given context
6	Listening to real or imaginary stories; The Chilean Miners' rescue	Narrating an event or a story
7	Listening to descriptions of technological gadgets; Days that shook the world	Describing a scientific invention or a piece of technology
8	Stand-up comedy; Mr. Beans; Miranda	Anecdotes and examples of wit and humour
9	Learning a new language; study habits	Talking about various aspects of language
10.	Goal-setting; motivation, positive thinking and time management	Understanding and explaining the meaning of famous quotes

**Total: 30****REFERENCES/MANUAL/SOFTWARE:**

1.	DVD, Podcasts and Authentic Videos
2.	Laboratory Manual

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	understand the pronunciation of the native speakers (English) about their real time experience after listening to the videos.	Understanding (K2), Manipulation (S2)
CO2	reconstruct information through writing after effectively listening.	Evaluating (K5), Imitation (S1)
CO3	take part in various professional, academic, and cultural and social events.	Analyzing (K4), Manipulation (S2)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				1		2		1	2	3		3	1	1
CO2				1		2		1	2	3		3	1	1
CO3				1		2		1	2	3		3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20ISL12 – PROGRAMMING IN C LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To introduce the field of programming using C language.						

**List of Exercises / Experiments:**

1.	Programs for demonstrating the use of different types of operators like arithmetic, logical, relational and ternary operators (Sequential structures).
2.	Programs to illustrate the different formatting options for input and output.
3.	Programs using decision making statements like 'if', 'else if', 'switch', conditional and unconditional 'goto' (Selective structures).
4.	Programs for demonstrating repetitive control statements like 'for', 'while' and 'do-while' (Iterative structures).
5.	Programs for demonstrating one-dimensional and two-dimensional numeric array.
6.	Programs to implement various character and string operations with and without built-in library functions.
7.	Programs to demonstrate modular programming concepts using functions (Using built-in and user-defined functions).
8.	Program to implement recursive functions.
9.	Programs to demonstrate the usage of pointers and functions.
10.	Programs to demonstrate the usage of pointers and arrays.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	demonstrate the execution of flowchart for the given problem using Raptor.	Applying (K3), Precision (S3)
CO2	demonstrate the application of sequential, selective and repetitive control structures.	Applying (K3), Precision (S3)
CO3	implement solutions to the given problem using derived and user defined data types and functions.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20ISL13 – DIGITAL PRINCIPLES AND LOGIC DESIGN LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>ES</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	To provide the knowledge in the basic concepts of Combinational and Sequential Circuits. It emphasizes on providing fundamental concepts related to electronics engineering.						

**List of Exercises / Experiments:**

1.	Verification of AND, OR, NOT, NAND, NOR, XOR Logic Gates
2.	Verification of Code Converter
3.	Verification of Parity Generator
4.	Verification of Half Adder and Full Adder
5.	Verification of Half Subtractor and Full Subtractor
6.	Verification of Decoder and Encoder
7.	Verification of Multiplexer and Demultiplexer
8.	Verification of SR and D Flipflops
9.	Verification of Binary and BCD counter
10.	Verification of Up / Down 4 bit Binary Counter

**Total: 30****REFERENCES/MANUAL/SOFTWARE:**

1.	Digital Trainer Kit, Integrated Circuits
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	perform the operation of identifying various digital ICs and understand their functionalities.	Understanding (K2), Manipulation (S2)
CO2	demonstrate basic combinational circuits and verify their functionalities.	Applying (K3), Precision (S3)
CO3	master the design procedures to design basic sequential circuits.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy



## 20MNT13 – STUDENT INDUCTION PROGRAM

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>1</b>	<b>MC</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>

<b>Preamble</b>	To make the student to understand the meaning of happiness and prosperity for a human being. Also to facilitate the students to understand the harmony of human living and importance of physical and mental strength through yoga and meditation.
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<b>Unit – I</b>	<b>Overview of College and Department:</b>	<b>9</b>
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General facilities - Autonomous System - Curriculum Overview & Assessment - Outcome Based Education – Placement and Higher Education Opportunities-Entrepreneurship-Value Added Course-Online Course.

<b>Unit – II</b>	<b>Universal Human Values:</b>	<b>9</b>
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Holistic Development & Role of Education - Understanding Happiness - Understanding the Human Being – Self & Body - Understanding the Human Being – Activities of Self - Prosperity - Understanding Relationship Trust - Understanding Relationship Respect - Understanding Relationship Other Feelings - Understanding Society - Understanding Nature Existence.

<b>Unit – III</b>	<b>Yoga and Meditation:</b>	<b>9</b>
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Introduction to Yoga – Objective – Physical Exercises: Need and Objectives of Simplified Physical Exercise – Types of Physical Exercises – Meditation: Qualities acquired through Meditation – Mental Health – Simple Meditation – Stress Management – Human Values: Self control - Self confidence – Honesty – Contentment – Humility – Modesty Tolerance – Adjustment – Sacrifice – Forgiveness – Importance of Thought Process – Self Realization.

**Total: 20**

<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	interpret the values and culture of the Institution.	Understanding (K2)
CO2	enhance the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human–human relationships and explore their role in ensuring a harmonious society.	Understanding (K2)
CO3	know the value holistic vision of life and take steps to develop physical and mental health.	Applying (K3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						3		3				1	2	3
CO2						3		3				1	2	3
CO3						3		3				1	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

**ASSESSMENT PATTERN – THEORY**

Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT	25	75					100

\* ±3% may be varied (CAT – 100 marks)



## 20IST21 – COMMUNICATIVE ENGLISH II

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>2</b>	<b>HS</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To construct sentences effectively and facilitate to improve interpersonal skills of the learners.						
<b>Unit – I</b>	<b>Grammar &amp; Vocabulary:</b>						<b>9</b>
Analogy – Meaning Based Classification of Sentences – Assertive, Imperative, Interrogative and Exclamatory and Positive, Negative – Reading: Passages Focusing on Factual Details, and Features of Text Organization as well as Gist, Opinions and Attitudes – Writing: Letter Writing: Inviting Guests, Job Application with Resume, Seeking Permission for Industrial Visit – Activities: Listening: Social Conversations – Speaking: Presentation.							
<b>Unit – II</b>	<b>Grammar &amp; Vocabulary:</b>						<b>9</b>
Homonyms and Homophones – Subject - Verb Agreement – Reading: Gapped – Text Exercises – Writing: Graphic Presentation and Transcoding – Preparing proposals – Activities: Listening: Telephone conversations – Speaking: Role-Play.							
<b>Unit – III</b>	<b>Grammar &amp; Vocabulary:</b>						<b>9</b>
Articles and Determiners- Structure Based Classification of Sentences: Simple, Compound And Complex – Reading: Multiple – Matching – Writing: Checklists – Memorandum – Designing brochures – Activities: Listening: Group Discussions – Speaking: Group Discussion.							
<b>Unit – IV</b>	<b>Grammar &amp; Vocabulary:</b>						<b>9</b>
Error Detection – Gerunds & Infinitives – Reading: Business English Certificate (BEC) Type Exercises – Writing: Technical / Standalone Report – Activities: Listening: Motivational Talks – Speaking: Soft skills.							
<b>Unit – V</b>	<b>Grammar &amp; Vocabulary:</b>						<b>9</b>
Single Word Substitution – Definitions – Purpose and function – Interpreting News / Advertisement – Reading: International English Language Testing System (IELTS) Type Exercises – Writing: Special Reports: Types – Accident / Incident or Event, Trip, Lab and Inspection – Activities: Listening: TED Talks – Speaking: Mock-Interviews.							

**Total: 45****TEXT BOOK:**

1.	Sanjay Kumar and Pushp Lata, "Communication Skills", 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi 2015
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**REFERENCES:**

1.	Raymond Murphy, "Intermediate English Grammar: Reference and Practice for South Asian Students", 2 <sup>nd</sup> Edition, Cambridge: Cambridge University Press, 2011.
2.	Glennis Pye, "Vocabulary in Practice, Parts 1 and 2", 1 <sup>st</sup> Edition, Cambridge: Cambridge University Press, 2011.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	use structural words appropriately in spoken and written texts.	Remembering (K1)
CO2	construct different types of sentences.	Applying (K3)
CO3	read longer academic and business English texts with maximum understanding.	Understanding (K2)
CO4	write beyond the sentence level.	Creating (K6)
CO5	communicate effectively in a vast range of personal, professional, academic, and cultural situations.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				1		2		1	2	3		3	1	1
CO2				1		2		1	2	3		3	1	1
CO3				1		2		1	3	3		3	1	1
CO4				1		2		1	3	3		3	1	1
CO5				1		2		1	3	3		3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	10	40	10		30	100
CAT2	10	10	50			30	100
CAT3	10	10	50			30	100
ESE	10	10	40	10		30	100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20IST22 – OPERATIONS RESEARCH

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>2</b>	<b>BS</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

**Preamble** To provide knowledge in using optimization techniques with limited resources for the engineering and science problems.

**Unit – I** **Linear Programming Model and its Applications:** **9+3**

Introduction – Formulation of Linear Programming Problem – Solution by Graphical method – Some Special Cases – Solution by Simplex Method – Artificial Variable Techniques : Big M Method – Two Phase Simplex method.

**Unit – II** **Transportation Models:** **9+3**

Formulation – Initial Basic Feasible Solution – Optimum Solution by MODI Method – Unbalanced and Maximization Transportation Problems – Assignment Models: Formulation – Optimum Solution by Hungarian Method – Unbalanced, Maximization and Impossible Assignment.

**Unit – III** **Network Models:** **9+3**

Introduction – Phases of Project Management – Network construction – Forward and Backward Pass Computations – Critical Path Method (CPM) – Total, Free and Independent Floats – Programme Evaluation and Review Techniques (PERT) – Cost Considerations in Network – Crashing.

**Unit – IV** **Decision Analysis:** **9+3**

Steps in Decision Theory Approach – Decision Making Environments: Decision under Uncertainty – Decision under Certainty – Decision Making under Risk – Expected Monetary Value (EMV) Criterion – Expected Opportunity Loss (EOL) Criterion – Expected Value with Perfect Information (EPPI).

Game Theory: Basic Terminologies – Two Person Zero Sum Game – 2 x2 Games - Games without Saddle Point – Mixed Strategies – Matrix method for 3 x 3 Games – Dominance Property – Graphical Method for 2 x n and n x2 Games.

**Unit – V** **Queuing and Inventory Models:** **9+3**

Characteristics of Queuing Models – Model I (M/M/1): ( $\infty$ /FIFO) – Model II (M/M/s): ( $\infty$ /FIFO) – Model III (M/M/1): (N/FIFO) – Model IV (M/M/s): (N/FIFO) – Inventory Models: Costs Involved in Inventory Problems – Economic Order Quantity (EOQ) – Model I: Purchasing Model with No Shortages – Model II: Manufacturing Model with No Shortages – Model III: Purchasing Model with Shortages – Model IV: Manufacturing Model with Shortages.

**Lecture: 45, Tutorial: 15, Total: 60**

**TEXT BOOK:**

1. Kanti Swarup, Gupta PK and Manmohan, "Operations Research", 14<sup>th</sup> Edition, Sultan Chand & Sons, New Delhi, 2014.

**REFERENCES:**

1. Natarajan A. M, Balasubramanie P., and Tamilarasi A., "Operations Research", 2<sup>nd</sup> Edition, Pearson, New Delhi, 2014.

2. Taha H.A., "Operations Research An Introduction", 10<sup>th</sup> Edition, Pearson, New Delhi, 2019.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	formulate and solve the linear programming problems.	Applying (K3)
CO2	formulate and solve the transportation and assignment problems.	Applying (K3)
CO3	apply CPM and PERT techniques to network models.	Applying (K3)
CO4	analyze various decision making environments and to solve the game theory problems.	Analyzing (K4)
CO5	solve the problems based on queuing and inventory models.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	3	2	2	1								3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	12	12	76				100
CAT2	12	12	76				100
CAT3	12	12	46	30			100
ESE	4	4	76	16			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST23 – PROGRAMMING AND LINEAR DATA STRUCTURES**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Programming in C</b>	<b>2</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To articulate the advanced concepts of C language and basic concepts and applications of linear data structures like linked list, stack and queue.
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<b>Unit – I</b>	<b>User-Defined Data Types:</b>	<b>9</b>
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Introduction to Structures – Nested Structures – Arrays of Structures – Structures and Functions – Self-referential Structures – Unions – Arrays of Union Variables – Unions Inside Structures – Structure Inside Union – Enumerated Data Type.

<b>Unit – II</b>	<b>Files:</b>	<b>9</b>
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Introduction – Using Files in C – Reading and Writing Data to Files – Detecting the End-of-File – Error Handling During File Operations – Accepting Command Line Arguments – Functions for Selecting a Record Randomly – remove() – Renaming the File.

<b>Unit – III</b>	<b>Memory Management and Preprocessor Directives:</b>	<b>9</b>
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Memory Allocation in C Programs – Dynamic Memory Allocation – Preprocessor Directives: Introduction – Types - #define - #include - #undef - #line - Pragma Directives – Conditional Directives – Defined Operator - #error Directive – Predefined Macro Names.

<b>Unit – IV</b>	<b>Data Structures and Linked List:</b>	<b>9</b>
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Introduction to Data Structures – Linked List Versus Arrays – Memory Allocation and Deallocation for a Linked List – Types of Linked Lists – Singly Linked Lists – Traversing – Searching – Inserting a New Node - Circular Linked List – Doubly Linked Lists – Circular Doubly Linked Lists – Header Linked Lists – Applications of Linked Lists.

<b>Unit – V</b>	<b>Stacks and Queue:</b>	<b>9</b>
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Stack – Array Representation of Stacks – Operations – Applications – Queues: Array Representation of Stacks – Operations – Applications.

**Total: 45****TEXT BOOK:**

1.	ReemaThareja., “Programming in C”, 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2018.
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**REFERENCES:**

1.	Sumitabha Das, “Computer Fundamentals & C Programming”, 1 <sup>st</sup> Edition, McGraw Hill Education (India) Private Limited, 2018.
2.	Yashavant Kanetkar, “Pointers in C”, 4 <sup>th</sup> Edition, BPP Publications, New Delhi, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	make use of user defined data types to solve given problems.	Applying (K3)
CO2	demonstrate the usage of file operations.	Applying (K3)
CO3	develop C programs using preprocessor directives.	Understanding (K2)
CO4	implement the operations of different types of linked list.	Applying (K3)
CO5	manipulate the operations on stacks and queues.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	30	40	30				100
CAT3	20	30	50				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST24 – BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>2</b>	<b>ES</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To emphasize the fundamental concepts and overview of Electrical and Electronics Engineering for beginners.						
<b>Unit – I</b>	<b>Power Generation</b> [Excluding Problems]:						<b>9</b>
Introduction – Conventional Energy: Generating Systems – Schematic Arrangements of Thermal – Hydro – Nuclear Power Plants – Comparison of the Power Plants – Non-Conventional Energy: Solar Energy.							
<b>Unit – II</b>	<b>Fundamentals of DC and AC Circuits:</b>						<b>9</b>
Basic Concepts: Electric Field – Electric Potential – Electric Current – Potential Difference – Resistance – Work – Electrical Power & Electrical Energy – Ohm’s Law – Problems Based on Simple Resistive Networks – Kirchhoff’s Law: Kirchhoff’s Current Law – Kirchhoff’s Voltage Law – Alternating Voltage and Current: Waveform – Cycle – Time Period – Frequency – RMS Value – Average Value – Form Factor and Peak Factor for Sine Wave only.							
<b>Unit – III</b>	<b>Electro Magnetic Induction and Electrical Machines</b> [Excluding Problems]:						<b>9</b>
Law of Electromagnetic Induction: Faraday’s Laws – Lenz’s Law – Fleming’s Left and Right – Hand Rule – Principle, Construction and Applications: DC Generator – DC Motor – Single Phase Transformer.							
<b>Unit – IV</b>	<b>Junction Diode and Transistor:</b>						<b>9</b>
Semiconductor Theory – Theory of PN Junction Diode – PN Diode Applications – Zener Diode – Construction of Bipolar Junction Transistor.							
<b>Unit – V</b>	<b>Rectifiers</b> [Excluding Problems]:						<b>9</b>
Half Wave Rectifier – Full Wave Bridge Rectifier – Power Conditioning Equipments: Switched Mode Power Supply (SMPS) – Uninterrupted Power Supply (UPS) (Block Diagram only).							

**Total: 45****TEXT BOOK:**

1.	R.Muthusubramanian., S.Salivahanan., “Basic Electrical and Electronics Engineering”, 1 <sup>st</sup> Edition , McGraw Hill Education (India) Pvt. Ltd., New Delhi, 2013.
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**REFERENCES:**

1.	Mottershead, Allen, “Electronic Devices And Circuits: An Introduction”, 4 <sup>th</sup> Edition, Prentice Hall of India, New Delhi, 2009.
2.	Prasad P.V., Sivanagaraju S., Prasad R., “Basic Electrical and Electronics Engineering”, Cengage Learning India Pvt. Ltd., New Delhi, 2013.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understand the different sources of energy and types of power plants.	Understanding (K2)
CO2	examine the DC and AC circuits.	Analyzing (K4)
CO3	demonstrate the working of electrical machines.	Understanding (K2)
CO4	discuss the principles of basic electronic devices.	Understanding (K2)
CO5	apply the electronic devices principles in the design of rectifiers.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	3	2	2	1								3	3
CO3	2	1											2	3
CO4	2	1											2	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	55	10	20			100
CAT2	15	55	10	20			100
CAT3	25	55	20				100
ESE	15	55	15	15			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST25 – COMPUTER ORGANIZATION**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>2</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	This course outlines the hardware architecture of computer. It also exemplifies the execution of instruction in the computer system.						
<b>Unit – I</b>	<b>Basic Structure and Machine Instructions:</b>						<b>9+3</b>
Introduction – Functional Units – Basic Operational Concepts – Bus Structures – Performance – Multiprocessors and Multicomputer – Machine Instructions: Numbers, Arithmetic Operations and Characters – Memory Locations and Addresses – Memory Operations – Instructions and Instruction Sequencing – Addressing Modes.							
<b>Unit – II</b>	<b>Arithmetic Operations:</b>						<b>9+3</b>
Addition and Subtraction of Signed Numbers – Design of Fast Adders – Multiplication of Positive Numbers – Signed Operand and Fast Multiplication – Integer Division – Floating Point Numbers and Operations.							
<b>Unit – III</b>	<b>Basic Processing Unit and Pipelining:</b>						<b>9+3</b>
Fundamental Concepts – Execution of a Complete Instruction – Multiple Bus Organization – Hardwired and Micro Programmed Control – Pipelining: Basic Concepts – Data and Instruction Hazards.							
<b>Unit – IV</b>	<b>Memory Systems:</b>						<b>9+3</b>
Basic Concepts – Semiconductor RAM – ROM – Speed Size and Cost – Cache Memories – Performance Considerations – Virtual Memories – Memory Management Requirements – Secondary Storage.							
<b>Unit – V</b>	<b>Input/output Organization:</b>						<b>9+3</b>
Introduction – Accessing I/O Devices – Interrupts – Direct Memory Access – Buses – Case Study of one RISC and one CISC Processor.							

**Lecture: 45, Tutorial: 15, Total: 60****TEXT BOOK:**

1.	Hamacher Carl, Vranesic Zvonko and ZakySafwat, “Computer Organization”, 5 <sup>th</sup> Edition, McGraw Hill, New York, 2016.
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**REFERENCES:**

1.	Patterson David A. and Hennessy John L., “Computer Organization and Design: The Hardware / Software Interface”, 2 <sup>nd</sup> Edition, Harcourt Asia, Morgan Kaufmann, Singapore, 2014.
2.	Hayes John P., “Computer Architecture and Organization”, 3 <sup>rd</sup> Edition, Tata McGraw Hill, New Delhi, 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer computer components and addressing modes.	Understanding (K2)
CO2	compute arithmetic operations on signed and unsigned numbers.	Applying (K3)
CO3	describe the execution of instructions.	Understanding (K2)
CO4	interpret the basic storage concepts.	Understanding (K2)
CO5	infer data transfer mechanism and CISC, RISC processors.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	2	1											2	3
CO4	2	1											2	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	55	30				100
CAT2	15	60	25				100
CAT3	20	80					100
ESE	20	65	15				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISL21 – COMMUNICATIVE ENGLISH II LABORATORY

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>2</b>	<b>HS</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	To provide good exposure in the field of communication.						

**List of Exercises / Experiments:**

	<b>Listening/ DVD, podcasts and Authentic Videos</b>	<b>Speaking</b>
1	Professional Presentation: Preparation	Talking about an unforgettable moment in one's life
2	Professional Presentation: Delivery	Presenting a paper on a topic related to one's area of study
3	Telephone Conversations	Role play or situational dialogues
4	Films / Book Excerpts	Reviewing a film or a book
5	Group Discussion	Participating in a GD
6	Generation of Ideas	Presenting innovative ideas on a given topic
7	Soft Skills	Speaking on goal-setting, motivation, positive thinking, time and stress management, emotional intelligence, working in teams, conflict resolution, negotiation etc.
8	Creative Skills	Presenting a poem or a project
9	Becoming an Entrepreneur	Talking about one's business plans or start-ups
10.	Job Interview	Answering mock interview questions

**Total: 30****REFERENCES/MANUAL/SOFTWARE:**

1.	Globarena, Study Skill Success, Tense Buster, Issues in English
2.	Laboratory Manual

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

**BT Mapped  
(Highest Level)**

CO1	understand the videos through effective listening (Presentation, telephone etiquette, Group Discussion and Soft skills).	Understanding (K2), Manipulation (S3)
CO2	reconstruct information on their own after effectively listening.	Evaluating (K5), Imitation (S1)
CO3	take part in Group Discussion, Paper or project presentation, mock interview and acquire knowledge on soft skills.	Analyzing (K4), Manipulation (S2)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1				1		2		1	2	3		3	1	1
CO2				1		2		1	2	3		3	1	1
CO3				1		2		1	2	3		3	1	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20ISL22 – PROGRAMMING AND LINEAR DATA STRUCTURES LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Programming in C</b>	<b>2</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To develop an in-depth knowledge in C language and implement linear data structures using C						

**List of Exercises / Experiments:**

1.	Programs to illustrate the use of structures.
2.	Programs to implement the use of union.
3.	Program to perform operations on files.
4.	Program to implement command line arguments.
5.	Program to demonstrate dynamic memory allocation for 1D and 2D array.
6.	Program using conditional preprocessor directives.
7.	Program to implement singly linked list.
8.	Program to implement doubly linked list.
9.	Program to implement stack using array
10.	Program to implement queue using array

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	implement programs to solve problems using pointers to arrays and structures.	Applying (K3), Precision (S3)
CO2	develop programs using files and preprocessor directives.	Applying (K3), Precision (S3)
CO3	use appropriate linear data structure for solving given problems.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

**20ISL23 – BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>2</b>	<b>ES</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To provide the knowledge in the basic concepts of Electrical science. It emphasizes on providing fundamental concepts related to electrical and electronics engineering						

**List of Exercises / Experiments:**

1.	Resistor colour code.
2.	Verification of Ohm's Law.
3.	Verification of Kirchhoff's Current Law.
4.	Verification of Kirchhoff's Voltage Law.
5.	Wiring circuit for fluorescent lamp and stair case wiring.
6.	Power measurement in DC circuits.
7.	VI characteristics of PN junction diode.
8.	VI characteristics of Zener diode.
9.	Implementation of half wave and full wave rectifier using diodes.
10.	Demo of DC/AC machine & parts.

**Total: 30****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	compute parameters in DC and AC circuits.	Understanding (K2), Imitation (S1)
CO2	conduct experiments to learn characteristics of PN junction diode and Zener diode.	Understanding (K2), Manipulation (S2)
CO3	perform simple wiring, stair case wiring and implement the rectifiers.	Analyzing (K4), Manipulation (S2)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1	1								3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20IST31 – OBJECT ORIENTED PROGRAMMING WITH C++**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Programming in C</b>	<b>3</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Preamble** To acquire acquaintance in object oriented programming and develop solutions for real time applications in C++.

**Unit – I** **Object-Oriented Programming:** **9**

The Object-Oriented Approach – Characteristics of Object-Oriented Languages – C++ Programming Basics – Loops and Decisions – Functions: Passing Arguments to Functions – Returning Values from Functions – Reference Arguments – Overloaded Functions – Recursion – Inline Functions – Default Arguments – Scope and Storage Class.

**Unit – II** **Objects and Classes:** **9**

A Simple Class – Objects as Data Types – Constructors – Constructor Types – Objects as Function Arguments – The Default Copy Constructor – Returning Objects from Functions – Classes – Objects and Memory – Static Class Data – Arrays: Arrays as Class Member Data – Arrays of Objects – Namespaces.

**Unit – III** **Operator Overloading and Inheritance:** **9**

Operator Overloading: Overloading Unary Operators – Overloading Binary Operators – Overloading the Assignment Operator – Data Conversion – Inheritance: Derived Class and Base Class – Derived Class Constructors – Overriding Member Functions – Class Hierarchies – Public and Private Inheritance – Types of Inheritance – Strings: The Standard C++ string Class.

**Unit – IV** **Pointers, Virtual and Friend Functions:** **9**

Pointers: Addresses and Pointers – The Address - of Operator (&) - Memory Management: new and delete – Virtual Functions: Normal Member Functions Accessed with Pointers – Virtual Member Functions Accessed with Pointers – Abstract Classes and Pure Virtual Functions – Friend Functions: Friends as Bridges – Static Functions.

**Unit – V** **IO Streams, Template and Exceptions:** **9**

Streams and Files: Stream Classes – Disk File I/O with Streams – Writing Data – Reading Data – Character I/O – Binary I/O – Templates and Exceptions: Function Templates – Class Templates – Exceptions.

**Total: 45****TEXT BOOK:**

1. Robert Lafore, "Object-Oriented Programming in C++", 4<sup>th</sup> Edition, SAMS Publishers, USA, 2008.

**REFERENCES:**

1. Stroustrup B, "The C++ Programming Language", 3<sup>rd</sup> Edition, Pearson Education, New Delhi, 2004.

2. Trivedi B, "Programming with ANSI C++", 2<sup>nd</sup> Edition, Oxford University Press, Oxford University, New Delhi, 2013.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	deduce the basic concepts of object oriented programming with C++.	Understanding (K2)
CO2	demonstrate the usage of classes and objects.	Applying (K3)
CO3	implementing application development using operator overloading and inheritance.	Applying (K3)
CO4	articulate the application of pointers, virtual and friend functions.	Applying (K3)
CO5	practice the concepts of I/O streams, template and exceptions.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	25	35	40				100
CAT3	20	30	50				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST32 – DATA STRUCTURES**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Programming and Linear Data Structures</b>	<b>3</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To provide the basic concepts, algorithms and applications of linear and non-linear data structures.						
<b>Unit – I</b>	<b>Stacks and Queues:</b>						<b>9</b>
Stacks: Linked Representation – Operations – Multiple Stacks – Applications: Reversing a List – Implementing Parentheses Checker – Recursion – Queues: Linked Representation – Operations – Types – Applications.							
<b>Unit – II</b>	<b>Trees:</b>						<b>9</b>
Introduction – Types – Creating a Binary Tree from a General Tree – Traversing a Binary Tree – Applications – Binary Search Trees (BST) – Operations: Searching – Insertion – Deletion – Finding the Smallest Node in BST – Finding the Largest Node in a BST – Threaded Binary Trees - AVL Trees: Operations- Searching for a Node in an AVL Tree.							
<b>Unit – III</b>	<b>Advanced Trees:</b>						<b>9</b>
Red-Black Trees: Properties – Operations: Insertion – Deletion- Applications – Splay Trees: Operations: Insertion – Deletion – Searching – Advantages and Disadvantages – B Trees: Searching – Insertion – Deletion – Application – Heap: Binary heaps – Operations: Insertion – Deletion – Applications.							
<b>Unit – IV</b>	<b>Graphs:</b>						<b>9</b>
Introduction – Graph Theory - Directed Graphs – Bi-connected Components – Representations : Adjacency Matrix – Adjacency List – Adjacency Multi-List – Graph Traversal Algorithms : Breadth First Search – Depth First Search – Topological Sort – Applications of Graphs.							
<b>Unit – V</b>	<b>Searching, Hashing and Collision:</b>						<b>9</b>
Searching: Introduction – Linear Search – Binary Search – Hashing: Introduction – Hash Tables – Hash Functions – Different Hash Functions – Collisions: Collision Resolution by Open Addressing – Collision Resolution by Chaining – Pros and Cons of Hashing – Applications of Hashing.							

**Total: 45****TEXT BOOK:**

1.	Reema Thareja., “Data Structures using C”, 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2018.
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**REFERENCES:**

1.	Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 2 <sup>nd</sup> Edition, Pearson Education, New York, 2016
2.	Jean Paul Tremblay and Paul G. Sorensen, “An Introduction to Data Structures with Applications”, 2 <sup>nd</sup> Edition, Tata McGraw Hill, New Delhi, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	solve the computational problems using linear data structures.	Applying (K3)
CO2	determine the structure and operations on trees.	Applying (K3)
CO3	implement the operations of special trees and heap concept.	Applying (K3)
CO4	apply appropriate graph algorithms for solving computing problems.	Applying (K3)
CO5	demonstrate the concept of searching, hashing and collision resolution techniques.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	25	55				100
CAT2	15	25	60				100
CAT3	15	20	65				100
ESE	15	20	65				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST33 – OPERATING SYSTEMS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To provide background knowledge in operating system and its functionalities. It exemplifies the classical internal algorithms and memory management strategies of operating systems.
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<b>Unit – I</b>	<b>Overview and Process:</b>	<b>9</b>
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Introduction: Roles of Operating System – Operating System Structure – Operating System Structures: Operating Systems Services – User and Operating System Interface – System Calls – System Services – Processes: Process Concept – Process Scheduling – Operation on Processes – Inter Process Communication.

<b>Unit – II</b>	<b>Threads, Synchronization and Scheduling:</b>	<b>9</b>
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Threads: Overview – Multithreading Models – Threading Issues – Synchronization: Background – The Critical Section Problem – Semaphores – Classical Problems of Synchronization – CPU Scheduling: Basic Concepts – Scheduling Criteria – Scheduling Algorithms.

<b>Unit – III</b>	<b>Deadlock and Memory Management:</b>	<b>9</b>
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Deadlock: System Model – Deadlock in Multithreaded Applications – Deadlock Characterization – Methods for Handling Deadlock – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock – Main Memory: Background – Contiguous Memory Allocation – Paging – Structure of Page Table – Swapping.

<b>Unit – IV</b>	<b>Virtual Memory and Mass Storage Structure:</b>	<b>9</b>
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Virtual Memory: Background – Demand Paging – Page Replacement – Thrashing – Mass Storage Structure: Overview – HDD and NVM scheduling – Storage Attachment.

<b>Unit – V</b>	<b>File System and Implementation:</b>	<b>9</b>
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File System Interface: File Concept – Access Methods – Directory Structure – File System Implementation: File System Structure and Operations – Directory Implementation – Allocation Methods – Free Space Management.

**Total: 45****TEXT BOOK:**

1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”, 10 <sup>th</sup> Edition, John Wiley & Sons, New Jersey, 2018.
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**REFERENCES:**

1.	Andrew S. Tanenbaum and Albert S. Woodhull, “Operating System Design and Implementation”, 3 <sup>rd</sup> Edition, Pearson Education, New Delhi, 2010.
2.	Harvey M. Deitel , Paul Deitel and David R. Choffnes, “Operating Systems”, 3 <sup>rd</sup> Edition, Pearson Education, New Delhi, 2009.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	define the architecture of operating system and explain its operations.	Understanding(K2)
CO2	illustrate process scheduling algorithms and demonstrate synchronization problems.	Applying(K3)
CO3	determine deadlock handling methods and explain memory management strategies.	Applying(K3)
CO4	examine page replacement and disk scheduling algorithms.	Applying(K3)
CO5	outline the file system concept and its implementation.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	40	50				100
CAT3	10	40	50				100
ESE	10	40	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**20IST34 – COMPUTER NETWORKS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	This course focuses on physical structure of networks, functions and applications of TCP/IP and OSI models and protocols for communication						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9+3</b>
Data Communications – Network Criteria – Physical Structure – Network Types – Internet History – Standardization and Administration – Protocol Layering – TCP/IP Protocol Suite – OSI Model – Physical Layer: Transmission Media – Switching.							
<b>Unit – II</b>	<b>Data Link Layer:</b>						<b>9+3</b>
Introduction – Link-Layer Addressing – DLC Services – Data Link Layer Protocols – HDLC – PPP – Media Access Control – Random Access – Controlled Access – Channelization – Wired LANs: Ethernet.							
<b>Unit – III</b>	<b>Network Layer:</b>						<b>9+3</b>
Network Layer Services – Packet Switching – Performance – IPv4 Addresses – Forwarding of IP Packets – Internet Protocol – Datagram Format – Fragmentation – Options – Security of IPv4 Datagram – Unicast Routing Algorithms: Distance Vector Routing – Link state Routing – Path Vector Routing.							
<b>Unit – IV</b>	<b>Transport Layer:</b>						<b>9+3</b>
Introduction – Transport Layer Services – Connectionless and Connection Oriented Protocols – Transport Layer Protocols: Simple – Stop and Wait – Go Back N – Selective Repeat – Piggybacking – Port Numbers – User Datagram Protocol – Transmission Control Protocol.							
<b>Unit – V</b>	<b>Application Layer:</b>						<b>9+3</b>
World Wide Web (WWW) and Hyper Text Transfer Protocol (HTTP) – File Transfer Protocol – Electronic Mail – Telnet – Secure Shell – Domain Name System (DNS).							

**Lecture: 45, Tutorial: 15, Total: 60**

**TEXT BOOK:**

1.	Behrouz A. Forouzan, "Data Communications and Networking", 5 <sup>th</sup> Edition, McGraw Hill, New Delhi, 2013.
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**REFERENCES:**

1.	Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 5 <sup>th</sup> Edition, Morgan Kaufmann Publishers Inc, USA, 2012.
2.	Andrew S. Tanenbaum and David J. Wetherall, "Computer Networks", 5 <sup>th</sup> Edition, Pearson Education, New York, 2013.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer the functions of layers in communication.	Understanding (K2)
CO2	articulate routing algorithms in communication.	Applying (K3)
CO3	determine the IP packet forwarding and performance of a network.	Applying (K3)
CO4	demonstrate the protocols for connectionless and connection oriented communication.	Applying (K3)
CO5	practice various application layer protocols.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	45	30				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST35 – SOFTWARE ENGINEERING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To determine specific software process model and also to gather requirements, design, implement and test the software to a real world problem.
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<b>Unit – I</b>	<b>Process Models:</b>	<b>9+3</b>
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The Nature of Software – Software Engineering – The Software Process – Software Engineering Practice – Software Myths – Process Models: A Generic Process Model – Process Assessment and Improvement – Prescriptive Process Models – Specialized Process Models – The Unified Process – Personal and Team Process Models – Process Technology – Product and Process.

<b>Unit – II</b>	<b>Requirements Engineering and Modeling:</b>	<b>9+3</b>
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Requirements Engineering – Establishing the Ground Work – Eliciting Requirements – Developing Use Cases – Building the Requirement Model – Negotiating Requirements – Validating Requirements – Requirement Modeling: Requirement Analysis – Scenario Based Modeling – UML Models – Data Modelling Concepts – Class Based Modeling.

<b>Unit – III</b>	<b>Design Concepts and Architectural Design:</b>	<b>9+3</b>
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Design within the Context of Software Engineering – The Design Process – Design Concepts – The Design Model – Architectural Design: Software Architecture – Architectural Genres – Architectural Styles – Architectural Design – Assessing Alternative Architectural Designs – Architectural Mapping Using Data Flow.

<b>Unit – IV</b>	<b>Software Testing Strategies:</b>	<b>9+3</b>
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A Strategic Approach to Software Testing – Strategic Issues – Test Strategies for Conventional Software – Test Strategies for Object Oriented Software – Validation Testing – System Testing – The Art of Debugging – Testing Conventional Applications: Software Testing Fundamentals – Internal and External Views of Testing – White-Box Testing – Basis Path Testing – Control Structure Testing – Black-Box Testing.

<b>Unit – V</b>	<b>Software Configuration Management:</b>	<b>9+3</b>
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Software Configuration Management – SCM Repository – SCM Process – Reengineering – Business Process Reengineering – Software Reengineering – Reverse Engineering – Restructuring – Forward Engineering – Economics of Reengineering.

**Lecture: 45, Tutorial: 15, Total: 60**

**TEXT BOOK:**

1.	Roger S.Pressman, Bruce R Maxim, “Software Engineering - A Practitioner’s Approach”, 8 <sup>th</sup> Edition, Tata McGraw-Hill, New Delhi, 2019.
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**REFERENCES:**

1.	Sommerville Ian., “Software Engineering”, 10 <sup>th</sup> Edition, Pearson Education, New Delhi, 2017.
2.	Rajib Mall., “Fundamentals of Software Engineering”, 5 <sup>th</sup> Edition, Prentice Hall of India, New Delhi, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	determine proper software engineering process model to develop application.	Understanding (K2)
CO2	prepare software requirements specification.	Applying (K3)
CO3	translate requirements specification into an implementable design.	Applying (K3)
CO4	perform various testing techniques.	Applying (K3)
CO5	explain SCM process and reengineering process.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	50	30	20				100
CAT2	45	40	15				100
CAT3	45	35	20				100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISL31 – OBJECT ORIENTED PROGRAMMING WITH C++ LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Programming in C</b>	<b>3</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To introduce object oriented programming concepts and develop solutions for real time applications in C++.						

**List of Exercises / Experiments:**

1.	Write simple C++ programs.
2.	Program with inline functions and default function arguments.
3.	Design C++ classes with data members and member functions.
4.	Program using different types of constructors and destructor.
5.	Implement complex number class with unary and binary operator overloading.
6.	Implement different types of inheritance.
7.	Develop suitable hierarchy of classes to demonstrate virtual functions.
8.	Design C++ classes with friend functions and function overloading.
9.	Implement programs with sequential access and random access file.
10.	Program using template and exceptions.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	develop C++ programs using classes and objects and demonstrate operator overloading and inheritance.	Applying (K3), Precision (S3)
CO2	implement the concepts of pointers, virtual and friend functions.	Applying (K3), Precision (S3)
CO3	demonstrate the usage of IO Streams, Template and Exceptions.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

**20ISL32 – DATA STRUCTURES LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To explore the concepts and techniques of linear and non-linear data structures, implements applications using these data structures and analyze the various algorithms.						

**List of Exercises / Experiments:**

1.	Program to implement stack operations using linked list.
2.	Application of stack – parentheses checker.
3.	Program to implement queue operations using linked list.
4.	Program to implement binary tree traversal.
5.	Program to implement binary search tree operations.
6.	Program to implement AVL tree operations.
7.	Program to implement red black tree operations.
8.	Program to implement graph traversal.
9.	Program to implement linear and binary search.
10.	Program to implement hash tables.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	adapt the appropriate data structure for solving the given problem.	Applying (K3), Manipulation (S2)
CO2	use a data structure to implement another data structure.	Applying (K3), Manipulation (S2)
CO3	synthesize operations like searching, insertion, deletion and traversing on various data structures.	Applying (K3), Manipulation (S2)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy



## 20ISL33 – OPERATING SYSTEMS LABORATORY

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>3</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To emphasize on Unix commands and implementation of disk scheduling, deadlocks and synchronization issues.						

**List of Exercises / Experiments:**

1.	Basic UNIX commands.
2.	Shell programs.
3.	Write a program using the system calls of unix operating system process management: fork, exec, getpid, exit, wait, close, stat, opendir, readdir.
4.	Write a program using file system related system calls to create, open, read, write, seek into, close files and open, write, search, close directories.
5.	Implement producer consumer problem using buffer concept.
6.	Implement interprocess communication using pipes and message queues.
7.	Given the list of processes, their CPU burst times and arrival times, compute and print the average waiting time and average turnaround time using FCFS scheduling.
8.	Given the list of processes, their CPU burst times and arrival times, compute and print the average waiting time and average turnaround time using SJF scheduling.
9.	Implement the page replacement algorithm using FIFO.
10.	Implement the page replacement algorithm using LRU.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Unix Operating System.
2.	C/C++ Compiler.

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	execute basic unix/linux commands and shell programs in unix/linux operating system.	Applying (K3), Precision (S3)
CO2	implement system calls, producer consumer problem and IPC using C.	Applying (K3), Precision (S3)
CO3	experiment scheduling and page replacement algorithms using C.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20IST41 – JAVA PROGRAMMING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Object Oriented Programming with C++</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To articulate the object-oriented programming concepts in core Java.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Java As a Programming Platform – The Java “White Paper” Buzzwords – Java Applets and the Internet – History of Java – Common Misconceptions about Java – Java Programming Environment – Fundamental Programming Structures in Java.							
<b>Unit – II</b>	<b>Classes and Inheritance:</b>						<b>9</b>
Introduction to Object-Oriented Programming – Using Predefined Classes – Defining Your Own Classes – Static Fields and Methods – Method Parameters – Object Construction – Packages – Classes, Superclasses, and Subclasses – Object: The Cosmic Superclass – Generic Array Lists – Object Wrappers and Autoboxing – Methods with a Variable Number of Parameters – Enumeration Classes.							
<b>Unit – III</b>	<b>Interfaces, Inner Classes and Exceptions:</b>						<b>9</b>
Interfaces – Object Cloning – Interfaces and Callbacks – Inner Classes – Dealing with Errors – Establishing Catching Exceptions – Tips for Using Exceptions.							
<b>Unit – IV</b>	<b>Multithreading, Streams and Files:</b>						<b>9</b>
Threads – Interrupting Threads – Thread States – Thread Properties – Synchronization – Blocking Queues – Thread-Safe Collections – Streams – Text Input and Output – Reading and Writing Binary Data							
<b>Unit – V</b>	<b>Generic Programming and Collections:</b>						<b>9</b>
Defining a Simple Generic Class – Generic Methods – Bounds for Type Variables – Generic Code and the Virtual Machine – Restrictions and Limitations – Inheritance Rules for Generic Types – Collection Interfaces – Concrete Collections – Collections Framework – Algorithms.							

**Total: 45****TEXT BOOK:**

1a.	Cay S. Horstmann, Gary Cornell, “Core Java Volume I-Fundamentals”, 9th Edition, Prentice Hall, 2013. For Unit – I, II, III, IV, V
1b.	Cay S. Horstmann, Gary Cornell, “Core Java, Volume II-Advanced Features”, 9th Edition, University of Connecticut, 2013. For Unit - IV

**REFERENCES:**

1.	Deitel and Deitel, “Java How to Program”, 11 <sup>th</sup> Edition, Pearson, New Delhi, 2019.
2.	Schildt Herbert, “Java – The Complete Reference”, 11 <sup>th</sup> Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018.
3.	<a href="https://docs.oracle.com/javase/tutorial/">https://docs.oracle.com/javase/tutorial/</a>



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	interpret the basic concepts of java programming.	Understanding (K2)
CO2	develop programs using inheritance.	Applying (K3)
CO3	make use of exceptions for solving problems.	Applying (K3)
CO4	implement the concept of threads and streams.	Applying (K3)
CO5	use collections and generics to solve the given problem.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST42 – DATABASE MANAGEMENT SYSTEMS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To focus on database fundamentals, database designing and implementation of queries.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Database System Applications – Purpose – View of Data – Data Models – Languages – Design – Storage and Querying – Transaction Management – Database Architecture – Data Mining and Information Retrieval – Specialty Databases – Users and Administrators – Relational Model: Structure of Relational Databases – Database Schema – Keys – Schema Diagrams – Relational Query Languages – Relational Algebra Operations.							
<b>Unit – II</b>	<b>Introduction to SQL:</b>						<b>9</b>
Overview – Data Definition – Basic Structure – Basic Operations – Set Operations – Null Values – Aggregate Functions – Nested Sub Queries – Modification of Databases – Join Expressions – Views – Transactions – Integrity Constraints – SQL Data Types and Schemas – Introduction to NoSQL.							
<b>Unit – III</b>	<b>ER Modeling and Relational Database Design:</b>						<b>9</b>
Database Design and E-R Model – E-R Model – E-R diagrams – Reduction to Schemas – Design Issues – Extended E-R Features – Relational Database Design: Features of Good Relational Designs – 1NF – Functional Dependencies – Decomposition using Functional Dependencies – 3NF – Boyce-Codd Normal Form – 4NF.							
<b>Unit – IV</b>	<b>Data Storage:</b>						<b>9</b>
Storage and File Structures – Overview – RAID – Tertiary Storage – File Organization – Data Dictionary – Indexing and Hashing – Basics – Ordered Indices – B+ tree Index Files – Static and Dynamic Hashing.							
<b>Unit – V</b>	<b>Transaction Management:</b>						<b>9</b>
Transaction Concept – A Simple Model – Transaction Atomicity and Durability – Isolation – Serializability – Isolation and Atomicity – Concurrency Control: Lock Based Protocols – Deadlock Handling, Timestamp Based Protocols – Validation Based Protocols.							

**Total: 45****TEXT BOOK:**

1.	Silberschatz Abraham, Korth F.Henry and Sudarshan S., “Database System Concepts”, 6 <sup>th</sup> Edition, McGraw Hill, New Delhi, 2019.
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**REFERENCES:**

1.	Ramez Elmasri and Shamkanth B.Navathe, “Fundamentals of Database Systems”, 7 <sup>th</sup> Edition, Pearson Education, Chennai, 2017.
2.	Date C.J., Kannan A. and Swamynathan S., “An Introduction to Database Systems”, Pearson Education, Chennai, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline relational database concepts.	Understanding (K2)
CO2	implement SQL Queries.	Applying (K3)
CO3	design entity relationship model and apply normalization techniques during database design.	Applying (K3)
CO4	explain indexing methods.	Understanding (K2)
CO5	employ concurrency aspects in transactions.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2	15	35	50				100
CAT3	20	50	30				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST43 – DESIGN AND ANALYSIS OF ALGORITHMS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Data Structures</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To introduce various algorithm design techniques and analyze the performance of the algorithms to improve their efficiency.						
<b>Unit – I</b>	<b>Introduction, Divide and Conquer:</b>						<b>9</b>
Introduction: Algorithm Specification – Performance Analysis: Space Complexity – Time Complexity – Asymptotic Notations – Divide and Conquer: General Method – Binary Search – Finding the Maximum and Minimum – Merge Sort – Quick Sort – Strassen’s Matrix Multiplication.							
<b>Unit – II</b>	<b>The Greedy Method:</b>						<b>9</b>
The General Method – Knapsack Problem – Tree Vertex Splitting – Job Scheduling with Deadlines – Minimum–Cost Spanning Trees – Prim’s Algorithm – Kruskal’s Algorithm – An Optimal Randomized Algorithm.							
<b>Unit – III</b>	<b>Dynamic Programming:</b>						<b>9</b>
The General Method – Multistage Graphs – All–Pairs Shortest Paths – Single–Source Shortest Paths – Optimal Binary Search Trees – 0/1 Knapsack Problem – The Travelling Salesperson Problem.							
<b>Unit – IV</b>	<b>Backtracking:</b>						<b>9</b>
The General Method – The 8–Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Knapsack Problem.							
<b>Unit – V</b>	<b>Branch–and–Bound, NP–Hard and NP–Complete Problems:</b>						<b>9</b>
Branch and Bound: The Method – Least Cost (LC) Search – The 15–puzzle – Control Abstractions – Bounding – FIFO Branch–and–Bound – LC Branch–and–Bound – 0/1 Knapsack Problem – Travelling Salesperson Problem – NP–Hard and NP–Complete Problems: Basic Concepts.							

**Total: 45****TEXT BOOK:**

1.	Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran, “Fundamentals of Computer Algorithms”, 2 <sup>nd</sup> Edition, Orient Black Swan Pvt. Ltd., Hyderabad, 2018.
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**REFERENCES:**

1.	Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3 <sup>rd</sup> Edition, Pearson Education, New Delhi, 2015.
2.	Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, “Introduction to Algorithms”, 3 <sup>rd</sup> Edition, Prentice Hall of India, New Delhi, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe the efficiency of algorithms using asymptotic complexity.	Understanding (K2)
CO2	use greedy method to solve the given problem.	Applying (K3)
CO3	solve the given problem using dynamic programming.	Applying (K3)
CO4	construct algorithms using backtracking for a given problem.	Applying (K3)
CO5	dramatize branch and bound algorithms for a given problem.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	40	30				100
CAT2	25	35	40				100
CAT3	20	30	50				100
ESE	20	20	60				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST44 – SOFTWARE TESTING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	This course aims to design test cases using Black box and White box testing strategies and understand test metrics and measurements.
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<b>Unit – I</b>	<b>White Box and Black Box Testing:</b>	<b>9+3</b>
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Introduction – Static Testing – Structural Testing – Challenges In White Box Testing – Black Box Testing: Black Box Testing – Need, Procedure to do Black Box Testing – Requirements Based Testing – Positive and Negative Testing – Boundary Value Analysis – Decision Tables – Equivalence Class Partitioning – State-Based Testing – Compatibility Testing – User Documentation Testing.

<b>Unit – II</b>	<b>Integration Testing:</b>	<b>9+3</b>
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Introduction – Integration Testing as a Type and a Phase of Testing – Scenario Testing – Defect Bash. System and Acceptance Testing: Functional System Testing – Non-Functional Testing – Acceptance Testing.

<b>Unit – III</b>	<b>Performance and Regression Testing:</b>	<b>9+3</b>
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Introduction – Factors Governing Performance Testing – Methodology – Tools And Process for Performance Testing – Challenges. Regression Testing – Types – Methods to do Regression Testing – Best Practices – Regression Testing for OO Systems.

<b>Unit – IV</b>	<b>Ad Hoc, Usability and Accessibility Testing:</b>	<b>9+3</b>
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Ad hoc Testing: Overview – Buddy and Pair Testing – Exploratory and Iterative Testing – Agile and Extreme Testing – Defect Seeding – Usability and Accessibility Testing: Usability Testing – Approach – Quality Factors – Accessibility Testing – Tools for Usability Testing – Lab Setup – Test Roles.

<b>Unit – V</b>	<b>Test Planning, Management, Execution and Reporting:</b>	<b>9+3</b>
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Introduction – Test Planning – Test Management – Test Process – Test Reporting – Best Practices – Process – People – Technology – Selecting a Testing Tool.

**Lecture: 45, Tutorial: 15, Total: 60****TEXT BOOK:**

1.	Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing: Principles and Practices", 1 <sup>st</sup> Edition, Pearson Education, New Delhi, 2016.
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**REFERENCES:**

1.	Renu Rajani and Pradeep Oak, "Software Testing Effective Methods, Tools and Techniques", Tata McGraw Hill, New Delhi, 2013.
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<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe black box and white box testing techniques and design test cases in practice.	Understanding (K2)
CO2	implement various levels of testing like integration, system and acceptance testing.	Applying (K3)
CO3	make use of performance and regression testing tools.	Applying (K3)
CO4	infer the ad hoc, usability and accessibility testing strategies.	Understanding (K2)
CO5	prepare test plan based on the document.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	65	10				100
CAT2	25	40	35				100
CAT3	20	50	30				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST45 – OBJECT ORIENTED SYSTEM DESIGN**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Software Engineering</b>	<b>4</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To understand the importance and basic concepts of object oriented analysis and design through Unified Modeling Language.						
<b>Unit – I</b>	<b>Object Basics:</b>						<b>9+3</b>
Introduction: An Object–Oriented Philosophy – Objects – Attributes – Object Behavior and Methods – Objects Respond to Messages – Encapsulation and Information Hiding – Class Hierarchy – Polymorphism – Object Relationships and Associations – Aggregations and Object Containment – Meta classes – Object Oriented System Development Life Cycle.							
<b>Unit – II</b>	<b>Object–Oriented Methodologies:</b>						<b>9+3</b>
Rumbaugh Object Modeling Technique – The Booch Methodology – The Jacobson Methodologies – Patterns – Frameworks – The Unified Approach.							
<b>Unit – III</b>	<b>Unified Modeling Language:</b>						<b>9+3</b>
Introduction: Static and Dynamic Models – Introduction to the Unified Modeling Language – UML Diagrams – UML Class Diagram – Use Case Diagram – UML Dynamic Modeling – UML Extensibility-UML Meta Model – Case Study on Bank ATM System.							
<b>Unit – IV</b>	<b>Object Oriented Analysis:</b>						<b>9+3</b>
Business Object Analysis – Use Case Driven Object Oriented Analysis – Business Process Modeling – Use Case Model – Object Analysis – Noun Phrase Approach – Common Class Pattern Approach – Use Case Driven Approach – Classes – Responsibilities and Collaborators.							
<b>Unit – V</b>	<b>Object Oriented Design:</b>						<b>9+3</b>
Object Oriented Design Process and Design Axioms – Object Oriented Design Process – Object Oriented Design Axioms – Corollaries – Design Patterns – Designing Classes – Case Study.							

**Lecture: 45, Tutorial: 15, Total: 60****TEXT BOOK:**

1.	Ali Bahrami, "Object Oriented System Development", McGraw Hill International 2 <sup>nd</sup> Edition, New Delhi, 2017.
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**REFERENCES:**

1.	Grady Booch, James Rumbaugh, Ivar Jacobson, "The Unified Modeling Language User Guide", Addison Wesley, 12 <sup>th</sup> Impression Edition, New Delhi, 2012.
2.	Michael R Blaha, James R Rumbaugh, "Object Oriented Modeling and Design with UML", 2 <sup>nd</sup> Edition, Pearson, New Delhi, 2011.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	illustrate the object oriented concepts and outline the object oriented life cycle model for a project.	Understanding(K2)
CO2	infer the various object oriented methodologies.	Understanding(K2)
CO3	construct UML diagrams in various applications.	Applying(K3)
CO4	infer classes and objects for real world problem.	Understanding(K2)
CO5	outline the object oriented design axioms and corollaries.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	30	45	25				100
CAT3	40	60					100
ESE	30	45	25				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISL41 – JAVA PROGRAMMING LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Object Oriented Programming with C++</b>	<b>4</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To provide knowledge on object oriented programming concepts and core Java Programming.						

**List of Exercises / Experiments:**

1.	Program using operators, arrays and control statements.
2.	Develop an application using class and object.
3.	Program to initialize objects using constructors.
4.	Program to implement method overloading.
5.	Program to create user defined packages.
6.	Program to implement inheritance.
7.	Develop an application using interfaces.
8.	Develop a program for exception handling.
9.	Program using multithreading.
10.	Program to illustrate collection class.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
2.	<a href="https://docs.oracle.com/javase/tutorial/">https://docs.oracle.com/javase/tutorial/</a>

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	execute simple Java applications using classes and objects.	Applying (K3), Precision (S3)
CO2	demonstrate the execution of Java programs using constructors, packages, method overloading and inheritance.	Applying (K3), Precision (S3)
CO3	demonstrate interfaces, collections, exception handling, multithreading mechanisms for robust application.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy



## 20ISL42 – DATABASE MANAGEMENT SYSTEMS LABORATORY

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

**List of Exercises / Experiments:**

1.	Implementation of data definition statements and keys.
2.	Perform data manipulation using simple queries.
3.	Implementation of data control statements.
4.	Perform set and join operations.
5.	Perform complex and nested queries.
6.	Creating views and index.
7.	Apply commit, rollback and check points.
8.	Creating triggers in PL/SQL.
9.	Apply cursors in PL/SQL.
10.	Implementation of exception handling.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	practice table creation with constraints.	Applying (K3), Manipulation (S2)
CO2	use queries for data manipulation.	Applying (K3), Precision (S3)
CO3	implement triggers and cursors.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20ISL43 – DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>4</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To analyze the efficiency of algorithms and explore the problem solving skills using different algorithmic techniques.						

**List of Exercises / Experiments:**

1.	Write simple programs and analyze their time and space complexity.
2.	Implement and analyze binary search algorithm using divide and conquer.
3.	Implement and analyze sorting algorithms using divide and conquer.
4.	Solve knapsack problem using greedy method.
5.	Implement minimum spanning tree algorithm using greedy method.
6.	Solve knapsack problem using dynamic programming.
7.	Solve all-pair shortest path problem using dynamic programming.
8.	Solve 8-queens problem using backtracking.
9.	Implement sum of subsets problem using backtracking.
10.	Solve 15-puzzle algorithms using branch and bound.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	implement algorithms using divide and conquer.	Applying (K3), Manipulation (S2)
CO2	demonstrate algorithms using greedy method and dynamic programming.	Applying (K3), Manipulation (S2)
CO3	solve problems using backtracking and branch and bound.	Applying (K3), Manipulation (S2)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20IST51 – PYTHON PROGRAMMING AND FRAMEWORKS**

Programme & Branch	MSc - SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	3	0	0	3

<b>Preamble</b>	To apply concepts of python to solve the real world problem.						
<b>Unit – I</b>	<b>Data Structures:</b>						<b>9</b>
Basic Concepts: Data Types – Collection Data Types: Sequence Types: Tuples – Named Tuples – Lists – Set Types: Sets – Frozen Sets – Mapping Types: Dictionaries – Default and Ordered Dictionaries – Iterating and Copying Collections: Iterators and Iterable Operations and Functions – Copying Collections.							
<b>Unit – II</b>	<b>Control Structures, Functions and Modules:</b>						<b>9</b>
Control Structures and Functions: Control Structures – Exception Handling – Custom Functions – Modules: Modules and Packages – Overview of Python’s Standard Library.							
<b>Unit – III</b>	<b>Object Oriented Programming and File Handling:</b>						<b>9</b>
Object Oriented Programming: The Object-Oriented Approach – Custom Classes – Custom Collection Classes – File Handling: Writing and Reading Binary Data – Writing and Parsing Text Files – Writing and Parsing XML Files – Random Access Binary Files.							
<b>Unit – IV</b>	<b>Thread, Database and Regular Expressions:</b>						<b>9</b>
Processes and Threading: Multiprocessing Module – Threading Module – Database Programming: DBM Databases – SQL Databases – Regular Expression: Python’s Regular Expression Language – The Regular Expression Module.							
<b>Unit – V</b>	<b>Web Development in PyCharm:</b>						<b>9</b>
Web development with JavaScript, HTML and CSS – Integrating Django in PyCharm – Understanding Database Management with PyCharm – Building a Web Application in PyCharm – Case Study: Web2py Framework.							

**Total: 45****TEXT BOOK:**

1a.	Mark Summerfield, “Programming in Python”, 2 <sup>nd</sup> Edition, Pearson Education, New Delhi, 2018. For Unit - I, II, III, IV.
1b.	Quan Nguyen, “Hands–On Application Development with PyCharm”, 1 <sup>st</sup> Edition, Packt Publishing Ltd. UK, 2019. For Unit V.

**REFERENCES:**

1.	Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, O’Reilly Publishers, 2 <sup>nd</sup> Edition, 2016.
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<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	execute basic programs make use of data types in python.	Applying(K3)
CO2	apply exception handling mechanism and libraries for problem solving.	Applying(K3)
CO3	use files to read and write the data and apply object oriented programming concepts.	Applying(K3)
CO4	examine the threading, regular expression and database.	Applying(K3)
CO5	develop web application with PyCharm.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	3	2	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	30	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST52 – DATA MINING AND DATA WAREHOUSING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Database Management Systems</b>	<b>5</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To articulate the data mining and data warehousing concepts and implement the various algorithmic techniques of data mining.
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<b>Unit – I</b>	<b>Introduction to Data Mining and Data Warehousing:</b>	<b>9</b>
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Introduction to Data Mining Systems – Evolution – Knowledge Discovery Process – Kinds of Data – Data Mining Techniques – Applications – Issues – Data Warehousing and Online Analytical Processing: Basic Concepts – Data Warehouse Modeling – Data Cube and OLAP.

<b>Unit – II</b>	<b>Data Preprocessing:</b>	<b>9</b>
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Data Objects and Attributes Types – Statistical Descriptions of Data – Data Visualization – Data Similarity and Dissimilarity Measures – Data Preprocessing – Data Cleaning – Data Integration – Data Reduction – Data Transformation and Data Discretization.

<b>Unit – III</b>	<b>Association Rule Mining:</b>	<b>9</b>
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Mining Frequent Patterns, Associations and Correlations: Frequent Itemset Mining Methods – Pattern Evaluation Methods – Pattern Mining in Multilevel, Multidimensional Space – Constraint-Based Frequent Pattern Mining.

<b>Unit – IV</b>	<b>Classification:</b>	<b>9</b>
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Decision Tree Induction – Bayes Classification Methods – Rule-Based Classification – Model Evaluation and Selection – Techniques to improve Classification Accuracy – Bayesian Belief Networks – Classification by Backpropagation.

<b>Unit – V</b>	<b>Clusters Analysis:</b>	<b>9</b>
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Requirements – Partitioning Methods – Hierarchical Methods – Density-Based Methods – Grid-Based Methods – Evaluation of Clustering – Outliers and Outlier Analysis – Outlier Detections Methods.

**Total: 45****TEXT BOOK:**

1.	Jiawei Han, Micheline Kamber, Jian Pei, "Data Mining Concepts and Techniques", 3 <sup>rd</sup> Edition, Elsevier, 2016.
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**REFERENCES:**

1.	K.P. Soman, Shyam Diwakar, V. Ajay, "Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India, 2014.
2.	G. K. Gupta, "Introduction to Data Mining with Case Studies", 3 <sup>rd</sup> Edition, Easter Economy Edition, Prentice Hall of India, 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	interpret the basic concepts of data mining and data warehousing.	Understanding(K2)
CO2	implement the various preprocessing techniques.	Applying(K3)
CO3	articulate frequent item sets in association rule mining.	Applying(K3)
CO4	apply the various classification methods.	Applying(K3)
CO5	demonstrate the clustering methods.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	45	25				100
CAT2	25	30	45				100
CAT3	25	30	45				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST53 – WEB TECHNOLOGY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>5</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

**Preamble** This course provides an introduction to HTML, CSS, Bootstrap, Client Side JS and Server Side JS Framework. The course also addresses the application of ReactJS for developing web applications.

**Unit – I** **UI Design: HTML 5:** **9**

Introduction – Basic tags – HTML Forms Element – Page Structured Elements – Media Tags. Cascading Style Sheet: Types of CSS – Positioning Elements – Backgrounds – Box Model – Dropdown Menus. Responsive Web Design: Introduction – Bootstrap – Grid basics – Nav – Nav Bar – List – Drop down – Tables – Button – Images – Forms – Input – Input Groups.

**Unit – II** **JavaScript:** **9**

Introduction – Operators – Control Structures: Selection: if – if-else – switch. Repetition: while – do-while – for – break and continue. Functions: Function Definition – Scope Rules – Recursion. Array: Declaration – Initialization – Growing Arrays – Passing Arrays to Function. Event Handling.

**Unit – III** **Server-side JS Framework:** **9**

Node JS: Introduction – Architecture – Features – Creating Web Servers with HTTP Request – Response – Event Handling – GET and POST Methods – Modules – Connect to NoSQL Database using Node JS – Implementation of CRUD operations.

**Unit – IV** **ReactJS Basics:** **9**

React: Introduction – Installation – Create React App – Components – State – Props - Props Validation – State Vs Props – Constructor – Component API – Component Life Cycle – Forms – Controlled and Uncontrolled Component – Events – Conditional Rendering.

**Unit – V** **ReactJS Animation and API:** **9**

ReactJS: List – Keys – Refs – Fragments - Router – CSS – Animation – Map – Table – Code splitting – Hooks – API Integration.

**Total: 45****TEXT BOOK:**

1a.	Paul Deitel, Harvey Deitel, Abbey Deitel, "Internet and World Wide Web - How To Program", 5 <sup>th</sup> Edition, Pearson Education, New Delhi, 2011. For Unit – I, II
1b.	Infosys campus connect material. For Unit – I, III
1c.	<a href="https://www.javatpoint.com">https://www.javatpoint.com</a> For Unit – IV, V

**REFERENCES:**

1.	DT Editorial Services, "HTML 5 Black Book (Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP, jQuery)", 2 <sup>nd</sup> Edition, Dreamtech Press, New Delhi, 2016.
2.	Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", Pearson Education, New Delhi 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	design static web pages using HTML, CSS and Bootstrap.	Applying(K3)
CO2	develop interactive and dynamic web pages using javascript.	Applying(K3)
CO3	develop a web application using node JS with database connectivity.	Applying(K3)
CO4	apply the features of React to develop web applications.	Applying(K3)
CO5	utilize client side JS framework to develop web applications	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	20	40	40				100
CAT3	10	45	45				100
ESE	15	40	45				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**20IST54 – CRYPTOGRAPHY AND NETWORK SECURITY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Computer Networks</b>	<b>5</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To obtain knowledge on cryptography techniques and security breaches.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
OSI Security Architecture – Attacks – Services – Mechanisms – Model for Network Security – Symmetric Cipher Model – Substitution and Transposition Techniques – DES – Strengths – Block Cipher Design Principles.							
<b>Unit – II</b>	<b>Public Key Cryptography:</b>						<b>9</b>
Advanced Encryption Standard – Principles of Public Key Crypto Systems – RSA Algorithm – Diffie Hellman Key Exchange – Elgamal – Elliptic Curve Arithmetic - Cryptography.							
<b>Unit – III</b>	<b>Hash Functions:</b>						<b>9</b>
Cryptographic Hash Functions – Applications – Two Simple Hash Functions – Requirements and Security – Secure Hash Algorithm – Message Authentication Codes: Message Authentication Requirements – Functions – Message Authentication Code (MAC) – Security of MAC.							
<b>Unit – IV</b>	<b>Key Management and Distribution:</b>						<b>9</b>
Key Management and Distribution – Symmetric Key Distribution – Distribution of Public Keys – X.509 Certificates – Public Key Infrastructure – User Authentication – Remote User Authentication – Principles – Symmetric Encryption – Kerbores.							
<b>Unit – V</b>	<b>Network Security Practice:</b>						<b>9</b>
IP Security: Overview and Policy – ESP – Security Associations – Internet Key Exchange – Intruders – Intrusion Detection – Password Management – Malicious Software – Types – Viruses – Worms – Distributed Denial of Service Attacks.							

**Total: 45**

**TEXT BOOK:**

1.	Stallings William, "Cryptography and Network Security: Principles and Practice", 7 <sup>th</sup> Edition, Pearson Education, New York, 2017.
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**REFERENCES:**

1.	Behrouz A. Forouzan, "Cryptography and Network Security", 3 <sup>rd</sup> Edition, McGraw Hill, 2015.
2.	Kaufman, Charlie, Perlman, Radia and Speciner, Mike, "Network Security–Private Communication in a Public World", 2 <sup>nd</sup> Edition, Pearson Education, 2016.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	employ the methods of conventional encryption.	Applying(K3)
CO2	articulate various public key cryptography mechanisms.	Applying(K3)
CO3	demonstrate authentication mechanisms and hash functions.	Applying(K3)
CO4	make use of various key distribution schemes for authentication.	Applying(K3)
CO5	summarize security threats and counter measures.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	30	50				100
CAT2	20	30	50				100
CAT3	30	40	30				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISL51 – PYTHON PROGRAMMING AND FRAMEWORKS LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>5</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To use predefined API and develop applications using Python.						

**List of Exercises / Experiments:**

1.	Write programs to illustrate string manipulation, list, tuple, set and dictionary.
2.	Develop programs using control structures.
3.	Develop programs using exception handling.
4.	Write programs to illustrate functions.
5.	Write a python script to illustrate class and object.
6.	Develop programs using polymorphism.
7.	Write programs to demonstrate reading and writing content from text, binary and XML files.
8.	Develop a python application with database.
9.	Write a program to demonstrate thread module in python.
10.	Develop a program using regular expression.
11.	Create web application using Django framework.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	<a href="https://docs.python.org/tutorial">https://docs.python.org/tutorial</a>
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	develop applications using control structure, exception handling and functions.	Applying (K3), Precision (S3)
CO2	calibrate application using class, polymorphism and read the data from text, binary and XML files.	Applying (K3), Precision (S3)
CO3	demonstrate applications using regular expression and database.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy



## 20ISL52 – DATA MINING LABORATORY

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Database Management Systems</b>	<b>5</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To provide hands-on training to preprocess and apply various data mining algorithms for the given data set.						

**List of Exercises / Experiments:**

1.	Perform data cleaning for a given data set.
2.	Perform data reduction for a given data set.
3.	Perform data transformation for a given data set.
4.	Extract the frequent item set using Apriori algorithm.
5.	Find the strong association rule for the frequent item set found.
6.	Find the classification rule and classification accuracy using decision tree algorithm.
7.	Find the classification rule and classification accuracy using Bayesian classification algorithm.
8.	Find the classification rule and classification accuracy using backpropagation.
9.	Implement the partition based clustering algorithm.
10.	Find the outliers using the outlier detection method.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	<a href="http://www.uci.edu">www.uci.edu</a>
2.	<a href="http://www.kaggle.com">www.kaggle.com</a>
3.	WEKA / R Programming / Python

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	apply the preprocessing techniques to clean the given data set.	Applying (K3), Manipulation (S2)
CO2	calibrate association rule mining, classification and clustering methods for the given data set.	Applying (K3), Precision (S3)
CO3	detect outliers using outlier detection methods for the given data set.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy



## 20ISL53 – WEB TECHNOLOGY LABORATORY

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>5</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>1</b>
<b>Preamble</b>	This course is designed to impart the knowledge to design and implement static and dynamic websites for real time applications.						

**List of Exercises / Experiments:**

1.	Design a web page using HTML tags and host it in github repository.
2.	Design an attractive webpage using style sheets.
3.	Design a responsive website using Bootstrap
4.	Design a webpage to create simple interactive CGPA calculator using Event Handling.
5.	Design a web application using HTTP Request and HTTP Response.
6.	Develop simple login page by performing event handling using GET and POST method.
7.	Design a simple calculator using “Modules” in Node.js.
8.	Design a webpage to maintain personal information using CRUD operations in MongoDB.
9.	Design a web application using components and forms in React.
10.	Design a reactive form to maintain personal information and perform validation using React.
11.	Miniproject

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
2.	Visual Studio code/ GEdit, Node JS+NPM, MongoDB
3.	ReactJS, Github

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	develop interactive web pages using HTML, CSS, JavaScript and Bootstrap.	Applying (K3), Precision (S3)
CO2	develop a web application to maintain information in a database using server-side scripting.	Applying (K3), Precision (S3)
CO3	apply the concepts of ReactJS to design web applications	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1					3	3	3	3	3	3
CO2	3	2	1	1					3	3	3	3	3	3
CO3	3	2	1	1					3	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

**20GEL51 – PROFESSIONAL SKILLS TRAINING – I**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>5</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>80</b>	<b>2</b>

<b>Preamble</b>	This subject is to enhance the employability skills and to develop career competency						
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<b>Unit - I</b>	<b>Soft Skills – I:</b>	<b>20</b>
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Soft skills and its importance: Pleasure and pains of transition from an academic environment to work environment – Need for change – Fear, stress and competition in the professional world – Importance of positive attitude – Self motivation and continuous knowledge upgradation – Self-confidence. Professional grooming and practices: Basics of corporate culture – Key pillars of business etiquette – Basics of etiquette – Introductions and greetings – Rules of the handshake, earning respect, business manners – Telephone etiquette – Body Language.

<b>Unit - II</b>	<b>Quantitative Aptitude &amp; Logical Reasoning – I:</b>	<b>30</b>
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Problem solving level I: Number System – LCM & HCF-Divisibility test – Surds and indices – Logarithms – Ratio – proportions and variation – Partnership – Time speed and distance – Data interpretation – data representation. Logical reasoning: Family tree-Deductions – Logical connectives – Binary logic Linear arrangements – Circular and complex arrangement

<b>Unit - III</b>	<b>Written Communication &amp; Verbal Aptitude:</b>	<b>30</b>
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Writing Skills: Writing strategies and formats – Importance of Résumés – Writing a Cover letter – Writing a fresher's CV / Résumés – Responding to Job Advertisements – Professional e-mail Writing – Responding to e-mails and business letters – Technical Report writing – Interpretation of Technical Data (Transcoding) – Writing One-page Essays. Verbal Aptitude – Synonyms – Antonyms – Homonyms – One word substitution – Idioms and Phrases – Paired words – Analogies – Spelling test – Cloze test – using suitable verb forms – using appropriate articles and prepositions; Spotting Error – Sentence Correction and Formation – Grammar Based questions (Transformation : Active – Passive & Direct – Indirect); Rearranging Jumbled Sentences & Jumbled paragraphs, Identifying Facts, Inferences and Judgements statements.

**Total: 80****TEXT BOOK:**

1	Thorpe, Showick and Edgar Thorpe, "Objective English For Competitive Examination", 6 <sup>th</sup> Edition, Pearson India Education Services Pvt Ltd, 2017.
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**REFERENCES:**

1	Bailey, Stephen. "Academic Writing: A practical guide for students", Routledge, New York, 2011.
2	Raman, Meenakshi and Sharma, Sangeeta. "Technical Communication- Principles and Practice". 3 <sup>rd</sup> Edition, Oxford University Press, New Delhi, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	Develop the soft skills of learners to support them work efficiently in an organization as an individual and as a team	Applying (K3), Precision (S3)
CO2	Solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	Apply communication skills effectively to understand and deliver information in various written discourses grammatically with accuracy	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	3		3		3	2	3	3
CO2	3	2				3	3		3		3	2	3	3
CO3		2				3	3		3	3	3	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2		50	50				100
CAT3		50	50				100
ESE	NA						

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20IST61 – FRONT END TECHNOLOGIES

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Web Technology</b>	<b>6</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To design interactive UI and web applications using jquery, angular and TypeScript.						
<b>Unit – I</b>	<b>JavaScript and jQuery:</b>						<b>9</b>
Query and JavaScript Syntax – Understanding and Using JavaScript Objects – Accessing DOM Elements Using JavaScript and jQuery Objects – Navigating and Manipulating jQuery Objects and DOM Elements with jQuery – Applying JavaScript and jQuery Events for Richly Interactive Web Pages.							
<b>Unit – II</b>	<b>Building Interactive Web Pages with jQuery:</b>						<b>9</b>
Dynamically Accessing and Manipulating Web Pages with JavaScript and jQuery – Working with Window, Browser, and Other Non-Web Page Elements – Enhancing User Interaction Through jQuery Animation and Other Special Effects – Interacting with Web Forms in jQuery and JavaScript – Creating Advanced Web Page Elements in jQuery.							
<b>Unit – III</b>	<b>Server Side Interaction Through jQuery:</b>						<b>9</b>
Accessing Server-Side Data via JavaScript and jQuery AJAX Requests – Introducing jQuery UI – Using jQuery UI Effects – Advanced Interactions With jQuery UI Interaction Widgets – Using jQuery UI Widgets to Add Rich Interactions to Web Pages.							
<b>Unit – IV</b>	<b>TypeScript and Angular 6.0:</b>						<b>9</b>
TypeScript: Introduction – Features – Variables – Data types – Enum – Array – Tuples – Functions – OOP concepts – Interfaces – Classes – Modules – Decorators. Angular 6.0 : Introduction – Needs – Features – Evolution – Setup and Configuration – Components and Modules – Templates – Change Detection – Directives –Nested Components.– Data Binding – Pipe.							
<b>Unit – V</b>	<b>Client-side JS Framework:</b>						<b>9</b>
Services – HTTP – Routing – Forms in Angular – Template Driven Forms – Model Driven Forms \ Reactive Forms – Custom Validators – Dependency Injection.							

**Total: 45****TEXT BOOK:**

1a.	Brad Dayley, Brendan Dayley, “AngularJS, Java Script and jQuery”, 1 <sup>st</sup> Edition, Pearson Education, New York, 2015. For Unit – I, II, III, IV.
1b.	Brad Dayley, “Node.js, MongoDB and AngularJS Web Development”, 1 <sup>st</sup> Edition, Pearson Education, New York, 2014. For Unit - V.

**REFERENCES:**

1.	Simon Holmes, Clive Herber, “Getting MEAN with Mongo, Express, Angular, and Node”, 1 <sup>st</sup> Edition, Manning Publications, New York, 2019.
2.	Vijay Josh, “Mastering jQuery UI”, 1 <sup>st</sup> Edition, Packt Publishers, Mumbai, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply jQuery objects for designing web page.	Applying (K3)
CO2	develop rich UI component sand controls.	Applying (K3)
CO3	use jQuery for server side interaction.	Applying (K3)
CO4	design web application using TypeScript.	Applying (K3)
CO5	develop UI with angularJS.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	35	45				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST62 – OPEN SOURCE SOFTWARE**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Web Technology</b>	<b>6</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To design web applications using PHP and MySQL.						
<b>Unit – I</b>	<b>Basics of PHP:</b>						<b>9+3</b>
PHP's Syntax – Comments – Variables – Types in PHP – The Simple Types – Doubles – Booleans – NULL – Strings – Output – Expressions – Branching – Looping – Using Functions – User Defined Functions – Functions and Variable Scope – Function Scope.							
<b>Unit – II</b>	<b>String Handling and Arrays:</b>						<b>9+3</b>
Strings in PHP – String Functions – PHP Arrays – Creating Arrays – Retrieving Arrays – Multidimensional Arrays – Inspecting Arrays – Deleting Arrays – Iteration – Numerical Types – Mathematical Operators – Simple Mathematical Functions – Randomness.							
<b>Unit – III</b>	<b>Object-Oriented PHP:</b>						<b>9+3</b>
Object Oriented Programming – Basics PHP constructs for OOP – Advanced OOP features – Introspection Functions – OOP Style in PHP.							
<b>Unit – IV</b>	<b>Session, Cookies and Web Server:</b>						<b>9+3</b>
Regular Expressions – Advanced String Functions – Session – Session in PHP – Session Functions – Cookies-Web Server – Feature – Architectures – Case Study: Apache Web Server.							
<b>Unit – V</b>	<b>Database Connectivity – MySQL:</b>						<b>9+3</b>
Connecting to MySQL – Queries – Fetching Data Sets – Data About Data – Multiple Connections – Creating MySQL Databases with PHP – MySQL Functions – HTML Tables and Database Tables – Complex Mappings – Creating the Sample Tables.							

**Lecture: 45, Tutorial: 15, Total: 60****TEXT BOOK:**

1a.	Steve Suehring, Tim Converse, Joyce Park, "PHP 6 and MySQL", 2 <sup>nd</sup> Edition, Wiley Publication, New Delhi, 2017. For Unit – I, II, III, IV, V
1b.	Julie C. Meloni, "Sams Teach Yourself PHP, MYSQL and Apache AllOne", 5 <sup>th</sup> Edition, Pearson Education, USA, 2012. For Unit – IV (Case Study: Apache Web Server).

**REFERENCES:**

1.	Larry Ullman, "PHP and MySQL for Dynamic Web Sites", 5 <sup>th</sup> Edition, Peachpit Press, 2017.
2.	Welling, Luke, "PHP and MYSQL Web Development", 5 <sup>th</sup> Edition, Addison-Wesley Professional, 2016.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	demonstrate the data types, looping structures, branching structures and functions.	Applying(K3)
CO2	make use of string functions, arrays and functions.	Applying(K3)
CO3	implement programs for given problems with object oriented programming concepts.	Applying(K3)
CO4	apply regular expression, session and cookie to solve problems.	Applying(K3)
CO5	develop web application using PHP and MySQL.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	40	50				100
CAT2	10	40	50				100
CAT3	10	40	50				100
ESE	10	40	50				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST63 – MACHINE LEARNING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Data Mining and Data Warehousing</b>	<b>6</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	The course focuses on supervised, unsupervised learning algorithms and reinforcement learning.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Learning Problems – Designing a Learning System – Perspectives and Issues in Machine Learning – Concept Learning – Task – Search – Finding Maximally Specific Hypotheses – Version Spaces and Candidate Elimination Algorithm – Inductive Bias.							
<b>Unit – II</b>	<b>Supervised Learning – Prediction:</b>						<b>9</b>
Linear Regression – Non Linear Regression – Decision Tree Learning: Decision Tree Representation – Problems – Basic Decision Tree Learning Algorithms – Hypotheses Search – Issues – Artificial Neural Networks: Introduction – Representations – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithm – Example.							
<b>Unit – III</b>	<b>Supervised Learning – Instance Based Learning:</b>						<b>9</b>
Bayesian Learning: Bayes Theorem – Concept Learning – Maximum Likelihood and Least-Squared Error Hypothesis – Bayes Optimal Classifier – Gibbs Algorithm – Naive Bayes Classifier – Example – Instance Based Learning: Introduction – k-Nearest Neighbour Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning.							
<b>Unit – IV</b>	<b>Unsupervised Learning:</b>						<b>9</b>
K – Means – K Medoids – Genetic Algorithms: Introduction – Example – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning – Parallelizing Genetic Algorithms.							
<b>Unit – V</b>	<b>Learning Sets of Rules:</b>						<b>9</b>
Learning Sets of Rules: Introduction – Sequential Covering Algorithms – First Order Rules – FOIL – Induction As Inverted Deduction – Inverting Resolution – Reinforcement Learning: Introduction – Markov Decision Processes – Values – SARSA vs Q-Learning.							

**Total: 45****TEXT BOOK:**

1.	Tom M. Mitchell, “Machine Learning”, Indian Edition, McGraw-Hill Education (India), Chennai 2018.
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**REFERENCES:**

1.	Stephen Marsland, “Machine Learning – An Algorithmic Perspective”, 2 <sup>nd</sup> Edition, Chapman and Hall/CRC Machine Learning and Pattern Recognition Series, 2014.
2.	Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, 3 <sup>rd</sup> Edition, Elsevier, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the perspectives of machine learning and formulate the hypothesis.	Applying(K3)
CO2	apply regression, decision tree and artificial neural networks for real world problems.	Applying(K3)
CO3	design parametric and non-parametric algorithms for solving a given problem.	Applying(K3)
CO4	make use of the principles of unsupervised learning and genetic algorithm for optimization.	Applying(K3)
CO5	interpret the algorithms for learning rules and outline reinforcement learning.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	35	50				100
CAT2	15	35	50				100
CAT3	15	55	30				100
ESE	15	40	45				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST64 – SOFTWARE PROJECT MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Software Engineering</b>	<b>6</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To provide a sound understanding of the software project management concepts. Also, to help the students understand the challenges and issues in software projects from project managers perspectives.
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<b>Unit – I</b>	<b>Introduction to Software Project Management:</b>	<b>9+3</b>
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Introduction to Software Project Management – Importance – Types of Project – Contract and Project Management – Activities – Plans, Methods and Methodologies – Ways of Categorizing Software Projects – Problems with Software Projects – Setting Objectives – Stakeholders – Business Case – Requirement Specification – Management Control – Project Planning: Introduction to Step Wise Project Planning – Select Project – Identify Project Scope and Objectives – Project Infrastructure – Analyse Project Characteristics – Identify Project Products and Activities – Estimate Effort for Activity – Identify Activity Risks – Allocate Resources – Review Plan – Execute Plan.

<b>Unit – II</b>	<b>Project Evaluation:</b>	<b>9+3</b>
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Introduction – Strategic Assessment – Technical Assessment – Cost Benefit Analysis – Cash Flow Forecasting – Cost Benefit Evaluation Techniques – Risk Evaluation – Software Effort Estimation: Introduction – Estimates – Problems with Over and Under Estimates – Basis – Software Estimates – Techniques – Expert Judgment – Estimating by Analogy – Albrecht Function Point Analysis – Function Point Analysis Mark II – Object Points – A Procedural Code Oriented Approach – COCOMO A Parametric Models.

<b>Unit – III</b>	<b>Activity Planning and Risk Management:</b>	<b>9+3</b>
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Objectives – Project Schedule – Sequencing and Scheduling Activities – Network Planning Models – Formulating a Network Model – Adding the Time Diversion – Forward Pass – Backward Pass – Identifying the Critical Path – Activity Float – Shortening the Project Duration Activities – Activity on Narrow Networks – Risk Management: Introduction – Nature of Risk – Types of Risk – Managing Risk – Hazard Identification and Analysis – Risk Planning and Control – Evaluating Risk to the Schedule.

<b>Unit – IV</b>	<b>Resource Allocation:</b>	<b>9+3</b>
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Introduction – Nature of Resources – Identifying Resource Requirements – Scheduling Resources – Creating Critical Paths – Counting the Cost – Being Specific – Resource and Cost Schedules – The Scheduling Sequence – Monitoring and Control: Introduction – Creating Framework – Collecting the Data – Visualizing Progress – Cost Monitoring – Earned Value – Prioritizing Monitoring – Getting Project Back to Target – Change Control.

<b>Unit – V</b>	<b>Managing Contracts and People, Organizing Teams:</b>	<b>9+3</b>
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Introduction – Types of Contract – Stages in Contract Placement – Typical Terms of a Contract – Contract Management – Acceptance – Managing People and Organizing Teams: Introduction – Understanding Behaviour – A Background – Selecting the Right Person for the Job – Instruction in the Best Methods – Motivation – The Oldham-Hackman Job Characteristics Model – Stress – Health – Safety.

**Lecture: 45, Tutorial: 15, Total: 60**

**TEXT BOOK:**

1.	Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", 6 <sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2017.
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**REFERENCES:**

1.	Roger S. Pressman, "Software Engineering", 7 <sup>th</sup> Edition, McGraw Hill Education Private Limited, 2016.
2.	Pankaj Jalote, "Software Project Management in Practice", Pearson Education, New Delhi, 2013



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline step wise project planning activities.	Understanding(K2)
CO2	explain cost- benefit evaluation techniques and software effort estimation.	Understanding(K2)
CO3	illustrate the project activity plan and project risk management.	Understanding(K2)
CO4	make use of project monitoring and controlling procedures for given applications.	Applying(K3)
CO5	organize project contracts and people.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	25	35	40				100
ESE	20	55	25				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISL61 – FRONT END TECHNOLOGIES LABORATORY

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Web Technology</b>	<b>6</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To use predefined API and develop applications using Python.						

**List of Exercises / Experiment:**

1.	Design web form using HTML, CSS and Java Script.
2.	Perform validation for the web from using Java Script.
3.	Develop interactive user interface with jQuery.
4.	Handle request and response with jQuery.
5.	Create web form with AngularJS.
6.	Implement AngularJS services.
7.	Design web application using AngularJS.
8.	Implement TypeScript class.
9.	Design web page using TypeScript.
10.	Mini Project.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
2.	Text Editor / Browser / Any IDE
3.	<a href="http://www.w3schools.com">www.w3schools.com</a>
4.	<a href="http://www.codementor.io">www.codementor.io</a>

**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	demonstrate website designing using jQuery.	Applying (K3), Precision (S3)
CO2	design application using angularJS.	Applying (K3), Precision (S3)
CO3	build applications with MongoDB and angularJS..	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	3				3	3	3	3	3	3
CO2	3	2	1	1	3				3	3	3	3	3	3
CO3	3	2	1	1	3				3	3	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy



## 20ISP61 – MINI PROJECT

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>6</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>

Total: 60

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the requirements and apply the concepts of mathematics, science, engineering and management principles necessary to solve the real world problem.	Creating (K6), Precision (S3)
CO2	apply the engineering tools to solve the identified real world problem.	Creating (K6), Precision (S3)
CO3	analyze and interpret results of experiments conducted on the designed solution to arrive at valid conclusions.	Analyzing (K4), Precision (S3)
CO4	engage in effective written communication by presenting the technical project report.	Applying (K3), Precision (S3)
CO5	demonstrate an ability to work in the team and contribute to the team.	Applying (K3), Precision (S3)

## Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	3	3	2	2	3	2	3	3
CO2	3	3	3	3	3	2	3	3	2	2	3	2	3	3
CO3	3	3	3	3	3	3	2	3	2	2	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3	2	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20GEL61 – PROFESSIONAL SKILLS TRAINING – II**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>6</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>80</b>	<b>2</b>

<b>Preamble</b>	This subject is to enhance the employability skills and to develop career competency						
<b>Unit - I</b>	<b>Soft Skills – II:</b>						<b>20</b>
Group discussions: Advantages of group discussions – Structured GD – Team work: Value of team work in organizations – Definition of a team, why team – Elements of leadership, disadvantages of a team, stages of team formation – Group development activities. Facing an interview: Foundation in core subject – industry orientation/knowledge about the company – professional personality – Communication skills – Activities before Interview, upon entering interview room, during the interview and at the end Mock interviews.							
<b>Unit - II</b>	<b>Quantitative Aptitude &amp; Logical Reasoning – II:</b>						<b>30</b>
Problem solving level II: Money related problems – Mixtures – Symbol base problem – Clocks and calendars – Simple – linear – quadratic and polynomial equations – Special, equations – Inequalities – Sequence and series – Set theory – Permutations and combinations – Probability – Statistics – Data sufficiency – Geometry – Trigonometry – Heights and distances – Co-ordinate geometry – Mensuration. Logical reasoning: Conditionality and grouping – Sequencing and scheduling – Selections – Networks:- Codes; Cubes – Venn diagram in logical reasoning – Quant based reasoning – Flaw detection – Puzzles – Cryptarithms.							
<b>Unit - III</b>	<b>Reading &amp; Speaking Skills:</b>						<b>30</b>
Reading: Reading comprehension – Effective Reading strategies – Descriptive, Inferential, & Argumentative reading passages – Identifying and locating factual information within a text – global reading/skimming for general understanding – selective comprehension / scanning for specific information – detailed comprehension / intensive reading – understanding the development of an argument – identifying the writer’s attitude and opinions – Reading news articles in business magazines, newspapers – Reading notices and book reviews –Interpreting graphic data & Advertisements. Speaking: Mock Interviews –Self-Introduction – Sharing of Real Time Experience; Conversational Practices –Role Play – Short Talks / TED Talks –Extempore; Giving a Presentation on Various Topics – Technical / Non-Technical Topics – Project Review Presentation – Oratory and Effective Public Speaking; Pair Discussion – Group Discussion – The process of Group Discussion – Strategies to be adopted – Skills Assessed – Telephonic Conversations & Skills – Negotiating Skills.							

**Total: 80****TEXT BOOK:**

1	Thorpe, Showick and Edgar Thorpe, “Objective English For Competitive Examination”, 6 <sup>th</sup> Edition, Pearson India Education Services Pvt Ltd, 2017.
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**REFERENCES:**

1	Aruna Koneru, “Professional Speaking Skills,” Oxford University Press India, 2015.
2	Thorpe, Showick and Edgar Thorpe, “Winning at Interviews,” 5 <sup>th</sup> edition, Pearson Education, India, 2013.
3	Rizvi, Ashraf M, “Effective Technical Communication,” 2 <sup>nd</sup> Edition, McGraw Hill Education India, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	develop the soft skills of learners to support them work efficiently in an organization as an individual and as a team	Applying (K3), Precision (S3)
CO2	solve real time problems using numerical ability and logical reasoning	Applying (K3), Precision (S3)
CO3	apply reading and speaking skills effectively for various academic and professional purposes	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2				3	3		3		3	2	3	3
CO2	3	2				3	3		3		3	2	3	3
CO3		2				3	3		3	3	3	2	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	40	40				100
CAT2		50	50				100
CAT3		50	50				100
ESE	NA						

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISP71 – PROJECT WORK I

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>7</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>15</b>

Total: 450

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the requirements and apply the concepts of mathematics, science, engineering and management principles necessary to solve the real world problem.	Creating (K6), Precision (S3)
CO2	apply the engineering tools to solve the identified real world problem.	Creating (K6), Precision (S3)
CO3	analyze and interpret results of experiments conducted on the designed solution to arrive at valid conclusions.	Analyzing (K4), Precision (S3)
CO4	engage in effective written communication by presenting the technical project report.	Applying (K3), Precision (S3)
CO5	demonstrate an ability to work in the team and contribute to the team.	Applying (K3), Precision (S3)

## Mapping of COs with POs and PSOs

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	2	3	3	2	2	3	2	3	3
CO2	3	3	3	3	3	2	3	3	2	2	3	2	3	3
CO3	3	3	3	3	3	3	2	3	2	2	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3	2	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy

**20IST81 – USER INTERFACE DESIGN**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Software Engineering</b>	<b>8</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To make user interaction with system as simple and efficient as possible, in terms of accomplishing user goals.						
<b>Unit – I</b>	<b>Design Methods:</b>						<b>9</b>
Goal-Directed Design: Design Methods – Evolution – Planning and Designing – User Goals – Design Process – Implementation Models and Mental Models: Implementation Models – User Mental Models – Represented Models – Beginners, Experts, and Intermediates: Perpetual Intermediates – Designing for Different Experience Levels.							
<b>Unit – II</b>	<b>Design Requirements and Synthesizing:</b>						<b>9</b>
Scenarios – Requirements – Definition - Design Framework – Form and Behavior – Validation and Testing – Design Principles – Design Values – Design Patterns.							
<b>Unit – III</b>	<b>Platform and Posture:</b>						<b>9</b>
Posture – Designing Desktop Software – Designing for the Web – Other Platforms – Orchestration and Flow: Flow and Transparency – Designing Harmonious Interactions.							
<b>Unit – IV</b>	<b>Excise and Good Behavior:</b>						<b>9</b>
Eliminating Excise: GUI Excise – Proceedings – Traps – Navigation is Excise – Improving Navigation – Designing Good Behavior: Designing Considerate Products – Smart Products.							
<b>Unit – V</b>	<b>Interface Paradigms and VID:</b>						<b>9</b>
Metaphors, Idioms and Affordances: Interface Paradigms – Metaphors – Building Idioms – Manual Affordances – Visual Interface Design: Design Disciplines – Building Blocks – Principles – Interface Design – Information Design – Consistency and Standards.							

**Total: 45****TEXT BOOK:**

1.	Alan Cooper, Robert Reimann and Dave Cronin, “About Face 3: The Essentials of Interaction Design”, Wiley Publishing Inc, 2007.
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**REFERENCES:**

1.	Wilbent, O.Galitz, “The Essential Guide to User Interface Design”, 2 <sup>nd</sup> Edition, John Wiley & Sons, 2002.
2.	Sheiderman Ben and Catherine Plaisant, “Designing the User Interface”, 5 <sup>th</sup> Edition, Pearson Education, New Delhi, 2009.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	interpret the different design models.	Understanding(K2)
CO2	elaborate the design framework and patterns.	Understanding(K2)
CO3	demonstrate software with flow, transparency and interaction.	Applying(K3)
CO4	design user interface with good behavior.	Applying(K3)
CO5	make use of interface paradigms in visual interface design.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	10	55	35				100
CAT3	10	55	35				100
ESE	15	45	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**20IST82 – AGILE SOFTWARE ENGINEERING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Software Engineering</b>	<b>8</b>	<b>PC</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To impart basic knowledge on agile paradigm, management of agile teams.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9+3</b>
Introduction to Agile Software Development - Overview and Objectives – Three Perspectives on Software Engineering – Agile Manifesto – Application – Data – Agile Software Development Learning Environments – Teamwork – Overview and Objectives – Role in Agile Teams – Implementation of the Role Scheme – Dilemmas in Teamwork – Teamwork in Learning Environments.							
<b>Unit – II</b>	<b>Customers and Users:</b>						<b>9+3</b>
Overview – The Customer – The User – Customers and Users in Learning Environments – Time: Overview and Objectives – Time-Related Problems in Software Projects – Tightness of Software Development Methods – Sustainable Pace – Time Management of Agile Projects – Time in Learning Environments.							
<b>Unit – III</b>	<b>Measures:</b>						<b>9+3</b>
Overview and Objectives – Need of Measures – Questions in Measures – Measures in Learning Environments – Quality – Overview and Objectives – The Agile Approach to Quality Assurance – Test-Driven Development – Measured TDD.							
<b>Unit – IV</b>	<b>Learning:</b>						<b>9+3</b>
Overview and Objectives – Support of Agile Software Development in Learning Processes – Abstraction – Abstraction Levels in Agile Software Development – Roles in Agile Teams – Stand Up Meeting – Design and Refactoring.							
<b>Unit – V</b>	<b>Trust and Globalization:</b>						<b>9+3</b>
Overview and Objectives – Software Intangibility and Process Transparency – Game Theory Perspective in Software Development – Ethics in Agile Teams – Diversity – Globalization – Overview and Objectives – The Agile Approach in Global Software Development – Application of Agile Principles in Non – Software Projects – Globalization in Learning Environments.							

**Lecture: 45, Tutorial: 15, Total: 60**

**TEXT BOOK:**

1.	Orit Hazzan and Yael Dubinsky, “Agile Software Engineering”, Springer-Verlag London Limited, 2009.
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**REFERENCES:**

1.	Thomas Stober, “Agile Software Development: Best Practices for Large Software Development Projects”, Springer-Verlag London Limited 2009.
2.	Mike Cohn, “Succeeding with Agile: Software Development Using Scrum”, Pearson Education, New Delhi, 2010.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer agile manifesto.	Understanding(K2)
CO2	classify customers and users.	Understanding(K2)
CO3	make use of the test-driven development.	Applying(K3)
CO4	explore various roles in agile teams.	Applying(K3)
CO5	describe agile approach in global software development.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	25	60	15				100
CAT3	25	60	15				100
ESE	30	50	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20IST83 – CLOUD COMPUTING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Computer Networks, Operating Systems</b>	<b>8</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To understand the basic concepts of cloud computing and apply cloud services in various applications.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Defining Cloud computing – Cloud Types – Characteristics of Cloud computing – Cloud Architecture – Cloud Computing Stack – Infrastructure as a Service – Platform as a Service – Software as a Service – Identity as a Service – Compliance as a Service – Parallel Processing: Introduction – Distributed Processing: Introduction.							
<b>Unit – II</b>	<b>Platforms and Cloud Based Services:</b>						<b>9</b>
Abstraction and Virtualization – Load Balancing and Virtualization – Hypervisors – Machine Imaging – Porting Applications – Capacity Planning – Google Web Services – Amazon Web Services – Microsoft Cloud Services.							
<b>Unit – III</b>	<b>Managing and Securing the Cloud:</b>						<b>9</b>
Adminstrating the Cloud – Cloud Management Products – Cloud Management Standards – Securing the Cloud – Securing Data – Establishing Identity and Presence.							
<b>Unit – IV</b>	<b>Cloud Based Storage and Productivity Software:</b>						<b>9</b>
Digital Universe – Provisioning Cloud Storage – Cloud Backup Solutions – Cloud Storage Interoperability – Using Productivity Applications – Online Office Systems.							
<b>Unit – V</b>	<b>Mobile Cloud and Mobile Web Services:</b>						<b>9</b>
Mobile Market – Smart Phones with the Cloud – Mobile Web Services – Service Types – Service Discovery – Using SMS – Defining WAP and Other Protocols – Performing Synchronization.							

**Total: 45****TEXT BOOK:**

1a.	Barrie Sosinsky, "Cloud Computing Bible", 1 <sup>st</sup> Edition, Wiley Publishing, 2015. For Unit I, II, III, IV, V
1b.	S.K. Basu, "Parallel And Distributed Computing: Architectures And Algorithms", PHI Learning Private limited -Delhi, 2016. For Unit - I

**REFERENCES:**

1.	Thomas Erl, Zaigham Mahood, Richard Puttini, "Cloud Computing, Concept, Technology and Architecture", Prentice Hall, USA 2013.
2.	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", 1 <sup>st</sup> Edition, Morgan Kaufmann Publishers, USA, 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe the main concepts, key technologies, strengths and limitations of cloud computing.	Understanding(K2)
CO2	outline the principle of abstraction, virtualization, load balancing, capacity planning and cloud based services.	Understanding(K2)
CO3	identify the core issues in cloud security and apply remedial measures.	Applying(K3)
CO4	determine the various interoperability and storage issues in modern cloud.	Applying(K3)
CO5	discover the key smartphone web features.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	35	65					100
CAT2	30	40	30				100
CAT3	25	35	40				100
ESE	30	35	35				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISL81 – USER INTERFACE DESIGN LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Web Technology</b>	<b>8</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To develop user interface for real world applications.						

**List of Exercises / Experiments:**

1.	Design a simple User Interface for E-commerce application using HTML and CSS.
2.	Design a simple User Interface for E-commerce application using scripting language.
3.	Design User Interface for competitive exam and perform appropriate validation using client side scripting language.
4.	Design User Interface for competitive exam and perform appropriate validation using Java framework.
5.	Design User Interface for competitive exam and perform appropriate validation using PHP.
6.	Design User Interface for financial application using Justinmind Sketch/Figma.
7.	Develop User Interface for pharmaceutical concern using Justinmind/Sketch/Figma.
8.	Develop User Interface for agro based industry using Justinmind/Sketch/Figma.
9.	Develop User Interface for manufacturing company using Justinmind/Sketch/Figma.
10.	Design a Web Application for grocery store with Java and MySQL .

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	Laboratory Manual
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<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	design an aesthetic user interface with appropriate validation.	Applying (K3), Precision (S3)
CO2	develop user interface using open source design tools for real world application.	Applying (K3), Precision (S3)
CO3	deploy web application with backend.	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

**20ISL82 – SOFTWARE APPLICATION DEVELOPMENT LABORATORY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>8</b>	<b>PC</b>	<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>
<b>Preamble</b>	To focus on software development in various domains.						

**List of Exercises / Experiments:**

1.	Construct SRS, DFD, UML & ERD for any one of the following <ul style="list-style-type: none"> <li>Library Management System</li> <li>Sales Order Processing</li> <li>Simple Banking System</li> </ul>
2.	Construct the design along with DFD, UML & ERD for <ul style="list-style-type: none"> <li>Employee Details and Pay Roll Maintenance</li> <li>Hospital Management System</li> </ul>
3.	Create a web application for online shopping.
4.	Create a web application for online bus ticket booking.
5.	Apply pair programming concept to design a simple game.

**Total: 60****REFERENCES/MANUAL/SOFTWARE:**

1.	PHP, Java, Oracle
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**COURSE OUTCOMES:**

On completion of the course, the students will be able to

		<b>BT Mapped (Highest Level)</b>
CO1	create software requirement specification for the application.	Applying (K3), Precision (S3)
CO2	design and develop web application.	Applying (K3), Precision (S3)
CO3	make use of agile concepts to develop software.	Applying (K3), Precision (S3)

**Mapping of COs with POs and PSOs**

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy



## 20ISP01 – PROJECT WORK II

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>9</b>	<b>EC</b>	<b>0</b>	<b>0</b>	<b>30</b>	<b>15</b>

Total: 450

<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	identify the requirements and apply the concepts of mathematics, science, engineering and management principles necessary to solve the real world problem.	Creating (K6), Precision (S3)
CO2	apply the engineering tools to solve the identified real world problem.	Creating (K6), Precision (S3)
CO3	analyze and interpret results of experiments conducted on the designed solution to arrive at valid conclusions.	Analyzing (K4), Precision (S3)
CO4	engage in effective written communication by presenting the technical project report.	Applying (K3), Precision (S3)
CO5	demonstrate an ability to work in the team and contribute to the team.	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	3	3	3	3	3	2	3	3	2	2	3	2	3	3
CO2	3	3	3	3	3	2	3	3	2	2	3	2	3	3
CO3	3	3	3	3	3	3	2	3	2	2	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	2	2	3	3	3	3	3	3	3	2	3	3	3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

**20ISE01 – ADVANCED JAVA PROGRAMMING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Java Programming</b>	<b>5</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

<b>Preamble</b>	This course enables the students to develop, test, and deploy applications ready for production and how to establish them as cloud-based applications using Spring Boot.
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<b>Unit – I</b>	<b>Spring Boot:</b>	<b>9</b>
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Introduction – Features - Advantages, Microservices, System Requirements, Setting up the environment, 12-factor app, Spring Initializr, Build Tools – Maven and Gradle, pom.xml and build.gradle, Building application using Maven and Gradle, entry point class, Bootstrap Application Context, Spring Boot Starter Dependencies - Auto-Configuration.

<b>Unit – II</b>	<b>Spring Annotations and Data:</b>	<b>9</b>
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Spring Boot Annotations: Java annotations – Existence of Spring Annotations - Spring and Spring Boot Annotations. Working with Spring Data JPA and Caching: Accessing relational data using Jdbc Template and Spring Data JPA with the in-memory database and MySQL - Query methods in Spring Data JPA - Caching.

<b>Unit – III</b>	<b>Learning RESTful API:</b>	<b>9</b>
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Building RESTful Microservices: Creating and Consuming RESTful APIs- Spring Boot Actuators – Custom health check indicators – Exception handling -Service discovery – Rest Template - Routing a request – Spring Cloud Gateway. Securing a Web Application: Authentication and Authorization concepts – Spring security filters – Enabling and Disabling security – OAuth security – Accessing REST secured APIs – REST services.

<b>Unit – IV</b>	<b>Implementing Resilience4J and Swagger:</b>	<b>9</b>
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Building Resilient System: Client-side load balancing – Circuit breaker – Implementing Resilience4J. Logging: Logging Data – Logback – Spring Cloud Sleuth and Zipkin – ELK. Working with the Swagger API Management Tool: API documentation – Implementing Swagger - Swagger UI – Swagger documentation – Swagger Codegen.

<b>Unit – V</b>	<b>Testing and Deploying:</b>	<b>9</b>
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Testing a Spring Boot Application: Unit Testing and Integration Testing – JUnit and Mockito framework – Checking code coverage – Testing RESTful web services – Cucumber automation testing. Deploying a Spring Boot Application – Docker and containerization - Setting up Docker- Heroku CLI and deployment. Case Study.

**List of Exercises / Experiments:**

1.	Building application using Maven and Gradle
2.	Create Spring Data JPA Repositories
3.	Building RESTful Microservices
4.	Working with the Swagger API Management Tool
5.	Testing and deploying Spring Boot Application

**Lecture: 45, Practical: 30, Total: 75****TEXT BOOK:**

1.	Shagun Bakliwal, "Hands-on Application Development using Spring Boot: Building Modern Cloud Native Applications by Learning RESTful API, Microservices, CRUD Operations, Unit Testing, and Deployment", BPB Publications, 1st Edition, 2021.
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**REFERENCES:**

1.	Rajput, D. "Mastering Spring Boot 2.0: Build modern, cloud-native, and distributed systems using Spring Boot", Packt Publishing Ltd, 2018.
2.	Claudio and Greg, "Developing Java Applications with Spring and Spring Boot", Packt Publishing Ltd, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the spring boot and all its capabilities.	Applying (K3)
CO2	demonstrate the common annotations of the spring data and spring data jpa	Applying (K3)
CO3	build restful microservices and secured web application	Applying (K3)
CO4	implement resilience4j and swagger api and host the apps on cloud.	Applying (K3)
CO5	learn to demonstrate testing and deploying a spring boot application	Applying (K3)
CO6	create a spring project from scratch	Applying (K3), Precision (S3)
CO7	explore the api gateway and practice how to run request routing	Applying (K3), Precision (S3)
CO8	create enterprise applications using spring boot	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3
CO6	3	2	1	1									3	3
CO7	3	2	1	1									3	3
CO8	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	5	20	75				100
CAT2	10	20	70				100
CAT3	10	20	70				100
ESE	10	20	70				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE02 – ADVANCED DATABASE TECHNOLOGIES**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Database Management Systems</b>	<b>5</b>	<b>PE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To focus on query optimization in parallel and distributed databases.						
<b>Unit – I</b>	<b>Query Optimization:</b>						<b>9+3</b>
Overview – Transformation of Relational Expressions – Estimating Statistics of Expression Results – Choice of Evaluation Plans – Materialized Views.							
<b>Unit – II</b>	<b>Recovery System and DBMS Architecture:</b>						<b>9+3</b>
Recovery System: Log Based Recovery – Recovery with Concurrent Transactions – Buffer Management – Database System Architecture: Centralized and Client – Server Architectures – Server System Architectures – Parallel Systems – Distributed Systems – Network Types.							
<b>Unit – III</b>	<b>Parallel Databases:</b>						<b>9+3</b>
Introduction – I/O Parallelism – Interquery Parallelism – Intraquery Parallelism – Intraoperation Parallelism – Interoperation Parallelism.							
<b>Unit – IV</b>	<b>Distributed Databases:</b>						<b>9+3</b>
Introduction – Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control in Distributed Databases – Availability – Distributed Query Processing – Cloud Databases.							
<b>Unit – V</b>	<b>Spatial and Temporal Data:</b>						<b>9+3</b>
Motivation – Time in Databases – Spatial and Geographic Data – Multimedia Databases – Mobility and Personal Databases – Advanced Transaction Processing: Transaction-Processing Monitors – Transactional Workflows – E-Commerce – Main-Memory Databases – Real-Time Transaction Systems – Long-Duration Transactions.							

Lecture: 45, Tutorial: 15, Total: 60

**TEXT BOOK:**

1.	Silberschatz Abraham, Korth F.Henry and Sudarshan S., “Database System Concepts”, 6 <sup>th</sup> Edition, McGraw Hill, New Delhi, 2019.
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**REFERENCES:**

1.	Ramez Elmasri and Shamkanth B.Navathe, “Fundamentals of Database Systems”, 7 <sup>th</sup> Edition, Pearson Education, Chennai, 2017.
2.	S. K. Singh, “Database Systems: Concepts, Design and Applications”, Pearson Education, New Delhi 2011.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	explain selection of the most efficient query-evaluation plan.	Understanding (K2)
CO2	apply the log based recovery schemes.	Applying (K3)
CO3	infer parallel execution of queries.	Understanding (K2)
CO4	explore distributed transactions and apply concurrency control schemes.	Applying (K3)
CO5	describe handling of spatial, temporal and multimedia data.	Understanding (K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	60	15				100
CAT2	30	60	10				100
CAT3	25	60	15				100
ESE	25	45	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISE03 – ARTIFICIAL INTELLIGENCE

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Data Structures</b>	<b>5</b>	<b>PE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To introduce the fundamental concepts of artificial intelligence and provide them the ability to design intelligent systems.						
<b>Unit – I</b>	<b>Introduction and Problem Spaces:</b>						<b>9+3</b>
Artificial Intelligence: AI Problems – Assumption – Technique – Model – Criteria – Problems – Problem Spaces and Search: Definition – Production Systems – Characteristics – Issues in the Design of Search Programs.							
<b>Unit – II</b>	<b>Heuristic Search Techniques:</b>						<b>9+3</b>
Heuristic Search Techniques: Generate and Test – Hill Climbing – Best-First Search – Problem Reduction – Constraint Satisfaction – Means-Ends Analysis.							
<b>Unit – III</b>	<b>Fundamentals of Knowledge Representation:</b>						<b>9+3</b>
Knowledge Representation Issues: Representations and Mappings – Approaches – Issues – Frame Problem – Using Predicate Logic: Representing Simple Facts in Logic – Instance and ISA Relationships – Functions and Predicates – Resolution – Deduction.							
<b>Unit – IV</b>	<b>Knowledge Representation and Structures:</b>						<b>9+3</b>
Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge – Logic Programming – Reasoning – Matching – Control Knowledge – Weak Slot-and-Filler Structures: Semantic Nets – Frames – Strong Slot-and-Filler Structures: Conceptual Dependency – Scripts – CYC.							
<b>Unit – V</b>	<b>Reasoning:</b>						<b>9+3</b>
Symbolic Reasoning Under Uncertainty: Non monotonic Reasoning – Logics – Issues – Problem Solver – Implementation – DFS – BFS – Statistical Reasoning: Probability and Bayes Theorem – Certainty Factors and Rule – Based Systems – Bayesian Networks – Dempster – Shafer Theory – Fuzzy Logic.							

Lecture: 45, Tutorial: 15, Total: 60

## TEXT BOOK:

1.	Elaine Rich, Kevin Knight, Shivashankar B.Nair, "Artificial Intelligence", 3 <sup>rd</sup> Edition, McGraw Hill Education Pvt. Ltd., 2018.
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## REFERENCES:

1.	Russell Stuart, Norvig Peter, "Artificial Intelligence: A Modern Approach", 3 <sup>rd</sup> Edition, Pearson Education, 2016.
2.	Parag Kulkarni, Prachi Joshi, "Artificial Intelligence –Building Intelligent Systems", PHI Learning Private Ltd, 2015.



<b>COURSE OUTCOMES:</b>		<b>BT Mapped (Highest Level)</b>
On completion of the course, the students will be able to		
CO1	apply the basic principles of artificial intelligence (AI) in problem space and search programs.	Applying (K3)
CO2	demonstrate the various heuristic search techniques.	Applying (K3)
CO3	interpret the techniques to represent and manipulate the knowledge.	Understanding (K2)
CO4	implement the knowledge representation techniques and structures.	Applying (K3)
CO5	explore techniques for solving problems with complete and uncertain models.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	35	50				100
CAT2	20	65	15				100
CAT3	10	35	55				100
ESE	10	45	45				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISE04 – MOBILE COMMUNICATIONS

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Computer Networks</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To study the specifications and functionalities of various protocols/standards of mobile networks.						
<b>Unit – I</b>	<b>Wireless Communication Fundamentals:</b>						<b>9</b>
Introduction: History of Wireless Communication – Wireless Transmission: Frequencies for Radio Transmission – Signals – Antennas – Signal Propagation – Multiplexing – Modulation – Spread Spectrum – Cellular Systems – Medium Access Control: Motivation for a Specialized MAC – SDMA – FDMA – TDMA – CDMA - Comparison of S/T/F/CDMA.							
<b>Unit – II</b>	<b>Telecommunications Systems:</b>						<b>9</b>
GSM: Mobile Services – System Architecture - Protocols – Localization and Calling – Handover – Security – New Data Services – Satellite Systems: Basics – Routing – Localization – Handover.							
<b>Unit – III</b>	<b>Wireless LAN:</b>						<b>9</b>
Infra Red vs Radio Transmission – Infrastructure and Ad-hoc Network – IEEE 802.11: System Architecture – Protocol Architecture – Physical Layer – Medium Access Control (MAC) Layer – MAC Management – Bluetooth: User Scenarios – Architecture – Radio Layer – Baseband Layer – Link Manager Protocol – L2CAP.							
<b>Unit – IV</b>	<b>Mobile Network Layer:</b>						<b>9</b>
Mobile IP: Goals, Assumptions and Requirements – Entities and Terminology – IP Packet Delivery – Agent Discovery – Registration – Tunneling and Encapsulation – Optimizations – Reverse Tunneling – IPv6 – IP Micro Mobility Support – Dynamic Host Configuration Protocol – Mobile Ad-hoc Networks: Routing – Destination Sequence Distance Vector – Dynamic Source Routing – Alternative Metrics – Overview Ad-hoc Routing Protocols.							
<b>Unit – V</b>	<b>Mobile Transport Layer and Application Layer:</b>						<b>9</b>
Mobile Transport Layer: Traditional TCP: Congestion Control – Slow Start – Fast Retransmit/Fast Recovery – Implications of Mobility – Classical TCP Improvements: Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit/fast Recovery – Transmission/Time – Out Freezing – Selective Retransmission – Transaction Oriented TCP – TCP over 2.5/3G Wireless Networks – Mobile Application Layer : Wireless Application Protocol: Architecture – Wireless Datagram Protocol – Wireless Transport Layer Security – Wireless Transaction Protocol – Wireless Session Protocol – Wireless Application Environment.							

**Total: 45****TEXT BOOK:**

1.	Jochen H Schiller, "Mobile Communications", 2 <sup>nd</sup> Edition, Pearson Education, New Delhi, 2018.
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**REFERENCES:**

1.	Raj Kamal, "Mobile Computing", 2 <sup>nd</sup> Edition, Oxford University Press, New Delhi, 2013.
2.	Asoke K Talukder, "Mobile Computing: Technology Applications and Service Creation", 2 <sup>nd</sup> Edition, Mcgraw-Hill Education (India) Private Limited, New York, 2013.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline the spread spectrum techniques and medium access schemes.	Understanding(K2)
CO2	interpret the features of GSM and Satellite systems.	Understanding(K2)
CO3	explain the concepts of wireless LAN and Bluetooth.	Understanding(K2)
CO4	illustrate the characteristics of mobile IP and demonstrate various Ad hoc network protocols.	Applying(K3)
CO5	solve the TCP issues for mobility.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	25	75					100
CAT3	20	50	30				100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE05 – BLOCKCHAIN TECHNOLOGY**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Cryptography and Network Security</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To provide technical fundamentals of blockchain, practical implications and development aspects of blockchain applications.						
<b>Unit – I</b>	<b>Introduction to Blockchain:</b>						<b>9</b>
Centralized vs. Decentralized Systems – Layers of Blockchain – Importance – Blockchain Uses and Use Cases – Working of Blockchain: Foundation – Cryptography.							
<b>Unit – II</b>	<b>Blockchain:</b>						<b>9</b>
Game Theory – Nash Equilibrium – Prisoner’s Dilemma – Byzantine Generals’ Problem – Zero-Sum Games – The Blockchain – Merkle Trees – Properties of Blockchain Solutions – Blockchain Transactions – Distributed Consensus Mechanisms – Blockchain Applications – Scaling Blockchain.							
<b>Unit – III</b>	<b>Bitcoin:</b>						<b>9</b>
The History of Money – Working with Bitcoins – The Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full Nodes vs. SPVs – Bitcoin Wallets.							
<b>Unit – IV</b>	<b>Ethereum:</b>						<b>9</b>
Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution – Ethereum Ecosystem – Swarm – Whisper – DApp – Development Components.							
<b>Unit – V</b>	<b>Blockchain Application Development:</b>						<b>9</b>
Decentralized Applications – Blockchain Application Development – Interacting with the Bitcoin Blockchain – Sending Transactions – Creating a Smart Contract – Executing Smart Contract Functions – Public vs. Private Blockchains – Decentralized Application Architecture.							

**Total: 45****TEXT BOOK:**

1.	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, “Beginning Blockchain: A Beginner’s Guide to Building Blockchain Solutions”, Apress, 2018.
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**REFERENCES:**

1.	Brenn Hill, Samanyu Chopra, Paul Valencourt, “Blockchain Quick Reference: A Guide to Exploring Decentralized Blockchain Application Development”, Packt Publishing, 2018.
2.	Imran Bashir, “Mastering Blockchain - Distributed Ledger Technology, Decentralization and Smart Contracts Explained”, 2 <sup>nd</sup> Edition, Packt Publishing, 2018.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline the history, background, and theoretical aspects of blockchain.	Understanding(K2)
CO2	illustrate core components of blockchain.	Understanding(K2)
CO3	elaborate Bitcoin’s technical concepts.	Understanding(K2)
CO4	exhibit Ethereum blockchain for different use cases.	Applying(K3)
CO5	demonstrate the end-to-end development of a decentralized application.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	30	70					100
CAT3	30	50	20				100
ESE	30	50	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE06 – COMPUTER GRAPHICS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>6</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge about 2D and 3D transformation and need of animation in software industries.						
<b>Unit – I</b>	<b>Introduction to Computer Graphics:</b>						<b>9</b>
Survey and Overview of Computer Graphics – Output Primitives: Points and Lines – DDA – Bresenham’s Algorithms – Properties of Circles and Ellipse – Circle and Ellipse Drawing Algorithm.							
<b>Unit – II</b>	<b>Two-Dimensional Geometric Transformations:</b>						<b>9</b>
Basic Transformations – Matrix Representations – Composite Transformations – Two-Dimensional Viewing: Line Clipping – Polygon Clipping – Curve Clipping – Text Clipping.							
<b>Unit – III</b>	<b>Three-Dimensional Concepts and 3D Transformations:</b>						<b>9</b>
Three-Dimensional Display Methods – Parallel and Perspective Projection – Depth Cueing – Visible Line Surface and Identification – Surface Rendering – Three-Dimensional Graphics Packages – Three Dimensional Geometric and Modeling Transformations.							
<b>Unit – IV</b>	<b>Three Dimensional Viewing:</b>						<b>9</b>
Viewing Pipeline – Coordinates – Transformation from World to Viewing Coordinates – Projections – General Projections – Clipping – Hardware Implementation – 3D Viewing – Visible Surface Detection Methods.							
<b>Unit – V</b>	<b>Color Models And Animation:</b>						<b>9</b>
Color Models and Color Applications: Properties of Light – Standard Primaries and the Chromaticity Diagram – Intuitive Color Concepts – RGB – YIQ – CMY – HSV– HLS – Computer Animation: Animation Sequences – Animation Functions – Morphing – Simulating Accelerations – Motion Specifications.							

**Total: 45****TEXT BOOK:**

1.	Donald Hearn and Baker Pauline M., “Computer Graphics with Open Gl”, C Version, 2 <sup>nd</sup> Edition, Prentice Hall of India, New Delhi, 2014.
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**REFERENCES:**

1.	Foley James D., Van Dam Andries, Feiner Stevan K. and Hughes John F., “Computer Graphics: Principles and Practices in C”, 3 <sup>rd</sup> Edition, Pearson Education, New Delhi, 2014.
2.	Harrington Steven, “Computer Graphics: A Programming Approach”, 2 <sup>nd</sup> Edition, McGraw-Hill, New York, 2014.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe the basics of computer graphics.	Understanding(K2)
CO2	interpret the 2D transformations and clipping algorithms.	Understanding(K2)
CO3	implement 2D and 3D geometrical transformation.	Applying(K3)
CO4	apply transformation from world to view coordinates.	Applying(K3)
CO5	acquire knowledge in computer animations.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	85					100
CAT2	10	65	25				100
CAT3	10	65	25				100
ESE	10	60	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISE07 – DEEP LEARNING

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Machine Learning</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To understand the fundamentals of deep learning and neural network techniques.						
<b>Unit – I</b>	<b>Overview of Machine Learning:</b>						<b>9</b>
The Learning Machines – The Math Behind Machine Learning: Linear Algebra – Converting Data into Vectors – Statistics – How Does Machine Learning Work – Regression – Classification – Clustering – Under Fitting and Over Fitting – Optimization – Convex Optimization – Gradient Descent – Stochastic Gradient Descent – Quasi-Newton Optimization Methods – Generative Versus Discriminative Models – Logistic Regression – Evaluating Models.							
<b>Unit – II</b>	<b>Deep Feed Forward Networks:</b>						<b>9</b>
Learning XOR: Example – Gradient-Based Learning – Hidden Units – Architecture Design – Back Propagation and Other Differentiation Algorithms.							
<b>Unit – III</b>	<b>Regularization for Deep Learning:</b>						<b>9</b>
Parameter Norm Penalties – Data Set Augmentation – Noise Robustness – Semi Supervised Learning – Multitask Learning – Early Stopping – Parameter Typing and Parameter Sharing – Bagging and Other Ensemble Methods – Dropout – Adversarial Training.							
<b>Unit – IV</b>	<b>Convolution Networks:</b>						<b>9</b>
The Convolution Operation – Motivation – Pooling – Variants of the Basic Convolution Function – Structured Outputs – Efficient Convolution Algorithms – Random or Unsupervised Feature.							
<b>Unit – V</b>	<b>Sequence Modeling-Recurrent and Recursive Nets:</b>						<b>9</b>
Recurrent Neural Networks – Bidirectional RNNs – Encoder – Decoder – Sequence-to-Sequence Architectures – Deep Recurrent Networks – Recursive Neural Networks – The Long Short-Term Memory and Other Gated RNNs – Explicit Memory.							

**Total: 45****TEXT BOOK:**

1a.	Josh Patterson and Adam Gibson, “Deep Learning-A Practitioner’s Approach”, 1 <sup>st</sup> Edition, O’Reilly Series, 2017. For Unit - I.
1b.	Ian Goodfellow, Yoshua Bengio and Aaron Courvill, “Deep Learning”, MIT Press, USA, 2016. For Unit - II,III,IV & V.

**REFERENCES:**

1.	Nikhil Buduma, Nicholas Locascio, “Fundamentals of Deep Learning: Designing Next Generation Machine Intelligence Algorithms”, O’Reilly Media, 2017.
2.	Indra den Bakker, “Python Deep Learning Cookbook”, 1 <sup>st</sup> Edition, Packt Publishing, October 2017.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer the fundamental concepts of machine learning.	Understanding(K2)
CO2	make use of deep feed forward networks and its algorithm for various applications.	Applying(K3)
CO3	apply various regularization techniques for real-time applications.	Applying(K3)
CO4	solve the real world applications using convolution neural network.	Applying(K3)
CO5	utilize the sequence modeling methods for large scale deep learning applications.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	20	40	40				100
CAT3	20	40	40				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE08 – SOFTWARE QUALITY ASSURANCE**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Software Engineering</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To highlight the elements of quality software and the need of software quality assurance in the software industry.						
<b>Unit – I</b>	<b>Introduction and Managing Software Quality:</b>						<b>9</b>
Introduction – Meaning – Quality Challenge – Quality Control Vs Quality Assurance – Quality Assurance at each Phase of SDLC – SQA in Software Support Projects – SQA Functions – Quality Management System in an Organization – Various Expectations – Need for the SQA.							
<b>Unit – II</b>	<b>Product Quality and Process Quality:</b>						<b>9</b>
SQA Plans – Organizational Level Initiatives – Quality Planning: Some Interested Dilemmas and Observations – Product Quality and Process Quality – Software Systems Evolution – Product Quality – Models for Software Product Quality – Process Quality.							
<b>Unit – III</b>	<b>Software Measurement and Metrics:</b>						<b>9</b>
Measurement During Software Life Cycle Context – Defect Metrics – Metrics for Software Maintenance – Classification – Requirements – Measurements Principles – Identifying Measures and Metrics – Implementation – Benefits – Earned Value Analysis – Planning – Issues – Object Oriented Metrics: Walkthrough and Inspection – Structured Walkthrough – Inspection.							
<b>Unit – IV</b>	<b>Software Configuration Management and ISO:</b>						<b>9</b>
Various Responsibilities in Reviews and Walkthrough – Some Physiological Aspects of Review – Software Configuration Management – Why and What – SCM Activities – Standards for Configuration Audit Functions – Personnel in SCM Activities – ISO 9001 – Overview – Origins of ISO 9000 – Standards Development Process – ISO 9000 family – ISO 9001:2000 – ISO Certification – Assessment / Audit Preparation – Assessment Process – ISO Consulting Services and Consultants.							
<b>Unit – V</b>	<b>Software CMM Models and Careers in Quality:</b>						<b>9</b>
Overview – CMM Model for Software – Practices – CMM and ISO – Types of CMM – CMMI – Other Models – P – CMM – Careers in Quality: Overview – P-CMM and Careers – People Issues – Finding a Mentor to Shape Your Career – Roles for Quality Professionals – Quality Certifications.							

**Total: 45****TEXT BOOK:**

1.	Nina S. Godbole, "Software Quality Assurance Principles and Practice", Narosa Publishing House, 2011.
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**REFERENCES:**

1.	Gordon G Schulmeyer, "Handbook of Software Quality Assurance", 3 <sup>rd</sup> Edition, Artech House Publishers, 2007.
2.	Watts S. Humphrey, "Managing the Software Process", 5 <sup>th</sup> Impression, Pearson Education Inc., 2008



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline the concepts, metrics and models in software quality assurance.	Understanding(K2)
CO2	identify the model for software quality assurance and discuss process and product quality aspects.	Understanding(K2)
CO3	describe the metrics and measurements for software quality assurance.	Understanding(K2)
CO4	configure the software and implement the ISO practices.	Applying(K3)
CO5	apply CMM and improve the quality.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	40	60					100
CAT3	30	40	30				100
ESE	30	45	25				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE09 – PRINCIPLES OF MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To present the basic concepts of management and various functions of managers.
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<b>Unit – I</b>	<b>Management Science and Society:</b>	<b>9</b>
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Definition of Management – Managing Science or Art – The Evolution of Management Thought – Patterns of Management Analysis – The System Approach to Management Process – Functions of a Manager – Management and Society the External Environment, Social Responsibility and Ethics.

<b>Unit – II</b>	<b>Planning:</b>	<b>9</b>
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Types of Plan – Steps in Planning – Objectives – Evolving Concepts in Management by Objectives – Strategies, Policies and Planning Premises: Nature and Purpose of Strategies and Policies – Strategic Planning Process – The TOWS Matrix – Blue Ocean Strategy – Portfolio Matrix – Major Kinds of Strategies and Policies – Hierarchy of Company Strategies – Porters Industry Analysis and Generic Competitive Strategies – Premising and Forecasting – Decision Making.

<b>Unit – III</b>	<b>Organizing and Staffing:</b>	<b>9</b>
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Formal and Informal Organization – Organizational Division – Organization Levels and the Span of Management – An Organizational Environment for Entrepreneurship and Intrapreneuring – Reengineering the Organization – The Structure and Process of Organizing – Basic Question for Effective Organizing – Organization Structure Departmentation – Line / Staff Authority, Empowerment and Decentralization – Human Resource Management and Selection.

<b>Unit – IV</b>	<b>Motivation:</b>	<b>9</b>
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Human Factors in Managing – Motivation – Motivation – An Early Behavioral Model – Maslow's Hierarchy of Needs Theory – Alderfers ERG Theory – Herzberg's Motivation Hygiene Theory – The Expectancy Theory of Motivation – Equity Theory – Goal Setting Theory of Motivation – Skinners Reinforcement Theory – McClelland's Needs Theory of Motivation – Special Motivational Techniques – Job Enrichment – A Systems and Contingency Approach to Motivation – Leadership – Communication: Purpose of Communication – Communication Process – Communication in the Organization – Barriers and Breakdowns in Communication – Toward Effective Communication – Electronic Media in Communication.

<b>Unit – V</b>	<b>Controlling:</b>	<b>9</b>
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The Basic Control Process – Critical Control Points, Standards and Benchmarking – Control as a Feedback System – Real Time Information and Control – Feed Forward or Preventive Control – Control of Overall Performance – Profit and Loss Control – Control Through Return on Investment – Management Audits and Accounting Firms – The Balanced Scorecard – Bureaucratic and Clan Control – Requirements for Effective Control – Control Techniques and Information Technology.

**Total: 45****TEXT BOOK:**

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|----|--|
| 1. | Koontz Harold and Wehrich Heinz, "Essentials of Management", 10 <sup>th</sup> Edition, Tata McGraw Hill Publishing Company, New Delhi, 2015. |
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**REFERENCES:**

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|----|--|
| 1. | Tripathi.P.C and Reddy. P.N, "Principles of Management", 5 <sup>th</sup> Edition, Tata McGraw–Hill Education, New Delhi, 2012. |
| 2. | Prasad L.M, "Principles and Practice of Management", 8 <sup>th</sup> Edition, Sultan Chand and Sons, New Delhi, 2013.          |



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	explain the management concepts as planning, organizing, staffing and controlling in real world environment.	Understanding(K2)
CO2	interpret the basic functions and strategies of management.	Understanding(K2)
CO3	articulate the steps in planning process.	Applying(K3)
CO4	outline various types of organizational structures.	Understanding(K2)
CO5	implement modern and traditional control devices in organization.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2		2	3	2	1	2	2	1
CO2								1	1	1	2	3	2	1
CO3								2	2	1	3	3	3	1
CO4						2		3	1	2	3	3	2	1
CO5						1		3	1	2	3	2	3	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	60					100
CAT2	45	45	10				100
CAT3	25	45	30				100
ESE	25	50	25				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE10 – INTRODUCTION TO DATA SCIENCE**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Data Mining and Data Warehousing</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To understand the importance of data science concepts and apply to end user.
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<b>Unit – I</b>	<b>Basics of Data Science:</b>	<b>9</b>
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Benefits and Uses of Data Science and Big Data: Facets of Data – Data Science Process – The Big Data Ecosystem and Data Science – The Data Science Process – Overview – Defining Research Goals and Creating a Project Charter – Retrieving Data – Cleansing, Integrating and Transforming Data – Exploratory Data Analysis – Build the Models – Presenting Findings and Building Applications.

<b>Unit – II</b>	<b>Handling Large Data:</b>	<b>9</b>
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Problems When Handling Large Data – General Techniques for Handling Large Volumes of Data – General Programming Tips for Dealing with Large Data Sets – Predicting Malicious URLs – Steps in Big Data – Distributing Data Storage and Processing with Frameworks – Assessing Risk When Loaning Money.

<b>Unit – III</b>	<b>Machine Learning:</b>	<b>9</b>
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Machine Learning – Modeling Process – Training Model – Validating Model – Predicting New Observations – Types of Machine Learning – Supervised Learning – Unsupervised Learning – Semi Supervised Learning.

<b>Unit – IV</b>	<b>No SQL and The Rise of Graph Database:</b>	<b>9</b>
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Introduction to No SQL – Predicting Disease Using Medical Data – Introducing Connected Data and Graph Databases – Introducing Neo4j: A Graph Database.

<b>Unit – V</b>	<b>Text Mining and Data Visualization:</b>	<b>9</b>
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Text Mining and Text Analytics – Text Mining in the Real World – Text Mining Techniques. Introduction to Data Visualization – Data Visualization Options – Filters – Map Reduce – Dashboard Development Tools – Creating an Interactive Dashboard Using Visualization Library.

**Total: 45****TEXT BOOK:**

1.	Davy Cielen, Arno D. B. Meysman, Mohamed Ali, “Introducing Data Science”, 1 <sup>st</sup> Edition, Manning Publications Co., 2018.
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**REFERENCES:**

1.	Cathy O’Neil, Rachel Schutt, “Doing Data Science, Straight Talk from the Frontline”, 1 <sup>st</sup> Edition, O’Reilly, 2013.
2.	Joel Grus, “Data Science from Scratch: First Principles with Python”, 1 <sup>st</sup> Edition, O’Reilly, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer the fundamental concepts of data science.	Understanding(K2)
CO2	make use of data analysis technique for handling large data set applications.	Understanding(K2)
CO3	apply the various machine learning algorithms for data science process.	Applying(K3)
CO4	implement the NoSQL principles and graph database for given application.	Applying(K3)
CO5	utilize the text mining techniques and visualization concepts to apply in the real world data.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	60	15				100
CAT2	20	65	15				100
CAT3	20	55	25				100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE11 – BUILDING ENTERPRISE APPLICATIONS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Software Engineering</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge in prescriptive technical architecture framework for raising a typical enterprise application.
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<b>Unit – I</b>	<b>Analysis and Modeling:</b>	<b>9</b>
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Introduction to Enterprise Applications and their Types – Software Engineering Methodologies – Life Cycle of Raising an enterprise Application – Key Determinants of Successful Enterprise Applications – Measuring the Success of Enterprise Applications – Inception of Enterprise Applications: Enterprise Analysis – Business Modeling – Requirements Elicitation and Analysis – Requirements Validation – Planning and Estimation.

<b>Unit – II</b>	<b>Architecting and Designing:</b>	<b>9</b>
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Concept of Architecture – Views and Viewpoints – Enterprise Architecture – Logical Architecture – Technical Architecture and Design – Data Architecture and Design – Infrastructure Architecture and Design – Architecture and Design Documentation.

<b>Unit – III</b>	<b>Constructing Enterprise Applications:</b>	<b>9</b>
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Construction Readiness of Enterprise Applications – Defining a Construction Plan – Defining a Package Structure – Setting up a Configuration Management Plan – Setting up a Development Environment – Introduction to the Concept of Software Construction Maps – Construction of Technical Solutions Layers – Methodologies of Code Review – Static Code Analysis – Build and Testing – Dynamic Code Analysis – Code Profiling and Code Coverage.

<b>Unit – IV</b>	<b>Testing and Rolling out Enterprise Applications:</b>	<b>9</b>
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Testing an Enterprise Application – Testing Levels and Approaches – Testing Environments – Integration Testing – Performance Testing – Penetration Testing – Usability Testing – Globalization Testing and Interface Testing – User Acceptance Testing – Rolling Out an Enterprise Application.

<b>Unit – V</b>	<b>Enterprise Programming:</b>	<b>9</b>
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Blueprints: Forethought Brokerage – Identified Needs – Proposed Solutions – Data Layer – Databases and Directory Servers – Data Access – Business Layer – Business Logic – Messaging – Presentation layer – Finalizing the Plans – Beyond Architecture: Flexibility – Decision Point.

**Total: 45****TEXT BOOK:**

1a.	Anubhav Pradhan, Satheesha B.Nanjappan, Senthil K.Nallasamy, Veerakumar Esakimuthu, "Raising Enterprise Applications", 1 <sup>st</sup> Edition, Wiley India Pvt. Ltd., 2011. For Unit - I, II, III & IV.
1b.	Brett McLaughlin, "Building Java Enterprise Applications", 1 <sup>st</sup> Edition, O'Reilly Media Publications, 2002. For Unit - V.

**REFERENCES:**

1.	Soren Lauesen, "Software Requirements: Styles & Techniques", 1 <sup>st</sup> Edition, Addison-Wesley Professional Publications, 2002.
2.	Srinivasan Desikan, Gopaldaswamy Ramesh, "Software Testing Principles and Practices ", 1 <sup>st</sup> Edition, Pearson Publications, 2006.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the concepts of enterprise analysis and business modeling.	Applying(K3)
CO2	design and document the application architecture.	Applying(K3)
CO3	explain code review, code analysis and build process.	Understanding(K2)
CO4	outline different testing involved with enterprise application and the process of rolling out an enterprise application.	Understanding(K2)
CO5	interpret different layers of enterprise programming.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	2	1											2	3
CO4	2	1											2	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	35	40				100
CAT2	25	45	30				100
CAT3	40	60					100
ESE	25	45	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE12 – DISTRIBUTED AND PARALLEL COMPUTING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Computer Networks</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To focus on communication, synchronization and consistency models in distributed systems as well as need of parallel systems and parallel algorithms.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Definition – Goals – Types of Distributed Systems – Communication: Fundamentals – Remote Procedure Call Architectures: Architectural Styles – System Architectures – Centralized Architectures – Decentralized Architectures – Hybrid Architectures.							
<b>Unit – II</b>	<b>Synchronization:</b>						<b>9</b>
Clock Synchronization – Logical Clocks – Mutual Exclusion – Centralized, Decentralized and Distributed Algorithms – Token ring Algorithm – Comparison – Election Algorithms – Bully Algorithm – Ring Algorithm.							
<b>Unit – III</b>	<b>Consistency and Replication:</b>						<b>9</b>
Introduction – Data-Centric Consistency Models – Client-Centric Consistency Models – Replica Management – Consistency Protocols.							
<b>Unit – IV</b>	<b>Solving Problems in Parallel:</b>						<b>9</b>
Utilizing Temporal Parallelism – Utilizing Data Parallelism – Comparison – Data Parallel Processing with Specialized Processors – Inter-Task Dependency – Instruction Level Parallel Processing: Pipelining of Processing Elements – Delays in Pipeline Execution – Difficulties in Pipelining – Superscalar Processors – VLIW Processor – Multithreaded Processors.							
<b>Unit – V</b>	<b>Structure of Parallel Computers:</b>						<b>9</b>
Generalized Structure of a Parallel Computer – Classification of Parallel Computers – Shared Memory Parallel Computers – Parallel Algorithms: Models of Computation – RAM – PRAM – Interconnection Networks – Combinational Circuit – Analysis of Parallel Algorithms.							

**Total: 45****TEXT BOOK:**

1a.	Andrew S. Tanenbaum, Maarten Van Steen, "Distributed Systems: Principles and Paradigms", Pearson Education, New Delhi, 2 <sup>nd</sup> Edition 2015. For Unit – I, II, III.
1b.	V. Rajaraman, C. Siva ram murthy, "Parallel Computers: Architecture and Programming", PHI Learning Private Limited, Delhi, 2016. For Unit – IV, V.

**REFERENCES:**

1.	Coulouris George, Dollimore Jean, Kindberg Tim, Blair Gordon, "Distributed Systems Concepts and Design", Pearson Education, New Delhi, 5 <sup>th</sup> Edition, 2017.
2.	Liu M.L., "Distributed Computing: Principles and Applications", 1 <sup>st</sup> Edition, Pearson Education, New Delhi, 2013.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer various types of distributed systems.	Understanding(K2)
CO2	apply synchronization and election algorithms.	Applying(K3)
CO3	make use of the consistency models.	Applying(K3)
CO4	describe temporal, data and pipelining parallelisms.	Understanding(K2)
CO5	explain various parallel computers and parallel algorithms.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				100
CAT2	20	50	30				100
CAT3	30	70					100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE13 – PRINCIPLES OF COMPILER DESIGN**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To impart knowledge in various phases of compilation process.						
<b>Unit – I</b>	<b>Basics of Compilers:</b>						<b>9</b>
Introduction: Language Processors – The Structure of a Compiler – Lexical Analysis: The Role of the Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – The Lexical – Analyzer Generator Lex – Finite Automata – from Regular Expressions to Automata.							
<b>Unit – II</b>	<b>Syntax Analysis:</b>						<b>9</b>
Introduction – Context – Free Grammars – Writing a Grammar – Top-Down Parsing – Bottom-Up Parsing – Introduction to LR Parsing: Simple LR – More Powerful LR Parsers.							
<b>Unit – III</b>	<b>Intermediate Code Generation:</b>						<b>9</b>
Three Address Code – Types and Declarations – Translation of Expressions – Control Flow – Back Patching – Switch Statements – Procedure Calls.							
<b>Unit – IV</b>	<b>Machine-Independent Optimizations:</b>						<b>9</b>
The Principal Sources of Optimization – Introduction to Data – Flow Analysis – Peephole Optimization – Run-Time Environments: Storage Organization – Stack Allocation of Space – Heap Management – Introduction to Garbage Collection.							
<b>Unit – V</b>	<b>Code Generation:</b>						<b>9</b>
Issues in the Design of a Code Generation – The Target Language – Addresses in the Target Code – A Simple Code Generator – Register Allocation and Assignment.							

**Total: 45****TEXT BOOK:**

1.	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", 2 <sup>nd</sup> Edition, Pearson Education, New Delhi, 2020.
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**REFERENCES:**

1.	Srikant Y.N, Priti Shankar, "The Compiler Design Handbook: Optimizations and Machine Code Generation", 2 <sup>nd</sup> Edition, CRC Press, New York, 2007.
2.	Keith Cooper, Linda Torczon, "Engineering a Compiler", 2 <sup>nd</sup> Edition, Morgan Kauffman Publishers, New York, 2004.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	implement lexical analysis for the given source program.	Applying(K3)
CO2	design syntax-analyzer for the given grammar.	Applying(K3)
CO3	develop intermediate code for the given source program.	Applying(K3)
CO4	infer optimization techniques for the given intermediate code.	Understanding(K2)
CO5	interpret the target code generation process of compiler and its optimization.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	45	40				100
CAT2	15	45	40				100
CAT3	20	80					100
ESE	15	45	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE14 – DESIGN THINKING**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>8</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To provide a systematic process of thinking and to develop new, innovative solutions to the problem based on how real users think, feel and behave.						
<b>Unit – I</b>	<b>Design Challenge and Opportunity:</b>						<b>9</b>
Introduction – Need for Design Thinking – Design and Business – Four Questions – Ten Tools – Explore – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.							
<b>Unit – II</b>	<b>Visualization:</b>						<b>9</b>
Design Brief – Visualization – Journey Mapping – Value Chain Analysis – Mind Mapping – Empathize – Observations – Need Finding – User Personas.							
<b>Unit – III</b>	<b>Brainstorming:</b>						<b>9</b>
Design Criteria – Four Reasons People Hate Brainstorming – Brainstorming – Concept Development – Experiment – Ideation – User Experience Journey – Prototyping							
<b>Unit – IV</b>	<b>Prototype:</b>						<b>9</b>
Assumption Testing – Steps and Case Study – Rapid Prototyping – Forms of 2D Prototype – Engage – Storyboarding.							
<b>Unit – V</b>	<b>Strategies &amp; Implementation:</b>						<b>9</b>
Customer Co-Creation Learning Launch – Leading Growth and Innovation – Evolve – Concept Synthesis – Strategic Requirements – Evolved Activity Systems – Quick Wins.							

**Total: 45****TEXT BOOK:**

1a.	Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press, New York, 2011. For Unit – I, II, III, IV & V.
1b.	Lee Chong Hwa, "Design Thinking The Guidebook", Design Thinking Master Trainers of Bhutan, 2017. For Unit – I, II, III, IV & V.

**REFERENCES:**

1.	Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth Field Book: A Step-by-Step Project Guide", 2 <sup>nd</sup> Edition, Columbia University Press, New York, 2014.
2.	Tim Brown, "Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation", 1 <sup>st</sup> Edition, HarperCollins Publishers, New York, 2009.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	apply the basic concepts of design thinking.	Applying(K3)
CO2	make use of the mind mapping process for designing any system.	Applying(K3)
CO3	develop creative ideas through structured brainstorming sessions.	Applying(K3)
CO4	design rapid prototypes to bring the ideas into reality.	Applying(K3)
CO5	plan the implementation of the system considering the real time feedback.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	35	50				100
CAT2	20	30	50				100
CAT3	15	40	45				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISE15 – INFORMATION SECURITY

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Computer Networks</b>	<b>8</b>	<b>PC</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To articulate the principal concepts, major issues and technologies in information security.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Computer Security – Threats – Harm – Vulnerabilities – Controls – Authentication: Identification Versus Authentication – Authentication Based on Phrases and Facts – Biometrics – Tokens – Cryptography: Problems Addressed by Encryption – Terminology – Data Encryption Standard (DES) – Advanced Encryption System (AES) – Public Key Cryptography.							
<b>Unit – II</b>	<b>Operating Systems and Database Security:</b>						<b>9</b>
Operating Systems: Security in Operating Systems – Security in the Design of Operating Systems – Databases: Introduction – Security Requirements of Databases – Reliability and Integrity – Database Disclosure – Data Mining and Big Data.							
<b>Unit – III</b>	<b>Security in Networks:</b>						<b>9</b>
Network Concepts – Threats to Network Communications – Wireless Network Security – Denial of Service – Distributed Denial of Service – Firewalls.							
<b>Unit – IV</b>	<b>Security in the Web and Cloud Computing:</b>						<b>9</b>
The Web: Browser Attacks – Web Attacks Targeting Users – Obtaining User or Website Data – Email Attacks – Email Security – Cloud Computing: Concepts – Moving to the Cloud – Cloud Security Tools and Techniques – Cloud Identity Management – Securing IaaS.							
<b>Unit – V</b>	<b>Legal Issues and Ethics:</b>						<b>9</b>
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.							

**Total: 45****TEXT BOOK:**

1.	Charles P. Pfleeger, Shari Lawrence Pfleeger and Jonathan Margulies., "Security in Computing", 5 <sup>th</sup> Edition, Pearson Education, New Delhi, 2018.
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**REFERENCES:**

1.	Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security", 5 <sup>th</sup> Edition, Cengage Learning, India, 2015.
2.	Matt Bishop, "Introduction to Computer Security", 1 <sup>st</sup> Edition, Pearson Education, New Delhi, 2013.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	explain about different kinds of threats and encryption techniques.	Understanding(K2)
CO2	outline various security schemes in operating systems and databases.	Understanding(K2)
CO3	discuss the features of Denial of Service and firewalls.	Understanding(K2)
CO4	summarize web attacks and make use of various cloud security technologies to protect the information.	Applying(K3)
CO5	demonstrate different types of ethical issues of information security.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	20	80					100
CAT3	20	60	20				100
ESE	20	60	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISE16 – BIG DATA ANALYTICS

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Database Management Systems</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To provide basic knowledge about big data, its framework, storage in databases and stream processing with SPARK.						
<b>Unit – I</b>	<b>Big Data Analytics:</b>						<b>9</b>
Introduction – Types of Digital Data – Characteristics – Evolution – Definition – Challenges – Big Data Analytics: Importance – Data Science – Terminologies used in Big Data Environments – NoSQL.							
<b>Unit – II</b>	<b>Hadoop &amp; MapReduce Programming:</b>						<b>9</b>
Introduction to Hadoop: RDBMS versus Hadoop – Distributed Computing Challenges – HDFS – Processing Data with Hadoop – Interacting with Hadoop Ecosystem – Introduction to MapReduce Programming: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression.							
<b>Unit – III</b>	<b>MongoDB and Cassandra:</b>						<b>9</b>
Introduction to MongoDB: Data Types – MongoDB Query Language – Introduction to Cassandra: Features – CQL Data Types – CQLSH – Keyspaces – CRUD Operations – Collections – Alter – Import and Export – Querying System Tables.							
<b>Unit – IV</b>	<b>HIVE and PIG:</b>						<b>9</b>
Introduction to Hive: Architecture – Data Types – File Format – Hive Query Language(HQL) – RC File Implementation – Introduction to Pig: Pig on Hadoop – Data Types – Running Pig – Execution Modes of Pig – HDFS Commands – Relational Operators – Eval Function – Complex Data Types.							
<b>Unit – V</b>	<b>APACHE SPARK:</b>						<b>9</b>
Stream Processing with SPARK: Introduction – SPARK Architecture – SPARK Eco System – SPARK for Big Data Processing – SPARK Applications.							

**Total: 45****TEXT BOOK:**

1a.	Seema Acharya, Subhashini Chellappan. "Big Data and Analytics", 2 <sup>nd</sup> Edition, Wiley, 2019. For Unit - I, II, III, IV.
1b.	<a href="https://spark.apache.org/docs/latest">https://spark.apache.org/docs/latest</a> . For Unit - V.

**REFERENCES:**

1.	Dr.Anil Maheshwari. "Big Data", 2 <sup>nd</sup> Edition, McGraw Hill Education, 2019
2.	"Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, John Wiley and Sons, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	outline the concepts and characteristics of big data.	Understanding(K2)
CO2	acquire the usage of Hadoop and Map Reduce programming.	Applying(K3)
CO3	demonstrate the application of MongoDB and Cassandra.	Applying(K3)
CO4	explore the architecture and formats of Hive and Pig.	Applying(K3)
CO5	interpret the need for stream processing and discuss SPARK.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	45	25				100
CAT2	20	35	45				100
CAT3	30	45	25				100
ESE	25	40	35				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



**20ISE17 – AD HOC AND SENSOR NETWORKS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Mobile Communications</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To focus on mobile Ad Hoc networks and applications of sensor networks.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Ad Hoc Wireless Networks – Introduction – Applications – Issues in Ad Hoc Wireless Networks – MAC Protocols: Introduction – Issues – Classification – Contention Based Protocols : MACAW.							
<b>Unit – II</b>	<b>Routing Protocols:</b>						<b>9</b>
Routing Protocols for Ad Hoc Wireless Networks – Issues – Classification – Table Driven Protocols – DSDV – WRP – CGSR – On Demand Protocols – DSR – AODV – TORA – Routing Protocols with Efficient Flooding Mechanisms – OLSR – Hybrid Protocols – ZRP – Hierarchical Protocols – HSR – Power Aware Routing Protocols.							
<b>Unit – III</b>	<b>Transport Layer Protocols:</b>						<b>9</b>
Transport Layer Protocols – Issues – Design Goals – Classification of Solutions – TCP over Ad Hoc Networks – Ad hoc Transport Protocol.							
<b>Unit – IV</b>	<b>Security:</b>						<b>9</b>
Security in Ad Hoc Networks – Network Security Requirements – Issues and Challenges – Network Security Attacks – Key Management – Secure Routing.							
<b>Unit – V</b>	<b>Wireless Sensor Networks:</b>						<b>9</b>
Wireless Sensor Networks – Introduction – Architecture – Data Dissemination – Directed Diffusion – Data Gathering.							

**Total: 45**

**TEXT BOOK:**

1.	C. Siva Ram Murthy and B.S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols", 1 <sup>st</sup> Edition, Pearson Education, New Delhi, 2014.
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**REFERENCES:**

1.	Subir Kumar Sarkar, T.G. Basavaraju, C. Puttamadappa, "Ad Hoc Mobile Wireless Networks", CRC Press, Taylor & Francis group, New York, 2013.
2.	C. K. Toh, "Wireless ATM and Ad-Hoc Networks: Protocols and Architectures", Springer Science and Business Media, New York, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer various issues in Ad Hoc wireless networks and MAC protocols.	Understanding(K2)
CO2	implement routing protocols.	Applying(K3)
CO3	make use of modified transport layer protocols.	Applying(K3)
CO4	identify security threats and issues.	Understanding(K2)
CO5	describe the features of wireless sensor networks.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	55	25				100
CAT2	20	50	30				100
CAT3	30	70					100
ESE	20	55	25				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISE18 – E-TECHNOLOGIES

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To provide a better understanding of the orientation in the current development of the modern network technologies which are used in E-business.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Electronic Commerce – The Second Wave of Global E-Business – Business Models – Revenue Models – Business Processes – Advantages and Disadvantages of Electronic Commerce – Economic Forces and Electronic Commerce – Identifying Electronic Commerce Opportunities – International Nature of Electronic Commerce.							
<b>Unit – II</b>	<b>Business Strategies for E-Commerce:</b>						<b>9</b>
Introduction – Selling on the Web – Revenue Models and Building a Web Presence – Revenue Models – Revenue Models in Transition – Revenue Strategy Issues – Creating an Effecting Web Presence – Web Site Usability – Connecting with Customers.							
<b>Unit – III</b>	<b>Marketing on the Web:</b>						<b>9</b>
Web Marketing Strategies – Communicating with Different Market Segment – Beyond Market Segmentation – Advertising on the Web – E-Mail Marketing – Technology – Enabled Customer Relationship Management – Creating and Maintaining Brands on the Web – Search Engine Positioning and Domain Names.							
<b>Unit – IV</b>	<b>Business-to-Business Activities:</b>						<b>9</b>
Purchasing, Logistics and Support Activities – Electronic Data Interchange – Supply Chain Management using Internet Technologies – Electronic Market Places and Portals – Mobile Commerce and Online Auctions.							
<b>Unit – V</b>	<b>Technologies for E-Commerce:</b>						<b>9</b>
Electronic Commerce Security – Online Security Issues Overview – Security for Client Computers – Communication Channel Security – Server Computers – Organizations that Promote Computer Security – Payment System for E-Commerce – Online Payment Basics – Payment Cards – Electronic Cash, Wallets – Stored Value Cards – Internet Technologies and the Banking Industry – Criminal Activity and Payment Systems.							

**Total: 45****TEXT BOOK:**

1.	Gary P Schneider, "Electronic Commerce", 9 <sup>th</sup> Edition, Cengage Learning, Copy Righted Material, 2017.
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**REFERENCES:**

1.	P.T.Joseph S.J, "E-Commerce an Indian Perspective", 5 <sup>th</sup> Edition, PHI Learning Private Limited, New Delhi, 2015.
2.	V.Rajaraman, "Essentials of E-Commerce Technology", Eastern Economy Edition, PHI Learning Private Limited, New Delhi, 2016.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer the basic concepts and technologies used in the field of E-Commerce.	Understanding(K2)
CO2	describe the strategies for marketing and revenue models.	Understanding(K2)
CO3	make use of marketing skills for E-Commerce.	Applying(K3)
CO4	attain the various Business-to-Business Activities.	Applying(K3)
CO5	interpret the need of security in electronic payments.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	35	65					100
CAT2	15	45	40				100
CAT3	15	55	30				100
ESE	15	55	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE19 – CUSTOMER RELATIONSHIP MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To focus the fundamentals of customer relationship, quality of service and technologies applied for customer relationship management.
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<b>Unit – I</b>	<b>Customer Relationship Management Fundamentals:</b>	<b>9</b>
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Theoretical Perspectives of Relationship – Types of Relationship – Stages of Relationship – Issues of Relationship – Evolution of Relationship as a Marketing Tool – Purpose of Relationship Marketing – Approach towards Marketing: A Paradigm Shift – CRM Definitions – Emergence of CRM Practice: CRM Cycle – Stakeholders in CRM – Significance of CRM.

<b>Unit – II</b>	<b>Customer Satisfaction:</b>	<b>9</b>
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Meaning and Definition – Components of Customer Satisfaction – Customer Satisfaction Models – Rationale of Customer Satisfaction – Measuring Customer Satisfaction – Need to Measuring Customer Satisfaction – Customer Loyalty: Concept and Significance – Definition – Customer Loyalty Ladder – Loyalty Principles – Rationale – Dimensions – Determinants – Categories – Factors Affecting Customer Loyalty.

<b>Unit – III</b>	<b>Service Quality:</b>	<b>9</b>
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Introduction – Definition of Service Quality – Types of Service Quality – Service Quality Dimensions – Service Quality Gaps – Measuring Service Quality – Service Quality Measurement Scales.

<b>Unit – IV</b>	<b>Technological Development in CRM:</b>	<b>9</b>
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E- CRM in Business – CRM: A Changing Perspective – Features of e-CRM – Advantages of e-CRM – Technologies of e-CRM – Functional Components of CRM – Important CRM Software Programs – Application of e-CRM – Information Technology Implementation in CRM: Database Management – Database Construction – Data Warehousing – Data Mining.

<b>Unit – V</b>	<b>Emerging Concepts and Perspectives:</b>	<b>9</b>
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CRM: A Cost Benefit Analysis – Customer Value – Customer Life Time Value – Customer Profitability – CRM Practices in Indian Service Business: Banking and Financial Sector – Hospitality Industry – Aviation Industry – Retail Industry – Telecom Industry.

**Total: 45****TEXT BOOK:**

1.	Alok Kumar Rai, "Customer Relationship Management: Concept & Cases", 2 <sup>nd</sup> Edition, Prentice Hall of India Private Limited, New Delhi, 2013.
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**REFERENCES:**

1.	Jagdish N Sheth, Parvatiyar A. and Shainesh G., "Customer Relationship Management: Emerging Concepts, Tools, & Applications", Tata McGraw-Hill Education, 2008.
2.	V. Kumar, Werner Reinartz, "Customer Relationship Management: Concept, Strategy, and Tools", 2 <sup>nd</sup> Edition, Springer Heidel Berg, New York, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	discuss different types of relationship issues for CRM.	Understanding(K2)
CO2	interpret the models of customer satisfaction and customer loyalty.	Understanding(K2)
CO3	articulate the service quality gap and measurement.	Applying(K3)
CO4	summarize the technologies of e-CRM.	Understanding(K2)
CO5	implement CRM practices in business.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1						2		2	3	2	1	2	2	1
CO2								1	1	1	2	3	2	1
CO3								2	2	1	3	3	3	1
CO4						2		3	1	2	3	3	2	1
CO5						1		3	1	2	3	2	3	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	45	55					100
CAT2	40	50	10				100
CAT3	30	40	30				100
ESE	30	40	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE20 – SOFTWARE MAINTENANCE**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Software Engineering</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To provide the detailed checklist and templates that can assist a software products organization to organize its maintenance and support function.
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<b>Unit – I</b>	<b>View of Maintenance and Problem Reporting:</b>	<b>9</b>
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View of Maintenance: Introduction – Product Life Cycle Activities – Different Types of Software Products – Deployment Models – An Overview of Corrective Maintenance – Other Forms of Maintenance – Problem Reporting: Introduction – Customer-Side Preliminary Activities – Customer Support Group Role – Defects – Logistics and Tooling – Skill Sets – Challenges, Best Practices and Pitfalls – Measurements of Effectiveness in Problem Reporting.

<b>Unit – II</b>	<b>Problem Resolution and Fix Distribution:</b>	<b>9</b>
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Problem Resolution: Introduction – High Level Overview – Categorizing – Prioritizing – Identifying the Right Developer for Fixing the Problem – Reproducing – Making the Fix and Testing – Scheduling for Release – Skill Sets – Challenges, Best Practices and Pitfalls – Measurements of Effectiveness in Problem Resolution – Fix Distribution: Introduction – Overview of Activities – Choosing the Method of Distribution – Composing the Fixes – Preparing and Testing the Shipment Unit – Scheduling for Release – People Issues – Challenges, Best Practices and Pitfalls – Tools and Measurements.

<b>Unit – III</b>	<b>Software Maintenance from the Customer’s Perspective:</b>	<b>9</b>
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Introduction – Types of Customer Organizations – Common Roles – Typical Customer Perceptions – Maintenance of Mission Critical Systems: Introduction – Mission – Importance of Mission Critical Systems – Requirements of Large Systems – Product and Environment Issues – Process Changes – People Changes.

<b>Unit – IV</b>	<b>Global Maintenance Teams:</b>	<b>9</b>
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Introduction – Roles, Responsibilities and Skill sets in Maintenance – Effects and Opportunities of Globalization – Organization Structures – Estimation of People Resources – Typical People Issues – Change of Processes for Different Organization Structures and Models – Compensation and Reward Systems – Best Practices and Pitfalls.

<b>Unit – V</b>	<b>Forms of Maintenance and Other Life Cycle Activities:</b>	<b>9</b>
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Maintenance and Other Lifecycle Activities: Introduction – Effect of Requirements Gathering on Maintenance – Design and Maintenance – Programming, Debugging and Maintenance – Testing and Maintenance – Common Technical Problems: Introduction – Trouble Shooting Approach – Categorization of Defects – Common Programming Defects – Use of Debuggers.

**Total: 45****TEXT BOOK:**

1.	Gopaldaswamy Ramesh and Ramesh Bhattiprolu, “Software Maintenance - Effective Practices for Geographically Distributed Environments”, Tata McGraw-Hill Education, New Delhi, 2012.
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**REFERENCES:**

1.	Alain April, Alain Abran, “Software Maintenance Management: Evaluation and Continuous Improvement”, John Wiley & Sons Publication, New York, 2012.
2.	Donald J.Reifer, “Software Maintenance Success Recipes”, CRC Press, New York, 2016.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	elucidate the importance of maintenance.	Understanding(K2)
CO2	interpret the problem resolutions and fix distribution.	Understanding(K2)
CO3	make use of various perceptions of customer to maintain the critical system.	Applying(K3)
CO4	interpret the opportunities of globalization for different organization structure.	Understanding(K2)
CO5	use the technical knowledge for design and maintenance of a system.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	20	60	20				100
CAT3	20	50	30				100
ESE	20	50	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE21 - INNOVATION, ENTREPRENEURSHIP AND VENTURE DEVELOPMENT**

Programme & Branch	MSc - SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisite	NIL	9	PE	3	0	0	3

**Preamble** This course will direct the students on how to employ their innovations towards a successful entrepreneurial venture development.

**UNIT – I Innovation and Entrepreneurship:** **9**

Creativity and Innovation – Types of Innovation – Challenges in Innovation – Steps in Innovation Management –Entrepreneurship – Role of Entrepreneurship in Economic Development – Factors Affecting Entrepreneurship – Entrepreneurship vs Intrapreneurship -Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test – Design Thinking Tools: Analogies – Brainstorming – Mind mapping.

**UNIT – II Design Thinking and Product Design:** **9**

Design Thinking and Entrepreneurship – Design Thinking Stages: Empathize – Define – Ideate – Prototype – Test – Design Thinking Tools: Analogies – Brainstorming – Mind mapping – Techniques and Tools for Concept Generation – Concept Evaluation – Product Architecture – Minimum Viable Product (MVP) – Product Prototyping – Tools and Techniques – Overview of Processes and Materials – Evaluation Tools and Techniques for User-Product Interaction.

**UNIT – III Business Model Canvas (BMC) and Business Plan Preparation:** **9**

Lean Canvas and BMC – Difference and Building Blocks – BMC: Patterns – Design – Strategy – Process – Business Model Failures: Reasons and Remedies – Objectives of a Business Plan – Business Planning Process and Preparation.

**UNIT – IV IPR and Commercialization:** **9**

Need for Intellectual Property – Basic concepts – Different Types of IPs: Copy Rights – Trademarks – Patents – Geographical Indications – Trade Secrets and Industrial Design – Patent Licensing – Technology Commercialization – Innovation Marketing.

**UNIT – V Venture Planning and Means of Finance:** **9**

Startup Stages – Forms of Business Ownership – Sources of Finance – Idea Grant – Seed Fund – Angel & Venture Fund – Institutional Support to Entrepreneurs – Bank and Institutional Finance to Entrepreneurs.

**Total: 45****REFERENCES:**

1.	Rishiksha T.Krishnan, “8 Steps To Innovation: Going From Jugaad To Excellence”, Collins India, 2013.
2.	Robert D.Hisrich, Michael P.Peters, Dean A.Shepherd “Entrepreneurship”, 11th Edition, McGraw-Hill Higher Education, 2020.
3.	Jeanne Liedtka and Tim Ogilvie, “Designing for Growth: A Design Thinking Tool Kit for Managers”, Columbia University Press, New York, 2011.
4.	Eppinger, S.D. and Ulrich, K.T. “Product design and development”, 7th Edition, McGraw-Hill Higher Education, 2020.
5.	Alexander Osterwalder, “Business model generation: A handbook for visionaries, game changers, and challengers”, 1st Edition, John Wiley and Sons; 2010.
6.	Indian Innovators Association, “Patent IPR Licensing – Technology Commercialization – Innovation Marketing: Guide Book for Researchers, Innovators”, Notion Press, Chennai, 2017.
7.	Howard Frederick, Allan O'Connor, Donald F. Kuratko “Entrepreneurship: Theory/process/practice”. Fifth Asia-Pacific edition, Cengage, 2019.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	interpret the relationship between innovation and entrepreneurship and employ design thinking process.	Applying (K3)
CO2	understand and employ design thinking process during product design and development.	Analysing (K4)
CO3	develop suitable business models as per the requirement of the customers.	Analysing (K4)
CO4	practice the procedures for protection of their ideas' IPR.	Applying (K3)
CO5	plan suitable type of venture and modes of finances.	Applying (K3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	2	1				3	2	1	3	2		1	2	2
CO2	1	2			3	2	1						3	2
CO3	3	1				1							3	2
CO4	1	2				3							3	2
CO5	1	2				3							3	2

1 – Slight, 2 – Moderate, 3 – Substantial, BT- Bloom's Taxonomy

<b>ASSESSMENT PATTERN - THEORY</b>							
<b>Test / Bloom's Category*</b>	<b>Remembering (K1) %</b>	<b>Understanding (K2) %</b>	<b>Applying (K3) %</b>	<b>Analyzing (K4) %</b>	<b>Evaluating (K5) %</b>	<b>Creating (K6) %</b>	<b>Total %</b>
CAT1	40	30	20	10			100
CAT2	30	30	30	10			100
CAT3	30	45	25				100
ESE	30	30	30	10			100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE28 – SERVICE ORIENTED ARCHITECTURE**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Web Technology</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To provide an overview of Service Oriented Architecture and Web services and their importance.						
<b>Unit – I</b>	<b>Introduction to SOA with Web Services:</b>						<b>9+3</b>
The Service-Oriented Enterprise – Service-Oriented Development – Service-Oriented Architecture – SOA & Web Services – Rapid Integration – Multi-Channel Access – Business Process Management – Extended Web Services Specifications.							
<b>Unit – II</b>	<b>Service-Oriented Architecture:</b>						<b>9+3</b>
Service-Oriented Business and Government – Service-Oriented Architecture Concepts – Service Governance, Processes, Guidelines, Principles, Methods and Tools – Key Service Characteristics – Technical Benefits – Business Benefits.							
<b>Unit – III</b>	<b>SOA and Web Services:</b>						<b>9+3</b>
The Web Services Platform – Service Contracts – Service-Level Data Model – Service Discovery – Service-Level Security – Service-Level Interaction Patterns – Atomic Services and Composite Services – Generating Proxies and Skeletons from Service Contracts – Service-Level Communication and Alternative Transports – A Retrospective on Service-Oriented Architectures.							
<b>Unit – IV</b>	<b>SOA &amp; Web Services for Integration and Multi-Channel Access:</b>						<b>9+3</b>
Overview – Integration and Interoperability using XML and Web Services – Two Approaches for Integration and Interoperability – Applying SOA and Web Services for Integration – .NET & J2EE Interoperability, Service Enabling Legacy Systems, Enterprise Service Bus Pattern – Business Benefits of SOA & Multi-Channel Access – SOA for Multi-Channel Access – Client/Presentation Tier – Channel Access Tier – Communication Infrastructure – Business Service Access Tier – Business Service Tier.							
<b>Unit – V</b>	<b>SOA and Business Process Management:</b>						<b>9+3</b>
Basic Business Process Management Concepts – Example Business Process – Combining BPM, SOA and Web Services – Orchestration and Choreography Specifications – Example of Web Services Composition.							

Lecture: 45, Tutorial: 15, Total: 60

**TEXT BOOK:**

1.	Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", 1 <sup>st</sup> Edition, Pearson Education, 2014.
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**REFERENCES:**

1.	Shankar Kambhampaty, "Service – Oriented Architecture for Enterprise Applications", Wiley India Pvt. Ltd., 2013.
2.	Thomas Erl, "Service Oriented Architecture Concepts, Technology and Design", Pearson Education, 2008.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	interpret the basic principles of service oriented architecture.	Understanding(K2)
CO2	explain the architecture of web services.	Understanding(K2)
CO3	demonstrate the relationship between SOA and web services.	Applying(K3)
CO4	employ SOA with web services and provide multi-channel access to business services.	Applying(K3)
CO5	make use of the service design and business process management.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	85					100
CAT2	10	65	25				100
CAT3	10	65	25				100
ESE	10	60	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE22 – HUMAN RESOURCE MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To explore the functions of human resource management, recruiting and training the employees.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9</b>
Nature and Scope of Human Resource Management – Objectives and Functions of HRM – Human Resource Planning – Objectives – Process – Problems – Job analysis and Design – Process – Methods of Data Collection – Job Design.							
<b>Unit – II</b>	<b>Recruitment:</b>						<b>9</b>
Factors Affecting Recruitment – Sources of Recruitment – Recruitment Process – Selection – Need for Scientific Selection – Process – Placement – Induction – Internal Mobility – Promotion – Transfer – Demotions – Separation.							
<b>Unit – III</b>	<b>Training:</b>						<b>9</b>
Need for Training – Importance – Steps in Training Programme – Performance Appraisal – Purpose – Approaches – Process – Methods – Problems – Making Performance Appraisal More Effective.							
<b>Unit – IV</b>	<b>Wage and Salary Administration:</b>						<b>9</b>
Objectives – Principles – Components – Methods of Wage Payments – Theory of Wages – Incentives and Benefits.							
<b>Unit – V</b>	<b>Maintenance and Control:</b>						<b>9</b>
Employee Grievances – Cause – Procedure – Human Resource Information System – Need – Advantages – Uses of HRIS – Designing of HRIS – Limitations – International HRM.							

**Total: 45****TEXT BOOK:**

1.	S.S.Khanka, "Human Resource Management", 1 <sup>st</sup> Edition, S.Chand Publications, New Delhi, 2013.
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**REFERENCES:**

1.	V.S.P. Rao, "Human Resource Management", 3 <sup>rd</sup> Edition, Excel Books, New Delhi, 2010.
2.	Aswathappa, "Human Resource Management", 6 <sup>th</sup> Edition, Tata McGraw Hill, New Delhi, 2010.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer the functions of human resource management.	Understanding(K2)
CO2	use the recruitment techniques for recruiting an employee.	Applying(K3)
CO3	explain the methods for training the employee.	Understanding(K2)
CO4	summarize wage and salary procedure for employee.	Understanding(K2)
CO5	interpret grievance handling mechanism.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1											3	2	2	1
CO2									2			2	3	1
CO3									2		2	3	2	1
CO4										3		1	2	1
CO5										3		1	2	1

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	55	5				100
CAT2	40	50	10				100
CAT3	40	60					100
ESE	40	50	10				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE23 – GREEN COMPUTING**

Programme & Branch	MSc - SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	9	PE	3	0	0	3

<b>Preamble</b>	To study the concepts related to Green IT with software methods.						
<b>Unit – I</b>	<b>Green IT - An Overview:</b>						<b>9</b>
Introduction – Environmental Concerns and Sustainable Development – Environmental Impacts of IT – Green IT – Holistic Approach to Greening IT – Greening IT – Applying IT for Enhancing Environmental sustainability – Green IT Standards and Eco-Labeling of IT – Enterprise Green IT Strategy – Green IT: Burden or Opportunity.							
<b>Unit – II</b>	<b>Green Devices, Hardware and Software:</b>						<b>9</b>
Introduction – Life Cycle of a Device or Hardware – Reuse – Recycle and Dispose – Green Software: Introduction – Energy-Saving Software Techniques – Evaluating and Measuring Software Impact to Platform Power.							
<b>Unit – III</b>	<b>Green Enterprises and the Role of IT:</b>						<b>9</b>
Introduction – Organization and Enterprise Greening – Information Systems in Greening Enterprises – Greening Enterprise: IT Usage and Hardware – Inter-Organizational Enterprise activities and Green Issues – Enablers and Making the Case for IT and Green Enterprise.							
<b>Unit – IV</b>	<b>Managing Green IT:</b>						<b>9</b>
Introduction – Strategizing Green Initiatives – Implementation of Green IT – Information Assurance – Communication and Social Media.							
<b>Unit – V</b>	<b>Green IT: An Outlook:</b>						<b>9</b>
Introduction – Awareness to Implementations – Greening by IT – Green IT: A Megatrend – A Seven-Step Approach to Creating Green IT Strategy – Research and Development Directions.							

**Total: 45****TEXT BOOK:**

1.	San Murugesan, G.R. Gangadharan, "Harnessing Green IT Principles and Practices", 1 <sup>st</sup> Edition, John Wiley & Sons, Ltd., Publication, New Delhi, 2017.
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**REFERENCES:**

1.	Deepak Shikarpur, "Green IT", 1 <sup>st</sup> Edition, Vishwkarma Publications, Pune, 2014.
2.	Samdanis Et al, "Green Communications: Principles, Concepts and Practice", 1 <sup>st</sup> Edition, John Wiley & Sons, Ltd., Publication, New Delhi, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	discuss Green IT with different dimensions and strategies.	Understanding(K2)
CO2	describe Green devices and hardware along with its Green software methodologies.	Understanding(K2)
CO3	organize various Green enterprise activities, functions and their role with IT.	Applying(K3)
CO4	elaborate the concepts to manage the Green IT with necessary components.	Understanding(K2)
CO5	examine the various key sustainability and Green IT trends.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	35	65					100
CAT2	30	55	15				100
CAT3	25	50	25				100
ESE	30	50	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISE24 – CYBER FORENSICS

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Cryptography and Network Security</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>

<b>Preamble</b>	To present the basic concepts of digital forensics, recent software and hardware tools for analyzing forensic data and social media investigation.
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<b>Unit – I</b>	<b>Understanding the Digital Forensics Profession and Investigations:</b>	<b>9</b>
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An Overview of Digital Forensics – Preparing for Digital Investigations – Maintaining Professional Conduct – Preparing a Digital Forensics Investigation – Procedures for Private-Sector High-Tech Investigations – Understanding Data Recovery Workstations and Software – Conducting an Investigation – The Investigator's Office and Laboratory: Understanding Forensics Lab Accreditation Requirements – Determining the Physical Requirements for a Digital Forensics Lab – Selecting a Basic Forensic Workstation.

<b>Unit – II</b>	<b>Data Acquisition:</b>	<b>9</b>
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Understanding Storage Formats for Digital Evidence – Determining the Best Acquisition Method – Contingency Planning for Image Acquisitions – Validating Data Acquisitions – Performing RAID Data Acquisitions – Using Remote Network Acquisition Tools – Processing Crime and Incident Scenes: Identifying Digital Evidence – Collecting Evidence in Private-Sector Incident Scenes – Processing Law Enforcement Crime Scenes – Preparing for a Search – Securing a Digital Incident or Crime Scene – Seizing Digital Evidence at the Scene – Storing Digital Evidence – Obtaining a Digital Hash.

<b>Unit – III</b>	<b>Current Digital Forensics Tools:</b>	<b>9</b>
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Evaluating Digital Forensics Tool Needs – Digital Forensics Software Tools – Digital Forensics Hardware Tools – Validating and Testing Forensics Software – Digital Forensics Analysis and Validation: Determining what Data to Collect and Analyze – Validating Forensic Data – Addressing Data – Hiding Techniques.

<b>Unit – IV</b>	<b>Recovering Graphics Files:</b>	<b>9</b>
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Recognizing a Graphics File – Understanding Data Compression – Identifying Unknown File Formats – Understanding Copyright Issues with Graphics – Virtual Machine Forensics – Live Acquisitions – Network Forensics: An Overview of Virtual Machine Forensics – Performing Live Acquisitions – Network Forensics Overview.

<b>Unit – V</b>	<b>E-Mail and Social Media Investigations:</b>	<b>9</b>
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Exploring the Role of E-mail in Investigations – Exploring the Roles of the Client and Server in E-mail – Investigating E-mail Crimes and Violations – Understanding E-mail Servers – Applying Digital Forensics Methods to Social Media Communications – Mobile Device Forensics and the Internet of Anything: Understanding Mobile Device Forensics – Understanding Acquisition Procedures for Mobile Devices – Understanding Forensics in the Internet of Anything.

**Total: 45****TEXT BOOK:**

1.	Bill Nelson, Amelia Philips and Christopher Steuart, "Guide to Computer Forensics and Investigations", 6 <sup>th</sup> Edition, Cengage Learning, New Delhi, 2019
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**REFERENCES:**

1.	John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", 1 <sup>st</sup> Edition, Charles River Media Inc., 2014.
2.	Marie-Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", 2 <sup>nd</sup> Edition, Jones & Bartlett Publishers, 2015.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer digital forensics investigation mechanisms.	Understanding(K2)
CO2	demonstrate data acquisition and collecting digital evidence.	Applying(K3)
CO3	explain digital forensics tools.	Understanding(K2)
CO4	interpret virtual machine forensics.	Understanding(K2)
CO5	use digital forensics methods for e-mail crime and social media communications.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	2	1											2	3
CO4	2	1											2	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	35	50	15				100
CAT2	35	50	15				100
CAT3	30	55	15				100
ESE	30	55	15				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE25 – BUSINESS INTELLIGENCE**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Data Mining and Data Warehousing</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To understand the fundamentals of business analytics and its application.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9+3</b>
Business View of Information Technology Applications: Core Business Processes – Baldrige Business Excellence Framework – Purpose of Using IT in Business – Characteristics of Internet-Ready IT Applications – Enterprise Applications – Information Users and their Requirements – Types of Digital Data: Introduction – Getting into Good Life Database – Structured Data – Unstructured Data – Semi-Structured Data – Difference Between Semi-structured and Structured data.							
<b>Unit – II</b>	<b>Business Intelligence and Data Integration:</b>						<b>9+3</b>
Business Intelligence: Definition – Evolution – Need for BI – BI Value Chain – Business Analytics – BI Framework – BI Users – BI Applications – BI Roles and Responsibilities – Data Integration : Need for Data Warehouse – Definition of Data Warehouse – Data Mart – Ralph Kimball’s Approach vs. W.H.Inmon’s Approach – Goals of Data Warehouse – ETL Process – Data Integration Technologies – Data Quality – Data Profiling.							
<b>Unit – III</b>	<b>OLTP, OLAP and Multidimensional Data Modeling:</b>						<b>9+3</b>
OLTP – OLAP – OLAP Architectures – Data Models – Role of OLAP Tools in BI - OLAP Operations – Basics of Data Modeling – Types of Data Model – Data Modeling Techniques – Fact Table – Dimension Table – Dimensional Models – Dimensional Modeling Life Cycle – Designing the Dimensional Model.							
<b>Unit – IV</b>	<b>Performance Management and Enterprise Reporting:</b>						<b>9+3</b>
Measures, Metrics, KPIs and Performance Management: Understanding Measures and Performance – Measurement System – Role of Metrics – KPIs – Enterprise Reporting: Reporting Perspectives – Report Standardization and Presentation Practices – Enterprise Reporting Characteristics – Balanced Scorecard – Dashboards – Creating Dashboards – Scorecards vs. Dashboards – Analysis.							
<b>Unit – V</b>	<b>BI Applications:</b>						<b>9+3</b>
Understanding BI and Mobility-BI and Cloud Computing – Business Intelligence for ERP Systems – Social CRM and BI-Application: Ten To Ten Retail Stores.							

**Lecture: 45, Tutorial: 15, Total: 60****TEXT BOOK:**

1.	Prasad R.N. and Seema Acharya, “Fundamentals of Business Analytics”, 2 <sup>nd</sup> Edition, Wiley-India Publication, 2016.
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**REFERENCES:**

1.	Ramesh Sharda, Dursun Delen, Efraim Turban, “Business Intelligence, Analytics, and Data Science: A Managerial Perspective” 4 <sup>th</sup> Edition, Pearson Education, 2017.
2.	David Loshin, “Business Intelligence: The Savvy Manager’s Guide”, 2 <sup>nd</sup> Edition, Morgan Kaufmann Publishers, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	infer the fundamental concepts of information technology in business.	Understanding(K2)
CO2	make use of data integration in business analytics.	Applying(K3)
CO3	use the various multidimensional data modeling for business intelligence.	Applying(K3)
CO4	identify the different ways of reporting for performance management.	Understanding(K2)
CO5	utilize the statistical analysis for real world applications.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	40	45	15				100
CAT2	20	40	40				100
CAT3	40	45	15				100
ESE	20	40	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE26 – SOCIAL NETWORK ANALYSIS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Data Mining and Data Warehousing</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To understand the data analytical aspects of social network in the internet scenario and different data analytic issues in online social networks.
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<b>Unit – I</b>	<b>Introduction:</b>	<b>9+3</b>
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Statistical Properties of Social Networks: Preliminaries – Static Properties – Dynamic Properties – Random Walks on Graphs: Background – Random Walk based Proximity Measures – Other Graph-based Proximity Measures – Graph – Theoretic Measures for Semi-Supervised Learning – Clustering with Random Walk Based Measures.

<b>Unit – II</b>	<b>Community Discovery:</b>	<b>9+3</b>
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Communities in Context – Core Methods: Quality Functions – The Kernighan-Lin (KL) Algorithm – Agglomerative/Divisive Algorithms – Spectral Algorithms – Multi-level Graph Partitioning – Markov Clustering – Node Classification in Social Networks: Problem Formulation – Methods using Local Classifiers – Random Walk based Methods – Applying Node Classification to Large Social Networks.

<b>Unit – III</b>	<b>Social Influence Analysis:</b>	<b>9+3</b>
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Introduction – Influence Related Statistics – Social Similarity and Influence – Influence Maximization in Viral Marketing – Expert Location in Social Networks: Definitions and Notation – Expert Location without Graph Constraints – Expert Location with Score Propagation.

<b>Unit – IV</b>	<b>Link Prediction in Social Networks:</b>	<b>9+3</b>
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Feature based Link Prediction : Feature Set Construction – Classification Models – Bayesian Probabilistic Models: Link Prediction by Local Probabilistic Models – Network Evolution based Probabilistic Model – Hierarchical Probabilistic Model – Probabilistic Relational Models : Relational Bayesian Network – Relational Markov Network – Linear Algebraic Methods.

<b>Unit – V</b>	<b>Visualization:</b>	<b>9+3</b>
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A Taxonomy of Visualizations: Structural Visualization – Semantic and Temporal Visualization – Statistical Visualization – Text Mining in Social Networks: Keyword Search: Query Semantics and Answer Ranking – Keyword Search over XML and Relational Data – Keyword Search Over Graph Data – Classification Algorithms – Clustering Algorithms.

**Lecture: 45, Tutorial: 15, Total: 60**

**TEXT BOOK:**

1. Charu C. Aggarwal, "Social Network Data Analytics", 1 <sup>st</sup> Edition, Springer – India, New Delhi, 2015.
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**REFERENCES:**

1. Peter Mika, "Social Networks and the Semantic Web", 1 <sup>st</sup> Edition, Springer – India, New Delhi, 2013.
2. Borko Furht, "Handbook of Social Network Technologies and Applications", 1 <sup>st</sup> Edition, Springer, New York, 2010.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe different random walk based proximity measures and their applications.	Understanding(K2)
CO2	infer the principle algorithms for community discovery.	Understanding(K2)
CO3	summarize the different algorithms for expertise evaluation and team identification.	Understanding(K2)
CO4	implement various link prediction models in social networks	Applying(K3)
CO5	model and visualize the social network.	Applying(K3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	2	1											2	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	30	70					100
CAT3	25	40	35				100
ESE	25	45	30				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE27 – AGILE PROJECT MANAGEMENT**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Software Engineering</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>1</b>	<b>0</b>	<b>4</b>

<b>Preamble</b>	To focus on Agile project planning, estimation and management tools.						
<b>Unit – I</b>	<b>Introduction:</b>						<b>9+3</b>
Introduction to Agile Project Management – Agile Early History – Agile Manifesto – Values and Principles – Scrum Overview – Scrum Roles – Principles – Values.							
<b>Unit – II</b>	<b>Agile Planning:</b>						<b>9+3</b>
Planning Requirements and Product Backlog – Agile Planning Practices – Agile Requirements Practices – User Personas and Stories – Product Backlog – Agile Software Development Practices – Agile Quality Management Practices – Agile Testing Practices.							
<b>Unit – III</b>	<b>Agile Project Management:</b>						<b>9+3</b>
Time-Boxing – Kanban Process – Theory of Constraints – Agile Estimation Overview – Estimation Practices – Burn-Down and Burn-Up Charts – Agile Project Management – Shifts in Thinking – Potential Agile Project Management Roles.							
<b>Unit – IV</b>	<b>Agile Communications and Tools:</b>						<b>9+3</b>
Agile Communications Practices – Agile Project Management Tools – Product/Project Planning – Release and Sprint Planning – Sprint Tracking – Understanding Agile at a Deeper Level Systems Thinking – Influence of Total Quality Management (TQM) – Influence of Lean Manufacturing.							
<b>Unit – V</b>	<b>Scaling Agile Projects:</b>						<b>9+3</b>
Scaling Agile to an Enterprise Level Enterprise-Level – Agile Challenges – Enterprise-Level Obstacles to Overcome – Enterprise-Level Implementation Considerations – Enterprise-Level Management Practices – Adapting an Agile Approach to Fit a Business: The Impact of Different Business Environments on Agile – Typical Levels of Management – Corporate Culture and Values.							

**Lecture: 45, Tutorial: 15, Total: 60****TEXT BOOK:**

1.	Charles G. Cobb, "The Project Manager's Guide to Mastering Agile: Principles and Practices for an Adaptive Approach", John Wiley & Sons, Inc. Publications, Hoboken, New Jersey, 2015
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**REFERENCES:**

1.	By Alan Moran, "Managing Agile: Strategy, Implementation, Organization and People", Springer, New York, 2015
2.	Roman Pichler, "Agile Product Management with Scrum Creating Products That Customers Love" Pearson Education, New Delhi, 2010



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	describe agile manifesto and scrum.	Understanding(K2)
CO2	infer agile planning & requirements.	Understanding(K2)
CO3	apply estimation tools for agile projects.	Applying(K3)
CO4	implement sprint planning and sprint tracking.	Applying(K3)
CO5	explain scaling and adaptation of agile approach.	Understanding(K2)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	2	1											2	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	70					100
CAT2	25	60	15				100
CAT3	25	60	15				100
ESE	25	55	20				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)



## 20ISE29 – INTERNET OF THINGS

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>Computer Networks</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

<b>Preamble</b>	To provide fundamental knowledge of internet of things and its applications.						
<b>Unit – I</b>	<b>Introduction to Internet of Things:</b>						<b>9</b>
Definition and Characteristics of IoT – Physical Design of IoT – IoT Protocols – IoT Communication Models – IoT Communication APIs – IoT Enabled Technologies – Wireless Sensor Networks – Cloud Computing – Big Data Analytics – Communication Protocols – Embedded Systems – IoT Levels and Templates.							
<b>Unit – II</b>	<b>IoT Design Methodology:</b>						<b>9</b>
M2M – Difference Between M2M & IoT – Software Defined Networks – Network Function Virtualization – IoT Platform Design Methodologies – Domain Specific IoT – Home Automation – Agriculture.							
<b>Unit – III</b>	<b>IoT Physical Devices and Endpoints:</b>						<b>9</b>
Python Packages: HTTP Lib – URL Lib – SMTP Lib – Introduction to Raspberry Pi – Interfaces (serial, SPI, 12C) Programming – Python Program with Raspberry Pi with Focus of Interfacing External Gadgets – Controlling Output – Reading Input from Pins – Connecting IoT to Cloud – Firebase.							
<b>Unit – IV</b>	<b>Application Protocols and Security of IoT:</b>						<b>9</b>
Application Protocols for IoT: The Transport Layer – IoT Application Transport Methods – SCADA – CoAP – MQTT – Securing IoT: History – Common Challenges in OT Security – IT and OT Security Practices – Formal Risk Analysis Structures: OCTAVE and FAIR.							
<b>Unit – V</b>	<b>Case Studies:</b>						<b>9</b>
Manufacturing – Smart and Connected Cities: Layered architecture – Smart Lighting – Smart Parking Architecture – Smart Traffic Control – Public Safety.							

**List of Exercises / Experiments:**

1.	Write a program using Arduino for traffic light controller.
2.	Perform experiment using Arduino Uno to measure the distance of any object using Ultrasonic Sensor.
3.	Write a program to monitor temperature and humidity using Arduino and Blynk.
4.	Write Python code in Raspberry Pi to blink LED.
5.	Build simple home automation system using Raspberry Pi and control it over web page.
6.	Upload any sensor data over MQTT to things board using Raspberry Pi.

**Lecture: 45, Practical: 30, Total: 75****TEXT BOOK:**

1a.	Arshdeep Bahgaand, Vijay Madiseti, "Internet of Things – A Hands-on Approach", Universities Press, 2020. For Unit – I, II, III.
1b.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things", Cisco Press, 2017. For Unit – IV, V.

**REFERENCES:**

1.	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1 <sup>st</sup> Edition, CRC Press, 2012.
2.	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Statmatis Karnouskos, Stefan Avesand and David Boyle, "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence", 1 <sup>st</sup> Edition, Academic Press, 2014.
3.	www.Raspberry Pi.org
5.	Laboratory Manual



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	interpret the vision of IoT from a global context.	Understanding (K2)
CO2	make use of IoT design methodology for the given application.	Applying (K3)
CO3	design web services to access and control IoT devices using python programming.	Applying (K3)
CO4	outline IoT application protocols and security.	Understanding (K2)
CO5	illustrate the application of IOT in industrial automation and identify real world design constraints.	Applying (K3)
CO6	demonstrate the basics of electronics.	Applying (K3), Precision (S3)
CO7	create IoT solution using sensors and devices.	Applying (K3), Precision (S3)
CO8	visualize and control IoT data through web page.	Applying (K3), Precision (S3)

<b>Mapping of COs with POs and PSOs</b>														
<b>COs/POs</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	<b>PO11</b>	<b>PO12</b>	<b>PSO1</b>	<b>PSO2</b>
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	3
CO5	3	2	1	1									3	3
CO6	3	2	1	1									3	3
CO7	3	2	1	1									3	3
CO8	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
<b>Test / Bloom’s Category*</b>	<b>Remembering (K1) %</b>	<b>Understanding (K2) %</b>	<b>Applying (K3) %</b>	<b>Analyzing (K4) %</b>	<b>Evaluating (K5) %</b>	<b>Creating (K6) %</b>	<b>Total %</b>
CAT1	15	55	30				100
CAT2	15	45	40				100
CAT3	15	55	30				100
ESE	15	45	40				100

\* ±3% may be varied (CAT 1,2,3 – 50 marks & ESE – 100 marks)

**20ISE30 – MULTIMEDIA SYSTEMS**

<b>Programme &amp; Branch</b>	<b>MSc - SOFTWARE SYSTEMS</b>	<b>Sem.</b>	<b>Category</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>Credit</b>
<b>Prerequisites</b>	<b>NIL</b>	<b>9</b>	<b>PE</b>	<b>3</b>	<b>0</b>	<b>2</b>	<b>4</b>

**Preamble** To impart the basic knowledge about multimedia and its components such as Text, Image, Sound, Animation and Video and to provide adequate knowledge in multimedia applications and usage of tools used in multimedia environment.

**Unit – I** **Multimedia and Text:** **9**

Multimedia: Definitions – Use of Multimedia – Delivering Multimedia – Text: Power of Meaning – Fonts and Faces – Using Text in Multimedia – Computers and Text – Font Editing and Design Tools – Hypermedia and Hypertext.

**Unit – II** **Images and Sound:** **9**

Images: Guidelines – Making Still Images – Color – Image File Formats – Sound: Power of Sound – Digital Audio – MIDI Audio – MIDI vs. Digital Audio – Multimedia System Sounds – Audio File Formats – Vaughan’s Law – Adding Sound to Multimedia Project.

**Unit – III** **Animation and Video:** **9**

Animation: Power of Motion – Principles of Animation – Animation by Computer – Making Animations that Work – Video: Using Video – Working of Video – Digital Video Containers – Obtaining Video Clips – Shooting and Editing Video.

**Unit – IV** **Compression:** **9**

Digital Video and Image Compression: Introduction – Video Compression Techniques – JPEG – H.261 – MPEG – DVI Technology.

**Unit – V** **The Internet and Multimedia on the Web:** **9**

The Internet and Multimedia: History – Internetworking – Multimedia on the Web – Designing for the WWW: Developing for the Web – Text – Images – Sound – Animation – Video.

**List of Exercises / Experiments:**

1.	Perform image editing/ cropping/ cloning using GNU Image Manipulation Program (GIMP) software.
2.	Design a visiting card using GIMP software.
3.	Design a poster using GIMP software.
4.	Design a banner using GIMP software.
5.	Perform video editing using Blender or Pencil Studio open source software.
6.	Create a movie clip using Blender or Pencil Studio open source software.
7.	Create 3D models using Open shot tool.

**Lecture: 45, Practical: 30, Total: 75****TEXT BOOK:**

1a.	Tay Vaughan, “Multimedia: Making It Work”, 9 <sup>th</sup> Edition, Tata McGraw Hill Publishing Company, New Delhi, 2016. For Unit - I, II, III, V.
1b.	Koegel Buferd, John F, “Multimedia Systems”, Pearson Education, New Delhi, 2004. For Unit - IV.

**REFERENCES:**

1.	Prabhat K.Andleigh and Kiran Thakrar, “Multimedia Systems and Design”, Pearson Education, New Delhi, 2015.
2.	Laboratory Manual



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	explain the features of multimedia elements.	Understanding (K2)
CO2	prepare presentation using image and audio components.	Applying (K3)
CO3	develop animation from still images and videos.	Applying (K3)
CO4	make use of video and image compression techniques.	Applying (K3)
CO5	design multimedia projects for web.	Applying (K3)
CO6	use graphics editor for image retouching and editing process.	Applying(K3), Manipulation(S2)
CO7	create animated scenes and visual effects.	Applying(K3), Manipulation(S2)
CO8	design a web page using multimedia components.	Applying(K3), Precision(S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	3
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	2	1	1									3	3
CO6	3	2	1	1									3	3
CO7	3	2	1	1									3	3
CO8	3	2	1	1									3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	10	60	30				100
CAT2	20	30	50				100
CAT3	20	30	50				100
ESE	20	40	40				100



## 20ISE31 – MOBILE APPLICATION DEVELOPMENT

Programme & Branch	MSc - SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	9	PE	3	0	2	4

<b>Preamble</b>	To understand the process of developing software for the mobile and to create mobile applications for real world problems.
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<b>Unit – I</b>	<b>Android Fundamentals:</b>	<b>9</b>
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How Java and Android Work Together – The Development Environment – Android Resources – Structure of Android's Java Code – Our First Android App – Java – First Contact: Examining the Project Assets and Code – Improving our App and Deploying Again – Java Comments – Writing the First Java Code.

<b>Unit – II</b>	<b>Building Application Framework:</b>	<b>9</b>
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Exploring Android Studio: Parts of the UI – Transforming the Editor into a Design Studio – Project Folder and File Structure – Designing Layouts: Exploring Android UI Design – Structure of a UI Design – Real-World Layouts: Building a Real – World UI: Creating Emulator – Layouts: Scroll view and Linear Layout – Relative Layout – The Life and Times of an Android App.

<b>Unit – III</b>	<b>Exploring Android UI Objects:</b>	<b>9</b>
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Everything's a Class – Exploring Android UI Objects – Exploring the Palette – Android Permissions – The Widget Exploration Mini App – Dialog Windows – Building the Project and Gathering Resources – Coding the Dialog Designs.

<b>Unit – IV</b>	<b>Handling Data:</b>	<b>9</b>
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List View and Base Adapter – Handling and Displaying Notes to Self – Android Intent: Switching Activity and Passing Data – Adding a Settings Page to the Note to Self App – Making the Note to Self apps' Setting Persist – Fragments – Lifecycle – Working Fragment – Capturing Images: Capturing Images using the Camera – The Capturing Images Mini App.

<b>Unit – V</b>	<b>Advances in Android Development:</b>	<b>9</b>
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Using SQLite Databases – Database101 – The SQL Syntax Primer – The Android SQLite API – The Database Mini App – Integrating Google Maps and GPS Locations: Global Positioning System – The GPS Mini App – The Google Maps Mini App – Publishing Apps

**List of Exercises / Experiments:**

1.	Develop an application that uses GUI components, font and colors
2.	Develop an application that uses layout managers, event listeners
3.	Design an android application using menus and adapters
4.	Develop an application that uses Intents
5.	Create an android application to make insert, update, delete & retrieve operation on the SQLite
6.	Create an android application that will change color of the screen when the user move the phone using sensors
7.	Create an application which convert entered text into speech
8.	Implement an application that creates an alert upon receiving message using notification
9.	Develop and deploy map based application
10.	Perform Async task using SQLite

**Lecture: 45, Practical: 30, Total: 75****TEXT BOOK:**

1.	John Horton, "Android Programming for Beginners", 1 <sup>st</sup> Edition, Packt Publishing, India, 2015.
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**REFERENCES:**

1.	Paul Deitel, Harvey Deitel and Alexander Wald, "Android 6 for Programmers an App-Driven Approach", 3 <sup>rd</sup> Edition, Pearson Education India, New Delhi, 2015.
2.	Reto Meier, "Professional Android™4 Application Development", 1 <sup>st</sup> Edition, John Wiley & Sons, New York, 2012.



<b>COURSE OUTCOMES:</b> On completion of the course, the students will be able to		<b>BT Mapped (Highest Level)</b>
CO1	understanding the android development environment concepts.	Understanding (K2)
CO2	exploring the building application framework for the android platform.	Applying (K3)
CO3	applying android UI objects to designing android applications.	Applying (K3)
CO4	practice the methods to handling the data for an android application.	Applying (K3)
CO5	explore and creating android applications using android APIs.	Analyzing (K4)
CO6	understand and implement device connectivity in android applications.	Applying(K3), Precision(S3)
CO7	understand how to integrate maps with mobile applications.	Applying(K3), Precision(S3)
CO8	develop simple hybrid applications.	Applying(K3), Precision(S3)

<b>Mapping of COs with POs and PSOs</b>														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2								3	3
CO2	3	2	2	2	2								3	3
CO3	3	3	3	3	3								3	3
CO4	3	2	2	2	2								3	3
CO5	3	3	3	3	3								3	3
CO6	3	2	2	2	2								3	3
CO7	3	2	2	2									3	3
CO8	3	2	2	2	2								3	3

1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom’s Taxonomy

<b>ASSESSMENT PATTERN – THEORY</b>							
Test / Bloom’s Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	60	20				100
CAT2	20	20	60				100
CAT3	10	20	40	30			100
ESE	10	30	50	10			100