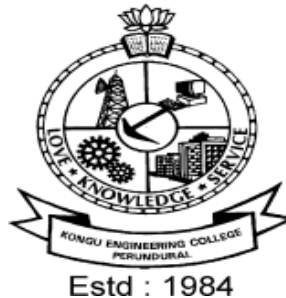# KONGU ENGINEERING COLLEGE

(Autonomous Institution Affiliated to Anna University, Chennai)

PERUNDURAI ERODE – 638 060

TAMILNADU INDIA

Estd : 1984

**REGULATIONS, CURRICULUM & SYLLABI – 2018
(CHOICE BASED CREDIT SYSTEM AND
OUTCOME BASED EDUCATION)**

(For the students admitted during 2018– 2019 and onwards)

**MASTER DEGREE OF SCIENCE
IN
SOFTWARE SYSTEMS**

DEPARTMENT OF COMPUTER TECHNOLOGY–PG

KONGU
Assuring the Best

INDEX

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:

MS1:   Inculcate conceptual knowledge with profound practical and real time industry exposure to the students.

MS2:   Nourish a learning ambience to enhance innovations, problem solving skills, leadership qualities, team–spirit and ethical responsibilities.

MS3:   Vitalize the students to acquire entrepreneurial skills to become global leaders.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

Post Graduates 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 (MS) WITH PEOs

MS\PEO	PEO1	PEO2	PEO3
MS1	3	2	2
MS2	3	2	2
MS3	2	3	1

1 – Slight, 2 – Moderate, 3 – Substantial

PROGRAM OUTCOMES (POs)

Post 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)

Post Graduates of Software Systems will**:**

PSO1 Design, develop and test software systems by applying mathematics and computing skills to provide creative solutions for real world problems

PSO2 Apply knowledge in diverse areas of computer science and experience an environment conducive in cultivating skills for successful career and entrepreneurship

MAPPING OF PEOs WITH POs AND PSOs

PEO\PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
PEO1	3	2	1	1	–	–	–	1	3	3	1	–	3	2
PEO2	3	3	2	2	1	1	–	3	3	1	3	3	–	3
PEO3	3	3	2	2	1	3	3	–	–	3	1	1	1	2

1 – Slight, 2 – Moderate, 3 – Substantial

KONGU ENGINEERING COLLEGE, PERUNDURAI, ERODE – 638060
(Autonomous)

REGULATIONS 2018
(Revision : 3)

CHOICE BASED CREDIT SYSTEM & OUTCOME BASED EDUCATION

MASTER OF SCIENCE (M.Sc.) DEGREE PROGRAMME – 5 YEARS

These regulations are applicable to all candidates admitted into M.Sc. Degree programmes from the academic year 2018 – 2019 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 (M.Sc.) Degree programme

   iv.   "Branch" means specialization or discipline of M.Sc. 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 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 M.Sc. 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 PROGRAMME

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 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. Open Elective (OE) Courses

vii. Employability Enhancement Courses (EC) like Project work, Professional Skills/Industrial Training, Entrepreneurships/Start ups and Internship in Industry or elsewhere

viii. Audit Courses (AC)

ix. Mandatory Courses (MC)

4.2 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 M.Sc. programme is 200.

4.3   Employability Enhancement Courses

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

4.3.1   Professional Skills Training/Industrial Training/ Entrepreneurships/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 course 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 or Professional Skills Training II. 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 internship during entire seventh semester and/or entire final semester and can earn credits through it for his/her academics vide clause 7.6, 7.7 and 7.10.

Such candidate can earn the number of credits for the internship in seventh semester / final semester same as that of Project Work I in the seventh semester / Project Work II in final semester.

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 Board of Studies. A candidate can earn a maximum of three 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 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 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 following due approval procedure. 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 (up to eighth semester).

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/Honors 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, Industrial / Professional Skills 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 Marks
1.	Theory	50	50
2.	Theory cum Practical	The distribution of marks shall be decided based on the credit weightage assigned to theory and practical components.	
3.	Practical / Professional Skills Training / Comprehensive Test & Viva / Entrepreneurships / Start ups / Mini Project I / Mandatory Course/ Industrial Training	100	---
4.	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 duration of three hours.

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 the continuous assessment shall be for 100 marks. Every exercise / experiment shall be evaluated based on the candidate's performance during the practical class and the candidate's records maintained.

7.5.1 The apportionment of continuous assessment marks for each course shall be decided by the course coordinator based on rubrics of that particular course.

Type	Max. Marks	Remarks
Assessment based on rubrics for each experiment	50	Absolute Mark System
Assessment Test	50	
Total	100	Rounded off to one decimal place

7.6 Project Work I / Project Work II

7.6.1 Project work shall be carried out individually. Candidates can opt for full time internship (vide clause 7.10) in lieu of project work I/ II. 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 three 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 Guide and Project Co-ordinator 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, 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 7.6.6.

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/Industrial Training

The evaluation method shall be same as that of the Project Work I as per clause 7.6 excluding 7.6.3, 7.6.5, 7.6.6, 7.6.7 and 7.6.8. The marks distribution is given below:

Continuous Assessment (Max. 100 Marks)								
Zeroth Review		Review I (Max.. 20 Marks)		Review II (Max.. 30 Marks)		Review III (Max. 50 Marks)		
						Report Evaluation (Max. 20 Marks)	Viva - Voce (Max. 30 Marks)	
Review Committee	Guide	Review Committee (excluding guide)	Guide	Review Committee (excluding guide)	Guide	Review Committee	Guide	Review Committee
0	0	10	10	15	15	20	10	20

7.8 Professional Skills Training

Phase I training shall be conducted for minimum 80 hours in 4th semester vacation and during 5th semester. Phase II training shall be conducted for minimum 80 hours in 5th semester vacation and during 6th semester. The evaluation procedure shall be approved by the board of the offering department and Principal.

7.9 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 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.

7.10 Internships

Each candidate shall submit a brief report about the 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 7.6.7.

7.11 Value Added Course

Two assessments shall be conducted during the value added course duration by the offering department concerned.

7.12 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.

7.13 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.

7.14 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 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.

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 entrepreneurships/ 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 and satisfy the attendance requirements.

9. REQUIREMENTS FOR APPEARING FOR END SEMESTER EXAMINATION

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 secure 50 % of the end semester examination marks in the project work I / II, he / she shall be required to resubmit the Project Report within 30 days from the date of declaration of the results. The candidate can register for the supplementary examination and the viva voce examination shall be conducted as per clause 7.6.5.

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:

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

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

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

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

   i. 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-2018 (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

<div align="center">(OR)</div>

    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.

All amendments until the 12th Academic council meeting have been incorporated.

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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	5									**9**	**4.5%**
BS	4	4	4								**12**	**6%**
ES	12										**12**	**6%**
PC		11	16	19	17	15		14			**92**	**46%**
PE					6	6		10	17		**39**	**19.5%**
EC					2	4	15			15	**36**	**18%**
Semester wise Total	**20**	**20**	**20**	**19**	**25**	**25**	**15**	**24**	**17**	**15**	**200**	**100.00**

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)							
SI.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18ISC11	Communicative English I	3	0	2	4	I
2.	18ISC21	Communicative English II	3	0	2	4	II
3.	18VEC11	Value Education	2	0	1	1	II
Total Credits to be earned						**9**	

BASIC SCIENCE (BS)							
SI.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**	**Sem**
1.	18IST11	Applied Mathematics	3	1	0	4	I
2.	18IST21	Numerical Methods	3	1	0	4	II
3.	18IST31	Probability and Statistical Methods	3	1	0	4	III
Total Credits to be earned						**12**	

ENGINEERING SCIENCE (ES)

Sl.No.	Course Code	Course Name	L	T	P	C	Sem
1.	18ISC12	Problem Solving and Programming	3	0	2	4	I
2.	18ISC13	Fundamentals of Computer Science	3	0	2	4	I
3.	18ISC14	Digital Principles	3	0	2	4	I
Total Credits to be earned						**12**	

PROFESSIONAL CORE (PC)

Sl. No.	Course Code	Course Name	L	T	P	C	Sem	Domain/ Stream
1.	18ISC22	Advanced C Programming	3	0	2	4	II	Prg
2.	18IST22	Computer Architecture	3	0	0	3	II	CS
3.	18ISC23	Operating Systems	3	0	2	4	II	CS
4.	18IST32	Object Oriented Programming with Java	3	0	0	3	III	Prg
5.	18IST33	Data Structures	3	0	0	3	III	Alg
6.	18IST34	Computer Networks	3	1	0	4	III	N/W
7.	18IST35	Database Management Systems	3	0	0	3	III	DB
8.	18ISL31	Object Oriented Programming with Java Laboratory	0	0	2	1	III	Prg
9.	18ISL32	Data Structures Laboratory	0	0	2	1	III	Alg
10.	18ISL33	Database Management Systems Laboratory	0	0	2	1	III	DB
11.	18IST41	Advanced Java Programming	3	0	0	3	IV	Prg
12.	18IST42	Web Technology	3	0	0	3	IV	Prg
13.	18IST43	Design and Analysis of Algorithms	3	0	0	3	IV	Alg
14.	18IST44	Principles of Compiler Design	3	1	0	4	IV	Prg
15.	18IST45	Software Engineering	3	0	0	3	IV	SE
16.	18ISL41	Advanced Java Programming Laboratory	0	0	2	1	IV	Prg
17.	18ISL42	Web Technology Laboratory	0	0	2	1	IV	Prg
18.	18ISL43	Design and Analysis of Algorithms Laboratory	0	0	2	1	IV	Alg
19.	18IST51	Python Programming	3	0	0	3	V	Prg
20.	18IST52	Data mining Techniques	3	0	0	3	V	DB
21.	18IST53	Software Testing	3	0	0	3	V	SE
22.	18IST54	Mobile Communications	3	0	0	3	V	N/W
23.	18ISL51	Python Programming Laboratory	0	0	4	2	V	Prg
24.	18ISL52	Data Mining Techniques Laboratory	0	0	4	2	V	DB
25.	18ISL53	Software Testing Laboratory	0	0	2	1	V	SE
26.	18IST61	Open Source Systems	3	0	0	3	VI	Prg
27.	18IST62	Cryptography and Network Security	3	1	0	4	VI	N/W

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Sl. No.	Course Code	Course Name	L	T	P	C	Sem	Domain/ Stream
28.	18IST63	Object Oriented System Design	3	0	0	3	VI	SE
29.	18IST64	Software Project Management	3	0	0	3	VI	SE
30.	18ISL61	CASE Tools Laboratory	0	0	4	2	VI	SE
31.	18IST81	Cloud Computing	3	0	0	3	VIII	N/W
32.	18IST82	User Interface Design	3	0	0	3	VIII	SE
33.	18IST83	Agile Software Engineering	3	1	0	4	VIII	SE
34.	18ISL81	Cloud Computing Laboratory	0	0	4	2	VIII	N/W
35.	18ISL82	User Interface Design Laboratory	0	0	4	2	VIII	SE
		Total Credits to be earned		**92**				

		PROFESSIONAL ELECTIVE (PE)						
Sl. No.	Course Code	Course Name	L	T	P	C	Sem	Domain/ Stream
		Elective 1						
1.	18ISE01	Network Protocols	3	0	0	3	V	N/W
2.	18ISE02	Software Architecture	3	0	0	3	V	SE
3.	18ISE03	Operations Research	3	0	0	3	V	Mgt
4.	18ISE04	Principles of Management	3	0	0	3	V	Mgt
		Elective 2						
5.	18ISE05	Advanced Database Technologies	3	0	0	3	V	DB
6.	18ISE06	Information Security	3	0	0	3	V	N/W
7.	18ISE07	XML and Web Services	3	0	0	3	V	Prg
8.	18ISE08	Computer Graphics	3	0	0	3	V	Prg
		Elective 3						
9.	18ISE09	Distributed Computing	3	0	0	3	VI	N/W
10.	18ISE10	Software Metrics	3	0	0	3	VI	SE
11.	18ISE11	Artificial Intelligence	3	0	0	3	VI	Alg
12.	18ISE12	Enterprise Resource Planning	3	0	0	3	VI	Mgt
		Elective 4						
13.	18ISE13	Introduction to Data Science	3	0	0	3	VI	DM
14.	18ISE14	Professional Ethics and Human Values	3	0	0	3	VI	Mgt
15.	18ISE15	Service Oriented Architecture	3	0	0	3	VI	N/W
16.	18ISE16	Multimedia Systems	3	0	0	3	VI	Prg

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Sl. No.	Course Code	Course Name	L	T	P	C	Sem	Domain/ Stream
		Elective 5						
17.	18ISE17	Big data Analytics	3	1	0	4	VIII	DM
18.	18ISE18	Building Enterprise Applications	3	1	0	4	VIII	SE
19.	18ISE19	Machine Learning	3	1	0	4	VIII	Alg
		Elective 6						
20.	18ISE20	Ad hoc and Sensor Networks	3	0	0	3	VIII	N/W
21.	18ISE21	Software Quality Assurance	3	0	0	3	VIII	SE
22.	18ISE22	Linux Administration	3	0	0	3	VIII	Prg
		Elective 7						
23.	18ISE23	Semantic Web	3	0	0	3	VIII	N/W
24.	18ISE24	Design Thinking	3	0	0	3	VIII	Mgt
25.	18ISE25	Entrepreneurship Development	3	0	0	3	VIII	Mgt
		Elective 8						
26.	18ISE26	Network Management	3	0	0	3	IX	N/W
27.	18ISE27	Infrastructure Management	3	0	0	3	IX	N/W
28.	18ISE28	Organizational Behaviour	3	0	0	3	IX	Mgt
		Elective 9						
29.	18ISE29	Business Intelligence	3	0	0	3	IX	DM
30.	18ISE30	Software Maintenance	3	0	0	3	IX	SE
31.	18ISE31	Human Resource Management	3	0	0	3	IX	Mgt
		Elective 10						
32.	18ISE32	E–Technologies	3	0	0	3	IX	Mgt
33.	18ISE33	Green Computing	3	0	0	3	IX	Mgt
34.	18ISE34	Cyber Forensics	3	0	0	3	IX	N/W
		Elective 11						
35.	18ISE35	Natural Language Processing	3	1	0	4	IX	Prg
36.	18ISE36	Block Chain Technology	3	1	0	4	IX	N/W
37.	18ISE37	Agile Project Management	3	1	0	4	IX	SE
		Elective 12						
38.	18ISE38	Social Network Analysis	3	1	0	4	IX	N/W
39.	18ISE39	Internet of Things	3	0	2	4	IX	N/W
40.	18ISE40	Front End Technologies	3	0	2	4	IX	Prg
	Total Credits to be earned					**39**		

SI. No.	Course Code	Course Name	L	T	P	C	Sem	Domain/ Stream
		EMPLOYABILITY ENHANCEMENT COURSES (EC)						
1	18GEL51	Professional Skills Training I	–	–	–	2	V	1
2	18GEL61	Professional Skills Training II	–	–	–	2	VI	2
3	18ISP61	Mini Project	0	0	4	2	VI	3
4	18ISP71	Project Work I	0	0	30	15	VII	4
5	18ISP01	Project Work II	0	0	30	15	X	5
		Total Credits to be earned				**36**		

M–Mathematics, SE–Software Engineering, DB– Database, Prg– Programming, N/W–Networks, Alg– Algorithms, Mgt–Management, DM–Data Mining

KEC R2018: SCHEDULING OF COURSES – MSc (SOFTWARE SYSTEMS)   Total Credits :200

Sem.	Course 1	Course 2	Course 3	Course 4	Course 5	Course 6	Course 7	Course 8	Course 9	Course 10	Credits
I	18ISC11 Communicative English I (3-0-2-4)	18IST11 Applied Mathematics (3-1-0-4)	18ISC12 Problem Solving and Programming (3-0-2-4)	18ISC13 Fundamentals of Computer Science (3-0-2-4)	18ISC14 Digital Principles (3-0-2-4)						20
II	18ISC21 Communicative English II (3-0-2-4)	18IST21 Numerical Methods (3-1-0-4)	18ISC22 Advanced C Programming (3-0-2-4)	18IST22 Computer Architecture (3-0-0-3)	18ISC23 Operating Systems (3-0-2-4)	18VEC11 Value Education (2-0-1-1)					20
III	18IST31 Probability and Statistical Methods (3-1-0-4)	18IST32 Object Oriented Programming with Java (3-0-0-3)	18IST33 Data Structures (3-0-0-3)	18IST34 Computer Networks (3-1-0-4)	18IST35 Database Management Systems (3-0-0-3)	18ISL31 Object Oriented Programming with Java Laboratory (0-0-2-1)	18ISL32 Data Structures Laboratory (0-0-2-1)	18ISL33 Database Management Systems Laboratory (0-0-2-1)			20
IV	18IST41 Advanced Java Programming (3-0-0-3)	18IST42 Web Technology (3-0-0-3)	18IST43 Design and Analysis of Algorithms (3-0-0-3)	18IST44 Principles of Compiler Design (3-1-0-4)	18IST45 Software Engineering (3-0-0-3)	18ISL41 Advanced Java Programming Laboratory (0-0-2-1)	18ISL42 Web Technology Laboratory (0-0-2-1)	18ISL43 Design and Analysis of Algorithms Laboratory (0-0-2-1)			19
V	18IST51 Python Programming (3-0-0-3)	18IST52 Data Mining Techniques (3-0-0-3)	18IST53 Software Testing (3-0-0-3)	18IST54 Mobile Communications (3-0-0-3)	Professional Elective – 1 (3-0-0-3)	Professional Elective – 2 (3-0-0-3)	18ISL51 Python Programming Laboratory (0-0-4-2)	18ISL52 Data Mining Techniques Laboratory (0-0-4-2)	18ISL53 Software Testing Laboratory (0-0-2-1)	18GEL51 Professional Skills Training I (0-0-80-2)	25
VI	18IST61 Open Source Systems (3-0-0-3)	18IST62 Cryptography and Network Security (3-1-0-4)	18IST63 Object Oriented System Design (3-0-0-3)	18IST64 Software Project Management (3-1-0-4)	Professional Elective – 3 (3-0-0-3)	Professional Elective – 4 (3-0-0-3)	18ISP61 Mini Project (0-0-4-2)	18ISL61 CASE Tools Laboratory (0-0-4-2)	18GEL61 Professional Skills Training II (0-0-80-2)		25
VII	18ISP71 Project Work I (0-0-30-15)										15
VIII	18IST81 Cloud Computing (3-0-0-3)	18IST82 User Interface Design (3-0-0-3)	18IST83 Agile Software Engineering (3-1-0-4)	Elective – 5 (3-1-0-4)	Elective – 6 (3-0-0-3)	Elective – 7 (3-0-0-3)	18ISL81 Cloud Computing Laboratory (0-0-4-2)	18ISL82 User Interface Design Laboratory (0-0-4-2)			24
IX	Elective – 8 (3-0-0-3)	Elective – 9 (3-0-0-3)	Elective – 10 (3-0-0-3)	Elective – 11 (3-1-0-4)	Elective – 12 (3-1-0-4)						17
X	18ISP01 Project Work II (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
1	18ISC11	Communicative English I	√			√	√	√	√	√					√	√
1	18IST11	Applied Mathematics	√	√	√	√									√	√
1	18ISC12	Problem Solving and Programming	√	√	√	√									√	√
1	18ISC13	Fundamentals of Computer Science	√	√	√										√	√
1	18ISC14	Digital Principles	√	√	√	√	√								√	√
2	18ISC21	Communicative English II	√			√	√	√	√	√					√	√
2	18IST21	Numerical Methods	√	√	√	√									√	√
2	18ISC22	Advanced C Programming	√	√	√	√									√	√
2	18IST22	Computer Architecture	√	√	√										√	√
2	18ISC23	Operating Systems	√	√	√										√	√
2	18VEC11	Value Education						√		√				√		
3	18IST31	Probability and Statistical Methods	√	√	√	√	√								√	√
3	18IST32	Object Oriented Programming with Java	√	√	√	√									√	√
3	18IST33	Data Structures	√	√	√	√									√	√
3	18IST34	Computer Networks	√	√	√	√									√	√
3	18IST35	Database Management Systems	√	√	√	√									√	√
3	18ISL31	Object Oriented Programming with Java Laboratory	√	√	√	√									√	√
3	18ISL32	Data Structures Laboratory	√	√	√	√									√	√
3	18ISL33	Database Management Systems Laboratory	√	√	√	√									√	√
4	18IST41	Advanced Java Programming	√	√	√	√	√								√	√
4	18IST42	Web Technology	√	√	√	√									√	√
4	18IST43	Design and Analysis of Algorithms	√	√	√	√									√	√
4	18IST44	Principles of Compiler Design	√	√	√	√									√	√
4	18IST45	Software Engineering	√	√	√	√									√	√
4	18ISL41	Advanced Java Programming Laboratory	√	√	√	√									√	√

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
4	18ISL42	Web Technology Laboratory	√	√	√	√									√	√
4	18ISL43	Design and Analysis of Algorithms Laboratory	√	√	√	√									√	√
5	18IST51	Python Programming	√	√	√	√	√								√	√
5	18IST52	Data mining Techniques	√	√	√	√									√	√
5	18IST53	Software Testing	√	√	√	√									√	√
5	18IST54	Mobile Communications	√	√	√	√									√	√
5	18ISL51	Python Programming Laboratory	√	√	√	√									√	√
5	18ISL52	Data Mining Techniques Laboratory	√	√	√	√									√	√
5	18ISL53	Software Testing Laboratory	√	√	√	√									√	√
5	18GEL51	Professional Skills Training I/Internship	√	√				√	√		√	√	√	√		
6	18IST61	Open Source Systems	√	√	√	√									√	√
6	18IST62	Cryptography and Network Security	√	√	√	√									√	√
6	18IST63	Object Oriented System Design	√	√	√	√									√	√
6	18IST64	Software Project Management	√	√	√	√									√	√
6	18ISP61	Mini Project	√	√	√	√	√	√	√	√	√	√	√	√	√	√
6	18ISL61	CASE Tools Laboratory	√	√	√	√									√	√
6	18GEL61	Professional Skills Training II /Internship	√	√				√	√		√	√	√	√		
7	18ISP71	Project Work I	√	√	√	√	√	√	√	√	√	√	√	√	√	√
8	18IST81	Cloud Computing	√	√	√	√									√	√
8	18IST82	User Interface Design	√	√	√	√									√	√
8	18IST83	Agile Software Engineering	√	√	√	√									√	√
8	18ISL81	Cloud Computing Laboratory	√	√	√	√									√	√
8	18ISL82	User Interface Design Laboratory	√	√	√	√									√	√
10	18ISP01	Project Work II	√	√	√	√	√	√	√	√	√	√	√	√	√	√

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Professional Elective																
5	18ISE01	Network Protocols	√	√	√	√									√	√
5	18ISE02	Software Architecture	√	√	√	√									√	√
5	18ISE03	Operations Research	√	√	√	√	√								√	√
5	18ISE04	Principles of Management						√		√	√	√	√	√	√	√
5	18ISE05	Advanced Database Technologies	√	√	√	√									√	√
5	18ISE06	Information Security	√	√	√	√									√	√
5	18ISE07	XML and Web services	√	√	√	√									√	√
5	18ISE08	Computer Graphics	√	√	√	√									√	√
6	18ISE09	Distributed computing	√	√	√	√									√	√
6	18ISE10	Software Metrics	√	√	√	√									√	√
6	18ISE11	Artificial Intelligence	√	√		√	√								√	√
6	18ISE12	Enterprise Resource Planning	√	√	√	√									√	√
6	18ISE13	Introduction to Data Science	√	√	√	√									√	√
6	18ISE14	Professional Ethics and Human values						√				√	√		√	√
6	18ISE15	Service Oriented Architecture	√	√	√	√									√	√
6	18ISE16	Multimedia systems	√	√	√	√									√	√
8	18ISE17	Big Data Analytics	√	√	√	√									√	√
8	18ISE18	Building Enterprise Applications	√	√	√	√									√	√
8	18ISE19	Machine Learning	√	√	√	√	√								√	√
8	18ISE20	Ad hoc and Sensor Networks	√	√	√	√									√	√
8	18ISE21	Software Quality Assurance	√	√	√	√									√	√
8	18ISE22	Linux Administration	√	√	√	√									√	√
8	18ISE23	Semantic Web	√	√	√	√	√								√	√
8	18ISE24	Design Thinking	√	√	√	√									√	√

Sem.	Course Code	Course Title	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
8	18ISE25	Entrepreneurship Development	√	√	√	√		√		√		√		√	√	√
9	18ISE26	Network Management	√	√	√	√									√	√
9	18ISE27	Infrastructure Management	√	√	√	√									√	√
9	18ISE28	Organizational Behaviour	√	√	√	√									√	√
9	18ISE29	Business Intelligence	√	√	√	√									√	√
9	18ISE30	Software Maintenance	√	√	√	√									√	√
9	18ISE31	Human Resource Management									√	√	√	√	√	√
9	18ISE32	E–Technologies	√	√	√	√	√								√	√
9	18ISE33	Green Computing	√	√											√	√
9	18ISE34	Cyber Forensics	√	√	√	√									√	√
9	18ISE35	Natural Language Processing	√	√	√	√									√	√
9	18ISE36	Block Chain Technology	√	√	√	√									√	√
9	18ISE37	Agile Project Management	√	√	√	√									√	√
9	18ISE38	Social Network Analysis	√	√	√	√									√	√
9	18ISE39	Internet of Things	√	√	√	√									√	√
9	18ISE40	Front End Technologies	√	√	√	√									√	√

MSc SOFTWARE SYSTEMS CURRICULUM – R2018

SEMESTER – I

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18ISC11	Communicative English I	3	0	2	4	50	50	100	HS
18IST11	Applied Mathematics	3	1	0	4	50	50	100	BS
18ISC12	Problem Solving and Programming	3	0	2	4	50	50	100	ES
18ISC13	Fundamentals of Computer Science	3	0	2	4	50	50	100	ES
18ISC14	Digital Principles	3	0	2	4	50	50	100	ES
Total Credits to be earned					**20**				

SEMESTER – II

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18ISC21	Communicative English II	3	0	2	4	50	50	100	HS
18IST21	Numerical Methods	3	1	0	4	50	50	100	BS
18ISC22	Advanced C Programming	3	0	2	4	50	50	100	PC
18IST22	Computer Architecture	3	0	0	3	50	50	100	PC
18ISC23	Operating Systems	3	0	2	4	50	50	100	PC
18VEC11	Value Education	2	0	1	1	100	0	100	HS
Total Credits to be earned					**20**				

MSc SOFTWARE SYSTEMS CURRICULUM – R2018

SEMESTER – III

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18IST31	Probability and Statistical Methods	3	1	0	4	50	50	100	BS
18IST32	Object Oriented Programming with Java	3	0	0	3	50	50	100	PC
18IST33	Data Structures	3	0	0	3	50	50	100	PC
18IST34	Computer Networks	3	1	0	4	50	50	100	PC
18IST35	Database Management Systems	3	0	0	3	50	50	100	PC
Practical / Employability Enhancement									
18ISL31	Object Oriented Programming with Java Laboratory	0	0	2	1	100	0	100	PC
18ISL32	Data Structures Laboratory	0	0	2	1	100	0	100	PC
18ISL33	Database Management Systems Laboratory	0	0	2	1	100	0	100	PC
Total Credits to be earned					**20**				

SEMESTER – IV

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18IST41	Advanced Java Programming	3	0	0	3	50	50	100	PC
18IST42	Web Technology	3	0	0	3	50	50	100	PC
18IST43	Design and Analysis of Algorithms	3	0	0	3	50	50	100	PC
18IST44	Principles of Compiler Design	3	1	0	4	50	50	100	PC
18IST45	Software Engineering	3	0	0	3	50	50	100	PC
Practical / Employability Enhancement									
18ISL41	Advanced Java Programming Laboratory	0	0	2	1	100	0	100	PC
18ISL42	Web Technology Laboratory	0	0	2	1	100	0	100	PC
18ISL43	Design and Analysis of Algorithms Laboratory	0	0	2	1	100	0	100	PC
Total Credits to be earned					**19**				

MSc SOFTWARE SYSTEMS CURRICULUM – R2018

SEMESTER – V

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18IST51	Python Programming	3	0	0	3	50	50	100	PC
18IST52	Data mining Techniques	3	0	0	3	50	50	100	PC
18IST53	Software Testing	3	0	0	3	50	50	100	PC
18IST54	Mobile Communications	3	0	0	3	50	50	100	PC
	Professional Elective I	3	0	0	3	50	50	100	PE
	Professional Elective II	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
18ISL51	Python Programming Laboratory	0	0	4	2	100	0	100	PC
18ISL52	Data mining Techniques Laboratory	0	0	4	2	100	0	100	PC
18ISL53	Software Testing Laboratory	0	0	2	1	100	0	100	PC
18GEL51	Professional Skills Training I/Internship *	–	–	-	2	100	0	100	EC
Total Credits to be earned					**25**				

 *80 Hours of Training

SEMESTER – VI

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18IST61	Open Source Systems	3	0	0	3	50	50	100	PC
18IST62	Cryptography and Network Security	3	1	0	4	50	50	100	PC
18IST63	Object Oriented System Design	3	0	0	3	50	50	100	PC
18IST64	Software Project Management	3	0	0	3	50	50	100	PC
	Professional Elective III	3	0	0	3	50	50	100	PE
	Professional Elective IV	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
18ISP61	Mini Project	0	0	4	2	100	0	100	EC
18ISL61	CASE Tools Laboratory	0	0	4	2	100	0	100	PC
18GEL61	Professional Skills Training II/ Internship *	–	–	–	2	100	0	100	EC
Total Credits to be earned					**25**				

 *80 Hours of Training

MSc SOFTWARE SYSTEMS CURRICULUM – R2018

SEMESTER – VII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Practical / Employability Enhancement									
18ISP71	Project Work I	0	0	30	15	50	50	100	EC
Total Credits to be earned					**15**				

SEMESTER – VIII

Course Code	Course Title	Hours / Week			Credit	Maximum Marks			Category
		L	T	P		CA	ESE	Total	
Theory/Theory with Practical									
18IST81	Cloud Computing	3	0	0	3	50	50	100	PC
18IST82	User Interface Design	3	0	0	3	50	50	100	PC
18IST83	Agile Software Engineering	3	1	0	4	50	50	100	PC
	Professional Elective V	3	1	0	4	50	50	100	PE
	Professional Elective VI	3	0	0	3	50	50	100	PE
	Professional Elective VII	3	0	0	3	50	50	100	PE
Practical / Employability Enhancement									
18ISL81	Cloud Computing Laboratory	0	0	4	2	100	0	100	PC
18ISL82	User Interface Design Laboratory	0	0	4	2	100	0	100	PC
Total Credits to be earned					**24**				

MSc SOFTWARE SYSTEMS CURRICULUM – R2018

SEMESTER – IX

Course Code	Course Title	L	T	P	Credit	CA	ESE	Total	Category
	Theory/Theory with Practical								
	Professional Elective VIII	3	0	0	3	50	50	100	PE
	Professional Elective IX	3	0	0	3	50	50	100	PE
	Professional Elective X	3	0	0	3	50	50	100	PE
	Professional Elective XI	3	1	0	4	50	50	100	PE
	Professional Elective XII	3	1	0	4	50	50	100	PE
Total Credits to be earned					**17**				

SEMESTER – X

Course Code	Course Title	L	T	P	Credit	CA	ESE	Total	Category
	Practical / Employability Enhancement								
18ISP01	Project Work II	0	0	30	15	50	50	100	EC
Total Credits to be earned					**15**				

Total Credits: 200

Sl. No.	Course Code	Course Name	L	T	P	C	Domain/ Stream
		LIST OF ELECTIVE COURSES					
		Semester V					
		Elective 1					
1.	18ISE01	Network Protocols	3	0	0	3	N/W
2.	18ISE02	Software Architecture	3	0	0	3	SE
3.	18ISE03	Operations Research	3	0	0	3	Mgt
4.	18ISE04	Principles of Management	3	0	0	3	Mgt
		Elective 2					
5.	18ISE05	Advanced Database Technologies	3	0	0	3	DB
6.	18ISE06	Information Security	3	0	0	3	N/W
7.	18ISE07	XML and Web Services	3	0	0	3	Prg
8.	18ISE08	Computer Graphics	3	0	0	3	Prg
		Semester VI					
		Elective 3					
9.	18ISE09	Distributed computing	3	0	0	3	N/W
10.	18ISE10	Software Metrics	3	0	0	3	SE
11.	18ISE11	Artificial Intelligence	3	0	0	3	Alg
12.	18ISE12	Enterprise Resource Planning	3	0	0	3	Mgt
		Elective 4					
13.	18ISE13	Introduction to Data Science	3	0	0	3	DM
14.	18ISE14	Professional Ethics and Human values	3	0	0	3	Mgt
15.	18ISE15	Service Oriented Architecture	3	0	0	3	N/W
16.	18ISE16	Multimedia Systems	3	0	0	3	Prg
		Semester VIII					
		Elective 5					
17.	18ISE17	Big Data Analytics	3	1	0	4	DM
18.	18ISE18	Building Enterprise Applications	3	1	0	4	SE
19.	18ISE19	Machine Learning	3	1	0	4	Alg
		Elective 6					
20.	18ISE20	Ad hoc and Sensor Networks	3	0	0	3	N/W
21.	18ISE21	Software Quality Assurance	3	0	0	3	SE
22.	18ISE22	Linux Administration	3	0	0	3	Prg
		Elective 7					
23.	18ISE23	Semantic Web	3	0	0	3	N/W
24.	18ISE24	Design Thinking	3	0	0	3	Mgt
25.	18ISE25	Entrepreneurship Development	3	0	0	3	Mgt

Sl. No.	Course Code	Course Name	L	T	P	C	Domain/Stream
		Semester IX					
		Elective 8					
26.	18ISE26	Network Management	3	0	0	3	N/W
27.	18ISE27	Infrastructure Management	3	0	0	3	N/W
28.	18ISE28	Organizational Behaviour	3	0	0	3	Mgt
		Elective 9					
29.	18ISE29	Business Intelligence	3	0	0	3	DM
30.	18ISE30	Software Maintenance	3	0	0	3	SE
31.	18ISE31	Human Resource Management	3	0	0	3	Mgt
		Elective 10					
32.	18ISE32	E–Technologies	3	0	0	3	Mgt
33.	18ISE33	Green Computing	3	0	0	3	Mgt
34.	18ISE34	Cyber Forensics	3	0	0	3	N/W
		Elective 11					
35.	18ISE35	Natural Language Processing	3	1	0	4	Prg
36.	18ISE36	Block Chain Technology	3	1	0	4	N/W
37.	18ISE37	Agile Project Management	3	1	0	4	SE
		Elective 12					
38.	18ISE38	Social Network Analysis	3	1	0	4	N/W
39.	18ISE39	Internet of Things	3	0	2	4	N/W
40.	18ISE40	Front End Technologies	3	0	2	4	Prg

M–Mathematics, SE–Software Engineering, DB– Database, Prg– Programming, N/W–Networks, Alg– Algorithms, Mgt–Management, DM–Data Mining

18ISC11 – COMMUNICATIVE ENGLISH I

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	HS	3	0	2	4

Preamble	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	
Unit – I	**Grammar & Vocabulary:**	**9**
	Content words– Nouns, Verbs, Adjectives and Adverbs identification – Changing Parts of speech; **Reading Comprehension**: Prediction and Surveying;**Writing**: Filling an application form. **Activities**: **Listening:** Types of listening; **Speaking**: Talking about oneself, one's family, friends and favorite persons.	
Unit – II	**Grammar & Vocabulary:**	**9**
	Prefixes and Suffixes– Nouns and Noun phrases; **Reading**: Skimming for gist and scanning for information; **Writing**: Describing persons, places and products. **Activities : Listening**: The process of listening;**Speaking:** Presentation	
Unit – III	**Grammar & Vocabulary:**	**9**
	Verbs – Main verbs, Primary and Modal auxiliary verbs – Finite Verbs and non–finite verbs; **Reading**: Comprehension;**Writing**: Paragraph writing (narrative, descriptive and process description passages). **Activities:Listening:** Effective listening strategies; **Speaking:** DET talk.	
Unit – IV	**Grammar & Vocabulary:**	**9**
	Adjectives – Attributive and Predicative functions – Classifiers – Verbs and tenses; **Reading**: Intensive reading and Note–making;**Writing**: Formal and Informal letters. **Activities**: **Listening:** Gap filling activity while listening;**Speaking:** 1.Narration of an event. 2. Description of a product	
Unit – V	**Grammar & Vocabulary:**	**9**
	Adverbs and Adverbial Phrases –Sentence Patterns in English; **Reading**: Reading passages;**Writing**: E–mails. **Activities**: **Listening:** Listening to a lecture and taking notes; **Speaking:** Describing a picture	

List of Exercises / Experiments :

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 the guests, proposing a 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, time management, Understanding and explaining the meaning of famous quotes

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Raymond Murphy, "Essential English Grammar: Reference and Practice for South Asian Students Cambridge", 1st Edition, Cambridge University Press, New Delhi,2010

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	identify and use content words which carry more meaning	Remembering (K1)
CO2	construct sentences in English	Creating (K6)
CO3	implement reading skills by reading short, simple messages and texts with complete understanding	Applying (K3)
CO4	construct words at sentence and paragraph level	Creating (K6)
CO5	demonstrate effectively in a vast range of personal, professional, academic, and cultural situations	Applying (K3)
CO6	understand the pronunciation of the native speakers (English) about their real time experience after listening the videos	Understanding(K2) Manipulation (S2)
CO7	reconstruct the information through writing after effectively listening	Evaluating (K5) Imitation (S1)
CO8	take part in various professional, academic, and cultural situations 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			1	2	2	2	3						
CO2	1			1	2	3	2	3						
CO3	1			1	2	3	2	3						
CO4	1			1	2	3	2	3					1	1
CO5	1			1	2	3	2	3					1	
CO6	1			1	2	3	2	3						
CO7	1			1	2	3	2	3					1	
CO8	1			1	2	3	2	3					1	1
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 %
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)

18IST11 – APPLIED MATHEMATICS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	BS	3	1	0	4

Preamble	To convert quadratic form to canonical form, solving ordinary differential equations of certain type, deriving inferences from propositions and predicates and deal with some counting techniques	
Unit – I	**Matrices:**	9+3
	Characteristic Equation of a Matrix – Eigen Values And Eigen Vectors of Real Non–Symmetric and Symmetric Matrices – Properties of Eigen Values and Eigen Vectors(Statement Only) – Cayley– Hamilton Theorem (Statement Only) – Similarity Transformation(Concept Only) –Orthogonal Matrices – Orthogonal Transformation of Symmetric Matrix to Diagonal Form – Quadratic Forms – Reduction of Quadratic Form to Canonical Form by Orthogonal Reduction	
Unit – II	**Solution of Ordinary Differential Equations:**	9+3
	Solution of Second and Third Order Ordinary Differential Equations with Constant Coefficients when the RHS is e^{ax}, Sin(ax), Cos(ax), x^n (N >0), $e^{ax}sin(bx)$, $e^{ax}cos(bx)$ – Differential Equations with Variable Coefficients (Euler's Cauchy Type Only)	
Unit – III	**Propositional Calculus:**	9+3
	Propositions – Truth Table – Logical Operators – Tautologies and Contradiction – Logical Equivalences and Implications – Laws of Logic – PDNF and PCNF– Proofs in Propositional Calculus – Direct Proof– Conditional Conclusion – Indirect Proof– Inconsistent Set of Premises	
Unit – IV	**Predicate Calculus:**	9+3
	Predicates – Statement Function – Variables and Quantifiers – Predicate Formulae – Free and Bound variables – The Universe of discourse – Logical implications and equivalence for Quantified statements – Theory of inference of predicate calculus	
Unit – V	**Counting Techniques:**	9+3
	Mathematical Induction – Permutations and Combinations – Permutations with Repetition –Pigeon Hole Principle – Principle of Inclusion and Exclusions – Recurrence Relations –Solution Of Linear Non–Homogeneous Recurrence Relations: When RHS is a Constant – When RHS is a Linear Polynomial – When RHS is an Exponential Function	

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Veerarajan T, "Discrete Mathematics with Graph Theory and Combinatorics", 18th Reprint Edition, Tata McGraw Hill, New Delhi, 2013.

REFERENCES:

1.	Balasubramanie P. and Tamilarasi A., "Engineering Mathematics", 1st Edition, Tata Mcgraw– Hill Education Pvt. Ltd, New Delhi, 2011.
2.	Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw – Hill Pub. Co. Ltd, New Delhi, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	reduce the quadratic form to canonical form by using orthogonal transformation	Applying (K3)
CO2	solve the ordinary differential equations of certain types	Applying (K3)
CO3	derive the inferences from propositions	Applying (K3)
CO4	deduce the inferences from predicates	Applying (K3)
CO5	make use of the counting techniques to some situations	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	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														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	13	13	74				100
CAT2	13	13	74				100
CAT3	13	13	74				100
ESE	4	4	92				100

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

18ISC12 – PROBLEM SOLVING AND PROGRAMMING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	ES	3	0	2	4

Preamble	To develop problem solving skills using C programming

Unit – I	Introduction to Computer and Problem Solving:	9

Problem Solving – Problem Solving Techniques: Flowchart – Algorithm – Pseudocode – Structuring the Logic – Top–down Design – Algorithm, Flowchart and Pseudocode for Simple Problems: Exchanging the Values of Two Variables – Simple Interest and Compound Interest Calculation – Finding the Biggest Number – Finding the Area of Different Shapes – Finding the Roots of Quadratic Equation.

Unit – II	Case Study on Problem Solving:	9

Counting – Summation of Numbers – Factorial Computation – Generation of Fibonacci Sequence – Summation of Series – Searching – Exchange Sorting – Matrix Manipulation – Prime Number Generation – Base Conversion: Decimal to Binary and Binary to Decimal – Reversing the Digits of a Number.

Unit – III	Introduction to C:	9

Basic Structure of a C Program –Executing the C Program – C Character Set – Tokens – Keywords and Identifiers – Constants – Variables – Data Types – Storage Classes – Managing Input and Output Operations: Formatted I/O – Unformatted I/O – Operators and Expressions: Types of Operators – Operator Associativity and Precedence.

Unit – IV	Control Statements:	9

Decision Making and Branching: if – if–else – Nested if – Ladder if – Switch–Case – Goto – Looping: Types of Looping Statements – For Statement – While Statement – Do–While Statement – Break and Continue Statement.

Unit – V	Arrays and Strings:	9

One Dimensional Array – Two Dimensional Arrays – Handling of Strings: Declaration – Initialization – Reading – Printing – String Handling Functions – String Manipulation.

List of Exercises / Experiments :

1.	Writing algorithms and drawing flowcharts for sequential structures using raptor tool
2.	Writing algorithms and drawing flowcharts for selection structures using raptor tool
3.	Writing algorithms and drawing flowcharts for repetitive structures using raptor tool
4.	Programs using sequential structures
5.	Programs using selection structures
6.	Programs using repetitive structures
7.	Programs using one–dimensional and two– dimensional arrays
8.	Programs using strings

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Compiled by Department of CSE, "Problem Solving and Programming", 1st Edition, Internal circulation, Kongu Engineering College, 2017.

REFERENCES:

1.	Dromey R.G, "How to Solve it by Computer", Edition, Pearson Education, New Delhi, 2009.
2.	Ashok N. Kamthane, "Computer Programming", 2nd Edition, Pearson Education, New Delhi, 2012.
3.	Yashavant Kanetkar, "Exploring C", 2nd Edition, BPB publications, New Delhi, 2003.
4.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the problem solving techniques using simple problems	Understanding (K2)
CO2	solve the real world problems in terms of algorithm, flowchart and pseudocode	Applying (K3)
CO3	interpret the fundamentals of C programming.	Understanding (K2)
CO4	identify the appropriate looping and decision making statements in C language to solve the problem.	Applying (K3)
CO5	demonstrate the usage of arrays and strings to solve the given problems.	Applying (K3)
CO6	demonstrate the execution of flowchart for the given problem using Raptor	Applying (K3), Precision (S3)
CO7	demonstrate the application of control statements using simple C programs	Applying (K3), Precision (S3)
CO8	implement solutions to the given problem using arrays and strings	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	2
CO2	3	2	1	1									3	3
CO3	2	1											2	2
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

ASSESSMENT PATTERN – THEORY

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)

18ISC13 – FUNDAMENTALS OF COMPUTER SCIENCE

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	ES	3	0	2	4

Preamble	To provide the fundamental knowledge of computer hardware and software. It also emphasizes the functionality of networks, database and internet services

Unit – I	Basics of Computer:	9

Introduction to Computer: Introduction–Digital and Analog Computers–Characteristics – History – Generations – Classification – Computer System – Applications. The Computer System Hardware: Introduction – Central Processing Unit – Memory – Instruction – Microprocessor – Interconnection – Performance – Inside a Computer Cabinet.

Unit – II	Fundamentals of Memory and I/O Devices:	9

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

Unit – III	Basics of Software:	9

Interaction of User and Computer: Introduction–Types of Software–System and Application Software – Software Acquisition. Operating System: Introduction – Objectives – Types and Functions of OS – Process Management – Memory Management – File Management – Device Management – Protection and Security – User Interface – Examples of OS.

Unit – IV	Network Fundamentals:	9

Data Communication and Computer Network: Introduction–Importance – Transmission Media – Data Transmission and Data Networking – Computer Network – Wireless Networking.

Unit – V	Internet and Database:	9

Internet and Internet Services: Introduction – History – Protocol – Architecture – Managing and Connecting to the Internet – Connections – Internet Address – Internet Services – Uses of Internet. Introduction–Database–Database System–Database Management System – Database System Architectures – Database Applications.

List of Exercises / Experiments :

1.	Create a word document by formatting the margin, page size, orientation, indent and change the font size, type, style, color and effects of the contents in the document
2.	Design an advertisement for a newspaper by inserting pictures, water mark, borders and charts.
3.	Insert a table to the document and apply table properties (insert a row and column, delete row and column, format height and width) and add hyperlink
4.	Type a letter in word document and send it to various recipients using mail merge
5.	Using spread sheet, create and format the contents using mathematical functions
6.	Analyze the marks of the students in a class using appropriate charts.
7.	Apply sorting and filtering options for the contents of the spread sheet
8.	Create a presentation with different layouts and designs.
9.	Design a database in Microsoft access to store the details of employees
10.	Import the above created table in spread sheet through external data sources

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Anita Goel, "Computer Fundamentals", 1st Edition, Pearson Education, New Delhi, 2013.

REFERENCES:

1.	Sinha K.Pradeep, Sinha Priti, "Computer Fundamentals", 3rd Edition, BPB publications, New Delhi, 2004.
2.	Balagurusamy E, "Fundamentals of Computers", 1st Edition, Tata McGraw–Hill Ltd, New Delhi, 2009.
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the functionalities of various computer components.	Understanding (K2)
CO2	classify memory types and I/O devices.	Understanding (K2)
CO3	discuss the functions of system and application software.	Understanding (K2)
CO4	describe the networking concepts in data communication.	Understanding (K2)
CO5	interpret the services of internet and database architecture.	Understanding (K2)
CO6	demonstrate the different formatting styles and experiment the mail merge operation in word processor	Applying (K3), Precision (S3)
CO7	excel expertly various functions in spreadsheet and analyze the data using different types of charts in excel.	Applying (K3), Precision (S3)
CO8	perform masterfully presentation with different layouts and animations. Design a database and integrate it with the other data sources	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	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	2	1											2	2
CO5	2	1											2	2
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

ASSESSMENT PATTERN – THEORY

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	70					100
ESE	25	75					100

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

18ISC14 – DIGITAL PRINCIPLES

Programme & Branch	MSc & SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	ES	3	0	2	4

Preamble	The course deals with the basic principles of number systems and Boolean algebra. It also exemplifies the fundamental concepts of combinational and synchronous sequential logic circuits.
Unit – I	**Binary Systems and Logic Gates:** 9
	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.
Unit – II	**Minimization and Boolean Algebra:** 9
	Basic Theorems and Properties of Boolean Algebra–Boolean Functions – Canonical and Standard Forms – K–Map Method: Two–variable, Three–variable, Four–variable – Don't Care Conditions – NAND and NOR Implementation.
Unit – III	**Combinational Logic:** 9
	Combinational Circuits–Analysis Procedure–Design Procedure– Binary adder – Subtractor – Half Adder – Full Adder – Half Subtractor – Full Subtractor – Decoders – Encoders – Multiplexers.
Unit – IV	**Synchronous Sequential Logic:** 9
	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.
Unit – V	**Registers And Counters:** 9
	Registers– Types ofShift Registers: SISO – SIPO – PISO – PIPO– Universal Shift Registers – Ripple Counters:Binary Ripple Counters–BCD Ripple Counters – Ring Counters – Johnson Counter.

List of Exercises / Experiments :

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

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Morris Mano M. and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson Education, New Delhi, 2015.

REFERENCES:

1.	Ghoshal Subrata, "Digital Electronics", 2nd Edition, Cengage Learning, New Delhi, 2018.
2.	AlamMansaf and AlamBashir, "Digital Logic Design", PHI Learning Pvt. Ltd, New Delhi, 2016.
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	solve problems related to number base conversions and binary codes	Applying (K3)
CO2	use the concept of boolean algebra and implement minimization techniques	Applying (K3)
CO3	design the basic combinational circuits	Applying (K3)
CO4	categorize the functions of basic flip–flops	Analyzing (K4)
CO5	interpret the concepts of registers and counters	Understanding (K2)
CO6	perform the operation of identifying various digital ICs and understand their functionalities.	Understanding (K2), Manipulation (S2)
CO7	demonstrate basic combinational circuits and verify their functionalities.	Applying (K3), Precision (S3)
CO8	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	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	2
CO6	2	1											2	2
CO7	3	2	1	1									3	3
CO8	3	2	1	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 %
CAT1	15	35	50				100
CAT2	15	35	50				100
CAT3	15	50	35				100
ESE	15	35	50				100

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

18ISC21 – COMMUNICATIVE ENGLISH II

Programme & Branch	MSc & SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	HS	3	0	2	4

Preamble	To construct sentences effectively and facilitate to improve interpersonal skills of the learners. It can also provide good exposure in the field of communication.	
Unit – I	**Grammar & Vocabulary:**	**9**
	Synonyms and antonyms – Meaning–based classification of sentences – Imperative, positive, negative, interrogative and exclamative; Reading: Passages focusing on factual details, and features of text organization as well as gist, opinions and attitudes; Writing: Note–making. Activities: Listening: Social Conversations; Speaking: Presentation	
Unit – II	**Grammar & Vocabulary:**	**9**
	Homonyms and homophones– Interrogative sentences–Reading: Gapped –text exercises; Writing: Graphic presentation and Transcoding. Activities: Listening: Telephone conversations. Speaking: Role–Play	
Unit – III	**Grammar & Vocabulary:**	**9**
	Articles and determiners– Structure–based classification of sentences – Simple, compound and complex sentences–Reading: Multiple–matching–Writing: Essays. Activities: Listening: Group Discussions–Speaking: Group Discussion	
Unit – IV	**Grammar & Vocabulary:**	**9**
	Prepositions – Active and normal and impersonal passive voice; Reading: BEC (Business English Certificate) type exercises; Writing: Informal reports. Activities: Listening: Motivational Talks–Speaking: Soft skills	
Unit – V	**Grammar & Vocabulary:**	**9**
	Conjunctions and discourse markers and text organization; Reading: IELTS (International English Language Testing System) type exercises– Writing: Reports. Activities: Listening: TED Talks; Speaking: Mock–Interviews	

List of Exercises / Experiments :

1.	Professional Presentation: Preparation , Self–introduction in detail and One–minute self–introduction
2.	Professional Presentation: Delivery , Presentation on a topic
3.	Telephone Etiquette , Role play
4.	Telephone Conversations , Answering Interview Questions
5.	Group Discussion I Participating in a GD (with prior preparation)
6.	Group Discussion II Participating in a GD (without preparation)
7.	Soft Skills I , Speaking on goal–setting, motivation, positive thinking etc.
8.	Soft Skills II Speaking on time and stress management, emotional intelligence, working in teams, conflict resolution, negotiation etc.
9.	Job Interview I , Group Activity–I
10.	Job Interview II , Group Activity–II

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Raymond Murphy, "Intermediate English Grammar: Reference and Practice for South Asian Students Cambridge", 2nd Edition, Cambridge University Press India, New Delhi, 2011.

REFERENCES:

1.	Globarena
2.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	use structural words appropriately in spoken and written texts	Applying (K3)
CO2	construct different types of sentences	Creating (K6)
CO3	practice reading longer academic and business English texts with maximum understanding	Applying (K3)
CO4	construct sentences beyond paragraph level	Creating (K6)
CO5	carry out their professional skills efficiently	Applying (K3)
CO6	understand the videos through effective listening (Presentation, telephone etiquette, Group Discussion and Soft skills)	Understanding (K2), Precision (S3)
CO7	reconstruct the information by their own after effectively listening	Evaluating (K5), Imitation (S1)
CO8	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			1	2	2	2	3						
CO2	1			1	2	3	2	3						
CO3	1			1	2	3	2	3						
CO4	1			1	2	3	2	3					1	1
CO5	1			1	2	3	2	3					1	
CO6	1			1	2	3	2	3						
CO7	1			1	2	3	2	3					1	
CO8	1			1	2	3	2	3					1	1

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 %
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)

18IST21 – NUMERICAL METHODS

Programme & Branch	MSc & SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	BS	3	1	0	4

Preamble	To solve equations of certain types, interpolate polynomials for given data, perform integration and differentiation of numerical data, fitting a best fitting curve to the given data and obtaining numerical solution of ordinary differential equations

Unit – I	Solution of Algebraic and Transcendental Equations:	9+3

Bisection Method – Newton–Raphson Method – Regula Falsi Method. Solution of Simultaneous Linear Equations: Gauss Elimination Method– Gauss Jordan Method– Inverse of a Matrix – Gauss– Jacobi and Gauss– Seidel Iterative Methods

Unit – II	Interpolation:	9+3

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

Unit – III	Numerical Differentiation and Integration:	9+3

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

Unit – IV	Curve Fitting:	9+3

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 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.

Unit – V	Numerical Solution of First Order Ordinary Differential Equations: Single Step Methods	9+3

Tailor Series Method – Euler's Method– Modified Euler's Method – Improved Euler's Method – Runge – Kutta Method of Fourth Order – Multi– Step Method: Milne's Predictor – Corrector Method.

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Kandasamy P., Thilagavathy K. and Gunavathi K., "Numerical Methods", 2nd Edition, S.Chand & Company, New Delhi, Reprint 2012.

REFERENCES:

1.	Sastry S.S., "Introductory Methods of Numerical Analysis", 5th Edition, PHI Learning Pvt. Ltd., New Delhi, 2012.
2.	Jain M.K., Iyenkar S.R.K. and Jain R.K., "Numerical Methods for Scientific and Engineering Computation", 4th Edition, New Age International, New Delhi, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	solve the algebraic and transcendental equations and simultaneous linear equations	Applying (K3)
CO2	perform interpolation, extrapolation for given data	Applying (K3)
CO3	perform numerical differentiation and integration for given data	Applying (K3)
CO4	identify the best fitting curve to the given data	Applying (K3)
CO5	obtain the numerical solution of First order ordinary differential equations	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	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

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	13	13	74				100
CAT2	13	13	74				100
CAT3	13	13	74				100
ESE	4	4	90				98

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

18ISC22 – ADVANCED C PROGRAMMING

Programme & Branch	MSc & SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	2	PC	3	0	2	4

Preamble	To develop in–depth knowledge in C programming	
Unit – I	**Functions:**	**9**
Introduction – Definition – Definition Syntax Function and Function Prototypes – The Return Statement – Types of Functions – Call by Value and Reference – Function Returning More Values – Function with Arrays and Pointers – Recursion – Pointer to Function		
Unit – II	**Pointers:**	**9**
Introduction – Features – Declaration – Arithmetic Operations with Pointers – Pointers and Arrays – Pointers and Two–dimensional Arrays – Array of Pointers – Functions and Pointers – Pointer to Pointer – Pointers and Strings – Void Pointers		
Unit – III	**Structures and Union:**	**9**
Introduction – Features – Definition, Declaration and Initialization of Structure – Structure within Structure – Array of Structures – Pointer to Structure – Structure and Functions – typedef – Enumerated Data Type – Union – Union of Structures		
Unit – IV	**Files:**	**9**
Introduction – Declaring, Opening, Closing and Flushing Files – Character Input and Output – Detecting the End of File (EOF) – Working with Binary Files – Direct File Input and Output – Files of Records: using fscanf(), fprintf, fread() and fwrite()–Random Access to Files of Records		
Unit – V	**Advanced Features:**	**9**
Command Line Arguments – Type Qualifiers: const – volatile – Variable Length Argument List – Storage Classes – Bitwise Operators – Preprocessor Directives – Dynamic Memory Allocation in C: calloc, malloc, realloc and free		

List of Exercises / Experiments :

1.	Programs using Functions
2.	Programs using Recursion
3.	Programs using Pointers and Arrays
4.	Programs using Pointers and Strings
5.	Programs using Structures
6.	Programs using Union
7.	Programs using Sequential Files
8.	Programs using Random Access Files
9.	Programs using Bitwise Operators
10.	Programs using Dynamic Memory Allocation

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Ashok N. Kamthane, "Computer Programming", 2nd Edition Edition, Pearson Education, New Delhi, 2012 for Units I,II,III.
2.	Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, New Delhi, 2009 for Units IV,V.

REFERENCES:

1.	Yashavant Kanetkar, "Let us C", 15th Edition, BPB Publications, New Delhi, 2016.
2.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	use functions to solve the given problems	Applying (K3)
CO2	write simple programs using pointers to access arrays, strings and functions	Applying (K3)
CO3	express the solution for a given problem using structures and union	Applying (K3)
CO4	implement file operations for a given application	Applying (K3)
CO5	demonstrate the usage of advanced features of C	Understanding (K2)
CO6	write C programs using functions, pointers and strings	Applying (K3), Precision (S3)
CO7	develop simple applications using structures, union and files	Applying (K3), Precision (S3)
CO8	demonstrate the usage of bitwise operators and dynamic memory allocation	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
CO4	3	2	1	1									3	3
CO5	2	1											2	2
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

ASSESSMENT PATTERN – THEORY

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	35	50				100
ESE	15	35	50				100

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

18IST22 – COMPUTER ARCHITECTURE

Programme & Branch	MSc & SOFTWARE SYSTEMS	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	PC	3	0	0	3

Preamble	This course outlines the hardware architecture of computer. It also exemplifies the execution of instruction in the computer system

Unit – I	**Basic Structure and Machine Instructions:**	9

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

Unit – II	**Arithmetic Operations:**	9

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

Unit – III	**Basic Processing Unit and Pipelining:**	9

Fundamental Concepts –Execution of a Complete Instruction – Multiple Bus Organization – Hardwired and Micro programmed Control – Pipelining: Basic Concepts –Data and Instruction Hazards

Unit – IV	**Memory Systems:**	9

Basic Concepts – Semiconductor RAM – ROM – Speed Size and Cost – Cache Memories – Performance considerations – Virtual Memories – Memory Management Requirements – Secondary Storage

Unit – V	**Input/Output Organization:**	9

Introduction – Accessing I/O Devices – Interrupts – Direct Memory Access – Buses – Case Study of one RISC and one CISC Processor

Total:45

TEXT BOOK:

1.	Hamacher Carl, Vranesic Zvonko and Zaky Safwat, "Computer Organization", 5th Edition, McGraw Hill, New York, 2016.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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)

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	2
CO2	3	2	1	1									3	3
CO3	2	1											2	2
CO4	2	1											2	2
CO5	2	1											2	2

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 %
CAT1	15	70	15				100
CAT2	20	70	10				100
CAT3	30	70					100
ESE	15	70	15				100

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

18ISC23 – OPERATING SYSTEMS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	2	PC	3	0	2	4

Preamble	To provide background knowledge in operating system and its functionalities. It exemplifies the classical internal algorithms and memory management strategies of operating system.

Unit – I	**Overview and Process:**	**9**

Introduction: Roles of Operating System– Operating System Structure – Operating System Operations. Operating System Structures: Operating System Services – System Calls – Types of System Calls. Processes: Process Concept – Process Scheduling – Operations on Processes – Inter process Communication.

Unit – II	**Threads, Scheduling and Synchronization:**	**9**

Threads: Overview – Multi threading Models – Threading Issues. Process Synchronization: Background – The Critical–Section Problem – Semaphores – Classic Problems of Synchronization. CPU Scheduling: Basic Concepts – Scheduling Criteria – Scheduling Algorithms

Unit – III	**Deadlock and Memory Management:**	**9**

Deadlocks: System Model–Deadlock Characterization–Methods for Handling Deadlocks – Deadlock Prevention – Deadlock Avoidance – Deadlock Detection – Recovery from Deadlock. Main Memory: Background –Swapping – Contiguous Memory Allocation – Segmentation – Paging

Unit – IV	**Virtual Memory and Mass Storage Structure:**	**9**

Virtual Memory: Background–Demand Paging– Page Replacement – Thrashing. Mass Storage Structure: Overview – Disk Structure – Disk Attachment – Disk Scheduling

Unit – V	**File System Interface and Implementation:**	**9**

File System Interface: File Concept – Access Methods – Directory and Disk Structure. File System Implementation: File–System Structure – File–System Implementation – Directory Implementation – Allocation Methods – Free Space Management

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, read, write, search, close directories
5.	Implement producer consumer problem using buffer concept
6.	Implement inter process 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

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, "Operating System Concepts", 9th Edition, John Wiley & Sons, USA, 2014.

REFERENCES:

1.	Andrew S. Tanenbaum and Albert S. Woodhull, "Operating Systems Design and Implementation", 3rd Edition, Pearson Education, New Delhi, 2010.
2.	Harvey M. Deitel, Paul Deitel and David R. Choffnes, "Operating Systems", 3rd Edition, Pearson Education, New Delhi, 2009.
3.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	explain the architecture of operating system and explain its operations.	Understanding (K2)
CO2	illustrate process scheduling algorithms and demonstrate synchronization problems.	Applying (K3)
CO3	execute deadlock handling methods and explain memory management strategies.	Applying (K3)
CO4	solve page replacement and disk scheduling algorithms.	Applying (K3)
CO5	outline the file system concept and its implementation.	Understanding (K2)
CO6	execute basic unix/linux commands and shell programs in unix/linux operating system.	Understanding (K2), Manipulation (S2)
CO7	demonstrate system calls, producer consumer problem and IPC using C.	Applying (K3), Precision (S3)
CO8	perform masterfully 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	2	1											2	2
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	2
CO6	2	1											2	2
CO7	3	2	1	1									3	3
CO8	3	2	1	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 %
CAT1	15	65	20				100
CAT2	15	55	30				100
CAT3	15	65	20				100
ESE	15	50	35				100

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

18VEC11 - VALUE EDUCATION
(Common to All Engineering and Technology Branches)

Programme & Branch	Msc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	1	HS	2	0	1	1

Preamble	The aim of the course is to make the students to understand the purpose and value of life and to exhibit positive human values.

Unit – I	Philosophy of Life Science:	4

Life - Purpose of life (four stages of life) - Philosophy of life (who am I') – Law of nature (cause of the life and body) - Content of the Life (five sheaths) - Goal of life. Five duties in life. Methodology: Life and messages of spiritual and national leaders - The forgotten hero, etc. Project report: Complementing with happiness - Every soul is potentially divine.

Unit - II	Human Values - Moral Foundation:	4

Truth, forgiveness, compassion, endurance, humility, non violence,moderate diet, non stealing, self purification, self discipline, self study, content, cleanliness, honesty, and totality in faith - Good habits - Attitude forming for Individual peace. Practical Methods: Personal experience with above characters, Puranic Stories - Self resolve diary maintenance.

Unit - III	Social Values:	4

Family - Family System - Greatness of women - World brotherhood (vasudeiva kudumbagam) - Glorious Bharath - Bharathian systems - Past-Present-Future - Team spirit - Goal setting - Economics - Education - Politics - Responsibilities of people - Preserving natural resources. Methodology: Preparing an album on glorious Bharath Past, Present and Future Plans. Goal setting - Management Games.Team Spirit - Yogic Games.

Unit - IV	Development of Mental Prosperity:	4

Prosperity of mind - Functions of mind - Obstacles of mind - Practical method to perfect mind is yoga - Types - Uses - Precaution - Contradiction - Kriyas - Asanas - Pranayamas - Meditative techniques. Methodology: Asana - Pranayama - Cyclic meditation - Nada anu sandhana - Meditation - Yogic games for memory. Album on asanas, pranayama and mantra.

Unit - V	Maintenance of Physical Health:	4

Human body - Structure - Ten Systems of the body as per modern science.Five elements - Harmonious relationship - Life force - Conserving vitality and health through natural life -Pranic food and its importance - Uses of herbs - Right way of cooking to preserve nutrients - Cause of the disease - Acute and chronic - Disease - Life and death. Methodology: Natural food making, traditional millet dishes. Asanas, pranayamas, cleansing procedures, Quiz on healthy living, Uses of herbs or kitchen garden.

List of Exercises / Experiments:

1.	List of Loosening Exercises: Neck Movements, Shoulder Joint Movements, Elbow Joint Movement, Wrist Joint Movements, Finger Joint Movements, Rip Joint Movement, Hip Joint Movements, Spinal Cord Movement, Knee Joint Movements, Ankle Joint Movements, Toe Joint Movements.
2.	List of Asanas: Surya Namaskara, Shavasana, Makarasanas, Uttanpadasana, Pawanamuktasana, Sedubandasana, Naukasana, Vipareetakarani, Bhujangasana, Sarpasana, Shalabasana, Dhanurasana, Padmasana,Parvatasana, Vakrasana, Janu Sirashasana, Ustrasana, Yoga Mudra, Meru Tandasana, Tadasana, Katichakrasana, Paadahastasana, Parivarta Trikonasana, Ardha Chakrasana, Viruksasana.
3.	List of Pranayamas: Naadi Sodhana Pranayama, Bhastrika Pranayama, Bhramari Pranayama, Sheetali Pranayama.

Lecture:20, Practical:10, Total:30

TEXT BOOK:

1.	Value Education, "Compiled by Vethathiri Maharishi Institute for Spiritual and Intuitional Education", Aliyar, Pollachi, 2018.

REFERENCES:

1.	Value Education - Yoga Practical Guide, "Compiled by Padmasoorya Naturopathy and Yoga Foundation", Coimbatore, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the purpose and value of life.	Understanding (K2)
CO2	exhibit positive human values.	Understanding (K2)
CO3	understand social values.	Understanding (K2)
CO4	take steps to develop mental and physical health	Applying (K3), Imitation (S1)

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		
CO2						3		3				3		
CO3						3		3				3		
CO4						3		3				3		
CO5														
CO6														
CO7														
CO8														

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 %
CAT1							
CAT2							
CAT3							
ESE	25	75					100

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

18IST31 – PROBABILITY AND STATISTICAL METHODS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	BS	3	1	0	4

Preamble	The Computer science student needs to have basic mathematical tools and techniques to apply in diversified fields. This course aims at giving adequate exposure in Probability, Correlation and regression, Tests of significance, Analysis of variance and Statistical Quality control	
Unit – I	Probability:	9+3
	Basic Terminology – Mathematical Probability– Axiomatic Approach to Probability–Some Theorems on Probability– Addition Theorem on Probability– Conditional Probability– Multiplication Theorem on Probability– Independence of Events– Total Probability– Baye's Theorem–Definition of Random variable	
Unit – II	Correlation and Regression:	9+3
	Definition and Meaning of Correlation– Scatter Diagram– Karl Pearson's Coefficient of Correlation – Rank Correlation– Spearman's Rank Correlation Coefficient– Repeated Ranks– Regression Line of Y on X– Regression Line of X on Y	
Unit – III	Test of Significance for Small Samples:	9+3
	Student's t Test: Test of Significance between the Sample Mean and the Population Mean– Test for Difference Between two Means– F–test for Difference Between two Population Variances– Chi–square Test for Goodness of Fit– Chi–square Test for Independence of Attributes	
Unit – IV	Analysis of Variance:	9+3
	Basic Definitions – Assumptions in Analysis of Variance– One Way Classification– Two way Classification– Randomized Block Design– Completely Randomized Block Design– Latin Square Design	
Unit – V	Statistical Quality Control:	9+3
	Control Charts: Control chart for variables: Mean Chart, R–Chart, Control Charts for attributes: c–Chart, p–Chart and np– chart – Advantages and limitations of Statistical Quality Control	

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Kandasamy P., Thilagavathi K. and Gunavathi K., "Probability and Queueing Theory", Revised Edition, S.Chand & Company Ltd, New Delhi, 2018.

REFERENCES:

1.	Gupta S.C. and Kapoor V.K., "Fundamentals of Mathematical Statistics", 11th Revised Edition, Sultan Chand & Sons, New Delhi, Reprint 2019
2.	Gupta S.P., "Statistical Methods", 45th Revised Edition, Sultan Chand & Sons, New Delhi, Reprint 2018

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of the concept of probability to some real life scenarios	Applying (K3)
CO2	identify the relation between two variables	Applying (K3)
CO3	experiment with test of significance for small samples	Applying (K3)
CO4	examine the variance for one way and two way classification	Analyzing (K4)
CO5	prepare control charts to monitor the production process	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	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

ASSESSMENT PATTERN – THEORY							
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	45	31			100
ESE	4	4	75	17			100

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

18IST32 – OBJECT ORIENTED PROGRAMMING WITH JAVA

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	PC	3	0	0	3

Preamble	To articulate the object–oriented programming concepts in core Java

Unit – I	Introduction:	9

Fundamentals of Object–Oriented Programming: Introduction – Object–Oriented Paradigm – Basic Concepts – Benefits – Applications – Java Evolution: Java Features – How Java Differs from C and C++ – Java and Internet – Java Environment – Overview of Java Language: Simple Java Program – An Application with Two Classes – Java Program Structure – Java Tokens – Implementing a Java Program – Java Virtual Machine – Command Line Arguments – Constants, Variables and Data Types: Constants –Variables – Data Types – Declaration of Variables – Giving Values to Variables – Scope of Variables – Symbolic Constants – Type Casting – Operators and Expressions.

Unit – II	Classes and Inheritance:	9

Decision Making and Branching – Decision Making and Looping – Classes, Objects and Methods: Defining a Class – Fields Declaration – Methods Declaration – Creating Objects – Accessing Class Members – Constructors – Method Overloading – Static Members –Nesting of Methods – Inheritance: Extending a Class – Overriding Methods – Final Variables and Methods – Final Classes – Finalizer Methods – Abstract Methods and Classes – Visibility Control

Unit – III	Arrays, Interfaces and Packages:	9

Arrays – One–dimensional Array – Creating an Array – Two–Dimensional Arrays – Strings – Vectors – Wrapper Classes – Enumerated Types – Interfaces: Defining Interfaces – Extending Interfaces – Implementing Interfaces – Accessing Interface Variables – Packages: Java API Packages – Using System Packages – Naming Conventions –Creating a Package – Accessing a Package – Using a Package – Adding a Class to a Package –Hiding Classes

Unit – IV	Multithreading and Exception Handling:	9

Creating Threads – Extending the Thread Class –Stopping and Blocking a Thread – Life Cycle of a Thread – Using Thread Methods – Thread Exceptions – Thread Priority – Synchronization – Implementing the Runnable Interface – Managing Errors and Exceptions: Types of Errors – Exceptions – Syntax of Exception Handling Code – Multiple Catch Statements – Using Finally Statement – Throwing Our Own Exceptions

Unit – V	Applet Programming and Streams:	9

How Applets Differ from Applications – Preparing to Write Applet – Building Applet Code – Applet Life Cycle – Creating an Executable Applet – Designing a Web Page – Applet Tag – Adding Applet to HTML File – Running the Applet – More About Applet Tag – Passing Parameters to Applets – Managing Input/Output Files in Java: Introduction – Concepts of Streams – Stream Classes – Byte Stream Classes – Character Stream Classes – Using Streams – Using the File Class – Creation of Files – Reading and Writing of Characters – Reading and Writing of Bytes – Random Access Files

Total:45

TEXT BOOK:

1.	Balagurusamy E., "Programming with Java – A Primer", 6th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2019.

REFERENCES:

1.	Deitel and Deitel, "Java How to Program", 11th Edition, Pearson, New Delhi, 2019.
2.	Schildt Herbert, "Java – The Complete Reference", 11th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basic concepts of object oriented programming and Java	Understanding (K2)
CO2	demonstrate the usage of classes, objects and examine how to achieve reusability using inheritance	Applying (K3)
CO3	implementing application development using interfaces and packages	Applying (K3)
CO4	articulate exception handling mechanisms and multithreading	Applying (K3)
CO5	inferring the concepts of streams and simple GUI design using Applet	Understanding (K2)

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	2
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	2
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 %
CAT1	15	35	50				100
CAT2	15	35	50				100
CAT3	15	35	50				100
ESE	15	35	50				100

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

18IST33 – DATA STRUCTURES

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	PC	3	0	0	3

Preamble	To provide an introduction to the basic concepts and techniques of linear and non linear Data Structures, Hashing Techniques	
Unit – I	**Arrays and Stacks:**	**9**
Linear Data Structures and their Sequential Storage Representation – Concepts and Terminology for Nonprimitive Data Structures – Storage Structures for Arrays – Stacks – Operations on Stacks – Application: Recursion – Conversion of Infix Expressions to Polish Notation		
Unit – II	**Queues and Linked List:**	**9**
Queues – Operations – Circular Queue – Priority Queue – Application: Simulation – Linear Data Structures and their Linked Storage Representation – Pointers and Linked Allocation – Linked Linear Lists – Operations – Circularly Linked Linear Lists – Doubly Linked Linear Lists – Applications: Polynomial Manipulation		
Unit – III	**Trees:**	**9**
General trees – Terminology – Representation of trees – Tree traversal – Binary tree – Representation – Expression tree – Binary tree traversal – Binary Search Tree: Construction – Searching – Insertion – Deletion – Find Min – Find Max – AVL trees: Rotation – Insertion – Deletion		
Unit – IV	**Graphs:**	**9**
Graphs and their Representations – Matrix Representation of Graphs – List Structures – Other Representation of Graphs – Breadth First Search – Depth First Search – Spanning Trees – Application: PERT		
Unit – V	**Advanced trees and Hashing:**	**9**
B–Trees–insertion–deletion, Splay trees, Red–Black Trees–Rotation–Insertion– Deletion – Hashing: Hash Functions – Separate Chaining – Open Addressing: Linear Probing – Quadratic Probing–Double Hashing – Rehashing – Extendible Hashing		

Total:45

TEXT BOOK:

1.	Jean Paul Tremblay and Paul G. Sorensen, "An Introduction to Data Structures with Applications", 2nd Edition, Tata McGraw Hill, New Delhi, 2017 for Units I,II,IV.
2.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education, New York, 2016 for Units III,V.

REFERENCES:

1.	Balagurusamy E., "Computer Programming and Data Structures", 3rd Edition, Tata McGraw–Hill, New Delhi, 2012.
2.	Reema Thareja, "Data Structures Using C", 2nd Edition, Oxford University Press, New Delhi, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	execute stack operations using array.	Applying (K3)
CO2	practice linked list programs and use queue concepts in real world scenario.	Applying (K3)
CO3	experiment tree operations.	Applying (K3)
CO4	implement graph traversal algorithms.	Applying (K3)
CO5	implement the operations of special trees and Hashing Techniques.	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	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

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	26	54				100
CAT2	15	25	60				100
CAT3	13	22	65				100
ESE	15	20	65				100

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

18IST34 – COMPUTER NETWORKS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	PC	3	1	0	4

Preamble	This course focuses on physical structure of networks, functions and applications of TCP/IP and OSI models and protocols for communication	
Unit – I	**Introduction:**	**9+3**
	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	
Unit – II	**Data Link Layer:**	**9+3**
	Introduction – Link–Layer Addressing – DLC Services – Data Link Layer Protocols – HDLC – PPP – Media Access Control – Random Access – Controlled Access – Channelization – Wired LANs: Ethernet	
Unit – III	**Network Layer:**	**9+3**
	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	
Unit – IV	**Transport Layer:**	**9+3**
	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	
Unit – V	**Application Layer:**	**9+3**
	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", 5th Edition, McGraw Hill, New Delhi, 2013.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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	identify the protocols for connectionless and connection oriented communication	Applying (K3)
CO5	express the features and operations of various application layer protocols	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	2	1											2	2
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

ASSESSMENT PATTERN – THEORY

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	15	30	55				100

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

18IST35 – DATABASE MANAGEMENT SYSTEMS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	PC	3	0	0	3

Preamble	To focus on database fundamentals, database designing and implementation of queries	
Unit – I	**Introduction:**	**9**
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		
Unit – II	**Introduction to SQL:**	**9**
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		
Unit – III	**ER Modeling and Relational Database Design:**	**9**
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 – Database Design Process		
Unit – IV	**Data Storage:**	**9**
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		
Unit – V	**Transaction Management:**	**9**
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", 6th Edition, Mc Graw Hill, New Delhi, 2013.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline relational database concepts	Understanding (K2)
CO2	implement SQL Queries	Applying (K3)
CO3	employ entity relationship modeling and normalization techniques during database design	Applying (K3)
CO4	explain indexing methods	Understanding (K2)
CO5	employ concurrency aspects in transactions	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	2	1											2	2
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	2
CO5	3	2	1	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 %
CAT1	20	40	40				100
CAT2	15	35	50				100
CAT3	20	50	30				100
ESE	20	35	45				100

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

18ISL31 – OBJECT ORIENTED PROGRAMMING WITH JAVA LABORATORY

Programme & Branch	MSc & Software Systems		Sem.	Category	L	T	P	Credit
Prerequisites	NIL		3	PC	0	0	2	1
Preamble								

List of Exercises / Experiments :

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

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	execute simple Java applications using classes and objects	Applying (K3), Precision (S3)
CO2	demonstrate the execution of Java programs using constructors, method overloading and inheritance	Applying (K3), Precision (S3)
CO3	Demonstrate interfaces, packages, multithreading and exception handling mechanisms for robust efficient application development	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														

18ISL32 – DATA STRUCTURES LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	PC	0	0	2	1
Preamble							

List of Exercises / Experiments :

1.	Program to implement stack operations
2.	Application of stack – infix to postfix expression
3.	Program to implement queue operations
4.	Program to implement circular queue operations
5.	Program to implement singly linked list operations
6.	Program to implement binary tree traversal
7.	Program to implement AVL tree operations
8.	Program to implement graph traversal.
9.	Program to implement Red black tree operations.
10.	Program to implement Hash tables.

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	execute simple applications using linear data structures.	Applying (K3), Manipulation (S2)
CO2	implement tree and graph algorithms.	Applying (K3), Manipulation (S2)
CO3	execute various Hashing techniques.	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														

18ISL33 – DATABASE MANAGEMENT SYSTEMS LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	3	PC	0	0	2	1
Preamble							

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:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer creation of tables with key constraints	Understanding (K2), 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														
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1											2	2
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy														

18IST41 – ADVANCED JAVA PROGRAMMING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	**Object Oriented Programming with Java**	4	PC	3	0	0	3

Preamble	To apply utility classes and develop web applications using servlet and JSP	
Unit – I	**Java Collections:**	**9**
Introduction – The Collection Interfaces – The Collection Classes – Iterator – Storing User–Defined classes in Collections – The Random Access Interface – Maps – Comparators – Collection Algorithms – Arrays – Generic Collections		
Unit – II	**Introduction to Servlet Programming:**	**9**
Introduction – Servlet – JSP Architecture – HTTP Requests – HTTP Responses – Servlet API Overview – Basic Servlet Application – Generic Servlet – HTTP Servlet – HTML Forms – Deployment Descriptor		
Unit – III	**Session, Cookies and Database Connection:**	**9**
URL Rewriting – Hidden Fields – Cookies – HTTPSession Objects – Authentication – Authorization – Secure Socket Layer (SSL) – Programmatic Security		
Unit – IV	**Introduction to Java Server Programming:**	**9**
JSP Overview – Comments – Implicit Objects – Directives – Scripting Elements – Actions – Expression Languages		
Unit – V	**Java Standard Template Library:**	**9**
Downloading JSTL –JSTL Libraries – General Purpose Actions – Conditional Actions – Iterator Actions – Formatting Actions – Function – Custom Tag –Database Connections		

Total:45

TEXT BOOK:

1.	Herbert Schildt, "Java: The Complete Reference Title", 11th Edition, McGraw–Hill, New Delhi, 2019 for Units I.
2.	Budi Kurniawan, "Servlet & JSP: A Tutorial", 2nd edition, Brainy Software, New York, 2015 for Units II,III,IV,V.

REFERENCES:

1.	Hunter Jason and Crawford William, "Java Servlet Programming", 2nd Edition, Shroff Publishers and Distributors, New Delhi, 2004.
2.	Hanna, Phil, "JSP2.0: Complete Reference", 2nd Edition, Tata McGraw–Hill, New Delhi, 2005.
3.	https://docs.oracle.com/javase/tutorial/

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the collection class for solving the problems.	Applying (K3)
CO2	interpret the servlet API's and programming basics.	Understanding (K2)
CO3	develop web application using servlet for the given problem.	Applying (K3)
CO4	use the expression and scriplets in JSP script.	Applying (K3)
CO5	integrate java server pages with database.	Analyzing (K4)

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	2	1											2	2
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	3	3	2	2	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 %
CAT1	20	30	50				100
CAT2	20	30	50				100
CAT3	20	20	40	20			100
ESE	20	30	40	10			100

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

18IST42 – WEB TECHNOLOGY

Programme & Branch	MSc & Software Systems		Sem.	Category	L	T	P	Credit
Prerequisites	NIL		4	PC	3	0	0	3

Preamble	This course provide in–depth knowledge in web designing

Unit – I	**Introduction to Internet and HTML:**	**9**

Evolution of the Internet and World Wide Web– Web Basics – Multitier Application Architecture – Client–Side Scripting versus Server–Side Scripting – Introduction to HTML5: Headings – Linking – Images –Lists – Tables– Forms – Internal Linking – Meta Elements

Unit – II	**CSS and Java script:**	**9**

Introduction to Cascading Style Sheets – Inline Styles – Embedded Style Sheets – Linking External Style Sheets – Positioning Elements. Java Script : Introduction to Scripting – Control Statements I : if Selection Statement – if/else Selection Statement – while Repetition Statement – Control Statements II :for Repetition Statement – switch Multiple–Selection Statement – do/while Repetition Statement – break and continue Statements – Logical Operators

Unit – III	**Java script Functions, Array:**	**9**

Java script Functions: Introduction – Function Definitions – Scope Rules – JavaScript Global Functions – Recursion – Recursion vs. Iteration. Java Script Arrays

Unit – IV	**Java script Object and DOM:**	**9**

Java script Object – Document Object Model (DOM) Objects and Collections:Modeling a Document: DOM Nodes and Trees – Traversing and Modifying a DOM Tree – DOM Collections – Dynamic Styles

Unit – V	**XML:**	**9**

Introduction – XML Basics – Structuring Data – XML Namespaces – Document Type Definitions (DTDs) – XML Schema Documents – XML Vocabularies – Extensible Stylesheet Language and XSL Transformations

Total:45

TEXT BOOK:

1.	Paul Deitel, Harvey Deitel and Abbey Deitel, "Internet and World Wide Web – How To Program", 5th Edition, Pearson Education, New Delhi, 2012.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	develop interactive web pages using HTML tags.	Applying (K3)
CO2	implement java script control structures.	Applying (K3)
CO3	experiment with java script functions and arrays.	Applying (K3)
CO4	outline Document Object Model and java script object.	Understanding (K2)
CO5	interpret well–formed XML documents.	Understanding (K2)

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
CO4	2	1											2	2
CO5	2	1											2	2

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 %
CAT1	15	35	50				100
CAT2	15	35	50				100
CAT3	30	70					100
ESE	15	45	40				100

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

18IST43 – DESIGN AND ANALYSIS OF ALGORITHMS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	PC	3	0	0	3

Preamble	The course aims to construct efficient algorithms for solving engineering problems by using appropriate algorithm design paradigms and data structures	
Unit – I	**Introduction, Divide and Conquer:**	**9**
Introduction: Algorithm Specification – Performance Analysis –Divide and Conquer: General Method – Binary Search – Finding the Maximum and Minimum – Merge Sort – Quick Sort		
Unit – II	**The Greedy Method:**	**9**
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		
Unit – III	**Dynamic Programming:**	**9**
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		
Unit – IV	**Backtracking:**	**9**
The General Method – The 8–Queens Problem – Sum of Subsets – Graph Coloring – Hamiltonian Cycles – Knapsack Problem		
Unit – V	**Branch–and–Bound, NP–Hard and NP–Complete Problems:**	**9**
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", 2nd Edition, Galgotia Publications, Hyderabad, 2011.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe the efficiency of algorithms using asymptotic complexity	Understanding (K2)
CO2	use greedy techniques for a given problem	Applying (K3)
CO3	solve algorithms 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)

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	2
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														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	65	10				100
CAT2	20	45	35				100
CAT3	20	40	40				100
ESE	15	45	40				100

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

18IST44 – PRINCIPLES OF COMPILER DESIGN

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	PC	3	1	0	4

Preamble	This course imparts programming language translation and compiler design concepts	
Unit – I	**Basics of Compilers:**	**9+3**
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		
Unit – II	**Syntax Analysis:**	**9+3**
Introduction– Context–Free Grammars– Writing a Grammar– Top–Down Parsing– Bottom–Up parsing. Introduction to LR Parsing: Simple LR – More Powerful LR Parsers		
Unit – III	**Intermediate Code Generation:**	**9+3**
Three Address Code– Types and Declarations– Translation of Expressions– Control Flow– Back patching–Switch Statements– Procedure calls		
Unit – IV	**Machine –Independent Optimizations:**	**9+3**
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		
Unit – V	**Code Generation:**	**9+3**
Issues in the design of a code generation – The target Language – Addresses in the Target code – A simple code Generator– Register allocation and assignment		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", 2nd Edition, Pearson Education, New Delhi, 2014.

REFERENCES:

1.	Srikant Y.N. and Priti Shankar, "The Compiler Design Handbook: Optimizations and Machine Code Generation", 2nd Edition, CRC Press, New York, 2007.
2.	Keith Cooper and Linda Torczon, "Engineering a Compiler", 2nd Edition, Morgan Kauffman Publishers, New York, 2004.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	make use of regular expression to perform lexical analysis for the given source program.	Applying (K3)
CO2	design a syntax–analysis tool 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)

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
CO4	2	1											2	2
CO5	2	1											2	2
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 %
CAT1	15	35	50				100
CAT2	15	35	50				100
CAT3	30	70					100
ESE	15	50	35				100

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

18IST45 – SOFTWARE ENGINEERING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	PC	3	0	0	3

Preamble	To determine specific software process model and also to gather requirements, design, implement and test the software to a real world problem

Unit – I	Process Models:	9

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

Unit – II	Requirements Engineering and Modeling:	9

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

Unit – III	Design Concepts and Architectural Design:	9

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

Unit – IV	Software Testing Strategies:	9

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

Unit – V	Software Configuration Management:	9

SCM repository – SCM process – Re– engineering – Business process Reengineering – Software reengineering – Reverse engineering – Restructuring – Forward engineering – Economics of reengineering

Total:45

TEXT BOOK:

1.	Roger S.Pressman, Bruce R Maxim , "Software Engineering – A Practitioner's Approach", 8th Edition, Tata McGraw–Hill, New Delhi, 2019.

REFERENCES:

1.	Sommerville, Ian, "Software Engineering", 10th Edition, Pearson Education, New Delhi, 2017.
2.	Rajib Mall, "Fundamentals of Software Engineering", 5th Edition, Prentice Hall of India, New Delhi, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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)

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	2
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	2

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 %
CAT1	25	45	30				100
CAT2	15	45	40				100
CAT3	25	45	30				100
ESE	15	45	40				100

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

18ISL41 – ADVANCED JAVA PROGRAMMING LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Object Oriented Programming with Java Laboratory	4	PC	0	0	2	1
Preamble							

List of Exercises / Experiments :

1.	Program to illustrate collection class
2.	Develop a java program using Iterator
3.	Develop a java program using Maps
4.	Programs to illustrate comparator
5.	Program to illustrate Arrays
6.	Develop programs using servlet
7.	Program to illustrate session and cookie using servlet
8.	Develop an servlet application with database
9.	Program to illustrate script and scriplets in JSP
10.	Develop a program using JSP and database connection

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	https://docs.oracle.com/javase/tutorial
2.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate utility classes for applications.	Applying (K3), Precision (S3)
CO2	calibrate web applications using servlet, cookie and session	Applying (K3), Precision (S3)
CO3	demonstrate applications using java server pages 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														

18ISL42 – WEB TECHNOLOGY LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	4	PC	0	0	2	1
Preamble							

List of Exercises / Experiments :

1.	Develop a HTML document using the following tags: Heading, Anchor, Link, Paragraph and Image
2.	Create a HTML web page using Lists
3.	Create a web page using Table tag
4.	Design a Web page using Frame and Frameset element
5.	Design a web form using HTML controls.
6.	Design a web page with menu layout. Apply the various formatting using CSS
7.	Develop a web form with simple java script.
8.	Create a form and validate using java Script
9.	Design a web form using java script and DOM
10.	Create a DTD for XML style sheet.

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate basic website designing using HTML5 and CSS	Applying (K3), Precision (S3)
CO2	perform masterfully HTML form validation using Java script	Applying (K3), Precision (S3)
CO3	build XML document for the given application.	Understanding (K2), 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	2	1											2	2
1 – Slight, 2 – Moderate, 3 – Substantial, BT– Bloom's Taxonomy														

18ISL43 – DESIGN AND ANALYSIS OF ALGORITHMS LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Data Structures Laboratory	4	PC	0	0	2	1

List of Exercises / Experiments :

1.	Writing programs for measuring Time complexity
2.	Implement Binary Search Algorithm using Divide and Conquer
3.	Implement 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 Travelling Salesman Problem using Dynamic Programming
8.	Solve8–Queens Problem using Backtracking
9.	Implement Sum of Subsets Problem using Backtracking
10.	Solve15–Puzzle Algorithms using Branch and Bound

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	implement algorithms using Divide and Conquer	Applying (K3), Manipulation (S2)
CO2	interpret algorithms using Greedy Method and Dynamic Programming	Applying (K3), Manipulation (S2)
CO3	solve problems using Back Tracking 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														

18IST51 – PYTHON PROGRAMMING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	5	PC	3	0	0	3
Preamble							

Preamble	To apply concepts of python to solve the real world problem.	
Unit – I	**Data Types:**	**9**
	Identifiers and Keywords – Integral Types – Floating–Point Types – Strings – Sequence Types – Set Types – Mapping Types – Iterating and Copying Collections	
Unit – II	**Control Structures, Functions and Libraries:**	**9**
	Control Structures – Exception Handling – Custom Functions – Modules and Packages – Overview of Python's Standard Library	
Unit – III	**Object Oriented Programming and File Handling:**	**9**
	The Object–Oriented Approach – Custom Classes – Custom Collection Classes – Writing and Reading Binary Data – Writing and Parsing Text Files – Writing and Parsing XML Files – Random Access Binary Files	
Unit – IV	**Advanced Programming Techniques:**	**9**
	Further Procedural Programming – Further Object Oriented Programming – Functional–Style Programming	
Unit – V	**Thread, Database and Regular Expressions:**	**9**
	Using Multiprocessing Module – Using Threading Module – DBM Databases – SQL Databases – Python's Regular Expression Language – The Regular Expression Module	

Total:45

TEXT BOOK:

1.	Mark Summerfield, "Programming in Python 3", 2nd Edition, Pearson Education, New Delhi, 2018.

REFERENCES:

1.	Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education, New Delhi, 2018.
2.	https://docs.python.org/tutorial

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the data types in python.	Understanding (K2)
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	explore set, dictionary and functions to solve real world problems.	Applying (K3)
CO5	examine the threading, regular expression and database.	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	2	1											2	2
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

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	30	50	20				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)

18IST52 – DATA MINING TECHNIQUES

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Database Management Systems	5	PC	3	0	0	3

Preamble	To articulate the data Mining and data warehousing concepts and implement the various algorithmic techniques of data Mining

Unit – I	Data Mining – Introduction and Data Warehousing:	9

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

Unit – II	Data Preprocessing:	9

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

Unit – III	Association Rule Mining:	9

Mining Frequent Patterns, Associations and Correlations: Frequent Itemset Mining Methods – Pattern Evaluation Methods – Pattern Mining in Multilevel, Multidimensional Space – Constraint–Based Frequent Pattern Mining

Unit – IV	Classification:	9

Decision Tree Induction – Bayes Classification Methods – Rule–Based Classification – Model Evaluation and Selection – Techniques to improve Classification Accuracy – Bayesian Belief Networks – Classification by Backpropagation

Unit – V	Clusters Analysis:	9

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 and Jian Pei, "Data Mining Concepts and Techniques", 3rd Edition, Elsevier, 2016.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basic concepts of data Mining and data warehousing	Understanding (K2)
CO2	implement the various preprocessing techniques	Applying (K3)
CO3	articulate frequent itemsets in association rule Mining	Applying (K3)
CO4	apply the various classification methods	Applying (K3)
CO5	demonstrate the clustering methods	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	2	1											2	2
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														

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

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

18IST53 – SOFTWARE TESTING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PC	3	0	0	3

Preamble	This course aims to design test cases using Black box and White box testing strategies and understand test metrics and measurements	
Unit – I	White Box and Black Box Testing:	9
White Box Testing: 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 – Boundary Value Analysis – Decision tables – Equivalence Class Partitioning – State–based testing –Compatibility testing – User documentation testing		
Unit – II	Integration, System and Acceptance Testing:	9
Integration Testing: 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		
Unit – III	Performance and Regression Testing:	9
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		
Unit – IV	Ad Hoc, Usability and Accessibility Testing:	9
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		
Unit – V	Test Planning, Management, Execution and Reporting:	9
Introduction – Test Planning – Test Management – Test Process – Test Reporting – Best Practices –Process – People – Technology–Selecting a testing tool		

Total:45

TEXT BOOK:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing: Principles and Practices", 1st Edition, Pearson Education, New Delhi, 2016.

REFERENCES:

1. Renu Rajani and Pradeep Oak, "Software Testing Effective Methods, Tools and Techniques", Tata McGraw–Hill, New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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	interpret the tools for Performance and Regression testing	Applying (K3)
CO4	infer the Ad Hoc, Usability and Accessibility testing strategies	Understanding (K2)
CO5	prepare Test plan based on the document	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	2	1											2	2
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	2
CO5	3	2	1	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 %
CAT1	25	65	10				100
CAT2	25	40	35				100
CAT3	20	40	40				100
ESE	20	40	40				100

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

18IST54 – MOBILE COMMUNICATIONS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	5	PC	3	0	0	3

Preamble	To study the specifications and functionalities of various protocols/standards of mobile networks	
Unit – I	Wireless Communication Fundamentals:	9

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

Unit – II	Telecommunications Systems:	9

GSM: Mobile Services – System Architecture – Protocols – Localization and Calling – Handover – Security – New data Services– Satellite Systems: Basics – Routing – Localization–Handover

Unit – III	Wireless Networks:	9

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

Unit – IV	Mobile Network Layer: Mobile IP:	9

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

Unit – V	Mobile Transport Layer:	9

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

Total:45

TEXT BOOK:

1.	Jochen H Schiller, "Mobile Communications", 2nd Edition, Pearson Education, New Delhi, 2016.

REFERENCES:

1.	Raj Kamal, "Mobile Computing", 2nd Edition, Oxford University Press, New Delhi, 2013.
2.	Asoke K Talukder, "Mobile Computing: Technology Applications and Service Creation", 2nd Edition, Mcgraw–Hill Education (India) Private Limited, New York, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline all mechanisms that control user access to a medium.	Understanding (K2)
CO2	discuss 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 traffic and increase TCP's performance in wireless and mobile environments by applying appropriate mechanisms.	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	2	1											2	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
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)

18ISL51 – PYTHON PROGRAMMING LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Problem Solving and Programming	5	PC	0	0	4	2
Preamble							

List of Exercises / Experiments :

1.	Program to illustrate String Manipulation, List, Tuple, Set, Dictionary
2.	Develop a python program on control structures
3.	Develop a python program on exception handling
4.	Programs to illustrate functions
5.	Program to illustrate class an d object
6.	Develop programs using polymorphism
7.	Program to illustrate reading and writing content from text, binary and XML files
8.	Develop an python application with database
9.	Program to illustrate thread module in python
10.	Develop a program using regular expression

Total:60

REFERENCES/MANUAL/SOFTWARE:

1.	https://docs.python.org/tutorial
2.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
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														

18ISL52 – DATA MINING TECHNIQUES LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Database Management Systems	5	PC	0	0	4	2
Preamble							

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 itemset using Apriori algorithm
5.	Find the strong association rule for the frequent itemset 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.	www.uci.edu
2.	www.kaggle.com
3.	WEKA / R Programming / Python
4.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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														

18ISL53 – SOFTWARE TESTING LABORATORY

Programme & Branch	MSc & Software Systems		Sem.	Category	L	T	P	Credit
Prerequisites	NIL		5	PC	0	0	2	1
Preamble								

List of Exercises / Experiments :

1.	Execute commands for recording the test a) Analog recording b) Context sensitive recording c) Record the test using Selenium
2.	a) Write a program for Spying on GUI objects b) Write a program for Checking on GUI objects
3.	a) Create a database checklist for default database and test it b) Create a database checklist for user database and test it
4.	Test the bitmap objects a) Create data driven test b) Testing html form using Selenium
5.	Testing xml using Selenium
6.	Write a program for testing script using Win runner
7.	Write a program for synchronizing test
8.	Write a program for test expression and analyze it
9.	Write a program for maintaining test script
10.	a)Create user defined function b) Creating test suite for 2 web pages using Selenium

Total:30

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	Sketch recording of tests	Applying (K3), Manipulation (S2)
CO2	Construct a test suite to meet the given adequacy criteria	Applying (K3), Manipulation (S2)
CO3	Develop scripts to automate the testing of a given software using appropriate testing tools	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														

18GEL51 - PROFESSIONAL SKILLS TRAINING I
(For all BE/ BTech / MSc /MCA /BSc Branches)

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	EC	0	0	80	2

Preamble	This subject is to enhance the employability skills and to develop career competency	
Unit - I	Soft Skills – I:	20

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.

Unit - II	Quantitative Aptitude & Logical Reasoning – I:	30

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

Unit - III	Written Communication & Verbal Aptitude:	30

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 Errors – 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", 6th Edition, Pearson India Education Services Pvt Ltd, 2017.

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". 3rd Edition, Oxford University Press, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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)

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				3	3		3		3	2		
CO2	3	2				3	3		3		3	2		
CO3		2				3	3		3	3	3	2		

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 %
CAT1	20	50	30				100
CAT2		50	50				100
CAT3		50	50				100
ESE							

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

18IST61 – OPEN SOURCE SYSTEMS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Web Technology	6	PC	3	0	0	3

Preamble	To design web applications using PHP and MySQL	
Unit – I	**Basics of PHP:**	9
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		
Unit – II	**String Handling and Arrays:**	9
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		
Unit – III	**Object–Oriented PHP:**	9
Object Oriented Programming – Basics PHP constructs for OOP – Advanced OOP features – Introspection Functions – OOP Style in PHP		
Unit – IV	**Regular Expressions, Session and Cookies:**	9
Transformation of Arrays – Stacks and Queues – Translating between Variables and Arrays – Sorting – Printing Functions for Visualizing Arrays – Tokenizing and Parsing Functions – Regular Expressions – Advanced String Functions – Session – Session in PHP – Session Functions – Cookies		
Unit – V	**Database Connectivity – MySQL:**	9
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		

Total:45

TEXT BOOK:

1.	Steve Suehring, Tim Converse and Joyce Park, "PHP 6 and MySQL", 2nd Edition, Wiley Publication, New Delhi, 2017.

REFERENCES:

1.	Larry Ullman, "PHP and MySQL for Dynamic Web Sites", 5thEdition, Peachpit Press, San Francisco, 2017.
2.	Welling, Luke, "PHP and MYSQL Web Development", 5th Edition, Addison–Wesley Professional, USA, 2016.
3.	http://www.w3schools.com/php

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the data types, looping structures, branching structures and functions.	Understanding (K2)
CO2	apply string functions, arrays, mathematical operators 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)

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	2
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

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	45	35				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)

18IST62 – CRYPTOGRAPHY AND NETWORK SECURITY

Programme & Branch	MSc & Software Systems		Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks		6	PC	3	1	0	4

Preamble	This course aims to obtain knowledge on security mechanisms and security breaches	
Unit – I	**Introduction:**	**9+3**
OSI Security Architecture – Attacks – Services – Mechanisms – Model for Network Security – Symmetric Cipher Model – Substitution and Transposition Techniques – DES – Strengths – Block Cipher Design Principles		
Unit – II	**Public Key Cryptography:**	**9+3**
Advanced Encryption Standard – Principles of Public Key Crypto Systems – RSA Algorithm – Diffie Hellman Key Exchange – Elgamal – Elliptic Curve Arithmetic, Cryptography		
Unit – III	**Hash Functions:**	**9+3**
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		
Unit – IV	**Key Management and Distribution:**	**9+3**
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		
Unit – V	**Network Security Practice:**	**9+3**
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		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Stallings William, "Cryptography and Network Security: Principles and Practice", 7th Edition, Pearson Education, New York, 2017.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	employ the methods of conventional encryption	Applying (K3)
CO2	articulate various public key cryptography mechanisms	Applying (K3)
CO3	use authentication mechanisms and hash functions	Applying (K3)
CO4	make use of the various schemes for key distribution among communication parties	Applying (K3)
CO5	infer security threats and countermeasures	Understanding (K2)

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
CO4	3	2	1	1									3	3
CO5	2	1											2	2

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 %
CAT1	20	30	50				100
CAT2	20	30	50				100
CAT3	30	40	30				100
ESE	20	30	50				100

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

18IST63 – OBJECT ORIENTED SYSTEM DESIGN

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	6	PC	3	0	0	3

Preamble	Understand the importance and basic concepts of object oriented analysis and design through Unified Modeling Language	
Unit – I	**Object Basics:**	**9**
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		
Unit – II	**Object–Oriented Methodologies:**	**9**
Object-Oriented Methodologies: Rumbaugh Object Modeling Technique – The Booch Methodology – The Jacobson Methodologies – Patterns – Frameworks – The Unified Approach		
Unit – III	**Unified Modeling Language:**	**9**
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		
Unit – IV	**Object Oriented Analysis:**	**9**
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		
Unit – V	**Object Oriented Design:**	**9**
Object Oriented Design Process and Design Axioms– Object Oriented Design Process– Object Oriented Design Axioms– Corollaries – Design Patterns – Designing Classes – Case Study		

Total:45

TEXT BOOK:

1.	Ali Bahrami, "Object Oriented System Development", McGraw Hill International Edition, McGraw Hill , New Delhi, 2017.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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 problems	Understanding (K2)
CO5	outline the Object–Oriented Design axioms and corollaries	Understanding (K2)

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	2
CO2	2	1											2	2
CO3	3	2	1	1									3	3
CO4	2	1											2	2
CO5	2	1											2	2

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 %
CAT1	30	70					100
CAT2	30	50	20				100
CAT3	30	70					100
ESE	20	60	20				100

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

18IST64 – SOFTWARE PROJECT MANAGEMENT

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	6	PC	3	0	0	3

Preamble	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

Unit – I	Introduction to Software Project Management:	9

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

Unit – II	Project Evaluation & Software Project Estimation:	9

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 for 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

Unit – III	Activity Planning and Risk Management:	9

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-PERT Techniques.

Unit – IV	Resource Allocation:	9

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 Analysis–Prioritizing Monitoring –Getting Project Back to Target –Change Control

Unit – V	Managing Contracts and People, Organizing Teams:	9

Introduction –Types of Contract –Stages in Contract Placement –Typical Terms of a Contract –Contract Management –Acceptance–Managing People and Organizing Teams: Introduction–Understanding Behavior–Selecting The Right Person for the Job–Instruction in the Best Methods–Motivation–The Oldham–Hackman Job Characteristics Model–Stress–Health and Safety.

Total:45

TEXT BOOK:

1.	Bob Hughes, Mike Cotterell and Rajib Mall, "Software Project Management", 6th Edition, Tata McGraw Hill, New Delhi, 2017.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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)

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	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
CAT1	20	80					100
CAT2	20	35	45				100
CAT3	15	40	45				100
ESE	15	50	35				100

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

18ISP61 – MINI PROJECT

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	6	EC	0	0	4	2

Total:60

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

18ISL61 – CASE TOOLS LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	6	PC	0	0	4	2
Preamble							

List of Exercises / Experiments :

1.	Define the problem statement and develop a SRS document
2.	Identify the business activities and develop business use case model
3.	Identify Use Cases and develop Use Case Model (System use case diagram and UML activity diagram).
4.	Draw Sequence and Collaboration diagram
5.	Identify the classes (boundary, controller and entity classes) with UML class diagram
6.	Using the identified scenarios find the interaction between objects and represent them using UML Interaction diagrams
7.	Draw the State Chart Diagram
8.	Identify the User Interface and domain objects. Draw the UML package diagram.
9.	Draw Component and Deployment diagrams.
10.	Code Generation using UML Class diagram

Total:60

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	develop SRS document	Applying (K3), Manipulation (S2)
CO2	execute business use case model	Applying (K3), Manipulation (S2)
CO3	demonstrate various UML diagrams	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														

18GEL61 - PROFESSIONAL SKILLS TRAINING II
(For all BE/ BTech / MSc /MCA /BSc Branches)

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	EC	0	0	80	2

Preamble	This subject is to enhance the employability skills and to develop career competency	
Unit - I	**Soft Skills – II**:	**20**

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.

Unit - II	**Quantitative Aptitude & Logical Reasoning – II:**	**30**

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.

Unit - III	**Reading & Speaking Skills:**	**30**

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", 6th Edition, Pearson India Education Services Pvt Ltd, 2017.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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)

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				3	3		3		3	2		
CO2	3	2				3	3		3		3	2		
CO3		2				3	3		3	3	3	2		

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 %
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)

18ISP71 – PROJECT WORK I

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	7	EC	0	0	30	15

Total:450

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

18IST81 – CLOUD COMPUTING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks, Operating Systems	8	PC	3	0	0	3

Preamble	Cloud computing is a scalable services consumption and delivery platform that provides on-demand computing service for shared pool of resources, namely servers, storage, networking, software, database, applications etc., over the Internet. This course will introduce various aspects of cloud computing, including fundamentals, management issues, security challenges and future research trends

Unit – I	Distributed System Models:	9

Scalable Computing - Network Based Systems - System Models and Software Environment for Distributed and Cloud Computing – Performance - Security and Energy Efficiency

Unit – II	Virtualization:	9

Implementation Levels of Virtualization - Virtualization Structures/Tools and Mechanisms – CPU, Memory, I/O devices Virtualization - Virtual Clusters and Resource Management - Virtualization for Data- Center Automation.

Unit – III	Cloud Platform Architecture over Virtualized Data Centers:	9

Cloud Computing Service Models, Data-Center Design and Interconnection Networks, Architectural Design of Compute and Storage Clouds, Public Cloud Platforms : Google App Engine, AWS, Azure, Inter - cloud Resource Management, Cloud Security and Trust Management.

Unit – IV	Service-Oriented Architectures for Distributed Computing:	9

Services and Service-Oriented Architecture - Message-Oriented Middleware - Portals and Science Gateways – Discovery, Registries, Metadata and Databases - Workflow in Service-Oriented Architectures.

Unit – V	Cloud Programming and Software Environments:	9

Features of Cloud and Grid Platforms - Parallel and Distributed Programming Paradigms - Programming Support: Google App Engine - Amazon AWS and Microsoft Azure - Cloud Frameworks: Eucalyptus – Nimbus – OpenNebula - Sector/ Sphere – OpenStack - Manjrasoft Aneka Cloud and Appliances.

Total:45

TEXT BOOK:

1.	Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things",1st Edition, Morgan Kaufmann Publishers,USA, Reprint 2017.

REFERENCES:

1.	Thomas Erl, Zaigham Mahood, Richard Puttini, "Cloud Computing, Concept, Technology and Architecture", Prentice Hall, USA 2013.
2.	Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, "Cloud Computing: Principles and Paradigms", 1st Edition, A John Wiley & Sons, Ltd., Publication, New Delhi,2013.

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1: explain the concepts, characteristics and benefits of distributed system models	Understanding (K2)
CO2: describe the importance of virtualization along with their technologies.	Understanding (K2)
CO3: use and examine different cloud computing services.	Applying(K3)
CO4: describe a general workflow approach illustrating it with the web service standard.	Understanding (K2)
CO5: analyze the components of cloud programming and software environments.	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	2	1											2	2
CO2	2	1											2	2
CO3	3	2	1	1									3	3
CO4	2	1											2	2
CO5	3	2	1	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 %
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)

18IST82 – USER INTERFACE DESIGN

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	8	PC	3	0	0	3

Preamble	The goal of user interface design is to make the user's interaction with system as simple and efficient as possible, in terms of accomplishing user goals

Unit – I	Design Methods:	9

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

Unit – II	Design Requirements and Synthesizing:	9

Scenarios – Requirements – Definition – Design Framework – Form and Behavior – Validation and Testing – Design Principles – Design Values – Design Patterns

Unit – III	Platform and Posture:	9

Posture – Designing desktop Software – Designing for the Web – Other Platforms. Orchestration and Flow: Flow and Transparency – Designing Harmonious Interactions

Unit – IV	Excise and Good Behavior:	9

Eliminating Excise:GUI Excise – Stopping the Proceedings – Traps – Navigation is Excise – Improving Navigation- Designing Good Behavior: Designing Considerate Products – Smart Products.

Unit – V	Interface Paradigms and VID:	9

Metaphors, Idioms and Affordances: Interface Paradigms – Metaphors – Building Idioms – Manual Affordances. Visual Interface Design: Design Disciplines – Building Blocks – Principles of Interface Design and 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", 3rd Edition, Wiley Publishing Inc, Noida, 2007.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the different design models	Understanding (K2)
CO2	elaborate the design framework and patterns	Understanding (K2)
CO3	demonstrate a software with flow transparency and interaction	Applying (K3)
CO4	design a good behavior product	Applying (K3)
CO5	make use of interface paradigms in visual interface design	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	2	1											2	2
CO2	2	1											2	2
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

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	80					100
CAT2	10	60	30				100
CAT3	10	50	40				100
ESE	10	50	40				100

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

18IST83 – AGILE SOFTWARE ENGINEERING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	8	PC	3	1	0	4

Preamble	To provide concepts of agile software engineering	
Unit – I	**Introduction:**	**9+3**

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 Scheme in Agile Teams– Implementation of the Role Scheme – Dilemmas in Teamwork–Teamwork in Learning Environments.

Unit – II	**Customers and Users, Time:**	**9+3**

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.

Unit – III	**Measures and Quality:**	**9+3**

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.

Unit – IV	**Learning and Abstraction:**	**9+3**

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.

Unit – V	**Trust and Globalization:**	**9+3**

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", 1st Edition, Springer–Verlag London Limited, UK, 2014.

REFERENCES:

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

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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)

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	2
CO2	2	1											2	2
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	2

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 %
CAT1	35	65					100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	50	30				100

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

18ISL81 – CLOUD COMPUTING LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks, Operating Systems	8	PC	0	0	4	2
Preamble							

List of Exercises / Experiments :

1.	Installing and configuring Virtual Machine on different flavors of Linux or windows OS.
2.	Installing application level compiler/interpreter on Virtual Machine
3.	Execution of simple programs on VM.
4.	Installing and Configuring web server on VM.
5.	Registering and configuring open source tools (Google Cloud / AWS / EC2)
6.	Design web service on open source platform tools
7.	Working on documents in Google Cloud Platform
8.	Working on spreadsheets, documents, PPT in Google Cloud Platform
9.	Execution of simple programs on open source tools.
10.	Design and Launch web app on Google Cloud Platform.

Total:60

REFERENCES/MANUAL/SOFTWARE:

1.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	configure various virtualization tools such as Virtual Box, VMware workstation.	Applying (K3), Precision (S3)
CO2	design and deploy a web application in a Saas, PaaS environment.	Applying (K3), Precision (S3)
CO3	learn how to simulate a cloud environment to implement new schedulers.	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														

18ISL82 – USER INTERFACE DESIGN LABORATORY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Web Technology	8	PC	0	0	4	2
Preamble							

List of Exercises / Experiments :

1.	Design a simple UI for e–commerce application using HTML and CSS
2.	Design a simple UI for e–commerce application using scripting language
3.	Design a user interface for competitive exam and perform appropriate validation using client side scripting language.
4.	Design a user interface for competitive exam and perform appropriate validation using java framework
5.	Design a user interface for competitive exam and perform appropriate validation using PHP
6.	Design a UI for financial application using Justinmind / Sketch / Figma.
7.	Develop a user interface for pharmaceutical concern using Justinmind / Sketch / Figma
8.	Develop an UI for agro based industry using Justinmind / Sketch / Figma
9.	Develop an UI 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

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
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 calibrate web application with 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														

18ISP01 – PROJECT WORK II

Programme & Branch	MSc & Software Systems		Sem.	Category	L	T	P	Credit
Prerequisites	Nil		10	EC	0	0	30	15

Total:450

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

18ISE01 – NETWORK PROTOCOLS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	5	PE	3	0	0	3

Preamble	Understanding the basic concepts of internetworking protocols and addressing concepts	
Unit – I	**Architecture and Protocol Layering:**	**9**
Internetworking Concept and Architectural Model – Application and Network Level Interconnection – Properties of the Internet– Internet Architecture – Interconnection of Multiple Network with IP Routers– User's View. Protocol Layering		
Unit – II	**Internet Addressing, ARP–RARP:**	**9**
IPv4 –Universal Host Identifiers– Classful Addressing Scheme – Dotted Decimal Notation– Subnet Addressing Fixed & Variable Length IPv4 Subnets – Implementation of Subnet Mask and Representation– IPv4 Address Blocks & CIDR Slash Notation– Classless Addressing Scheme– IPv4 CIDR Blocks –IPv6. Mapping Internet Address to Physical Address		
Unit – III	**Forwarding IP Datagrams and ICMP:**	**9**
Forwarding in an Internet– Direct and Indirect Delivery– Transmission Across a Single Network– Table – Driven IP Forwarding– Next–Hop Forwarding– Default and Host Specific Routes– IP Forwarding Algorithms– Longest–Prefix Match Paradigm– Forwarding Tables & IP Address– Handling Incoming Datagrams– Forwarding in Broadcast and Multicast– Software Routers & Lookup– Forwarding Tables. ICMP		
Unit – IV	**Routing–RIP, OSPF and Internet Multicasting:**	**9**
Static Vs Dynamic Routes– Routing Information Protocol– Slow Convergence Problem– RIP Message Format– Fields in RIP and RIP for Ipv6– Disadvantage of Using Hop– Delay Metric, Oscillation And Route Flapping– OSPF Protocol– OSPFv2 Message Format– Changes in OSPFv3 to Support IPv6. Internet Multicasting		
Unit – V	**BGP and DHCP:**	**9**
BGP: Scope– DeterMining a Practical Limit– Fundamental Idea– Autonomous System & Exterior Gateway– Characteristics– Functionality– Message Types –Message Header– Open Message –Update Message– Notification Message– Keep Alive Message– Compressed IPv4 Mask–Address–Path Attributes– Information from Receiver and Key Restriction– Routing Architecture– Multiprotocol. DHCP– IPv6 NDP		

Total:45

TEXT BOOK:

1.	Douglas E. Comer, "Internetworking with TCP/IP Vol.1: Principles, Protocols and Architecture", 6th Edition, Pearson Education, New Delhi, 2014.

REFERENCES:

1.	Behrouz A.Forouzan, "TCP/IP Protocol Suite", 4th Edition, Tata McGraw–Hill, New Delhi, 2012.
2.	Kurose, K.F and Ross, K.W, "Computer Networking: A Top–down approach featuring the Internet", 5th Edition, Pearson Education, New Delhi, 2010.
3.	Black, Uyless , "Computer Networks–Protocols, Standards And Interfaces", 2nd Edition, Prentice Hall of India, New Delhi, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the design principles of internetworking protocol architecture	Understanding (K2)
CO2	explain the various features of Internet Addressing	Understanding (K2)
CO3	interpret the features of error control protocols and forwarding IP datagrams	Understanding (K2)
CO4	identify the Routing Protocols and Internet Multicasting	Applying (K3)
CO5	make use of border gateway and dynamic host protocol to configure DHCP	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	2	1											2	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
CAT1	40	60					100
CAT2	40	60					100
CAT3	25	45	30				100
ESE	20	50	30				100

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

18ISE02 – SOFTWARE ARCHITECTURE

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	5	PE	3	0	0	3

Preamble	To provide a thorough knowledge about the modeling and designing of software architecture	
Unit – I	**Introduction:**	**9**

Software Architecture–Architectural Structures and Views–Architectural Patterns–Good Architecture–Importance of Software Architecture –Contexts of Software Architecture–Technical Context–Business Context – Professional Context–Stakeholders–Influence of Architecture

Unit – II	**Quality Attributes:**	**9**

Understanding Quality Attributes–Architecture and Requirements – Functionality – Considerations – Specifying Quality Attribute Requirements – Achieving Quality Attributes Tactics – Guiding Quality Design Decisions - Availability: Tactics–A Design Check List –Availability – Performance – Security

Unit – III	**Architecture in the Life Cycle:**	**9**

Architecture in Agile Projects–Agility and Architecture methods–Example–Guidelines – Architecture and Requirements – Gathering ASRs from requirements documents – Gathering ASRs by interviewing stakeholders – Understanding Business Goals – Capturing ASRs–Tying the methods – Designing an Architecture – Design Strategy – Attribute driven design method – Steps of ADD

Unit – IV	**Documenting and Implementation of Software Architecture:**	**9**

Uses and Notations Of Architecture Documentation–Views–Choosing Views–Combining Views – Building The Documentation Package – Document Behavior – Quality Attributes – Documenting Architecture that Change Faster – Agile Development Project – Architecture And Implementation – Architecture and Testing

Unit – V	**Reconstruction and Evaluation:**	**9**

Architecture Reconstruction and Conformance – Reconstruction Process – Raw View Extraction – Database Construction – View Fusion – Finding Violations – Guidelines – Architecture Evaluation – Evaluation Factors – Tradeoff Analysis Method – Lightweight Architecture Evaluation

Total:45

TEXT BOOK:

1.	Len Bass, Paul Clements and Rick Kazman, "Software Architecture in Practice", 3rd Edition, Addison Wesley, USA, 2013.

REFERENCES:

1.	Mary Shaw and David Garlan, "Software Architectural Perspectives on an Emerging Discipline", Prentice Hall , 2013.
2.	Brahma Dathan, Sarnath Ramnath, "Object–Oriented Analysis, Design and Implementation, An Integrated Approach", 2nd Edition, Springer Universities Press, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	describe the technical importance of software architectures and elaborate the types of context.	Understanding (K2)
CO2	classify the various tactics being used and tabulate how they help to achieve quality attributes in detail.	Applying (K3)
CO3	explain agile and architect methods and illustrate the guidelines for agile architecture	Understanding (K2)
CO4	make use of software architecture for various documentation approaches	Applying (K3)
CO5	elaborate the reconstruction and evaluation of software architecture	Understanding (K2)

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	2
CO2	3	2	1	1									3	3
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	2	1											2	2

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 %
CAT1	15	60	25				100
CAT2	15	60	25				100
CAT3	15	55	30				100
ESE	15	60	25				100

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

18ISE03 – OPERATIONS RESEARCH

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PE	3	0	0	3

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

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 & Assignment Models:	9

Transportation models: 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

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 & Game Theory:	9

Decision Analysis: 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 ×2 Games – Games without Saddle point – Mixed Strategies – Matrix method for 3 × 3 games – Dominance Property – Graphical Method for 2 × n and n ×2 Games

Unit – V	Queuing Models and Inventory Models:	9

Queueing Models: Characteristics - Model I (M/M/1) : (∞/FIFO) – Model II (M/M/s) : (∞/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

Total:45

TEXT BOOK:

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

REFERENCES:

1.	A. M. Natarajan, P. Balasubramanie and A.Tamilarasi , "Operations Research", 2nd Edition, Pearson, New Delhi, 2014.
2.	H.A.Taha, "Operations Research An Introduction", 10th Edition, Pearson, New Delhi, 2019.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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)

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
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														

ASSESSMENT PATTERN – THEORY							
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)

18ISE04 – PRINCIPLES OF MANAGEMENT

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	5	PE	3	0	0	3

Preamble	This course presents basic concepts of management and various functions of managers	
Unit – I	**Management: Science and Society:**	**9**

Definition of Management –The Evolution of Management Thought – Patterns of Management Analysis –The System Approach to the Management Process–Functions of Manager – Management and Society: The External Environment, Social Responsibility and Ethics.

Unit – II	**Planning:**	**9**

Types of Plan – Steps in Planning – Objectives – Evolving Concepts in Management by Objectives – Strategies, Polices 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 Polices – Hierarchy of Company Strategies – Porters Industry Analysis and Generic Competitive Strategies – Premising and Forecasting – Decision Making.

Unit – III	**Organizing and Staffing:**	**9**

Formal and Informal Organization – Organizational Division – Organization Levels and the Span of Management – An Organizational Environment for Entrepreneuring 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

Unit – IV	**Motivation:**	**9**

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

Unit – V	**Controlling:**	**9**

The Basic Control Process – Critical Control Points, Standards and Benchmarking – Control as a Feedback System – Real Time Information and Control – Feedforward 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:

1.	Koontz Harold and Weihrich Heinz, "Essentials of Management", 10th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2016.

REFERENCES:

1.	Tripathi.P.C and Reddy. P.N, "Principles of Management", 5th Edition, Tata McGraw–Hill Education, New Delhi, 2012.
2.	Prasad L.M, "Principles and Practice of Management", 8th Edition, Sultan Chand and Sons, New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the management concepts as planning, organising, staffing and controlling in real world environment	Understanding (K2)
CO2	interpret the basic functions, strategies of management	Understanding (K2)
CO3	articulate the steps in planning process	Applying (K3)
CO4	interpret the various types of organizational structures	Understanding (K2)
CO5	implement modern and traditional control devices in organisation	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						2		2	3	2	1	2	2	2
CO2								1	1	1	2	3	2	2
CO3								2	2	1	3	3	3	3
CO4						2		3	1	2	3	3	2	2
CO5						1		3	1	2	3	2	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 %
CAT1	40	60					100
CAT2	45	45	10				100
CAT3	25	45	30				100
ESE	25	45	30				100

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

18ISE05 – ADVANCED DATABASE TECHNOLOGIES

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Database Management Systems	5	PE	3	0	0	3

Preamble	To focus on parallel, distributed and Spatial databases	
Unit – I	**Query Optimization:**	**9**
Overview – Transformation of Relational Expressions – Estimating Statistics of Expression Results – Choice Of Evaluation Plans – Materialized Views		
Unit – II	**Recovery system and DBMS Architecture:**	**9**
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		
Unit – III	**Parallel Databases:**	**9**
Parallel Databases – Introduction – I/O Parallelism – Interquery Parallelism – Intraquery Parallelism – Intraoperation Parallelism– Interoperation Parallelism		
Unit – IV	**Distributed databases:**	**9**
Distributed Databases – Data Storage – Distributed Transactions– Commit Protocols – Concurrency Control In Distributed Databases – Availability – Distributed Query Processing – Cloud Databases		
Unit – V	**Spatial and Temporal Data:**	**9**
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		

Total:45

TEXT BOOK:

1.	Silberschatz Abraham, KorthF.Henry and Sudarshan S, "Database System Concepts", 6th Edition, McGraw Hill, New Delhi, 2013.

REFERENCES:

1.	RamezElmasri and Shamkanth B.Navathe, "Fundamentals of Database Systems", 7th Edition, Pearson Education, Chennai, 2017.
2.	S. K. Singh, "Database Systems: Concepts, Design and Applications", Pearson Education, New Delhi, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain query optimization	Understanding (K2)
CO2	apply the recovery concepts of databases	Applying (K3)
CO3	infer parallel databases	Understanding (K2)
CO4	explore distributed databases	Applying (K3)
CO5	describe Spatial and Multimedia Databases	Understanding (K2)

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	2
CO2	3	2	1	1									3	3
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	2	1											2	2

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 %
CAT1	20	55	25				100
CAT2	30	60	10				100
CAT3	25	50	25				100
ESE	25	45	30				100

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

18ISE06 – INFORMATION SECURITY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	5	PE	3	0	0	3

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

Unit – I	**Introduction:**	**9**

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

Unit – II	**Operating Systems and Database Security:**	**9**

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

Unit – III	**Security in Networks:**	**9**

Network Concepts – Threats to Network Communications – Wireless Network Security – Denial of Service – Distributed Denial of Service – Firewalls

Unit – IV	**Security in the Web and Emerging Topics:**	**9**

Browser Attacks – Web Attacks Targeting Users – Obtaining User or Website Data – Email Attacks – Emerging Topics: The Internet of Things – Cyber warfare.

Unit – V	**Security in Cloud Computing:**	**9**

Cloud Computing Concepts – Moving to the Cloud – Cloud Security Tools and Techniques – Cloud Identity Management – Securing IaaS

Total:45

TEXT BOOK:

1.	Charles P. Pfleeger , Shari Lawrence Pfleeger and Jonathan Margulies, "Security in Computing", 5th Edition, Pearson Education, New Delhi, 2018.

REFERENCES:

1.	Michael E. Whitman and Herbert J. Mattord, "Principles of Information Security", 5th Edition, Cengage Learning, India, 2015.
2.	Matt Bishop, "Introduction to Computer Security", 1st Edition, Pearson Education, New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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 attacks against from web sites.	Understanding (K2)
CO5	make use of security tools for cloud environments.	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	2	1											2	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	2	1											2	2
CO5	3	2	1	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 %
CAT1	20	80					100
CAT2	18	82					100
CAT3	20	60	20				100
ESE	20	60	20				100

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

18ISE07 – XML AND WEB SERVICES

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Web Technology	5	PE	3	0	0	3

Preamble	This course provides fundamental knowledge in XML technologies.	
Unit – I	**The Fundamentals of XML:**	**9**
Revolutions of XML – Introduction to XML syntax – XML Document Structure – Rules of XML structure –Well–Formed and Valid Documents – Namespaces in XML.		
Unit – II	**XML DTD and Schema:**	**9**
Document Type Definitions – Simple DTD Examples – Structure of DTD – DTD Drawbacks and Alternatives – Creating XML Schemas: Declaring attributes– elements –complex elements – simple data types.		
Unit – III	**XML Technologies:**	**9**
The X–Files: X–Path – X–Pointer – X–Link. XSL Technologies – XSLT for Document Publishing – XSL – Formatting object.		
Unit – IV	**SOAP and Web Services:**	**9**
SOAP: Background–Protocol – SOAP Message Structure – Message Paths –SOAP Intermediaries – SOAP and Actors – SOAP Design Patterns – SOAP Faults –SOAP with Attachments. Web Services Technologies–UDDI –WSDL.		
Unit – V	**XML Security:**	**9**
Security Overview –Canonicalization –XML Security Framework –XML Encryption –XML Digital Signature –XKMS Structure – Guidelines for Signing XML Documents.		

Total:45

TEXT BOOK:

1.	Ron Schmelzer, Travis Vandersypen, Jason Bloomberg et al, "XML and Web Services: Unleashed", 1st Edition, Pearson Education, New Delhi, 2014 for Units I,II,III.
2.	Frank Coyle P, "XML, Web Services and the Data Revolution", Pearson Education, New Delhi, 2012 for Units IV, V.

REFERENCES:

1.	Nagappan Ramesh, Skoczylas Robert and Sriganesh Rima Patel, "Developing Java Web Services", Wiley Publishing Inc, New York, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the fundamental concept of XML	Understanding (K2)
CO2	develop DTD and XML schema for the given application.	Applying (K3)
CO3	make use of XML technologies to format XML document	Applying (K3)
CO4	interpret SOAP and Web Services technologies.	Understanding (K2)
CO5	outline XML security framework.	Understanding (K2)

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	2
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	2
CO5	2	1											2	2

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 %
CAT1	15	70	15				100
CAT2	10	55	35				100
CAT3	30	70					100
ESE	15	55	30				100

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

18ISE08 – COMPUTER GRAPHICS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Advanced C Programming	5	PE	3	0	0	3

Preamble	To provide basic concepts of 2D and 3D graphics	
Unit – I	**Introduction to Computer Graphics:**	**9**
Video Display Devices– Raster–Scan and Random–Scan Displays– input devices– Hard–Copy Devices–Graphics on the Internet– DDA and Bresenham's line Algorithms – Properties of Circle and Ellipse – Circle and Ellipse Drawing Algorithms		
Unit – II	**Two Dimensional Geometric Transformations:**	**9**
Basic Two Dimensional Transformations – Matrix Representations– Inverse Transformations–Composite Transformations– reflection and shear – Two Dimensional Viewing: viewing–transformation Pipeline – Clipping Algorithms Line Clipping – Polygon Clipping– Curve Clipping – Text Clipping		
Unit – III	**Three– Dimensional Transformations:**	**9**
Three Dimensional Translation– Rotation and Scaling Transformations – Composite and other Transformations. Three Dimensional Viewing: overview– viewing Pipeline–Transformation from World to Viewing Coordinates		
Unit – IV	**Three Dimensional Viewing:**	**9**
Projection Transformations: Parallel and Perspective Projections, Orthogonal Projections– Oblique Parallel Projections. Visible Surface Detection Methods: Classification–Back–Face Detection–Depth–Buffer Method– A–Buffer Method–Scan–Line Method– Depth–Sorting Method–BSP–Tree Method–Area–Subdivision Method–Octree Methods– Ray–Casting Method – Comparison		
Unit – V	**Color Models And Animation:**	**9**
Color Models and Color Applications: Properties of Light– Standard Primaries and the Chromaticity Diagram– Intuitive Color Concepts– RGB – YIQ – CMY – HSV– HLS. Computer Animation: design of Animation Sequences– Traditional Animation Techniques Computer–Animation Languages Key–Frame Systems– Motion Specifications		

Total:45

TEXT BOOK:

1.	Donald Hearn and Baker Pauline ,Carithers, "Computer Graphics with Open GL", 4th Edition, Pearson Education, New Delhi, 2014.

REFERENCES:

1.	Foley James D., Van Dan Andries, Feiner Stevan K. and Hughes John F, "Computer Graphics: Principles and Practices in C", 2nd Edition, Pearson Education, New Delhi, 2012.
2.	Harrington Steven, "Computer Graphics : A Programming Approach", 2nd Edition, McGraw Hill, New York, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer basic drawing algorithms in computer graphics	Understanding (K2)
CO2	demonstrate 2D graphics and algorithms	Applying (K3)
CO3	explain 3D geometrical transformations	Understanding (K2)
CO4	implement 3D viewing techniques	Applying (K3)
CO5	explore computer animation techniques	Understanding (K2)

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	2
CO2	3	2	1	1									3	3
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	2	1											2	2

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 %
CAT1	25	50	25				100
CAT2	25	55	20				100
CAT3	25	55	20				100
ESE	25	45	30				100

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

18ISE09 – DISTRIBUTED COMPUTING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	6	PE	3	0	0	3

Preamble	To provide concepts distributed computing and fault tolerant systems	
Unit – I	**Introduction:**	**9**

Definition – Goals – Types of Distributed Systems – Architectures: Architectural Styles – System Architectures – Centralized Architectures – Decentralized Architectures – Hybrid Architectures.

Unit – II	**Communication:**	**9**

Fundamentals – Remote Procedure Call : Basic RPC Operation - Parameter Passing - Asynchronous RPC – Message–Oriented Communication: Message Oriented Transient and Persistent Communication – Multicast Communication : Application-Level Multicasting – Gossip-Based Data Dissemination.

Unit – III	**Synchronization:**	**9**

Clock Synchronization - Logical Clocks – Mutual Exclusion: Centralized, Decentralized, Distributed and Token Ring Algorithms – Comparison – Election Algorithms: Traditional, Wireless and Large Scale Systems.

Unit – IV	**Consistency and Replication:**	**9**

Introduction – Data–Centric Consistency Models – Client–Centric Consistency Models – Replica Management – Consistency Protocols.

Unit – V	**Fault Tolerance:**	**9**

Introduction – Process Resilience – Reliable Client–Server Communication – Reliable Group Communication – Distributed Commit – Recovery.

Total:45

TEXT BOOK:

1.	Andrew S. Tanenbaum, Maarten van Steen, "Distributed Systems: Principles and Paradigms", 2nd Edition, Pearson Education, New Delhi, 2015.

REFERENCES:

1.	Coulouris George, Dollimore Jean, Kindberg Tim, Blair Gordon, "Distributed Systems concepts and design", 5th Edition, Pearson Education, New Delhi, 2017.
2.	Liu M.L, "Distributed Computing: Principles and Applications", 1st Edition, Pearson Education, New Delhi, 2013.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the types of distributed systems	Understanding (K2)
CO2	explain remote procedure call and multicast communication	Understanding (K2)
CO3	make use of the synchronization algorithms	Applying (K3)
CO4	make use of the consistency models	Applying (K3)
CO5	describe fault tolerant systems	Understanding (K2)

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	2
CO2	2	1											2	2
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	2

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 %
CAT1	35	65					100
CAT2	25	55	20				100
CAT3	25	55	20				100
ESE	20	50	30				100

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

18ISE10 – SOFTWARE METRICS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	6	PE	3	0	0	3

Preamble	This course provides a basic knowledge of the software metrics and measurement techniques	
Unit – I	Basic Metrics for Software:	9
Fundamentals of Measurement–Measurement in Software Engineering – Scope of Software Metrics – Representation Theory of Measurement– Measurement and Models– Measurement Scales and Scale Types		
Unit – II	Investigation Procedures:	9
Empirical investigation–principles of Empirical Studies–Planning Experiments – Process Model for Performing Experiments–Key Experimental Design Concepts –Types of Experiment Design–Selecting Experiment Design		
Unit – III	Software Metrics Data Collection:	9
Defining Good Data – Data Collection for Incident Reports – How to Collect Data – Reliability of Data Collection Procedures– Analyzing Software Measurement Data – Statistical Distributions and Hypothesis Testing – Examples of Simple Analysis Techniques		
Unit – IV	Measurement of Software Attributes:	9
Measurement of Internal Product Attributes: Size– Properties of Software Size – Code Size – Design Size – Functional Size Measures and Estimators - Measurement of Internal Product Attributes: Structure – Control Flow Structure of Program Units		
Unit – V	Software Quality Metrics:	9
Measuring External Product attributes–Modeling Software Quality–Measuring Aspects of Quality – Usability Measures – Maintainability Measures – Security Measures		

Total:45

TEXT BOOK:

1.	Norman Fenton, James Bieman, "Software Metrics: A Rigorous and Practical Approach", 3rd Edition, CRC Press, A Chapman and Hall Book, Florida, 2015.

REFERENCES:

1.	Kan Stephen H, "Metrics and Models in Software Quality Engineering", 2nd Edition, Addison Wesley, New York, 2016.
2.	Ravindranath Pandian.C, "Software Metrics A Guide to Planning, Analysis and Application", AUERBACH Publications, USA, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer fundamental of software measurement and scale for measurement.	Understanding (K2)
CO2	outline empirical investigation and experimental design concepts	Understanding (K2)
CO3	determine data collection and analysis techniques	Applying (K3)
CO4	make use of measurement for internal product attributes	Applying (K3)
CO5	outline measuring external product attributes	Understanding (K2)

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	2
CO2	2	1											2	2
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	2

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 %
CAT1	30	70					100
CAT2	15	70	15				100
CAT3	15	60	25				100
ESE	15	55	30				100

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

18ISE11 – ARTIFICIAL INTELLIGENCE

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Data Structures	6	PE	3	0	0	3

Preamble	To introduce the students to the fundamental concepts of artificial intelligence and provide them the ability to analyze and design intelligent systems

Unit – I	Introduction:	9

Definition – Foundation of Artificial Intelligence – History of Artificial Intelligence –The state of the Art– Intelligent Agents: Agents and Environments – Behavior – Nature of Environments – Structure of Agents

Unit – II	Problem Solving:	9

Solving problems by searching–Problem solving agents–Example problems–Searching for solutions– Uninformed search strategies– Informed search strategies – Heuristic Functions–Constraint Satisfaction Problem: Defining Constraint Satisfaction Problem - Constraint Propagation–Backtracking Search– Local Search – Structure of Problems

Unit – III	Knowledge Reasoning:	9

Logical Agents L: Knowledge Based Agents-The Wumpus World – Logic – Propositional Logic – Propositional Theorem Proving– Model Checking – Agents based on Propositional logic – First-Order Predicate Logic – Syntax and Semantics of First-Order Logic – Uses – Knowledge Engineering in First-Order Logic.

Unit – IV	Classical Planning:	9

Definition – Algorithms – Planning Graphs and other Approaches–Analysis of Planning Approaches – Planning and Acting: Time, Schedules and Resources – Hierarchical – Planning and Acting in Nondeterministic Domains– Multi agent Planning.

Unit – V	Learning from Examples:	9

Forms–Supervised Learning– Decision Trees–Evaluating and Choosing the Best Hypothesis– Theory of Learning – Regression and Classification–Artificial Neural Networks– Non Parametric Models–Support Vector Machines– Ensemble Learning – Practical Machine Learning.

Total:45

TEXT BOOK:

1.	Russell Stuart, Norvig Peter, "Artificial Intelligence: A Modern Approach", 3rd Edition, Pearson Education, New Delhi, 2016.

REFERENCES:

1.	Elaine Rich, Kevin Knight, Shivashankar B.Nair, "Artificial Intelligence", 3rd Edition, McGraw Hill Education Pvt. Ltd.,India, 2018.
2.	Parag Kulkarni, Prachi Joshi, "Artificial Intelligence –Building Intelligent Systems", PHI learning private Ltd, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	demonstrate fundamental understanding of the history of artificial intelligence (AI) and its foundations.	Applying (K3)
CO2	outline the concepts of heuristic search techniques and constraint satisfaction problems	Understanding (K2)
CO3	represent knowledge of the world using logic and infer new facts from that knowledge	Understanding (K2)
CO4	make use of classical planning in Artificial Intelligence Techniques	Applying (K3)
CO5	attain the capability to represent various real life problem domains of learning	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	2	1	1									3	3
CO2	2	1											2	2
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
CAT1	15	35	50				100
CAT2	20	60	20				100
CAT3	15	40	45				100
ESE	10	40	50				100

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

18ISE12 – ENTERPRISE RESOURCE PLANNING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PE	3	0	0	3

Preamble	Infer the basic functions of ERP and their business approach to implement ERP projects in various fields.	
Unit – I	**ERP and Management:**	**9**

Introduction to ERP : An Overview – Accommodating Variety – Integrated Management Information–Seamless Integration–Supply Chain Management–Resource Management–Integrated Data Model–Scope – Technology–Benefits of ERP – Evolution– ERP Revisited – ERP and the Modern Enterprise - Business Engineering and ERP : An Overview – Business Engineering – Significance of Business Engineering – Principles of Business Engineering – BPR, EPR and IT – Business Engineering with Information Technology – ERP and Management Concerns

Unit – II	**Business Modeling and ERP Implementation:**	**9**

Business modeling for ERP : An Overview – Building the Business Model – ERP Implementation: An Overview – Role of Consultants, Vendors and Users – Customization – Precautions – ERP:Post–Implementation Options – ERP Implementation Methodology – Guidelines for ERP Implementation

Unit – III	**ERP Advantages and ERP Domain:**	**9**

ERP and the Competitive Advantage : An Overview – ERP and the Competitive Strategy - The ERP Domain : An Overview – MFG/PRO – IFS/Avalon–Industrial and Financial Systems – Baan IV – SAP – SAP R/3 Applications – An Indian ERP Package – The Arrival of ERP III.

Unit – IV	**Marketing and Case Studies:**	**9**

Marketing of ERP : An Overview – Market Dynamics and Competitive Strategy – Case Studies: An Overview – Mercedes Benz – Kee Hin Industries – Bull Electronics Angers Plant Manufacturers – Ameritech – Essar Steel – Jindal Iron and Steel Company – Godrej Soaps and Associate Companies – Indian Renewable Energy Development Agency (IREDA) – ERP handles Pressure – A Wholesome Enterprise Application

Unit – V	**ERP Projects and Supply Chain Management:**	**9**

Managing an ERP Project: An Overview – Implementation Success – Causes of Information Systems Project Failures – Risk Factors in Information Systems Projects – Risks in Implementing an ERP System – Managing Large – Scale ERP Projects – Project Related Factors – Additional Factors. Supply Chain Management and the eMarketplace – Supply Chain Management – eBusiness and ERP– eSupply Chain and ERP – Business Intelligence with ERP – Future Directions for ERP.

Total:45

TEXT BOOK:

1.	Vinod Kumar Garg, N.K Venkitakrishnan, "Enterprise Resource Planning–Concepts and Practice", 2nd Edition, Prentice Hall of India, New Delhi, 2014 for Units I,II,III,IV.
2.	Mary Sumner, "Enterprise Resource Planning", 1st Edition, Pearson Education, New Delhi, 2006 for Unit V.

REFERENCES:

1.	Alexis Leon, "Enterprise Resource Planning", 1st Edition, Tata McGraw–Hill, New Delhi, 2003.
2.	Prince, Dennis .L, "Supporting SAP R/3 ", 1st Edition, Galgotia Publications Pvt. Ltd, New Delhi, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basic functions of ERP.	Understanding (K2)
CO2	make use of business modeling approach for ERP.	Applying (K3)
CO3	outline the key features of ERP packages in Market.	Understanding (K2)
CO4	utilize the implementation of ERP in various fields.	Applying (K3)
CO5	demonstrate about managing an ERP project and eMarketplace.	Applying (K3)

<table>
<tr><th colspan="15">Mapping of COs with POs and PSOs</th></tr>
<tr><th>COs/POs</th><th>PO1</th><th>PO2</th><th>PO3</th><th>PO4</th><th>PO5</th><th>PO6</th><th>PO7</th><th>PO8</th><th>PO9</th><th>PO10</th><th>PO11</th><th>PO12</th><th>PSO1</th><th>PSO2</th></tr>
<tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td>3</td><td></td><td></td><td></td><td></td><td>2</td><td>2</td></tr>
<tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td></td><td>2</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td>2</td><td></td><td></td><td></td><td>3</td><td>2</td><td>2</td></tr>
<tr><td>CO4</td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td>2</td><td></td><td></td><td></td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO5</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td>2</td><td>3</td><td>3</td><td>3</td></tr>
</table>

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

<table>
<tr><th colspan="8">ASSESSMENT PATTERN – THEORY</th></tr>
<tr><th>Test / Bloom's Category*</th><th>Remembering (K1) %</th><th>Understanding (K2) %</th><th>Applying (K3) %</th><th>Analyzing (K4) %</th><th>Evaluating (K5) %</th><th>Creating (K6) %</th><th>Total %</th></tr>
<tr><td>CAT1</td><td>25</td><td>40</td><td>35</td><td></td><td></td><td></td><td>100</td></tr>
<tr><td>CAT2</td><td>25</td><td>45</td><td>30</td><td></td><td></td><td></td><td>100</td></tr>
<tr><td>CAT3</td><td>20</td><td>40</td><td>40</td><td></td><td></td><td></td><td>100</td></tr>
<tr><td>ESE</td><td>20</td><td>40</td><td>40</td><td></td><td></td><td></td><td>100</td></tr>
</table>

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

18ISE13 – INTRODUCTION TO DATA SCIENCE

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Data Mining Techniques	6	PE	3	0	0	3

Preamble	To Understand the importance of data science concepts and apply to end user	
Unit – I	**Basics of Data Science:**	**9**
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		
Unit – II	**Handling Large Data:**	**9**
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		
Unit – III	**Machine Learning:**	**9**
Machine Learning – Modeling Process – Training Model – Validating Model – Predicting New Observations – Types of Machine Learning–Supervised Learning – Unsupervised Learning – Semi Supervised Learning.		
Unit – IV	**No SQL and The Rise of graph database:**	**9**
Introduction to No SQL–Predicting Disease Using Medical Data – Introducing Connected Data and Graph Databases – Introducing Neo4j: A Graph Database		
Unit – V	**Text Mining and Data Visualization:**	**9**
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", 1st Edition Dreamtech Press, New Delhi, 2018.

REFERENCES:

1.	Cathy O'Neil, Rachel Schutt, "Doing Data Science, Straight Talk from the Frontline", 1st Edition, O'Reilly, 2013.
2.	Joel Grus, "Data Science from Scratch: First Principles with Python", 1st Edition, O'Reilly, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the fundamental concepts of data science.	Understanding (K2)
CO2	make use of data analysis technique for handling large data sets application.	Applying (K3)
CO3	outline the various machine learning algorithms for data science process.	Understanding (K2)
CO4	identify the No SQL principles and graph database for given application.	Understanding (K2)
CO5	utilize the text Mining techniques and visualization concepts to apply in the real world data.	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	2	1											2	2
CO2	3	2	1	1									3	3
CO3	2	1											2	2
CO4	2	1											2	2
CO5	3	2	1	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 %
CAT1	25	40	35				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)

18ISE14 – PROFESSIONAL ETHICS AND HUMAN VALUES

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	6	PE	3	0	0	3

Preamble	This course provides the awareness on moral values and ethics. It educates codes of ethics and intellectual property rights	
Unit – I	Understanding:	9
Morals – Values–Ethics– Honesty – Integrity – Work Ethic – Service Learning – Civic Virtue – caring – Sharing – Courage – Valuing Time – Co–operation – Commitment – Empathy – Self–Confidence – Challenges – Spirituality – Senses of 'Engineering Ethics' – Variety of Moral Issues – Types of Inquiry.		
Unit – II	Moral Theories:	9
Moral Dilemmas – Moral Autonomy – Kohlberg's Theory – Gilligan's Theory – Consensus and Controversy – Models of Professional Roles – Theories About Right Action – Self– Interest – Customs and Religion – Uses of Ethical Theories. Meaning of Engineering Experimentation – Engineers as Responsible Experimenters.		
Unit – III	Codes of Ethics:	9
Codes of Ethics for Engineers – A Balanced Outlook on Law – The Challenger Case Study. Safety and Risk – Assessment of Safety =and Risk – Risk Benefit Analysis and Reducing Risk, Bhobal Gas Tragedy and Chernobyl Case Studies.		
Unit – IV	Rights:	9
Collegiality and Loyalty – Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Human Rights – Employee Rights – Discrimination – Intellectual Property Rights (IPR) – Multinational Corporations – Environmental Ethics.		
Unit – V	Codes for Engineers:	9
Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Sample Code of Ethics Like ASME, ASCE, IEEE, Institution of Engineers (India), Indian Institute of Materials Management, Institution of Electronics and Telecommunication Engineers(IETE).		

Total:45

TEXT BOOK:

1.	Naagarazan R.S, "Professional Ethics and Human Values", 2nd Edition, Newage International Publications, New Delhi, 2016

REFERENCES:

1.	Govindarajan M., Natarajan S. and Senthil Kumar V.S., "Engineering Ethics", Prentice Hall of India, New Delhi, Reprint 2013.
2.	Martin Mike and Schinzinger Roland, "Ethics in Engineering", 4th Edition, Tata McGraw–Hill, New Delhi, 2014.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the terminologies associated with ethics and values	Understanding (K2)
CO2	express the knowledge on interpersonal and organizational issues in ethics	Understanding (K2)
CO3	articulate ethical theories and their application	Applying (K3)
CO4	employ ethical issues in workplace situations	Applying (K3)
CO5	infer the components of ethics as codified by professional bodies	Understanding (K2)

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							2	2
CO2						2					2		2	2
CO3						3							3	3
CO4						3				3	2		3	3
CO5						2				2			2	2

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 %
CAT1	45	55					100
CAT2	35	55	10				100
CAT3	35	50	15				100
ESE	30	45	25				100

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

18ISE15 – SERVICE ORIENTED ARCHITECTURE

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Web Technology	6	PE	3	0	0	3

Preamble	To provide an overview of Service Oriented Architecture and Web services and their importance	
Unit – I	**Introduction to SOA with Web Services:**	**9**

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

Unit – II	**Service–Oriented Architecture:**	**9**

Service–Oriented Business and Government – Service–Oriented Architecture Concepts – Service Governance, Processes, Guidelines, Principles, Methods and Tools – Key Service Characteristics – Technical Benefits – Business Benefits

Unit – III	**SOA and Web Services:**	**9**

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

Unit – IV	**SOA & Web Services for Integration and Multi–Channel Access:**	**9**

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

Unit – V	**SOA and Business Process Management:**	**9**

Basic Business Process Management Concepts – Example Business Process – Combining BPM, SOA and Web Services – Orchestration and Choreography Specifications – Example of Web Services Composition

Total:45

TEXT BOOK:

1.	Eric Newcomer, Greg Lomow, "Understanding SOA with Web Services", 1st Edition, Pearson Education, New Delhi, 2014.

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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basic principles of service oriented architecture	Understanding (K2)
CO2	explain the architecture of webservices	Understanding (K2)
CO3	demonstrate the relationship between SOA and webservices	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)

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	2
CO2	2	1											2	2
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

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	75					100
CAT2	20	55	25				100
CAT3	20	55	25				100
ESE	20	55	25				100

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

18ISE16 – MULTIMEDIA SYSTEMS

Programme & Branch	MSc & Software Systems		Sem.	Category	L	T	P	Credit
Prerequisites	NIL		6	PE	3	0	0	3

Preamble	To impart the basic knowledge about multimedia and its components such as Text, Image, Sound, Animation and Video	
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**
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**
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 – Evaluating a Compression System - Redundancy and Visibility – Video Compression Techniques – JPEG – H.261 – MPEG – DVI Technology		
Unit – V	**Internet and Multimedia on the Web:**	**9**
Internet History – Internet Working – Multimedia on the Web: Designing for the WWW: Developing for the Web – Text – Images – Sound – Animation – Video		

Total:45

TEXT BOOK:

1.	Tay Vaughan, "Multimedia: Making It Work", 9th Edition, Tata McGraw Hill, New Delhi, 2016 for Units I,II,III,V.
2.	Koegel Buferd, John F, "Multimedia Systems", Pearson Education, New Delhi, 2004 for Unit IV.

REFERENCES:

1.	Prabhat K.Andleigh and KiranThakrar, "Multimedia Systems and Design", Pearson Education, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	explain the features of multimedia elements.	Understanding (K2)
CO2	make presentation using image and audio components.	Applying (K3)
CO3	build animation from still images as well as videos.	Applying (K3)
CO4	use video and image compression tools for the files.	Applying (K3)
CO5	design multimedia projects for web.	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	2	1											2	2
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														

ASSESSMENT PATTERN – THEORY							
Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	65	10				100
CAT2	22	43	35				100
CAT3	18	42	40				100
ESE	25	35	40				100

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

18ISE17 – BIG DATA ANALYTICS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Data Mining Techniques	8	PE	3	1	0	4

Preamble	To provide basic knowledge about Big data, its framework, storage in databases and stream processing with SPARK	
Unit – I	**Big Data Analytics:**	**9+3**
Introduction –Types of Digital Data –Characteristics– Evolution – Definition – Challenges – Big Data Analytics: Importance – Data Science – Terminologies used in Big Data Environments – NoSQL		
Unit – II	**Hadoop & MapReduce Programming:**	**9+3**
Introduction to Hadoop: RDBMSversus Hadoop – Distributed Computing Challenges – HDFS – Processing Data with Hadoop – Interacting with Hadoop Ecosystem – Introduction to Map Reduce Programming: Mapper – Reducer – Combiner – Partitioner – Searching – Sorting – Compression		
Unit – III	**MongoDB and Cassandra:**	**9+3**
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		
Unit – IV	**HIVE and PIG:**	**9+3**
Introduction to Hive: Architecture – Data Types – File Format – Hive Query Language(HQL) – RCFile Implementation – Introduction to Pig: Pig on Hadoop – Data Types – Running Pig – Execution Modes of Pig – HDFS Commands – Relational Operators – Eval Function – Complex Data Types		
Unit – V	**APACHE SPARK:**	**9+3**
Stream processing with SPARK: Introduction – SPARK Architecture – SPARK Eco System – SPARK for Big Data Processing – SPARK Applications		

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Seema Acharya, Subhashini Chellappan, "Big Data and Analytics", 2nd Edition, Wiley India Pvt, Noida, 2019.

REFERENCES:

1.	Dr.Anil Maheshwari, "Big Data", 2nd Edition, McGraw Hill Education, 2019.
2.	"Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data", EMC Education Services, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	articulate the concepts and characteristics of big data	Understanding (K2)
CO2	acquire the usage of Hadoop and MapReduce programming	Applying (K3)
CO3	determine 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)

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	2
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	2
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 %
CAT1	20	50	30				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)

18ISE18 – BUILDING ENTERPRISE APPLICATIONS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	8	PE	3	1	0	4

Preamble	To impart knowledge in prescriptive technical architecture framework for raising a typical enterprise application.	
Unit – I	**Analysis and Modeling:**	9+3
	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.	
Unit – II	**Architecting and Designing:**	9+3
	Architecture, Views and viewpoints - Enterprise application - Logical architecture - Technical architecture and Design - Data architecture and Design – Infrastructure Architecture and Design – Architecture and Design Documentation.	
Unit – III	**Constructing Enterprise Applications:**	9+3
	Construction Readiness -Introduction to Software Construction Maps- Constructing the Solutions Layers - Code Review -Static Code Analysis -Build Process and Unit Testing - Dynamic Code Analysis.	
Unit – IV	**Testing and Rolling out Enterprise Applications:**	9+3
	Testing an Enterprise Applications–Enterprise Application Environments -Integration Testing –System Testing - User Acceptance Testing -Rolling out Enterprise Applications.	
Unit – V	**Enterprise Programming:**	9+3
	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.	

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Anubhav Pradhan, Satheesha B.Nanjappan, Senthil K.Nallasamy, Veerakumar Esakimuthu, "Rasing Enterprise Applications", 1st Edition, Wiley India Pvt. Ltd., Bengaluru, Karnataka, India, 2011 for Units I, II, III, IV.
2.	Brett McLaughlin, "Building Java Enterprise Applications", 1st Edition, O"Reilly Media Publications, California, 2002 for Unit V.

REFERENCES:

1.	Soren Lauesen, "Software Requirements: Styles & Techniques", Addison-Wesley Professional Publications, Bostan, US,2002.
2.	Srinivasan Desikan, Gopalaswamy Ramesh, "Software Testing Principles and Practices ", Pearson Publications, New Delhi, India, 2006.

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
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 understand different testing involved with enterprise application and the process of rolling out an enterprise application.	Understanding (K2)
CO5 interpret vital planning and requirements of phase of enterprise programming	Understanding (K2)

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	2	1											2	2
CO4	2	1											2	2
CO5	2	1											2	2

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 %
CAT1	30	40	30				100
CAT2	30	50	20				100
CAT3	40	60					100
ESE	30	40	30				100

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

18ISE19 – MACHINE LEARNING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	PE	3	1	0	4

Preamble	To design and implement machine learning solutions to Bayesian learning and artificial neural networks, and be able to evaluate and interpret the results of the algorithms

Unit – I	Introduction:	9+3

Designing a Learning System – Perspectives and Issues– Concept Learning– Concept Learning Task–Concept Learning as Search– Find–S Algorithm, Version Spaces and Candidate Elimination Algorithm – Inductive bias.

Unit – II	Bayesian Learning:	9+3

Bayes Theorem –Concept Learning – Maximum Likelihood Hypothesis for Predicting Probabilities – Minimal Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier– Example – Bayesian Belief Network – EM Algorithm.

Unit – III	Artificial Neural Networks:	9+3

Introduction – Representations – Problems – Perceptrons – Multilayer Networks and BACKPROPAGATION Algorithm–Remarks on the BACKPROPAGATION Algorithm– An Illustrative Example: Face Recognition.

Unit – IV	Instance Based Learning and Genetic Algorithm:	9+3

Introduction – k-Nearest Neighbor Learning – Locally Weighted Regression - Radial Basis Functions - Case-Based Reasoning. Genetic Algorithms – Example – Hypothesis Space Search – Genetic Programming - Models of Evolution and Learning – Parallelizing Genetic Algorithms.

Unit – V	Learning Sets of Rules:	9+3

Learning Sets of Rules: Introduction –Sequential Covering Algorithms – First-Order Rules – FOIL – Induction as Inverted Deduction - Inverting Resolution – Reinforcement learning : Introduction –The Learning Task – Q learning.

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Tom M. Mitchell, "Machine Learning", Indian Edition, McGraw Hill Education(India) Private Limited, New Delhi, 2018

REFERENCES:

1.	Simon Rogers and Mark Girolami, "A First Course in Machine Learning", CRC Press, 2015
2.	Ethem Alpaydin, "Introduction to Machine Learning", 3rd Edition, Prentice Hall India Private Limited, New Delhi, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	infer the knowledge about basic concepts of Machine Learning	Understanding(K2)
CO2	compute the machine learning techniques for a given problems	Understanding(K2)
CO3	make use of artificial neural networks and back propagation algorithm for real world problems	Applying(K3)
CO4	design applications using instance based learning and genetic algorithm	Applying(K3)
CO5	describe the algorithms for rule and reinforcement learning	Understanding(K2)

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	2
CO2	2	1											2	2
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	2
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 %
CAT1	30	70					100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	40	40				100

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

18ISE20 – AD HOC AND SENSOR NETWORKS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Mobile Communications	8	PE	3	0	0	3

Preamble	To focus on mobile ad hoc networks and applications of sensor networks	
Unit – I	**Introduction:**	**9**
Ad hoc Wireless Networks – Introduction – Applications – Issues in Ad Hoc Wireless Networks – MAC Protocols: Introduction – Issues – Classification – Contention based protocols : MACAW		
Unit – II	**Routing Protocols:**	**9**
Routing Protocols for Ad Hoc Wireless Networks – Issues – Classification – Table Driven – On Demand and Hybrid Protocols– Hierarchical and Power Aware Routing protocols		
Unit – III	**Transport Layer Protocols:**	**9**
Transport Layer Protocols – Issues – Design Goals – Classification of Solutions – TCP over Ad Hoc Networks – Ad hoc Transport Protocol.		
Unit – IV	**Security:**	**9**
Security in Ad Hoc Networks – Network Security Requirements – Issues and Challenges – Network Security Attacks – Key Management – Secure Routing		
Unit – V	**Wireless Sensor Networks:**	**9**
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", 1st Edition, Pearson Education, New Delhi, 2014.

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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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 Ad Hoc and sensor networks	Understanding (K2)

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	2
CO2	3	2	1	1									2	2
CO3	3	2	1	1									3	3
CO4	2	1											3	3
CO5	2	1											2	2

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 %
CAT1	20	55	25				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)

18ISE21 – SOFTWARE QUALITY ASSURANCE

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	PE	3	0	0	3

Preamble	The course highlights almost all the elements of the Certified Software Quality Engineer and the need of Software Quality Assurance in the software industries	
Unit – I	**Introduction and Managing Software Quality:**	**9**
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		
Unit – II	**Product Quality and Process Quality:**	**9**
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		
Unit – III	**Software Measurement and Metrics:**	**9**
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 - Various Responsibilities in Reviews and Walk Through – Some Physiological Aspects of Review.		
Unit – IV	**Software Configuration Management and ISO:**	**9**
Software Configuration Management–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 – Recertification – Reassessment Audits – ISO Consulting Services and Consultants.		
Unit – V	**Software CMM Models and Careers in Quality:**	**9**
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 for the New Paradigm", 2nd Edition, Narosa Publishing House, New Delhi, 2017.

REFERENCES:

1.	Gordon G Schulmeyer, "Handbook of Software Quality Assurance", 3rd Edition, Artech House Publishers, 2007.
2.	Watts S. Humphrey, "Managing the Software Processǁ", 5th Impression Edition, Pearson Education Inc, New Delhi, 2008.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the concepts, metrics, and models in software quality assurance	Understanding (K2)
CO2	identify a framework for software quality assurance and discusses individual components in the framework	Understanding (K2)
CO3	identify the components of software quality assurance systems	Understanding (K2)
CO4	evaluate the methodologies for SCM and understand how to apply it in practice	Applying (K3)
CO5	evaluate commitment to quality, Integrity and Insistence on measurable results	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	2	1											2	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
CAT1	25	75					100
CAT2	25	75					100
CAT3	20	40	40				100
ESE	20	45	35				100

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

18ISE22 – LINUX ADMINISTRATION

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Operating Systems	8	PE	3	0	0	3

Preamble	To design interactive UI and web applications using jquery, angular and node	
Unit – I	**Basics of Linux Administration:**	9
Essential Duties of System Administrator – Linux Distributions – Man Pages – Ways to Find and Install Software – Booting and System Management Domains – Access Control and Rootly Powers		
Unit – II	**Files and Process Control:**	9
File System – Process Control – User Management – Logging		
Unit – III	**Storage and Software Management:**	9
Software Installation and Management: Operating System Installation – Managing Packages – Managing Linux Packages. Cloud Computing: Cloud Platform Choices – Cloud Service Fundamentals – VPS Quick Start by Platform		
Unit – IV	**Internet Services:**	9
Domain Name Service (DNS) – File Transfer Protocol (FTP) – The Secure Shell (SSH)		
Unit – V	**Intranet Services:**	9
Network File System (NFS) – Network Information Service (NIS) – LDAP – DHCP – Virtualization.		

Total:45

TEXT BOOK:

1.	Evi Nemeth, Garth Snyder, Trent R. Hein Ben Whaley, Dan Mackin, "Unix and Linux System Administration Handbook", 5th Edition, Pearson Education, New York, 2018 for Units I,II,III.
2.	Wale Soyinka, "Linux Administration: A Beginner's Guide", 7th Edition, Pearson Education, New York, 2015 for Units IV,V.

REFERENCES:

1.	Dan Mackin, Ben Whaley, Trent R. Hein, Garth Snyder, Evi Nemeth, "UNIX and Linux System Administration Handbook", 5th Edition, Addison–Wesley Professional, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	interpret the basics of linux distributions	Understanding (K2)
CO2	apply the concept of files and process control	Applying (K3)
CO3	explain the linux packages and cloud storage	Understanding (K2)
CO4	demonstrate SSH and FTP	Applying (K3)
CO5	use virtualization techniques and LDAP	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	2	1											2	2
CO2	3	2	1	1									3	3
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
CAT1	20	60	20				100
CAT2	20	60	20				100
CAT3	20	60	20				100
ESE	20	40	40				100

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

18ISE23 – SEMANTIC WEB

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Web Technology	8	PE	3	0	0	3

Preamble	To obtain the knowledge about Semantic Web and Web Resources for knowledge based real world applications using ontologies and semantic web tools

Unit – I	**Introduction to Semantic Web:**	**9**

Introduction – Semantic Web Technologies – Layered approach – Describing Web Resources: RDF: Data Model – Syntaxes – RDFS: Adding Semantics – RDF Schema: Language – RDF and RDF Schema in RDF Schema – Axiomatic Semantics for RDF and RDF Schema – Direct Inference System for RDF and RDFS

Unit – II	**Querying the Semantic Web:**	**9**

SPARQL Infrastructure – Basics: Matching Patterns – Filters – Constructs for Dealing with an Open World – Organizing Result Sets – Other Forms of SPARQL Queries – Querying Schemas – Adding Information with SPARQL Update

Unit – III	**Web Ontology Language OWL2:**	**9**

Introduction – Requirements for Ontology Languages – Compatibility of OWL2 with RDF/RDFS – OWL Language – OWL2 Profiles

Unit – IV	**Logic and Inference:**	**9**

Rules: Introduction – Example of Monotonic Rules: Family Relationships – Monotonic Rules: Syntax – Monotonic Rules: Semantics – OWL2RL: Description Logic meets Rules – Rule Interchange Format: RIF – Semantic Web Rules Language (SWRL) – Rules in SPARQL: SPIN – Nonmonotonic Rules: Motivation and Syntax – Example of Nonmonotonic Rules: Brokered Trade – Rule Markup Language (RuleML)

Unit – V	**Applications & Ontology Engineering:**	**9**

Good Relations – BBC Artists –BBC World Cup 2010 Website – Government Data – New York Times – Sigma and Sindice – Open Calais – Schema.org. Constructing Ontologies Manually – Reusing Existing Ontologies – Semiautomatic Ontology Acquisition – Ontology Mapping – Exposing Relational Databases – Semantic Web Application Architecture

Total:45

TEXT BOOK:

1.	Grigoris Antoniou, Paul Groth, Frank van Harmelen, Rinke Hoekstra, "A Semantic Web Primer", 3rd Edition, Prentice Hall of India Pvt Ltd, New Delhi, 2015.

REFERENCES:

1.	Dieter Fensel, James A. Hendler, Henry Lieberman and Wolfgang Wahlster, "Spinning the Semantic Web: Bringing the world wide web to its full potential", 1st Edition, The MIT Press, 2005.
2.	Shelley Powers, "Practical RDF", 1st Edition, O'Reilly Publishers, 2003.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the concepts and structure of semantic web vision and technology	Understanding (K2)
CO2	demonstrate query ontologies using (SPARQL)	Applying (K3)
CO3	design RDF schemas for web ontology language (OWL).	Applying (K3)
CO4	outline the logic semantics and inference with OWL	Understanding (K2)
CO5	make use of semantic web technologies to real world applications.	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	2	1											2	2
CO2	3	2	1	1									3	3
CO3	3	2	1	1									3	3
CO4	2	1											2	2
CO5	3	2	1	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 %
CAT1	20	50	30				100
CAT2	15	40	45				100
CAT3	15	40	45				100
ESE	15	40	45				100

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

18ISE24 – DESIGN THINKING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Nil	8	PE	3	0	0	3

Preamble	This course provides a systematic process of thinking which empowers even the most traditional thinker to develop new, innovative solutions to the problem at hand are studied with an emphasis on bringing ideas to life based on how real users think, feel and behave.	
Unit – I	**Explore:**	**9**
Introduction – Need for design thinking – Design and Business – Four Questions, Ten Tools – Explore – STEEP Analysis – Strategic Priorities – Activity System – Stakeholder Mapping – Opportunity Framing.		
Unit – II	**Empathize:**	**9**
Design Brief -Visualization –Journey Mapping –Value Chain Analysis –Mind Mapping–Empathize–Observations–Need Finding–User Personas.		
Unit – III	**Experiment:**	**9**
Design Criteria- Four Reasons People Hate Brainstorming – Brainstorming–Concept Development–Experiment–Ideation–Prototyping –Purpose and case study		
Unit – IV	**Engage:**	**9**
Assumption Testing – Steps and case study – Rapid Prototyping - Forms of 2D prototype – Engage – Storyboarding.		
Unit – V	**Evolve:**	**9**
Customer Co-Creation Learning Launch– Leading Growth and Innovation– Evolve–Concept Synthesis– Strategic Requirements – Evolved Activity Systems – Quick Wins.		

Total:45

TEXT BOOK:

1.	Jeanne Liedtka and Tim Ogilvie, "Designing for Growth: A Design Thinking Tool Kit for Managers", Columbia University Press,New York, 2011 for Units I,II,III,IV,V.
2	Lee Chong Hwa, "Design Thinking The Guidebook", NA Edition, Design Thinking Master Trainers of Bhutan, 2017 for Units I,II,III,IV,V.

REFERENCES:

1.	Jeanne Liedtka, Tim Ogilvie, and Rachel Brozenske, "The Designing for Growth FieldBook: A Step-by-Step Project Guide", Columbia University Press, New York, 2014.
2.	Tim Brown, "Change by Design: How design thinking transforms organizations and inspires innovation", 1st Edition, HarperCollins Publishers,New York, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1: examine the basic concepts of design thinking	Applying (K3)
CO2: make use of the mind mapping process for designing any system	Applying (K3)
CO3: develop many creative ideas through structured brainstorming sessions.	Applying (K3)
CO4: develop rapid prototypes to bring the ideas into reality	Applying (K3)
CO5: plan the implementation of the system considering the real time feedback	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	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

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	25	40	35				100
CAT2	35	45	20				100
CAT3	40	35	25				100
ESE	30	40	30				100

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

18ISE25 – ENTERPRENEURSHIP DEVELOPMENT

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	8	PE	3	0	0	3

Preamble	To provide a concise introduction to the development in the various aspects of entrepreneurship.	
Unit – I	**Entrepreneur and Entrepreneurship:**	**9**
Characteristics of Successful Entrepreneurs – Charms – Functions of Entrepreneur – Need – Types of Entrepreneur – Intrapreneur – Concept of Entrepreneurship – Role of Entrepreneurship in Economic Development – Concept and Functions of Women Entrepreneur – Growth of Women Entrepreneurship in India – Problems and Development of Women Entrepreneurship.		
Unit – II	**Rural and Agri-Preneurship:**	**9**
Meaning and need of Rural Entrepreneurship – Industrialization in Retrospect – Problems and development of Entrepreneurship – NGOs in Rural Entrepreneurship – Introduction to Agri-Preneurship – Need and Opportunities for Agri-Preneurship – Challenges and Suggestions for Developing Agri-Preneurship		
Unit – III	**Formulation and Forms of Business:**	**9**
Meaning and Contents of Business Plan – Significance and Formulation of Business Plan – Guidelines for Formulating Project Report – Network Analysis – Common Errors in Business Plan Formulation – Forms of Business Ownership: Sole Proprietorship – Partnership – Company – Cooperative – Selection – Ownership Pattern.		
Unit – IV	**Small Business Management:**	**9**
Objectives of Growth – Stages of Growth – Types of Growth Strategies – signals and symptoms of Industrial Sickness – Causes and Consequences of Industrial Sickness		
Unit – V	**E-commerce and Franchising:**	**9**
Meaning – Evolution – Advantages and Disadvantages – E-Commerce Suitability for Small Enterprises – Prospective Areas – Challenges – Franchising definition – Types – Advantages and Disadvantages – Evaluation –Franchising in India – Case study: McDonald.		

Total:45

TEXT BOOK:

1.	S.S.Khanka, "Entrepreneurial Development", 1st Edition, S.Chand & Company Ltd., New Delhi, 2020.

REFERENCES:

1.	Raj Shankar, "Entrepreneurship, Theory and Practice", Vijay Nicole Imprints Pvt. Ltd., Chennai 2012.
2.	Barringer and Ireland, "Entrepreneurship", 3rd Edition, Pearson Education, New Delhi, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	understand the concepts of entrepreneurship and its importance.	Understanding (K2)
CO2	infer the need of rural and agri-preneurship and their needs.	Applying (K3)
CO3	understand the components of a business plan.	Understanding (K2)
CO4	understand the nature of small business and causes of industrial sickness.	Understanding (K2)
CO5	demonstrate the knowledge of various sources of e-commerce and concept of franchise.	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	2	1				2		2		1		3	2	2
CO2	3	2	1	1		2		2		1		3	3	3
CO3	2	1				2		2		1		3	2	2
CO4	2	1				2		2		1		3	2	2
CO5	3	2	1	1		2		2		1		3	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 %
CAT1	30	50	20				100
CAT2	30	50	20				100
CAT3	30	40	30				100
ESE	30	50	20				100

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

18ISE26 – NETWORK MANAGEMENT

Programme &Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	9	PE	3	0	0	3

Preamble	This course focuses on network management functions and protocols	
Unit – I	**Basic Concepts of SNMP Network Management:**	**9**

Network Management Standards – Network Management Models – Organization Models – Information Model – Communication Model – Abstract Syntax Notation One – Encoding Structure – Macros – Functional Model.

Unit – II	**SNMPv1 Network Management Models:**	**9**

History of SNMP Management – Internet Organizations and Standards – Organizations – Internet Documents – SNMP Model – Organization Model – System Overview – Information Model – Introduction – Structure of Management Information – Managed Objects – Management of Information Base.

Unit – III	**SNMPv2 Network Management:**	**9**

Major Changes in SNMPv2 – System Architecture – SNMPv2 Structure of Management Information – SMI Definitions – Information Modules – SNMP Keywords –Module Definitions – Object Definitions – Textual Conventions – Creation and Deletion of Rows – Notification – Conformance Statements – SNMv2 Management Information Base – Changes –Information for Notification – Conformance Information – Expanded Internet – SNMPv2 Protocol – Data Structure and Protocol Operations – Compatibility with SNMPv1– Bilingual Manager – SNMP Proxy Server.

Unit – IV	**Network Management Tools, Systems and Engineering:**	**9**

System Utilities for Management – Basic Tools – SNMP Tools – Protocol Analyzer – Network Statistics Measurement Systems – Traffic Load Monitoring – Protocol Statistics – Data and Error Statistics – MRTG – MIB Engineering – Principles and Limitations of SMI – Counters vs Rates – Object Oriented Approach – SMI Tables – SMI Actions – SMI Transactions – NMS Design – Network Management Systems.

Unit – V	**Network Management Applications:**	**9**

Configuration Management – Network Provisioning – Inventory Management – Network Topology – Fault Management – Fault Detection – Fault Location and Isolation Techniques – Performance Management – Metrics – Data Monitoring – Problem Isolation – Performance Statistics – Event Correlation Techniques – Rule-based Reasoning – Mode-based Reasoning – Case-based Reasoning – Codebook Correlation Model – State Transition Graph Model – Finite State Machine Model – Security Management – Accounting Management – Report Management – Policy-Based Management – Service Level Management.

Total:45

TEXT BOOK:

1.	Mani Subramanian, "Network Management – Principles and Practice", 2nd Edition, Pearson Education, New Delhi, 2010.

REFERENCES:

1.	William Stallings, "SNMP, SNMPv2, SNMPv3, and RMON 1&2", 3rd Edition, Pearson Education, New Delhi, 2002.
2.	Gerard Blokdyk, "SNMP Simple Network Management Protocol", Create Space Independent Publishing Platform, South Carolina, 2017.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the basic concepts of SNMP network management	Understanding (K2)
CO2	interpret the network management models	Understanding (K2)
CO3	explain SNMPv2 network management	Understanding (K2)
CO4	demonstrate network management tools	Understanding (K2)
CO5	use network management techniques to various applications	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	2	1											2	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	2	1											2	2
CO5	3	2	1	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 %
CAT1	50	50					100
CAT2	50	50					100
CAT3	45	35	20				100
ESE	30	60	10				100

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

18ISE27 – INFRASTRUCTURE MANAGEMENT

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	9	PE	3	0	0	3

Preamble	To provide fundamental knowledge on structure and control of the functions responsible for diverse technical operations which generally involve hardware, software, and networking in both physical and virtual environments

Unit – I	IT Infrastructure:	9

Introduction - Evolution of Computer – Computer Basics – Network and Internet – Computing Resources – Information Technology – IT Infrastructure Management. IT Infrastructure: Introduction - Challenges – Design issues – Deter Mining Customer's Requirements - IT Systems Management Process – IT Service Management Process – Information System Design Process – Patterns – IT Infrastructure Library. Case Study: Understanding the UID Aadhaar project and IT's role in its success.

Unit – II	Service Delivery Process:	9

Service Level Management- Financial Management – IT Service Continuity Management – Capacity Management – Availability Management. Case Study: Deployment of India's first smart card based Public Distribution System (PDS) solution.

Unit – III	Service Support Process and Storage Management:	9

Configuration Management – Incident Management – Problem Management - Change Management – Release Management. Storage Management: Introduction – Backup and Storage – Archive and Retrieve – Disaster Recovery – Space Management – Database and Application Protection – Bare Machine Recovery – Data Retention. Case Study: Digital India Through Smart Technology.

Unit – IV	Security Management:	9

Introduction – Computer Security – Internet Security – Physical Security – Identity Management – Access Control System – Intrusion Detection. Case Study: IBM infrastructure and endpoint security services.

Unit – V	IT Ethics and Emerging Trends in IT:	9

Introduction – Intellectual Property – Privacy and Law – Computer Forensics – Ethics and Internet – Cyber Crimes – Emerging Trends in IT: Introduction – E-commerce – Electronic Data Interchange – Global system for Mobile Communication – Bluetooth – Infrared Technology- Case Study: Services offered by Asset Network Incorporation.

Total:45

TEXT BOOK:

1.	Phalguni Gupta, Surya Prakash and Umarani Jayaraman, "IT Infrastructure and its Management", Tata McGraw Hill Ltd., 2011.

REFERENCES:

1.	Anita Sengar, "IT Infrastructure Management",S.K.Kataria & Sons, 2012.
2.	Manoj Kumar Choube and Saurabh Singhal, "IT Infrastructure and Management", Pearson Education, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to	BT Mapped (Highest Level)
CO1	understand information technology services and management processes	Understanding (K2)
CO2	infer the information technology infrastructure facilities	Understanding (K2)
CO3	outline service support and storage management process	Understanding (K2)
CO4	demonstrate the need for security management in IT infrastructure	Applying (K3)
CO5	employ the code of ethics in information technology	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	2	1											2	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
CAT1	20	80					100
CAT2	20	80					100
CAT3	10	50	40				100
ESE	10	50	40				100

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

18ISE28 – ORGANIZATIONAL BEHAVIOR

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	9	PE	3	0	0	3

Preamble	The course aims at providing fundamental knowledge and exposure of concepts theories and practices in the field of management of human behavior at the individual, group and organizational levels	
Unit – I	**Organizational Behavior:**	**9**
Meaning – Importance – Disciplines contributing to OB. Challenges and opportunities of OB. Personality: Myers Briggs Type Indicator, Big Five Model – Values and attitudes, Job Attitudes–Perception and Individual Decision Making–Emotions and Moods: Positive and Negative Effect– Functions and Sources of Emotions.		
Unit – II	**Motivation:**	**9**
Early theories of motivation–Contemporary theories of motivation. Group & Team: Defining & Classifying Group – Stages of Group Development – Group Properties: Roles, Norms, Status, Size, Cohesiveness & Diversity, Type of Teams–Creating Effective Teams.		
Unit – III	**Communication and Leadership:**	**9**
Functions of Communication – Direction, Interpersonal and Organizational Communication – Persuasive Communications – Barriers to effective Communication. Leadership: Trait, Behavioral, Contingency – Charismatic and Transformational Leadership – Authentic Leadership – Mentoring – Challenges to the Leadership – Finding and Creating Effective Leaders.		
Unit – IV	**Conflict Process:**	**9**
Conflict – Transitions in conflict thought – The conflict process – Negotiation – Organization Structure: Basics of Organization Structure – Common Organizational Designs – New Design Options – Organizational Strategy.		
Unit – V	**Organizational Culture and Change:**	**9**
Basics of Organizational Culture – Creating and sustaining culture – Employees to learn culture – Creating Ethical and Positive Culture – Spirituality and Organizational Culture – Organizational Change: Resistance to Change – Approaches to Manage Change – Creating a Culture for Change – Work Stress and its Management.		

Total:45

TEXT BOOK:

1.	Robbins Stephen P, Timothy A. Judge, Neharika Vohra,"Organizational Behavior", 15th Edition, Pearson Education, New York, 2013.

REFERENCES:

1.	Mcshane L. Steven, Von Glinow Mary, and Ann Sharma R. Radha, "Organizational Behavior", Tata McGraw Hill, New Delhi, 2012.
2.	Luthans Fred, "Organizational Behavior", 12th Edition, McGraw Hill, 2016.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the fundamental theories of organizational behavior	Understanding (K2)
CO2	demonstrate a critical understanding of motivational theories and group differences	Applying (K3)
CO3	determine communication and leadership traits	Applying (K3)
CO4	interpret the potential effects of individual problems on organizational context	Understanding (K2)
CO5	infer the individual behavior with organizational culture	Understanding (K2)

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	2	1	3	1	3
CO2								3	3	3	3	2	1	2
CO3						3		2	3	2	2	2	1	2
CO4								2	2	2	3	3	3	2
CO5						3		2	3	3	3	3	2	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 %
CAT1	15	55	30				100
CAT2	15	55	30				100
CAT3	30	70					100
ESE	15	55	30				100

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

18ISE29 – BUSINESS INTELLIGENCE

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Data Mining Techniques	9	PE	3	0	0	3

Preamble	To improve application development and high scale development	
Unit – I	**Introduction:**	**9**

Introduction to Digital Data and its Types: Structured, Semi–structured and Unstructured Data – Introduction to OLTP and OLAP: OLTP – OLAP – Architectures – Data Models – Role of OLAP in BI – OLAP Operations on Multidimensional Data.

Unit – II	**Business Intelligence and Data Integration:**	**9**

BI Definition and Concepts: BI Component Framework – BI Users, 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.

Unit – III	**Multidimensional Data Modeling and Measures:**	**9**

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 – Measures, Metrics, KPIs and Performance Management: Understanding Measures and Performance – Measurement System – Role of metrics – KPIS.

Unit – IV	**Basics of Enterprise Reporting:**	**9**

Reporting Perspectives – Report Standardization and Presentation Practices – Enterprise Reporting Characteristics – Balanced Scorecard – Dashboards – Creating Dashboards – Scorecards Vs Dashboards – Analysis.

Unit – V	**BI Applications and Case Studies:**	**9**

Understanding Business Intelligence and Mobility – Business Intelligence and Cloud Computing – Business Intelligence for ERP Systems – Social CRM and Business Intelligence – Case Studies : Good Life HealthCare Group, Good Food Restaurants Inc., Ten to Ten Retail Stores.

Total:45

TEXT BOOK:

1.	Prasad R.N and Seema Acharya, "Fundamentals of Business Analytics", 1st Edition, Wiley–India Publication, New Delhi, India, 2014.

REFERENCES:

1.	Ramesh Sharda, Dursun Delen and Efraim Turban, "Business Intelligence: A Managerial Perspective on Analytics", 3rd Edition, Pearson Education, , New Delhi, India, 2013.
2.	David Loshin, "Business Intelligence: The Savvy Manager's Guide", 2nd Edition, Morgan Kaufmann Publishers, USA, 2012.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	apply the key elements of data warehouse.	Applying (K3)
CO2	apply the concepts and technology of BI space in any domain with BI tools.	Applying (K3)
CO3	explain about analysis, integration and reporting services.	Understanding (K2)
CO4	summarize the functionalities of key performance indicators.	Understanding (K2)
CO5	apply BI to mobile, cloud, ERP and social CRM systems.	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	2	1	1									3	3
CO2	3	2	1	1									3	3
CO3	2	1											2	2
CO4	2	1											2	2
CO5	3	2	1	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 %
CAT1	30	30	40				100
CAT2	30	30	40				100
CAT3	30	30	40				100
ESE	30	30	40				100

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

18ISE30 – SOFTWARE MAINTENANCE

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	9	PE	3	0	0	3

Preamble	To provide the detailed checklist and templates that can assist a software products organization to organize its maintenance and support function.

Unit – I	View of Maintenance and Problem Reporting:	9

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 – Skillsets – Challenges, Best Practices and Pitfalls – Measurements of Effectiveness in Problem Reporting.

Unit – II	Problem Resolution and Fix Distribution:	9

Introduction – High Level Overview – Categorising – Prioritising – Identifying the Right Developer for Fixing the Problem – Reproducing – Making the Fix and Testing It – 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.

Unit – III	Software Maintenance from the Customer's Perspective:	9

Introduction – Types of Customer Organisations – Common Roles –Typical Customer Perceptions–Conclusions. Maintenance of Mission – Critical Systems :Introduction – Mission – critical Systems Important to a Software Product Organisation–Requirements of Large Mission – Critical Systems – Product and Environment Issues to Address while Supporting Mission – Critical Systems – Process Changes – People Changes Required for Maintenance Supporting Mission Critical Systems –Conclusions.

Unit – IV	Global Maintenance Teams:	9

Introduction – Roles, Responsibilities and Skillsets in Maintenance – Effects and Opportunities Because of Globalisation – Organisation Structures – Estimation of People Resources for Maintenance – Typical People Issues Faced in Maintenance – How the Processes get Changed for Different Organisation Structures and Models – Compensation and Reward Systems – Best Practices and Pitfalls.

Unit – V	Forms of Maintenance and Other Life Cycle Activities:	9

Introduction – Effect of Requirements Gathering on Maintenance – Design and Maintenance – Programming, Debugging and Maintenance – Testing and Maintenance.

Total:45

TEXT BOOK:

1.	Gopalaswamy Ramesh and Ramesh Bhattiprolu, "Software Maintenance – Effective Practices for Geographically Distributed Environments", 1st Edition, Tata McGraw–Hill Education, New Delhi, 2012.

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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	elucidate the importance of maintenance	Understanding (K2)
CO2	know how to resolve problems in software maintenance	Understanding (K2)
CO3	make use of critical systems for software product organisation	Applying (K3)
CO4	gain knowledge of software maintenance from customer perception	Understanding (K2)
CO5	use different methodologies to reduce the overall maintenance cost of a product.	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	2	1											2	2
CO2	2	1											2	2
CO3	3	2	1	1									3	3
CO4	2	1											2	2
CO5	3	2	1	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 %
CAT1	25	75					100
CAT2	24	51	25				100
CAT3	26	47	27				100
ESE	26	44	30				100

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

18ISE31 – HUMAN RESOURCE MANAGEMENT

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	9	PE	3	0	0	3

Preamble	This course focuses the functions of human resource management, recruiting and training the employees.	
Unit – I	**Introduction:**	**9**

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.

Unit – II	**Recruitment:**	**9**

Factors affecting recruitment – Sources of recruitment – Recruitment process – Selection – Need for scientific selection – Process – Placement – Induction – Internal mobility – Promotion – Transfer – Demotions – Separation.

Unit – III	**Training:**	**9**

Need for training – Importance – Steps in training programme – Performance appraisal – Purpose – Approaches – Process – Methods – Problems – Making performance appraisal more effective.

Unit – IV	**Wage and Salary Administration:**	**9**

Objectives – Principles – Components – Methods of wage payments – Theory of wages – Incentives and benefits.

Unit – V	**Maintenance and Control:**	**9**

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", 1st Edition, S.Chand Publications, New Delhi, 2013.

REFERENCES:

1.	V.S.P. Rao, "Human Resource Management", 3rd Edition, Excel Books, New Delhi, 2010.
2.	Aswathappa, "Human Resource Management", 6th Edition, Tata McGraw Hill, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer the functions of human resource management	Understanding (K2)
CO2	use the recruitment techniques for recruiting an employee	Applying (K3)
CO3	demonstrate the methods for training the employee	Understanding (K2)
CO4	summarize wage and salary procedure for employee	Understanding (K2)
CO5	interpret the grievance handling mechanism	Understanding (K2)

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	2	2	2
CO2									2			2	3	3
CO3									2		2	2	2	2
CO4										2		1	2	2
CO5										2		1	2	2

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 %
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)

18ISE32 – E TECHNOLOGIES

Programme & Branch	MSc & Software Systems		Sem.	Category	L	T	P	Credit
Prerequisites	NIL		9	PE	3	0	0	3

Preamble	Provides a better understanding of the orientation in the current development of the modern network technologies which are used in E–business.

Unit – I	Introduction:	9

Electronic Commerce – The Second Wave of Global E–Business – Business Models, Revenue Models, and Business Processes – Advantages and Disadvantages of Electronic Commerce – Economic Forces and Electronic Commerce – Identifying Electronic Commerce Opportunities – International Nature of Electronic Commerce.

Unit – II	Business Strategies for E–Commerce:	9

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.

Unit – III	Marketing on the Web:	9

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.

Unit – IV	Business –to– Business Activities:	9

Purchasing, Logistics and Support Activities – Electronic Data Interchange – Supply Chain Management using Internet Technologies – Electronic Market Places and Portals – Mobile Commerce and Online Auctions.

Unit – V	Technologies for E–Commerce:	9

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", 12th Edition, Cengage Learning, Copy righted material, Noida, 2017.

REFERENCES:

1.	P.T.Joseph S.J, "E–Commerce an Indian Perspective", 5th 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.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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	acquire skills in marketing and CRM	Applying (K3)
CO4	attain the various Business –to– Business Activities	Applying (K3)
CO5	explain the need of security and online payments in E–Commerce	Understanding (K2)

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			1								2	2
CO2	2	1			1								2	2
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1			1								2	2

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 %
CAT1	30	70					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)

18ISE33 – GREEN COMPUTING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	NIL	9	PE	3	0	0	3

Preamble	To study the concepts related to Green IT– Green devices and hardware along with software methods – green enterprise activities – managing the green IT and various laws – standards – protocols along with outlook of green IT.

Unit – I	**Green IT - An Overview:**	**9**

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–Labelling of IT – Enterprise Green IT strategy – Green IT: Burden or Opportunity?

Unit – II	**Green Devices and Hardware:**	**9**

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.

Unit – III	**Green Enterprises and the Role of IT:**	**9**

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.

Unit – IV	**Managing Green IT:**	**9**

Introduction – Strategizing Green Initiatives – Implementation of Green IT – Information Assurance – Communication and Social media.

Unit – V	**Green IT - An Outlook:**	**9**

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", 1st Edition, A John Wiley & Sons, Ltd., Publication, UK, 2012.

REFERENCES:

1.	Deepak Shikarpur, "Green IT", 1st Edition, Vishwkarma Publications, Pune, 2014.
2.	Samdanis et al, "Green Communications: Principles, Concepts and Practice", 1st Edition, A John Wiley & Sons, Ltd., Publication, New Delhi, 2015.
3.	Mark G. O'Neill, "Green IT for Sustainable Business Practice: An ISEB Foundation Guide", 1st Edition, BCS, The Chartered Institute for IT, UK, 2011.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	discuss Green IT with its different dimensions and Strategies.	Understanding (K2)
CO2	describe Green devices and hardware along with its green software methodologies.	Understanding (K2)
CO3	discuss the various green enterprise activities, functions and their role with IT.	Understanding (K2)
CO4	describe the concepts of how to manage the green IT with necessary components.	Understanding (K2)
CO5	identify the various key sustainability and green IT trends.	Understanding (K2)

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	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	2	1											2	2
CO5	2	1											2	2

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 %
CAT1	35	65					100
CAT2	30	70					100
CAT3	25	75					100
ESE	30	70					100

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

18ISE34 – CYBER FORENSICS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Cryptography and Network Security	9	PE	3	0	0	3

Preamble	This course presents the basic concepts of digital forensics and investigations.	
Unit – I	**Understanding the Digital Forensics Profession and Investigations:**	9
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.		
Unit – II	**Data Acquisition:**	9
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.		
Unit – III	**Current Digital Forensics Tools:**	9
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.		
Unit – IV	**Recovering Graphics Files:**	9
Recognizing a Graphics File - Understanding Data Compression - Identifying Unknown File Formats - Understanding Copyright Issues with Graphics. Virtual Machine Forensics, Live Acquisitions, and Network Forensics: An Overview of Virtual Machine Forensics - Performing Live Acquisitions - Network Forensics Overview.		
Unit – V	**E-Mail and Social Media Investigations:**	9
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", 6th Edition, Cengage Learning, New Delhi, 2019

REFERENCES:

1.	John R. Vacca, "Computer Forensics: Computer Crime Scene Investigation", 1st Edition, Charles River MediaInc., 2014.
2.	Marie-Helen Maras, "Computer Forensics: Cybercriminals, Laws, and Evidence", 2nd Edition, Jones & Bartlett Publishers, 2015.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	infer digital forensics investigation mechanisms	Understanding (K2)
CO2	articulate data acquisition and collecting digital evidence	Applying (K3)
CO3	illustrate digital forensics tools	Understanding (K2)
CO4	interpret virtual machine forensics	Understanding (K2)
CO5	use digital forensics methods for E-mail crimes	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	2	1											2	2
CO2	3	2	1	1									3	3
CO3	2	1											2	2
CO4	2	1											2	2
CO5	3	2	1	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 %
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)

18ISE35 – NATURAL LANGUAGE PROCESSING

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Principles of Compiler Design	9	PE	3	1	0	4

Preamble	The goal of user interface design is to make the user's interaction with system as simple and efficient as possible, in terms of accomplishing user goals.

Unit – I	Introduction:	9+3

Regular Expressions, Text Normalization, Edit Distance: Regular Expressions – Words – Corpora – Text Normalization – Minimum Edit Distance. N–gram Language Models: N–Grams – Evaluating Language Models – Generalization and Zeros – Smoothing – Kneser–Ney Smoothing – The Web and Stupid Backoff – Advanced: Perplexity's Relation to Entropy.

Unit – II	Naive Bayes and Sentiment Classification:	9+3

Naive Bayes Classifiers and Training –Example – Optimizing for Sentiment Analysis – Text classification tasks – Language Model – Evaluation: Precision, Recall, F–measure – Test sets and Cross–validation – Statistical Significance Testing. Logistic Regression: Classification – Learning – Cross entropy loss function – Gradient Descent – Regularization – Multinomial logistic regression – Interpreting models – Deriving the Gradient Equation.

Unit – III	Vector Semantics and Embeddings:	9+3

Lexical and Vector Semantics – Words and Vectors –Cosine for measuring similarity – TF–IDF and its Applications – Pointwise Mutual Information (PMI) – Word2vec – Visualizing Embeddings – Semantic properties of embeddings – Bias and Embeddings – Evaluating Vector Models. Neural Networks: Units – The XOR problem – Feed–Forward Neural Networks – Training Neural Nets.

Unit – IV	Neural Language Models and Part–of–Speech Tagging:	9+3

Neural Language Models. Part–of–Speech Tagging: English Word Classes – The Penn Treebank Tagset – Part–of–Speech Tagging – HMM Part–of–Speech Tagging – Maximum Entropy Markov Models – Bidirectionality – Morphological Rich Languages.

Unit – V	Sequence Processing with Recurrent Networks:	9+3

Simple Recurrent Neural Networks – Applications – Deep Networks – Managing Context – Words, Subwords and Characters. Encoder–Decoder Models: Neural Language Models and Generation Revisited – Encoder–Decoder Networks – Attention – Applications – Self–Attention and Transformer Networks.

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Daniel Jurafsky and James H. Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 3rd Edition, Prentice–Hall, New Delhi, 2019.

REFERENCES:

1.	Roland R. Hausser, "Foundations of Computational Linguistics: Human–Computer Communication in Natural Language", MIT Press, 2011.
2.	Steven Bird, Ewan Klein and Edward Loper, "Natural Language Processing with Python", 1st Edition, O'Reilly Media, 2009.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	discuss regular expressions and evaluation models	Understanding (K2)
CO2	interpret naive bayes classifier and logistic regression with evaluation metrics and validation measure	Understanding (K2)
CO3	use different vector semantics and explain neural network	Applying (K3)
CO4	outline neural language models and make use of part of speech tagging for english	Applying (K3)
CO5	employ interface paradigms in visual interface design	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	2	1											2	2
CO2	2	1											2	2
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

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	15	85					100
CAT2	10	55	35				100
CAT3	10	55	35				100
ESE	10	50	40				100

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

18ISE36 – BLOCKCHAIN TECHNOLOGY

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Cryptography and Network Security	9	PE	3	1	0	4

Preamble	To provide technical fundamentals of blockchain, practical implications and development aspects of blockchain applications.	
Unit – I	**Introduction to Blockchain:**	**9+3**
	Centralized vs. Decentralized Systems – Layers of Blockchain – Importance – Blockchain Uses and Use Cases – Working of Blockchain: Foundation – Cryptography.	
Unit – II	**Blockchain:**	**9+3**
	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.	
Unit – III	**Bitcoin:**	**9+3**
	The History of Money – Working with Bitcoins – The Bitcoin Blockchain – The Bitcoin Network – Bitcoin Scripts – Full Nodes vs. SPVs – Bitcoin Wallets.	
Unit – IV	**Ethereum:**	**9+3**
	Bitcoin to Ethereum – Ethereum Blockchain – Ethereum Smart Contracts – Ethereum Virtual Machine and Code Execution – Ethereum Ecosystem – Swarm – Whisper – DApp – Development Components.	
Unit – V	**Blockchain Application Development:**	**9+3**
	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.	

Lecture:45, Tutorial:15, Total:60

TEXT BOOK:

1.	Bikramaditya Singhal, Gautam Dhameja, Priyansu Sekhar Panda, "Beginning Blockchain: A Beginner's Guide to Building Blockchain Solutions", 1st Edition, Apress, New York, 2018.

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", 2nd Edition, Packt Publishing, 2018.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	outline the history, background, and theoretical aspects of blockchain	Understanding (K2)
CO2	illustrate core components of blockchain	Understanding (K2)
CO3	present 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)

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	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
CAT1	30	70					100
CAT2	30	70					100
CAT3	35	45	20				100
ESE	35	45	20				100

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

18ISE37 – AGILE PROJECT MANAGEMENT

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Software Engineering	9	PE	3	1	0	4

Preamble	To focus on Agile software concepts and agile project management	
Unit – I	**Introduction:**	**9+3**
Introduction to Agile Project Management: Evolution of Project Management Profession, Agile Project Management Benefits – Agile Early History– Agile Manifesto: Values and Principles – Scrum Overview: Scrum Roles – Principles, Values.		
Unit – II	**Agile Planning:**	**9+3**
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.		
Unit – III	**Agile Project Management:**	**9+3**
Time–Boxing – Kanban Process – Theory of Constraints – Agile Estimation Overview: Estimation Practices – Burn–Down / Burn–Up Charts – Agile Project Management Role :Shifts in Thinking – Potential Agile Project Management Roles		
Unit – IV	**Agile Communications and Tools:**	**9+3**
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		
Unit – V	**Scaling Agile Projects:**	**9+3**
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", 1st Edition, John Wiley & Sons,Inc. Publications, Hoboken, New Jersey, 2015.

REFERENCES:

1.	By Alan Moran, "Managing Agile: Strategy, Implementation, Organisation and People", Springer, New York, 2015.
2.	Roman Pichler, "Agile product management with scrum creating products that customers love", Pearson Education, New Delhi, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
CO1	describe Agile Manifesto and Scrum	Understanding (K2)
CO2	infer Agile Planning & Requirements	Understanding (K2)
CO3	estimate Agile projects	Applying (K3)
CO4	implement Sprint Planning and Sprint Tracking	Applying (K3)
CO5	explain Scaling and Adaptation of Agile Approach	Understanding (K2)

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	2
CO2	2	1											2	2
CO3	3	2	1	1									3	3
CO4	3	2	1	1									3	3
CO5	2	1											2	2

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 %
CAT1	30	70					100
CAT2	20	50	30				100
CAT3	20	50	30				100
ESE	20	50	30				100

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

18ISE38 – SOCIAL NETWORK ANALYSIS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Data Mining Techniques	9	PE	3	1	0	4

Preamble	To understand the data analytical aspects of social network in the internet scenario and different data analytic issues in online social networks.

Unit – I	Introduction:	9+3

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.

Unit – II	Community Discovery:	9+3

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.

Unit – III	Social Influence Analysis:	9+3

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.

Unit – IV	Link Prediction in Social Networks:	9+3

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.

Unit – V	Visualization:	9+3

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", 1st Edition, Springer – India, New Delhi, 2015.

REFERENCES:

1.	Peter Mika, "Social Networks and the Semantic Web", 1st Edition, Springer – India, New Delhi, 2013.
2.	Borko Furht, "Handbook of Social Network Technologies and Applications", 1st Edition, Springer , New York, 2010.

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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)

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	2
CO2	2	1											2	2
CO3	2	1											2	2
CO4	3	2	1	1									3	3
CO5	3	2	1	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 %
CAT1	20	80					100
CAT2	23	77					100
CAT3	25	40	35				100
ESE	25	35	40				100

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

18ISE39 – INTERNET OF THINGS

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Computer Networks	9	PE	3	0	2	4

Preamble	This course aims at providing fundamental knowledge of internet of things and applies the concepts of IoT in the real world scenario.

Unit – I	Introduction to Internet of Things:	9

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.

Unit – II	IoT Design Methodology:	9

M2M – Difference between M2M & IoT – Software Defined Networks – Network Function Virtualization – IoT Platform Design Methodologies – Domain Specific IoT – Home Automation – Smart Agriculture.

Unit – III	Python for IoT:	9

Language Features of Python – Data Types – Data Structures – Control Flow – Functions – Modules – Packaging – File Handling – Date/Time Operations – Classes – Python Packages : HTTP Lib, URL Lib, SMTP Lib.

Unit – IV	IoT Physical Devices and Endpoints:	9

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.

Unit – V	IoT USE CASES:	9

Asset Management – The Smart Grid – Commercial Building Automation – Smart Cities.

List of Exercises / Experiments :

1.	Write a program using Arduino for traffic light controller
2.	Perform experiment using ArduinoUno to measure the distance of any object using Ultrosonic 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.	Program the Raspberry Pi to automatically switch ON/OFF the street lights whenever the sunlight intensity crosses a certain value and store the status in local database
6.	Build simple home automation system using Raspberry Pi and control it over web page
7.	Upload any sensor data over MQTT to things board using Rasberry Pi

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Arshdeep Bahga and Vijay Madisetti, "Internet of Things–A Hands–on Approach", 1st Edition, Universities Press, Hyderabad, 2015 for Units I,II,III,IV.
2.	Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Statmatis Karnouskos,Stefan Aves and David Boyle, "From Machine–to–Machine to the Internet of Things – Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014 for Unit V.

REFERENCES:

1.	Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 1st Edition, CRC Press, 2012.
2.	www.Raspberry Pi.org
3.	https://firebase.google.com/
4.	https://www.tutorialspoint.com/python
5.	Laboratory Manual

COURSE OUTCOMES: On completion of the course, the students will be able to		BT Mapped (Highest Level)
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	develop internet of things and logical design using Python	Applying (K3)
CO4	design web services to access/control IoT devices.	Applying (K3)
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 in the cloud	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	2
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

ASSESSMENT PATTERN – THEORY							
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	15	35	50				100
ESE	15	35	50				100

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

18ISE40 – FRONT END TECHNOLOGIES

Programme & Branch	MSc & Software Systems	Sem.	Category	L	T	P	Credit
Prerequisites	Web Technology	9	PE	3	0	2	4

Preamble	To design interactive UI and web applications using jquery, angular and node JS	
Unit – I	**Java Script and jQuery:**	9

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.

Unit – II	**Building Interactive Web Pages with jQuery:**	9

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.

Unit – III	**Server Side interaction through jQuery:**	9

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.

Unit – IV	**Building Web Applications with AngularJS:**	9

Getting Started with AngularJS – Understanding AngularJS Application Dynamics – Implementing the Scope as a Data Model – Using AngularJS Templates to Create Views – Implementing Directives in AngularJS Views– Creating Your Own Custom Directives to Extend HTML – Using Events to Interact with Data in the Model – Implementing AngularJS Services in Web Applications – Creating Your Own Custom AngularJS Services – Creating Rich Web Application Components using AngularJS.

Unit – V	**Node.js:**	9

Getting started with Node.js – Using Listeners, Timers and Callbacks – Handling Data From I/O – Accessing File System from Node.js – MongoDB and Node.js

List of Exercises / Experiments :

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.	Configuring and working with Node.js
9.	Data handling using Node.js
10.	Implement web from with MongoDB and AngularJS

Lecture:45, Practical:30, Total:75

TEXT BOOK:

1.	Brad Dayley, Brendan Dayley, "Angular Js, Java Script and jQuery", 1st Edition, Pearson Education, New York, 2015 for Units I,II,III,IV.
2.	Brad Dayley, "Node.js, MongoDB and AngularJS Web Development", 1st Edition, Pearson Education, New York, 2014 for Unit V.

REFERENCES:

1.	Simon Holmes, Clive Herber, "Getting MEAN with Mongo, Express, Angular, and Node", 1st Edition, Manning Publications, New York, 2019.
2.	Vijay Josh, "Mastering jQuery UI", 1st Edition, PACKT Publishers, Mumbai, 2015.
3.	Text Editor / Browser / Any IDE
3.	www.codementor.io
4.	Laboratory Manual

COURSE OUTCOMES:

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

		BT Mapped (Highest Level)
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	develop UI with angularJS	Applying (K3)
CO5	use node.js for web development	Applying (K3)
CO6	demonstrate website designing using jQuery	Applying (K3), Precision (S3)
CO7	design application using AngularJS	Applying (K3), Precision (S3)
CO8	build applications with MongoDB and Node.js	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
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

ASSESSMENT PATTERN – THEORY

Test / Bloom's Category*	Remembering (K1) %	Understanding (K2) %	Applying (K3) %	Analyzing (K4) %	Evaluating (K5) %	Creating (K6) %	Total %
CAT1	20	50	30				100
CAT2	20	50	30				100
CAT3	20	40	40				100
ESE	20	20	60				100

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