CSIBER Trust's
CHHATRAPATI SHAHU INSTITUTE OF BUSINESS EDUCATION AND RESEARCH (CSIBER) KOLHAPUR
An Autonomous Institute under UGC, New Delhi and Shivaji University,
College with Potential for Excellence (CPE) III Phase,
Reaccredited by NAAC with 'A+' Grade (CGPA 3.55)

Ref. CSIBER/BOS-Meeting/2019-20/351 Date:06-03-2020

To,

Sir,

Meeting of the **Social Work Board** is scheduled on **10th March 2020 at 3.30 p.m** in MSW HOD room of this Institute to transact the following business.

You are requested to attend the meeting.

Thanking you,

With regards,

Dr. C.S.Dalvi
I/C Director

Agenda for the meeting of the Board of Studies

1. To read and confirm the minutes of the last meeting.
2. To consider the changes in the syllabi of different courses/Programmes if any.
3. To prepare syllabi of various courses as per new program structure.
4. To review the question papers of academic year 2019-20.
5. To prepare panel for internal and external, paper setters & examiners.
6. Any other item with the permission of the Chairman.

Dr. C.S.Dalvi
I/C Director

- AEC-2 Statistics needs to be continued as it is still related and required for MSW students. The present paper / paper shall have written and semester end examination
- All MSW papers shall have 5 units
- MOOC courses can not be offered to MSW students as statistics is offered as AEC-2 in second semester

Item 3 - To prepare syllabi of various courses as per new programme structure

Resolution: The members discussed about syllabi and revision of structure, and resolved the following

- The existing GE3 title Counselling: theory & practice shall be renamed as fundamentals of Counselling (wef 2019-2020)

DSE 4.1, 4.2 & 4.3 shall have no theory Exams, spl. assignments can be conducted

- The existing GE4 paper entitle Rural Economy shall be replaced with "Basics of social legislation" The syllabus drafted by Dr S.S. Apte and Dr D.M. Bhosale with help of external legal expert. (wef 2019-2020)

- The dept of Economics has proposed to include following GE papers from academic year 2019-20
  GE1 Principles of Economics
  GE2 - Principles of Microeconomics
  GE3 - Fundamentals of micro Economics
  GE4 - Indian Economy

Item: To review question papers of academic years 2018-19

Resolution: Members reviewed the question papers and

The meeting of BOS in Social work was held on 10.03.2020 at 3.30 pm in the Dept of social work The following members were present

1. Dr S.V. Shirol Chairman
2. Dr K. Pradeep kumar
3. Dr B.N. Patil
4. Dr K.N. Rankhore
5. Dr Shailaja Mane SUK Nominee Arts & Commerce College, Nagthane : Mane madam could not attend due to urgent official work in the college
6. Dr D.N. Valvi

	Minutes of the meeting
Item 1	To read and confirm the minutes of the last meeting
Resolution	The minutes of the last meeting were read and confirmed
Item 2	To consider the changes in the syllabi of different courses / programmes, if any.
Resolutions	The Members discussed and no changes were suggested
Item 3.	To ~~prepa~~ prepare syllabi of various course as per new programme structure
Resolution	The Members discussed existing recently revised course / programme structure and found satisfactory, hence no changes were suggested
Item 4	To review the question papers of the academic year 2019-20

DATE

The meetings of the B.O.S. in Computer Studies is held on 14th March, 2020 at 4 P.m. in M.C.A. Department. The following Members were Present.

1) Dr. R.V. Kulkarni (Chairman)
2) Dr S.D. Bhojte (Member)
3) Dr. Ajay D. Shinde (Member)
4) Dr. P.G. Naik (Member)
5) Dr. R.S. Kamath (Member)
6) Prof(Mrs) M.K. Mane (Member)
7) Dr S.S. Jamsandekar (Member)
7) Prof(Dr) V.R. Ghorpade (University Nominee)
8) Prof G.A. Patil (Invitee)

1. Read & confirmed the minutes of the last meeting held on 29th April, 2019.

2. New structure for M.C.A. was approved. (M.C.A. 2 year) which will be implemented from academic year 2020-21. as per AICTE norms.
As per the suggestion from members it was decided to float two Specialisations Data Science & Network Security.

DATE / /

External

1) Prof(Mrs) Vidya Baddas 6 years class By de

Read & Confirmed

Ve

25/11/2021.

PAGE NO.
DATE / /

The following Subcommitte is formed to finalize the Syllabus of the Revised Structure.

1) Dr. Ajay D. Shinde (Chairman)
2) Dr. P. G. Naik
3) Dr. R. S. Kamath

4. Question Papers were reviewed

5. External.

1. Prof. P. A. Khasade (10 years) Web Technology
Bharati Vidyapeeth Computer Networks
Kolhapur

2. Prof. S. B. Patil (11 years) Web & Database
Bharati Vidyapeeth, Kolhapur.

3. Prof. V. V. Mangave (8 years) Software Eng.
D. Y. Patil Object oriented Design.

4. Prof (Mrs) S. B. Patil (10 years) Core Java.
D. Y. Patil Eng. Database Mgmt

5. Prof (Mrs) S. S. Kokate (12 years) Database File Structure
D. Y. Patil Program with C.

6. Prof A. S. Yadav (10 years). Asp.net
Dot. net

The meeting of the B.O.S. in Computer Studies is held on 25th Jan. 2021 at 4 P.M. in M.C.A Department. The following members were Present.

) Dr. R.V. Kulkarni (Chairman) R Kulkarni
) Dr. S.D. Bhosle (Member)
) Dr. Ajay D. Shinde (Member)
) Dr. P.G. Naik (Member)
) Dr. R.S. Kamath (Member)
) Dr. S.S. Jamsandekar (Member)
) Prof (Mrs) M.L. Mane (Member)
) Prof (Dr.) V.R. Gherpade (Univ. Nominee)
) Prof (Dr) R.K. Kamath (Invitee)

The minutes of the last meeting were read & confirmed

The detail Syllabus of M.C.A 2 years ~~was discussed~~ Submitted by the Subcommittee ~~was~~ reviewed & finalized

2.1. It was Unanimously resolved to Introduce Two Specialisations for M.C.A. Programme.
(I) Data Science (II) Network security.

For each specialisation the student has to select & clear all the four Papers Under the Specialisation.

3. The Structure for Msc C.S. in Cyber Security was discussed in the BOS. As per the suggestion of Dr. R.K. Kamath Dean of Science faculty Shivaji University, it was decided to change the Nomenclature of Msc C.S. in Cyber Security to Msc C.S. in Cyber Security with data Science

4. All the Question Papers of different Subjects Under different Programs were reviewed.

5. There was no suggestion for including the names of Paper setter & examiners in the Panel.

6. No Other Item

Chh Shahu Institute of Business Education & Research Kolhapur

(An Autonomous Institute under UGC Act.)

Department of Computer Studies

Structure & Syllabus of the MCA Program Under the Faculty of Science

(Revised and Effective from 2020-21)

C.B.C.S. Pattern

INTRODUCTION:

The M.C.A. programme is of two-year duration, named as M.C.A. (Part-I), M.C.A. (Part-II), in Faculty of Science. Each year is divided into two semesters for the convenience of teaching and examination. In each semester, there will be teaching for 15 weeks followed by an End-of-Semester (EOS) examination. The teaching for Semesters -I, III will be held between 1st July and 31st October, and the teaching for Semesters-II and IV will be held between 1st December and 31st March.

The students are supposed to undergo summer Internship in organization for 60 days After Semester-II and before Semester-III, they are supposed to submit a report about the same along with organizational certificate. Also they are supposed to present the same in semester-III end semester examination.

ELIGIBILITY:

1. A candidate for being eligible for admission to MCA programme (Faculty of Science) must have passed Bachelors Degree Examination of the Shivaji University or any other University recognized by A.I.U. (Association of Indian Universities) with minimum of ***aggregate 50% marks for open category and 45% for Reserve category.***
2. Having studied Mathematics at 12^{th} examination or having studied Mathematics as one of the subject at graduation level examination.
3. The candidates who have done B.C.A. are also eligible.
4. In order to become eligible for admission to MCA programme, the candidate has undergo the process prescribed by DTE-Maharashtra from time to time.

DURATION:

The programme of the study of the degree of M.C.A. shall be full time programme and its duration shall be of Two Years. The programme consists of Four Semesters. The examination to be held in the First and Second Semester will be called Part – I (First Year), the examination to be held in the Third and Fourth Semester will be called Part – II (Second Year) .

If a candidate fails to clear all the theory papers, practical, term papers and project report within **Six** years of his/her registration, the past performance will stand automatically nullified.

If a candidate discontinues any of the terms (i.e. Semester – I to IV) on any account, will be allowed to complete the incompleted terms in the subsequent years subject to it is within the stipulated time duration of **Six** years.

In addition to the above, once a student's term (Semester) is granted, he/she shall be allowed to appear and pass in any of the subsequent examinations held, provided the examinations are within the stipulated period of **Six** years.

In case the term (Semester) is not granted the student has to seek fresh admission in the next year and complete the term and pass the examination, this too within **Six** years of his/her registration.

- **Programme Completion with Break in Between :**

A student who has passed M.C.A.–I and is seeking admission to M.C.A.–II after a long gap (Provided the gap lies within the stipulated duration of **Six** years) should complete the programme syllabus which is in existence at the time he has sought the admission for the academic year

ASSESSMENT:

Taking into considerations of the UGC and AICTE requirements SIBER has adopted "Choice Based Credit System." (CBCS). Each course is of 100 marks and contact hours for each course is 60/45/30. One credit is allotted to 15 contact hours. All courses are considered as Full credit course i.e. **FOUR** credits are allotted to each course.

For Theory paper of 100 marks (**Four** credits) the distribution of the marks will be as follows –

- Internal Marks i.e. Concurrent evaluation - 40 Marks
- External Marks i.e. End examination - 60 marks

For Practical paper of 100 marks (**Four** credits) the distribution of the marks will be as follows –

- Practical Examination - 40 Marks

- External Marks i.e. End examination - 60 marks

Breakup of Internal Marks i.e. Concurrent evaluation -

Sr. No.	Head	Marks
1.	Class Participation	10 Marks
2.	Moodle Test (Minimum One Test Per Unit)	10 Marks
3.	Seminar /Article Review (Based on Emerging Trends in Information Technology and Computer Science)	10 Marks
4.	Case Study / Term Paper	10 Marks
5.	Total	40 Marks

Each student is expected to appear for a minimum **FIVE** Class Test to be conducted on moodle. A student has to submit one library based assignment, two case studies, one article reading, one seminar for each course in the syllabus. The final internal marks will be calculated using the heads shown in above table. **The internal marks obtained by the student has to be disclosed and signed by the student.**

For Practical examination of 40 marks there shall be three questions of 15 marks each, the student has to attempt any two. 10 marks reserved for journal.

- Journal marks - 10 Marks
- Practical Marks i.e. End examination - 30 Marks

The practical examination should be considered as one head of passing i.e. 40 marks.

For the Project Work of 100 marks, the distribution of the marks will be as follows –

- Internal Examiner - 30 Marks
- External Examiner - 30 Marks
- Seminar/Term Paper - 40 Marks

For Theory Paper Assessment

1. The assessment of papers will be done by an Internal and External examiner. A difference of more than **20%** in the marks awarded by these examiners would necessitate the valuation of these paper by the Third examiner. The **'nearest'** marks will be considered for determining the average mark of such papers.
2. The examiners should submit the marks on separate sheets supplied to them. No marks should be entered directly in the inside pages of the answer book.
3. Once the Student passed in the internal marks (Concurrent evaluation out of 40) and submitted to the examination department, should be carried forward whenever required.
4. Students who failed in the internal marks (Concurrent evaluation out of 40) in such cases student should reappear for the same, then only the revised marks will be considered further calculation.
5. There shall be seven questions, question no.1 and 7 shall be compulsory and from question no. 2 to 6 student has to attempt any 3. Equal weightage should be given to each unit.

STANDARD OF PASSING:

1. In order to pass in each passing head, a candidate will have to obtain 50% in the internal marks (Concurrent evaluation), 40% marks in theory, and minimum of 50% of the marks in aggregate in passing head.

2. To pass the M.C.A. examination, a candidate will have to pass in all Four Semester in Two Parts i.e. Part – I (Semester – I to II) and Part – II (Semester – III & IV)
3. To pass the Project work / Seminar course/ Term paper a candidate must obtain a minimum of 50% of the total marks. If a candidate fails in the seminar / project report/ term paper and its viva-voce, he/she will be required to join the particular seminar / project report/ term paper and its viva-voce as a fresh candidate in the subsequent year.
4. A candidate from first year MCA will be eligible to proceed to the semester III ,if he/she is not having more than five courses backlog (25% of passing heads) from the first year (i.e. Semester I and II)
6. Semester Performance Index (SPI)/Cumulative Performance Index(CPI) will be as follows.

Grading System:

Full Credit 100 Marks

Grade Table for Trimester/Semester Examination			
Marks Obtained	Letter Grade	Grade Point	Description of Performance
96-100	S+	10	SUPER
91-95	S	9.0	
86-90	E+	8.5	Exemplary
81-85	E	8.0	
76-80	O+	7.5	Outstanding
71-75	O	7.0	
66-70	A+	6.5	Good
61-65	A	6.0	
56-60	B+	5.5	Average
50-55	B	5.0	
--	X	0	Defaulter
--	XX	---	Incomplete

Half Credit 50 Marks

Grade Table for Trimester/Semester Examination			
Marks Obtained	Letter Grade	Grade Point	Description of Performance
48 – 50	S+	10.0	SUPER
46 – 47	S	9.0	
43 – 45	E+	8.5	Exemplary
41 – 42	E	8.0	
38 – 40	O+	7.5	Outstanding
36 – 37	O	7.0	
33 – 35	A+	6.5	Good
31 – 32	A	6.0	
28 – 30	B+	5.5	Average
25 – 27	B	5.0	
--	X	0.0	Defaulter
--	XX	---	Incomplete

6. Final Result: For the final result of the student Cumulative Performance Index (CPI) based on total earned credits vis-à-vis total earned grade points shall be calculated will be as follows.

Total earned grade points / Total credits i.e. **126** credits.

Result		
CPI	Final Grade	Classification of Final Result.
9.6-10.0	S+	SUPER
9.1-9.5	S	
8.6-9.0	E+	Exemplary
8.1-8.5	E	
7.6-8.0	O+	Outstanding
7.1-7.5	O	
6.6-7.0	A+	Good
6.1-6.5	A	
5.6-6.0	B+	Average
5.0-5.5	B	

Note: An aggregate of **5.0** credit points are required to pass the M.C.A. program.

CALCULATION OF PERFORMANCE INDICES:

A distinction of the performance of one student from the other student is rather impossible to carry out from the grades obtained by a student in all the courses taken by him in a semester/year. Hence, the evaluation of various courses is cumulated in two performance indices termed as semester performance index (SPI) and cumulative performance index (CPI), the explanation of which is given below:

Semester Performance Index (SPI):

The performance of a student in a semester is indicated by a number called Semester Performance Index (SPI). SPI is the weighted average of all the grade points obtained by him in all the courses registered during the semester. If Gi is a grade with numerical equivalent as Gi obtained by a student for the course with credit Ci then, SPI for that semester is calculated using formula.

$$SPI = \frac{\sum_i C_i g_i}{\sum_i C_i}$$

Where summation is for all the courses registered by a student in that Semester SPI is calculated to two decimal places and rounded off. SPI once calculated shall never be modified. Generally, for the students failed in regular examinations SPI is calculated only after the declaration of re-examination grades.

Cumulative Performance Index (CPI):

An up-to-date assessment of the overall performance of a student from the first semester till completion of the programme is obtained by calculating an index called as Cumulative Performance Index (CPI). The CPI is weighted average of the grade points obtained in all the courses registered by a student since the first semester of the programme.

$$CPI = \frac{\sum_i C_i g_i}{\sum_i C_i}$$

Besides SPI, CPI is also calculated at the end of every semester upto two decimal places and is rounded off. It is necessary to ensure that one course appears only once in calculation of CPI and the denominator in above equation does not exceed the total number of credits registered by him.

GRACE MARKS UNDER DIFFERENT ORDINANCE.

S.O. No. 1:-Grace Marks for Passing in each head of Passing (Theory/Practical/Oral/ Sessional/External/Internal).

The Examinee shall be given the benefit of grace marks only for passing in each head of Passing (Theory/Practical/Oral/Sessional/ in External /Internal examination as follows.

Head of Passing	Grace Marks
Upto –50	2
051-100	3
101-150	4
151-200	5
201-250	6
251-300	7
301-350	8
351-400	9
And 401 and above.	10

Provided that the benefit of such gracing marks in different heads of passing shall not exceed 1% of the aggregate marks in that examination.

Provided further that the benefit of gracing of Marks under this Ordinance shall be applicable only if the candidate passes the entire examination of Trimester/Semester.

Provided further that this gracing is concurrent with the rules and guidelines of Professional statutory bodies at the All India level such as AICTE, MCI, Bar Council, CCIM, and CCIII. NCTE, UGC etc.

S.O. No. 2:- **Grace Marks for getting higher Class**

A Candidate who passes in all the courses and heads of passing in the examination without the benefit of either gracing or condonation rules and whose total number of Marks falls short for securing Second Class/Higher Second Class or First Class by marks not more 1% of the aggregate marks of that examination or up to 10 marks, whichever is less, shall be given the required marks to get the next higher class of grade as the case may be.

Provided that benefits of above mentioned grace marks shall not be given, if the candidate fails to secure necessary passing marks in the aggregate head of passing also, if prescribed in the examination concerned.

Provided further that the benefits of above mentioned grace marks shall be given to the candidate for such examination/s only for which provision of award of class has been prescribed.

Provided further that this gracing is concurrent with the rules and guidelines of Professional statutory bodies at the All India level such as AICTE, MCI, Bar Council, CCIM, and CCIII. NCTE, UGC etc.

S.O. No. 3 Condonation

If a candidate fails in more than one head of passing, his/her deficiency of marks in such head of passing may be condoned by not more than 1% at the aggregate marks of the examination. However condonation, whether in one head of passing or aggregate head of passing be restricted to maximum upto 10 marks only.

Condonation of deficiency of marks be shown in the statement of Marks in the form of asterisk and Ordinance number

Provided further that this gracing is concurrent with the rules and guidelines of Professional statutory bodies at the All India level such as AICTE, MCI, Bar Council, CCIM, and CCIII. NCTE, UGC etc..

VERIFICATION OF MARKS (Only Theory Papers)

Candidates who feel that the marks secured by them are less than their expectations, shall be allowed to apply for the verification of marks by paying the requisite fee of Rs.100/- per paper (Only Theory papers),

A candidate shall apply for verification within 7 days from declaration of the Result. This facility will be available only for maximum of three papers of that particular examination only.

BACKLOG:

1. A candidate will be permitted to proceed to the second Semester even though he/she fails in one or more courses of the first semester, provided the first semester term is granted..
2. The students who have a backlog of not more than **five courses (25% of passing heads)** in the First year examination (Semester I & II) will be eligible to be admitted to the Second year (III Semester) of M.C.A.
3. A Candidate will be permitted to proceed to the Fourth Semester even though he/she fails in one or more courses of the third semester, provided the third semester term is granted.

CHHATRPATI SHAHU INSTITUTE OF BUSINESS EDUCATION AND RESEARCH (CSIBER)
University Road, Kolhapur – 416 004
Out Line Theory Question paper for all the programmes
(Four Unit Course)

Class:
Course Name:
Paper no. :
Time: Three hours **Total marks: 60**

INSTURUCTIONS:

1. Question no. 1 is **COMPULSORY**
2. Attempt any **FOUR** from Q. No.2 to Q. No.7.
3. Figures to right indicate **FULL** marks

Q. 1.: Case study / Problems / Program (Based on Unit I to IV) **(12)**

Q.2 : Long Question / Brief answer Questions A and B (Based on Unit I) **(12)**

Q.3 : Long Question / Brief answer Questions A and B (Based on Unit II) **(12)**

Q.4 : a) Question (Based on Unit III) **(06)**

b) Question (Based on Unit III) **(06)**

Q.5 : a) Question (Based on Unit IV) **(06)**

b) Question (Based on Unit IV) **(06)**

Q.6 : a) Question (Based on Unit I or III) **(06)**

b) Question (Based on Unit II or IV) **(06)**

Q.7 : Write Short Answers . **(12)**

a) Based on Unit I (3 Marks)
b) Based on Unit II (3 Marks)
c) Based on Unit III (3 Marks)
d) Based on Unit IV (3 Marks)

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CHHATRPATI SHAHU INSTITUTE OF BUSINESS EDUCATION AND RESEARCH (CSIBER)
University Road, Kolhapur – 416 004
Out Line Theory Question paper for all the programmes
(Two Unit ourse)

Class :
Course Name :
Paper no. :
Time : Two hours **Total marks : 30**

INSTURUCTIONS:

4. Question no. 1 is **COMPULSORY**
5. Attempt any Three from Q. No.2 to Q. No.5.
6. Figures to right indicate **FULL** marks

Q. 1.: Case study / Problems / Program (Based on Unit I or II) **(6)**

Q.2 : Long Answer Question (Based on Unit I) **(8)**

Q.3 : Long Answer Question (Based on Unit II) **(8)**

Q.4 : a) Brief Answer Question (Based on Unit I) **(4)**

b) Brief Answer Question (Based on Unit II) **(4)**

Q.5 : a) Brief Answer Question (Based on Unit II) **(4)**

b) Brief Answer Question (Based on Unit I) **(4)**

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NATURE OF PRACTICAL QUESTION PAPER

Time : 2 Hours **Total Marks : 40**

Instructions:

1. Attempt any two questions.
2. **10 Marks are reserved for journal**

Q. 1: **(15 Marks)**

Q. 2: **(15 Marks)**

Q. 3: **(15 Marks)**

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MCA-I Semester-I

Nature of choice	**Course Code**	**Course Name**	Credits	Contact Hours	Int./Pract. Marks	Ext. Marks	Total Marks
Core Courses (CC)	**CC-101**	Computer Architecture and Operating system	3:1:0	60	40	60	100
	CC-102	Software engineering and Object Oriented Design	3:1:0	60	40	60	100
	CC-103	Design and Analysis of Algorithms	3:1:0	60	40	60	100
Core Practical Courses	**CC-104**	Programming with 'C'	3:1:0	60	40	60	100
	CC-105	Web Design and Development	3:1:0	60	40	60	100
Discipline Specific Elective (DSE)	**DSE-I (Any One)**	A. Programming with Python. B. Programming with R.	3:1:0	60	40	60	100
Ability Enhancement course (AEC)	**AEC-I**	Business Communication	2:0:0	30	50	00	50
		Total Credits	**26**	**390**	**290**	**360**	**650**

M. C. A. - I Semester-II

Nature of choice	**Course Code**	**Subject**	Credits	Hours	Int./Pract Marks	Ext. Marks	Total Marks
Core Courses (CC)	**CC-201**	Relational Database Management Systems	3:1:0	60	40	60	100
	CC-202	Mathematical & Statistical Foundation	3:1:0	60	40	60	100
	CC-203	Linux Administration & Programming	3:1:0	60	40	60	100
Core Practical Courses	**CC-204**	Data and File structures	3:1:0	60	40	60	100
	CC-205	Core Java	3:1:0	60	40	60	100
	Project-I	Mini Project-I and Term Paper	0:1:3	60	40	60	100
Discipline Specific Elective (DSE)	**DSE-II (Any One)**	A. Full Stack Web Development B. Theoretical Computer Science	3:1:0	60	40	60	100
Ability Enhancement course (AEC)	**AEC-II**	Soft Skills & Personality Development	2:0:0	30	50	00	50
		Total Credits	**30**	**450**	**330**	**420**	**750**

M. C. A. - II Semester-III

Specializations given under : DSE
DS : Data Science
NS : Network Security

Nature of choice	**Course Code**	**Course Name**	Credits	Hours	Int./Pract Marks	Ext. Marks	Total Marks
Core Courses (CC)	**CC-301**	Computer Communication and Network	3:1:0	60	40	60	100
	CC-302	Software Project Management and Quality Assurance	3:1:0	60	40	60	100
	CC-303	Ethical Hacking	3:1:0	60	40	60	100
Core Practical Courses	**CC-304**	Advanced Web Technologies.	3:1:0	60	40	60	100
	CC-305	.Net Programming	3:1:0	60	40	60	100
	Project-II	Industrial/Mini Project-II	0:1:3	60	40	60	100
Discipline Specific Elective (DSE	**DSE-III**	DS-I. Data Warehousing & Data Mining NS-I. Network Administration	3:1:0	60	40	60	100
Discipline Specific Elective (DSE	**DSE-IV**	DS-II. R for data Science NS-II. Information and Network Security	3:1:0	60	40	60	100
Ability Enhancement course (AEC)	**AEC-III**	Software design Patterns	2:0:0	30	20	30	50
	AEC-IV	Internship Presentation	0:0:2	30	--	50	50
		Total Credits	**36**	**510**	**300**	**600**	**900**

M. C. A. - II Semester-IV

Nature of choice	**Course Code**	**Course Name**	Credits	Hours	Int./Pract. Marks	Ext. Marks	Total Marks
Core Courses (CC)	**CC-401**	Artificial Intelligence	3:1:0	60	40	60	100
	CC-402	Mobile Computing	3:1:0	60	40	60	100
	CC-403	Block chain Technology	3:1:0	60	40	60	100
Core Practical Courses	**CC-404**	Web development using ASP.Net	3:1:0	60	40	60	100
	CC-405	Advanced Java	3:1:0	60	40	60	100
	Project-III	Mini Project-III Industrial Seminars	0:1:3	60	40	60	100
Discipline Specific Elective (DSE)	**DSE-V**	DS-III. Machine Learning using Python NS-III. Cloud Computing	3:1:0	60	40	60	100
Discipline Specific Elective (DSE)	**DSE-VI**	DS-IV. Big Data Analytic NS-IV. Database and Web Security	3:1:0	60	40	60	100
Ability Enhancement Course(AEC)	**AEC-V**	Internet of things	2:0:0	30	20	30	50
		Total Credits	**34**	**525**	**340**	**510**	**850**

Total Credits:

Semesters	**Core Credits**	**DSE**	**AEC**	**Total**
I	**5x 4 = 20**	**1 x 4= 4**	**1 x 2= 2**	**26**
II	**6 x 4 = 24**	**1 x 4= 4**	**1 x 2= 2**	**30**
III	**6x 4 = 24**	**2x 4= 8**	**1 x 2= 2** **1 x 2= 2**	**36**
IV	**6x 4 = 24**	**2x 4= 8**	**1 x 2= 2**	**34**
Total	**92**	**24**	**10**	**126**
Percentage	**73.01**	**19.04**	**7.95**	**100**
Total marks	**2300**	**600**	**250**	**3150**

Semester	**I**	**Total Credit**	**4**
Course Code	**CC101**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**COMPUTER ARCHITECTURE AND OPERATING SYSTEM**		

Course Objectives	
1	To feature a strong emphasis on the fundamentals underlying digital circuit design
2	To explore computer design components like Boolean Algebra, Logic Circuits and Computer Organization
3.	Learn objective and functions of modern operating systems.
4.	To get in-depth knowledge of process management and inter-process communication and learn the different memory management

Course Outcomes: The students will be able to	
1.	Build understanding and problem-solving skills required for digital circuit design
2.	Learn the Computer Architecture concepts like Boolean Algebra, Logic Circuits and Organization
3.	Capable of explaining the basic structure and functioning of operating system and able to point the problems related to process management and synchronization as well as is able to apply learned methods to solve basic problems.
4.	Able to explain the cause,effect related to deadlocks and to analyze them related to common circumstances in operating systems. Capable to explain the basics of memory management, the use of virtual memory in modern operating systems as well as the structure of the most common file-systems.00000000

Unit Number	**Contents**	**Number of Sessions**	
1	**Boolean Algebra and Logic Circuits** Boolean Algebra: Binary Logic, Logic Gates, Postulates of Boolean Algebra, Boolean Function, Algebraic Simplification, Karnaugh Maps Combinational Circuits: Half Adder, Full Adder, Decoder, Encoder, Multiplexer, Sequential Circuits: Flip Flops - SR, D and JK, Registers, Counters	**L= 12**	
		T= 3	**P= 0**
2	**Computer Organization** Memory Organization: Memory Hierarchy, Main Memory, Auxiliary memory, Associative Memory, Cache memory, Virtual Memory CPU Organization: CPU Building Blocks, Registers, Addressing Modes, Instruction sets Control Organization: Micro Programmed Control, Micro Instructions, Micro Operation Address Sequencing Input-Output Processing: Input/ Output Devices, Input-Output Interface, Modes of Transfer	**L= 12**	
		T=3	**P=0**
3	**Operating System Concepts** Definition of Operating System, Operating system structures, Process Concept, Process scheduling, inter-process, communication, and threads overview. CPU Scheduling: Scheduling and Criteria, Scheduling Algorithms, performance evaluation of scheduling algorithm. Process Synchronization: The critical–Section problem, synchronization hardware, and semaphore, classic problems of synchronization(Producer consumer problem) critical regions. Deadlock: System Model, Deadlock Characterization, Resource-Allocation Graph, Methods for Handling Deadlock, Deadlock Prevention, Deadlock Avoidance (Bankers Algorithm), Deadlock Detection.	**L= 12**	
		T= 3	**P= 0**
4	**Memory Management, File Systems, Disk Manaement** Memory Management: Concept, Memory Management Techniques, Swapping, Contiguous Memory Allocation, Memory Protection, Memory Allocation, Fragmentation, Paging, Basic Method, Segmentation with Paging, Virtual Memory Concept, Demand Paging, Page Replacement algorithm . **F**ile systems: File Naming, File Structure, file types, File access, Directory : directory structure, operations, File layout, File systems implementation (Contiguous, linked list, I-node). Disk Structure, Disk scheduling, FCFS Scheduling, SSTF Scheduling, SCAN,	**L= 12**	
		T= 3	**P= 0**

	CSCAN, Selection of Disk Scheduling Algorithm,		

Learning Resources		
1	**Text Books**	• M. Morris Mano, Computer System Architecture, Pearson, 3rd Edition • M. Morris Mano, Digital Logic and Computer Design, Prentice Hall • Andrew S. Tanenbaum, ―Modern Operating Systems‖, Prentice Hall of India, 2 nd Ed. 2006 • AchyutGodbole, ―Operating System‖, Tata McGraw Hill,3rd Ed.2013
2	**Reference books**	• J. P. Hayes, Computer Architecture & Organization, MGH, 3rd Edition • Pal Chaudhary, Computer Organization & Design, PHI, 3rd Edition • William Stallings, Computer Organization and Architecture: Designing for Performance, PHI, 7th Edition • Abraham Siberschatz, Peter Galvin Operating Systems: Concepts - Willey- Sixth edition. • D.M. Dhamdhere, System Programming and Operating Systems -TMH – SecondEdition. • William Stallings,Operating Systems: Internals and Design Principles, Seventh Edition, Pearson Publications • Madnick and Donovan , Operating Systems -Tata McGraw-Hill Education
3	**Websites**	• https://www.studytonight.com/computer-architecture/ • https://www.tutorialspoint.com/computer_organization/index.asp • https://www.geeksforgeeks.org/introduction-of-operating-system-set-1/ • https://www.javatpoint.com/os-tutorial • https://nptel.ac.in/courses/106/105/106105214/
4	**Journals**	• IEEE Computer Architecture Letters ISSN: 1556-6056 • ACM SIGARCH Computer Architecture News ISSN:0163-5964 • Journal of Operating Systems Development & Trends http://stmjournals.com/Journal-of-Operating-Systems-development-and-Trends.html eISSN: 2454–9355
5	**Supplementary Reading**	• Study Material of Web Course Developed for NPTEL , Computer Organization and Architecture, https://nptel.ac.in/courses/106103068/pdf/coa.pdf • Study material on operating system ,https://www.cse.iitb.ac.in/~mythili/os/
6	**Practical Components**	• Virtual Labs - Digital Electronic Circuits http://vlabs.iitkgp.ernet.in/dec/

Semester	**I**	**Total Credit**	**4**
Course Code	**CC 102**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title		**SOFTWARE ENGINEERING AND OBJECT ORIENTED DESIGN**	

Course Objectives	
1	To learn and understand the principles of Software Engineering
2	To Learn and understand Software Development Life Cycle
3.	To introduce object oriented concepts and its representation in UML
4.	To provide knowledge about object oriented model and its constituents
Course Outcomes: The students will able to	
1.	Compare and select a process model for a software project development
2.	Analyse and design software of software system
3.	Understand the usage of UML, its components, notation and syntax
4.	Choose correct model element and build design for object oriented system

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction to Software Engineering :** **(15)** Definitions, Characteristics of Software - Software Myths – Software Engineering, A Generic Process Model, Prescriptive Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Extreme Programming (XP), Scrum, Requirements Engineering, Requirements Modelling Strategies, SRS.	**L= 12**	
		T=3	**P=0**
2	**Use case and Class model :** **(15)** Overview of UML - views, diagrams, Model elements, UML extensions, Use-case modeling, use cases and actors, identifying use cases and actors, relationship between use cases and actors, drawing use case diagrams, describing the use cases, validating and verifying use case diagram, case studies-II Object Oriented System, Classes, objects and their relationships-concept of classes and objects, identifying the classes, Relationships between classes, Associations, Generalizations, aggregation, Interfaces (protocols), Packages and templates, drawing class diagrams, Case studies	**L= 12**	
		T=3	**P=0**
3	**Dynamic Model and Architecture :** **(15)** Dynamic modeling – concept of State of an object, relationship between attribute values states and operations, drawing state diagrams, various concepts related to Sequence diagrams, drawing sequence diagram, concepts related to Collaboration diagrams, drawing collaboration diagram, concepts related to activity diagrams, drawing activity diagram, Logical and Physical Architectures - Component diagram, Deployment diagrams	**L= 12**	
		T=3	**P=0**
4	**UML Extension and Real time modeling in UML :** **(15)** Extending UML –, Stereotypes, Constraints, Tagged values. Active objects, processes and threads, real time concepts, special real-time modeling concerns, drawing various UML diagrams for real time systems with real time concepts, case studies.	**L= 12**	
		T=3	**P=0**

Learning Resources		
1	**Text Books**	• Roger S Pressman “Software Engineering : A Practitioner’s Approach “ 7th Edition Mcgraw-Hill ISBN: 0073375977 • Hans - Erik Erikson and Magnus Penker - UML Toolkit 2
2	**Reference books**	• Ivar Jacobson - Object-oriented Software Engineering • Grady Booch - Object Oriented Analysis and Design with Applications • Ian Sommerville “ Software Engineering” 9th edition Pearson Education ISBN-13: 978-0-13-703515-1
3	**Websites**	• https://www.ece.rutgers.edu/~marsic/books/SE/links/ • **Software Engineering Lectures** Easy Engineering Classes
4	**Journals**	• https://link.springer.com/journal/10270 • https://www.computer.org/csdl/journal/ts
5	**Supplementary Reading**	• https://www.javatpoint.com/software-engineering-tutorial • https://www.guru99.com/software-engineering-tutorial.html • https://www.tutorialspoint.com/software_engineering/
6	**Practical Components**	Case Studies on software design, modelling.

Semester	**I**	**Total Credit**	**4**
Course Code	**CC-103**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**DESIGN AND ANALYSIS OF ALGORITHM**		

Course Objectives	
1	To provide a solid foundation in algorithm design and analysis.
2	Become familiar with fundamental data structures and with the manner in which these data structures can best be implemented; become accustomed to the description of algorithms in both functional and procedural styles.
3	To develop problem solving abilities using mathematical theories.
4	To apply algorithmic strategies while solving problems. Also expected to understand find out the time complexity of the algorithm.
5	To study the important algorithmic design paradigms and methods of analysis.

Course Outcomes: After successful completion of the course, the students would be able to	
1.	Learn good principles of algorithm design;
2.	To analyze worst-case running times of algorithms using asymptotic analysis.
3.	Describe the Divide-and-Conquer, Bound and Branch-programming, greedy paradigm and explain when an algorithmic design situation calls for it.
4.	Explain the major graph algorithms and their analyses. Employ graphs to model problems.

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction to Algorithms**: Problem solving aspect, top down design, implementation of algorithm, the efficiency of algorithm analysis, analysis of Algorithm (Best-case, Worst-case, Average-case, Amortised analysis), time complexity and space complexity, O-notation, Omega notation and Theta notation.	**L= 12**	
		T=3	**P= 0**
2	**Fundamental and Graph Algorithms**: Exchanging values of two variables, counting, summation of set of numbers, factorial computation, generation of Fibonacci sequence, reversing of the digits of an integer, base conversion, Generating prime numbers, raising number to a large power, finding maximum, minimum from the same, array techniques, array order reversal. Simple graph, Multistage graphs, Graph Coloring, Depth -First search, Depth -First search on directed graph, Breadth-First search , Best-First search, path finding problems, shortest path algorithm, topologicalsort	**L= 12**	
		T= 3	**P= 0**
3	**Algorithm Design Paradigms:** Recursive Algorithm design Methods: Tower of Hanoi problem , Algorithm Design Paradigms : Greedy method- knapsack problem, Minimum cost spanning tree algorithms (prims and kruskals), Divide and Conquer : General Strategy, Exponentiation, Matrix multiplication. Backtracking – n Queen problem, Hamiltonian circuit problem , Branch and Bound – assignment problem and Travelling Salesman problem, dynamic programming – general stratergy, Matrix chain multiplication	**L= 12**	
		T= 3	**P= 0**
4	**Sorting & Searching algorithms and Complexities :** Sequential search, Binary Search, Hash search, Selection sort, Exchange sort, Insertion sort , Radix sort, Quick Sort and Merge Sort, Two ways merge ,Building Heaps and Heap sort. Complexity and classification of Problems -: NP-HARD AND NP-COMPLETE PROBLEMS: Basic concepts, non-deterministic algorithms, NP-HARD and NP-COMPLETE classes .	**L=12**	
		T= 3	**P= 0**

Learning Resources		
1	**Text Books**	● R.G. Dromey,‖"How to Solve it by Computes"‖ , Prentice- Hall of India, 1982 ● Horowitz and Sahani, "Fundamentals of Computer Algorithms", Galgotia Publication, 2nd edition.
2	**Reference books**	● T. H. Cormen, C. E. Leiserson, R. L. Rivest and C. Stein. " Introduction to Algorithms", Prentice – Hall of India ,2nd edition , 2002. ● Weiss, Mark Allen, —"Data Structures and Algorithm Analysis in C"‖, Addison Wesley, 2nd edition , 1999. ● D.E Knuth, "Fundamental Algorithms", Narosa Publishing house, 2nd edition
3	**Websites**	● https://www.guru99.com/design-analysis-algorithms-tutorial.html ● https://nptel.ac.in/courses/106101060/ ● http://openclassroom.stanford.edu/MainFolder/CoursePage.php?course=IntroToAlgorithms
4	**Journals**	● IEEE Journal of Computing in Science & Engineering (https://ieeexplore.ieee.org/document/6664963) ● Springer US :Algorithmica (https://link.springer.com/journal/453) ● Science direct : Elsevier - journal of Algorithms (https://www.sciencedirect.com/journal/journal-of-algorithms)
5	**Supplementary Reading**	**Lecture Notes On Design And Analysis Of Algorithms B ...** Lecture Notes For Algorithm Analysis And Design - Cse Iit Delhi

Semester	**I**	**Total Credit**	**4**
Course Code	**CC 104**	**Credit Pattern**	**L-45, T-8, P-7**
Course Title	**PROGRAMMING WITH 'C'**		

Course Objectives	
1	To teach how to write programs in C language
2	To explain the data types and structures with their usage
3.	To demonstrate implementation of flat files using C language
4.	To demonstrate use of graphics in C language
Course Outcomes: The students will able to	
1.	Write correct programs in C language
2.	Understand use of data types and structures
3.	Implement flat files in C language, Use graphics in C language

Unit Number	**Contents**	**Number of Sessions**
1	Overview of Programming and programming languages, Types of programming Languages, Introduction to C, Features of C, Structure of C program, C Character set, Identifiers and keywords, variables and constants, Variables and their scope, modifiers and storage class specifiers. Unary operators, Binary arithmetic operators, relational operators and Logical operators, size of operator, ternary conditional operator, Operator precedence and associatively Bitwise operators, control flow and iterative structures, break, continue and goto statements. Input and output statements in C, printf, scanf functions, getchar, putchar, getch, getche functions, gets, puts functions, Escape sequence characters, Format specifiers	**L= 11** **T= 2** **P= 2**
2	**Arrays in C** Definition, one dimensional and two dimensional array, declaration, initialization and processing the elements of array, String handling. **Functions in C** Function declaration (Prototype), Function call, Function header and definition, Passing arguments (actual arguments, formal arguments), Types of function call (call by value, call by reference), Recursion	**L= 12** **T= 2** **P= 1**
3	**Pointers and structures in C** Pointer fundamental, Pointer declaration, Operations on pointer, Pointer with array and function, character pointer, array of pointer, pointer to array, dynamic memory allocation using dynamic memory allocation functions, Structure – declaration, initialization of structure, array of structure, array within structure, array of structure, structure and pointer, union and enumerated data types.	**L= 11** **T= 2** **P= 2**
4	**File Handling and Introduction to Graphics** File structure, Opening and closing file, Creating files, Processing files, File handling using command line arguments, Library functions for file handling, Introduction to Graphics in C, Graphics library functions (initgraph, close, getpixel, putpixel, line, rectangle, circle, ellipse.	**L=11** **T= 2** **P= 2**

Learning Resources		
1	**Text Books**	• C: The Complete Reference: Herbert Schildt • Let us C Solutions: Y.P. Kanetkar
2	**Reference books**	• Spirit Of "C": Moolish Kooper. • Programming in C : S. Kochan. • C Programming Language: Kernighan & Ritchie. • Programming in C: R. Hutchison. • Graphics Under C: Y. Kanetkar
3	**Websites**	• tutorialspoint.com • cprogramming.com
4	**Journals**	• C/C++ Users Journal • Computer Bits
5	**Supplementary Reading**	• The C programming language by Brain W. Kernighan • C Programming: A Modern Approach, 2nd Edition 2nd Edition, K. N. King

Semester	**I**	**Total Credit**	**4**
Course Code	**CC 105**	**Credit Pattern**	**L-45, T-8, P-7**
Course Title		**WEB DESIGN AND DEVELOPMENT**	

Course Objectives	
1	To teach the basic internet concepts and train them to develop internet applications.
2	Knowledge of the new JavaScript APIs.
3.	To introduce various tools for web services.
4	To introduce PHP and MySQL and its usages

Course Outcomes: The students will able to	
1.	Design and develop internet applications.
2.	Do JavaScript APIs.
3.	Use various tools for web services.
4.	Design and develop web application using PHP and MySQL

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction to HTML and CSS: (15)** Introduction To HTML, WWW, W3C, Common HTML, Tags Physical & Logical, Some basic tags like , changing background color of page, text color etc., Text formatting tags, Ordered & Unordered Lists Tags, Inserting image, Inserting Links: text, image links, Image mapping , Tables , Frames, Form Introduction with various input control - text box, text area, buttons, List box, radio, checkbox etc. Introduction to HTML5, HTML5 features and Elements: semantic tags, the selector API, new form input controls, improved accessibility Creating drop shadows and rounded corner CSS Introduction To Style sheet, types of style sheets- Inline, External, Embedded CSS, text formatting properties, CSS Border, margin properties, Positioning Use of classes in CSS, color properties, use of and . CSS3 Specifications, CSS3 features selectors	**L= 11** **T=2**	**P=2**
2	**Introduction to JavaScript: (15)** Introduction to script, types, Intro of JavaScript, JavaScript identifiers, operators, control & Looping structure, Intro of Array, Array with methods, Math, String, Date Objects with methods User defined & Predefined functions, Working with Frames, Forms and Form elements and the associated events. Form validation, three types of dialog boxes: alert, prompt, confirm, JavaScript Regular Expression	**L= 11** **T=2**	**P=2**
3	**Introduction to PHP: (15)** Concept of PHP, Constants, variables declaration, Comments, Data types, Operators, Command line arguments, Conditional statements, If-else, Switch, Ternary operators, looping statements- For loop, While loop, Do-while loop, Creating arrays, Inserting elements in arrays, Retrieving elements from array, Displaying arrays, Sorting array elements	**L= 11** **T=2**	**P=2**
4	**PHP and MySQL Connection:** Introduction to Databases, Connecting to MySQL database, Creating database, Creating tables, Inserting values in table, displaying, changing, searching, deleting records from the table, SQL queries- insert, select, delete, update, where, order by	**L= 11** **T=2**	**P=2**

Learning Resources		
1	**Text Books**	1.Html and css: design and build websites, by jon duckett 2. Javascript and jquery: interactive front-end web development, by jon duckett 3. Learning web design: a beginner's guide to html, css, javascript, and web graphics, by jennifer niederst robbins
2	**Reference books**	1. M. Morris Mano, Computer System Architecture, Pearson, 3rd Edition 2. M. Morris Mano, Digital Logic and Computer Design, Prentice Hall 3. M. Morris Mano, Michael D. Ciletti, Digital Design, Prentice Hall, 4th Edition 4. J. P. Hayes, Computer Architecture & Organization, MGH, 3rd Edition 5. V. Rajaraman & Radhakrishnan, Introduction to Digital Computer Design, PHI 6. Pal Chaudhary, Computer Organization & Design, PHI, 3rd Edition
3	**Websites**	www.Udemy.com www.Coursera.com www.W3Schools.com www.Tutorialspoint.com

4	**Journals**	Wei Willy. Usability tool for analysis of web designs using mouse tracks Advances in Informatics. Springer; 2003 Design Studies
5	**Supplementary Reading**	www.Lynda.com + LinkedIn Learning www. Codeacademy.com www.The Odin Project .com
6	**Practical Components**	Total 20 practical's based on Web Design and Development.

Semester	**I**	**Total Credit**	**4**
Course Code	**DSE I (A)**	**Credit Pattern**	**L-45, T-8, P-7**
Course Title	**PROGRAMMING WITH PYTHON**		

Course Objectives	
1	To familiarize the student with general computer programming concepts like conditional execution, loops, Python programming language syntax, semantics, and the runtime environment, as well as with general coding techniques and object-oriented programming.
2	To familiarize numpy ndimensional array, various ways to create numpy array, various numpy array operations
3.	To familiarize with data visualization using python

Course Outcomes: The students will able to	
1.	Be fluent in the use of procedural statements — assignments, conditional statements, loops, method calls — and arrays. Be able to design, code, and test small Python programs
2.	Understand the concepts of object-oriented programming as used in Python: classes, subclasses, properties, inheritance, and overriding.
3.	Have knowledge of various python data structures and data visualization

Unit Number	**Contents**	**Number of Sessions**	
1	**Programming Fundamentals and Overview of Python** Introduction, History and overview of Python, Basic features of Python Installation of python, Python IDE's. Variables in python Control Flow (if-then statements, looping) Overview of Object-Oriented Programming (OOP)	**L= 11**	
		T=2	**P= 2**
2	**DataTypes** - strings, lists, tuple, dictionary, operations on these data strcuturs. Organizing code (functions, modules, packages)	**L=11**	
		T=2	**P=2**
3	**Numpy** Introduction to NumPy Understanding the N-dimensional data structure , Basic operations and manipulations on N-dimensional arrays	**L= 12**	
		T= 2	**P= 1**
4	**Data Visualization:** scatter plots, line plots, box plots, bar charts, and histograms with matplotlib	**L=11**	
		T= 2	**P= 2**

Learning Resources		
1	**Text Books**	• Practical Programming: An introduction to Computer Science Using Python, second edition • Programming collective intelligence, O'Reilly publication
2	**Reference books**	• Python for Informatics: Exploring Information, Charles Severance • Python for Data Analysis, Wes McKinney, O'Reilly publication • Mastering Python for data science, Samir Madhavan, PACKT
3	**Websites**	• https://www.python.org • https://www.sololearn.com • https://realpython.com
4	**Journals**	• Python weekly • Pycoders weekly
5	**Supplementary Reading**	• Python Programming for the Absolute Beginner, 3rd Edition, Michael Damson • Fluent Python: Clear, Concise, and Effective Programming 1st Edition, by Luciano Ramalho, Kindle Edition, O'Reilly publication • DIVE INTO PYTHON 3 by Mark Pilgrim, Apress publication
6	**Practical Components**	• List of experiments to be executed during laboratory hours
		•

Semester	**I**	**Total Credit**	**4**
Course Code	**DSE I (B)**	**Credit Pattern**	**L-45, T-7, P-8**
Course Title	**PROGRAMMING WITH R**		

Course Objectives	
1	To learn and apply R programming
2	To understand R environment setup
3.	To explore, analyze and visualize data using R
4	To use R for effective data analysis

Course Outcomes: The students will able to	
1.	Program in R and use R for effective data analysis
2.	Explore, analyze and visualize data using R
3.	Handle practical issues in programming, reading data into R, accessing R packages, writing R functions
4.	Apply R Programming for basic data science operation

Unit Number	**Contents**	**Number of Sessions**	
1	**Getting started with R** R Installation, Getting started with R interface, Basic Syntax, R Data Types, Variables, Objects, Attributes, Vectors, Matrices, Lists, Factors, Data Frame, Data Type Examples, Operators	**L= 12**	
		T=2	**P= 2**
2	**Loops and Function** Decision Making, Control Structures – If statement, If else Statement, Looping Statements – For Loop, While Loop, Functions, Built-in Functions, Argument Matching, Develop R Scripts	**L= 11**	
		T= 2	**P= 2**
3	**Data and File Handling** R Environment, Getting Data into R, Reading and writing Data, Data Frames in detail, Filtering and subsetting Data, R Packages, Statistical analysis with R	**L= 11**	
		T= 2	**P= 2**
4	**Data Exploration and Visualization** Basic Data Summaries, Basic plotting - Histograms, Bar Charts, Scatter Plots, Box Plots, Plot functions, Data Visualization using R packages, Plot using ggplot2	**L=11**	
		T= 1	**P= 2**

Learning Resources		
1	**Text Books**	• Roger D. Peng, R Programming for Data Science, Lulu.com, 2012 • Garrett Grolemund, Hadley Wickham, R for Data Science, O'Reilly First Edition, 2017
2	**Reference books**	• Michael J. Crawley, The R Book, Wiley, 2nd Edition • Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media; 1 edition • Murray Aitkin, Brian Francis, John Hinde, and Ross Darnell, Statistical Modelling in R, Oxford University Press; 1 edition, 2009 • Brian Everitt and Torsten Hothorn, A Handbook of Statistical Analyses Using R, Chapman and Hall/CRC; 2 edition
3	**Websites**	• https://www.tutorialspoint.com/r/index.htm • https://data-flair.training/blogs/r-programming-language/ • https://www.guru99.com/r-programming-introduction-basics.html
4	**Journals**	• ACM Transactions on Programming Languages and Systems ISSN: 0164-0925 • Science of Computer Programming ISSN: 0167-6423 • The art, science, and engineering of software development: ISSN 0740-7459
5	**Supplementary Reading**	• R Programming, https://www.coursera.org/learn/r-programming • R Programming , https://www.datacamp.com/tracks/r-programming
6	**Practical Components**	• R Installation, R Programs based on Data Types, Loops and Functions, Data Visualization

Semester	**I**	**Total Credit**	**2**
Course Code	**AEC-I**	**Credit Pattern**	**L-26, T-4**
Course Title	**BUSINESS COMMUNICATION**		
Course Objectives			
1	To familiarize learners with the mechanics of communication.		
2	To develop students written expression of thought and build connections between content areas		
3	To develop students oral communication skills by a variety of communication activities, from informal discussion to formal presentation		
Unit Number	**Contents**		
1	**Effective Business Communication: (15)** • Meaning & Definition, Role of communication in today's business • Effective communication in Formal and Informal Environment • Barriers to communication • Measures to overcome barriers to communication • Non-verbal communication: Nonverbal Cues, Kinesics, Haptic and Proxemics Body language, Facial Expressions • Public Speaking		
2	**Business Communication and Technology: (15)** • Social Media Communication • Email Writing • Presentations Skills • Group Discussion • Critical Thinking		
Practical Components: 1. To be well in Verbal and Non- verbal communication 2. Make students enact and analyze the non-verbal cues 3. Each student to give presentation of 15 minutes (this can be spread throughout the semester) and to be evaluated by the faculty 4. Each Student will give 10 minutes speech on given topic that will be evaluated by the Faculty			
Learning Resources			
1	**Recommended Books**	1. **1** Business Communication – Lesikar, Flatley, Rentz&Pande, 11/e, TMH, 2010 2. How to win Friends and Influence People by Dale Carnegie 3. Skill with People by Les Giblin 4. The Power of Communication: Skills to Build Trust, Inspire Loyalty, and Lead Effectively, by Helio Fred Garcia, 2012	
2	**Reference Books**	1. Business Communication - Sehgal M. K &Khetrapal V, Excel BOOKS. 2.. Business Communication – Krizan, Merrier, Jones, 8/e, Cengage Learning, 2012.	

M. C. A. - I Semester-II:

Semester	**II**	**Total Credit**	**4**
Course Code	**CC 201**	**Credit Pattern**	**L-45, T-8, P-7**
Course Title	**RELATIONAL DATABASE MANAGEMENT SYSTEM**		

Course Objectives	
1	To understand the design of Database aspects and to understand various Data Modeling concepts for better database design.
2	Also to know various Phases involved in building simple well structured database(s).
Course Outcomes	
After completion of this course the student will be able to:	
1	The learners will study how to do better database designing and which further enhances powerful and user friendly application development

Unit Number	**Contents**	**Number of Sessions**
1	**Database Systems Concepts And Architecture: (15)** Introduction and definition of , data, Information & Database, Advantages, schemas and instance; three-schema architecture and data independence; the database system environment; centralized and client/server architecture of DBMSs.	
2	**Data Modeling : (15)** Meaning & Concept, High- level conceptual data models for database design; Entity types, entity sets, attributes and keys; relationship types, relationship sets, ER diagrams, Hierarchical Data Model(HDM), Network Data Model (NDM), The Relational Data Model and Relational Database Constraints; Relational model concepts; Relational Database Design .	
3	**The Relational Algebra And Relational Calculus Unary relational operations: (15)** SELECT and PROJECT; relational algebra operations from set theory; Normalization: Meaning & Functional Dependencies And Normalization ForRelational Databases: functional dependencies; normal forms based on primarykeys-1NF with example; general definitions of 2nd and 3rd normal forms; Boyce-Codd normal (BCNF)forms, 4 Normal Form.	
4	**Transaction Processing Concepts & Database Recovery : (15)** Introduction to transaction processing; Transaction Problems, Locking techniques, characteristics schedule based on serializability. Two phase locking techniques for concurrency control; concurrency control based on timestamp ordering; Database Recovery Techniques: Recovery concepts; Techniques ; Introduction SQL, Components DML, DDL, DCL with queries.	

Learning Resources			
1	References	1. C.J. Date, " An introduction to database systems", (3rd edNarosa publishers, 1985), 1997(reprint) 2. Ullman, "Principles of database systems", (2nd ed. Galgotia, 1984). 3. D. Kroenke, " Database Processing", (Galgotia, 1987) 4. Naveen Prakash, Introduction to database management", TMH, 1993. 5. Bobrowski, " client server architecture and introduction to oracle 7", 19	
2	Text Books	1. Fundamentals of Database Systems RamezElmasri and Shamkant B. Navathe, Pearsoneducation. 2. Database Concepts, Abraham Silberschatz, Henry F Korth, S.Sudarshan, McGraw-Hill	
3	Website	www.oracle/appalication	

Semester	**II**	**Total Credit**	**4**
Course Code	**CC 202**	**Credit Pattern**	**L-48, T-0, P-12**
Course Title	**MATHEMATICAL AND STATISTICAL FOUNDATION**		

Course Objectives	
1	Students will learn basic methods of Discrete Mathematics and apply the basic methods of discrete mathematics in Computer Science. They will be able to use these methods in subsequent courses in the design and analysis of algorithms, software engineering, Artificial Intelligence.
2	Topics like Propositional and Predicate Calculus provide the foundation for imbedding logical reasoning in computer science.

Course Outcomes: The students will able to	
1.	Use logical notation to define and reason about fundamental mathematical concepts such as sets, relations, and functions
2.	Reason mathematically about basic data types and structures (such as numbers, sets, graphs, and trees) used in computer algorithms and systems; 3. Apply graph theory models of data structures and state machines to solve problems of connectivity and constraint satisfaction,

Unit Number	**Contents**	**Number of Sessions**	
1	**Set Theory , Relations and Functions: (15)** Definition of Sets, Venn Diagrams, complements, Cartesian products, power sets, cardinality, operations on Sets, Basic set Identities, proofs of some general identities on sets ,Principle of Inclusion- exclusion. Relation: Definition, types of relation, composition of relations, domain and range of a relation, closure properties of relation, equivalence relations, Warshall's algorithm, Pictorial and computer representation of relations. Function: Definition and types of function, inverse of a function, composition of functions, permutations and their properties.	**L= 12** **T=3**	**P= 0**
2	**Graph Theory and Logic: (15)** Graph Theory: Graph terminology and representation, types of graphs, directed graph, weighted graph, representation of graph,(Adjacency Matrix and Incidence Matrix) ,Bipartite Graphs, Eularian and Hamiltonian Graphs. Propositional logic: Proposition logic, basic logic, logical connectives, truth tables, Converse, Inverse and Contrapositive of a conditional statement, tautologies, contradiction, contingency, normal forms(conjunctive and disjunctive), Logical equivalence and Implications, predicate logic, universal and existential quantification. Theory of inference for Predicate calculus.	**L= 12** **T= 3**	**P= 0**
3	**Measures of Central Tendency: (15)** Introduction, Objectives of statistical average, Requisites of a Good Average, Statistical Averages - Arithmetic Mean, Median and Mode **Measures of Dispersion*:*** Appropriate Situations for the Use of Various Averages, Mean deviation, Standard Deviation - Properties of standard deviation, Coefficient of Variation. **Correlation**: Karl Pearson's correlation coefficient. Algorithms to obtain each of these.	**L= 12** **T= 3**	**P= 0**
4	**Permutation & Combination: (15)** Basic Principle of Counting (BPC), Generalized BPC, Permutations and Combinations, Algorithms to generate permutations and Algorithms to compute number of combinations .**Probability:** Random experiment, sample space and classification of sample spaces, definition of probability, Properties,	**L=12** **T= 3**	**P= 0**

Learning Resources		
1	**Text Books**	● Tremblay J.P. and Manohar, R:Discrete Mathematical Structures with applications to Computer Science.(McGraw-Hill book company) ● Discrete Mathematical Structures – Bernard Kolman, Robert Busby, S.C. Ross and Nadeemur-Rehman (Pearson Education) ● Statistical Computing (Statistics: A Series of Textbooks and Monographs) 1st Edition by Kennedy

		(Author) ● Statistics and Computing S C Gupta, Fundamentals of Statistics ● Discrete mathematics - Semyour Lipschutz, Marc Lipson (MGH), Schaum's outlines. ● Discrete mathematics and its applications - Kenneth H. Rosen (AT&T Bell Labs) ● Schaums solved problem series – Lipschutz ● S. Santha, Discrete Mathematics with combinatorics and graph theory- CENGAGE Learning
2	**Referenc e books**	● N D Vohra, Business Statistics, Tata McGraw Hill ● G C Beri, Business Statistics, Tata McGraw Hill ● Probability and Statistics for Computer Scientists- The Complete Idiot's Guide to Statistics, 2nd Edition by— Robert A. Donnelly Jr. Ph.D. ● An Introduction to Statistical Learning: by— Gareth James, Daniela Witten, Trevor Hastie, Robert Tibshirani.
3	**Websites**	● https://nptel.ac.in/courses/106106094 https://www.coursera.org/specializations/discrete-mathematics ● https://stats.idre.ucla.edu/ ● www.stattrek.com ● www.statisticsbyjim.com
4	**Journals**	Hindawi Journal of Discrete Mathematics Elsevier – Dicrete Mathematics statistics and Computing Journal of Statistical Computation and Simulation A Course in Discrete Structures - Cornell Computer Science
5	**Supplemen ntary Reading**	Notes on Discrete Mathematics - Computer Science Numerical Issues in Statistical Computing for the Social Scientist Glyn Davis & Branko Pecar, Business Statistics Using Excel, Oxford University Press.
6	**Practical Compone nts**	Analyzing collected raw data or online available data. Finding relations among two or more variables and fitting regression Components equation to predict value of dependent variables

Semester	**II**	**Total Credit**	**4**
Course Code	**CC 203**	**Credit Pattern**	**L-44, T-8, P-8**
Course Title	**LINUX ADMINISTRATION AND PROGRAMMING**		

Course Objectives	
1	To familiarize the student with Linux operating system environment.
2	To demonstrate various Communication utilities and the familiarize with various system calls .
3	To make them familiarize with various administration tools.

Course Outcomes	
After completion of this course the student will be able to:	
1	Students will able to differentiate between Linux and other operating systems.
2	Students will able to install and administer Linux Servers .Use various Filters and editors
3	Students will able to fine-tune Linux system for better performance.
4	Students will able to program the system to enhance the abilities.

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction of Linux Operating System** Overview of Operating System, Types of Operating System, Overview of Network, Introduction to Linux - History, Architecture, Comparison with UNIX, Features and Facilities of Linux, Basic commands in Linux, Files and File Structure - Linux File System, Boot block, Super block, Inode table, Data blocks, Linux standard directories. File naming Conventions, Path, Types of file names , Types of Users, File Commands in Linux, file comparisons, Directory Commands, Text Editors-Functions of a Text Editor, vi Editor, leafpad editor. Checking and monitoring system performance.	**L= 11**	
		T=2	**P=2**
2	**Ubuntu Linux Administration, File Security, Permissions** Installing and Configuring Ubuntu Linux Server and Desktops, Hard Disk Partition Management, Linux File System - ext2 / ext3,Dual Boot Windows 7 and Ubuntu Installation, Network Configuration, Protocols, Installation Methods, Creating USB booting, identifying administrative files configuration and log files, Role of system administrator, Managing user accounts, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Disk quota management, Hiding Usernames Displayed on Login Screen, File security & Permissions, becoming super user using su. Locating Files, File Access Permissions [FAP], Viewing and Changing FAPs, Redirection, Filters, Getting system information with uname, host name, disk partitions & sizes, users, kernel. Run levels in Ubuntu.	**L= 11**	
		T= 2	**P= 2**
3	**Package Management, Backup and Restore Utilities in Linux:** Backup, restore and Compress utilities - tar, cpio, dump, sync and restore utilities. Installation of software's on Linux, Introduction to Ubuntu Package Management Software – apt, yum, Adding and Removing Software Packages, RPM Package Management, IP addressing, features of IPv4, static and dynamic IP addressing, Setting Printer, Scanner, Installing and Configuring of servers on Ubuntu- Telnet, FTP, NFS, Proxy Server, Apache, Samba DHCP Server setup Client setup, dosbox, SSH Server ,XAMP, PHP, Daemons- init, crond, atd, xinetd, inetd, the services file. named, sshd, httpd, System Initialization and Services, Boot Sequence Network, ,	**L= 11**	
		T= 2	**P= 2**
4	**Shell Programming** Basics of shell programming, various types of shell available in Linux, comparisons between various shells, shell programming in bash - Conditional and looping statements, Iterations, Command Substitution - expr command, Modifying files Sed, awk command, arithmetic expansion, parameter passing and arguments, Shell variables, system shell variables, shell keywords, Creating Shell programs for automating system tasks, handling files using command line argument. Introduction to system calls.	**L=11**	
		T= 2	**P= 2**

Learning Resources		
1	**Text Books**	Beginning Linux Programming: Neil Mathrew Richard Steve Wrox publication. Design of Linux Operating Systems : Maurice Bach Ubuntu on a Dime : James Floyd Kelly
2	**Reference books**	Operating System - Linux, NUT Press, PHI Publisher, 2006 Edition Red Hat Linux Bible, Cristopher Negus, Wiley Dreamtech India UNIX Shell Programming by YeswantKanetkar, BPB Linux Administration Handbook, EviNemeth,Garth Snyder, Trent KHein - Pearson Education. Beginning Linux Programming by Neil Mathew & Richard Stones, Wiley Dreamtech India
3	**Websites**	https://www.tutorialspoint.com/operating_system/os_linux.htm https://ubuntu.com/ www.guru99.com › introduction-linux
4	**Journals**	https://www.linuxjournal.com/ https://www.journals.elsevier.com/computer-networks https://www.reddit.com/r/linux/comments/cnfs48/linux_journal_ceases_publication_an_awkward/ **Linux Networking Clearly Explained/ebook**
5	**Supplementary Reading**	https://nptel.ac.in/courses/117/106/117106113/ Study Material of Web Course Developed for NPTEL Linux Programming & Scripting https://nptel.ac.in/content/syllabus_pdf/117106113.pdf

II		**Total Credit**	**4**
Course Code	**CC 204**	**Credit Pattern**	**L-48, T-0, P-12**
Course Title		**DATA AND FILE STRUCTURES**	

Course Objectives	
1	To find out types and difference between primitive and non-primitive structures.
2	To Design and apply appropriate data structures for solving computing problems.
3.	To Understand and use various file structures.
Course Outcomes: The students will able to	
1.	Differentiate between primitive and non-primitive structures.
2.	Design and create appropriate data structures for solving computing problems.
3.	Assess and develop new data structure if required.
4.	Understand and use various file structures.

Syllabus:

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction to Data Structure : (15)** Data Management concepts, Data types – primitive and non-primitive, Types of Data Structures- Linear & Non Linear Data Structures, implementation of some of the user defined data types such as – rational number, complex number, string, matrix etc**.**	**L= 12**	
		T=0	**P=3**
2	**Stack and Queue : (15)** Stack-Definitions & Concepts, Operations on Stacks, Implementation of stack using array and linked list, Applications of Stacks – Parenthesis checker, Infix to postfix conversion, Expression evaluation, Queue- Representation Of Queue, Operations On Queue, Circular Queue, Priority Queue, Array representation of Priority Queue, Double Ended Queue, Applications of Queue**.**	**L= 12**	
		T=0	**P=3**
3	**Linked List and Tree : (15)** Singly Linked List, Doubly Linked list, Circular linked list, Linked implementation of Stack, Linked implementation of Queue, Applications of linked list. Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Applications Of Trees-Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance.	**L= 12**	
		T=0	**P=3**
4	**Hashing and File structures : (15)** Hashing: The symbol table, Hashing Functions, Collision-Resolution Techniques, File Structure: Concepts of fields, records and files, Sequential, Indexed and Relative/Random File Organization, Indexing structure for index files, hashing for direct files, Multi-Key file organization and access methods**.**	**L= 12**	
		T=0	**P=3**

Learning Resources		
1	**Text Books**	• An Introduction to Data Structures with Applications. by Jean-Paul Tremblay & Paul G. Sorenson Publisher-Tata McGraw Hill. • Data Structures using C & C++ -By Ten Baum Publisher – Prenctice-Hall International.
2	**Reference books**	• Fundamentals of Computer Algorithms by Horowitz, Sahni,Galgotia Pub. 2001 ed. • Fundamentals of Data Structures in C++-By Sartaj Sahani. • Data Structures: A Pseudo-code approach with C -By Gilberg&Forouzan Publisher-Thomson Learning.
3	**Websites**	• https://www.udacity.com/course/data-structures-and-algorithms-nanodegree--nd256 • *https://www.edx.org/course/data-structures-fundamentals* • *https://www.coursera.org/learn/data-structures*
4	**Journals**	• https://jea.acm.org/ • *https://technav.ieee.org/tag/500/data-structures*
5	**Supplementary Reading**	• *https://www.javatpoint.com/data-structure-tutorial* • *https://www.geeksforgeeks.org/data-structures/* • https://www.tutorialspoint.com/data_structures_algorithms/
6	**Practical Component**	Implementation of various data structures on a computer.

Semester	**II**	**Total Credit**	**4**
Course Code	**CC 205**	**Credit Pattern**	**L-45, T-7, P-8**
Course Title	**CORE JAVA**		

Course Objectives

1	To provide a student with the solid foundation of the syntax and semantics of java Programming and object-oriented concepts in Java.
2	To familiarize the student to the application of Exception Handling mechanism in Java application
3	To familiarize the student to the development of console-based and event handling applications in Java
4	To demonstrate use of multi threaded application development in Java.
5	To demonstrate interfacing Java application with various Database Management Systems.

Course Outcomes: Students will be able to;

1	To design console based application, accessing command-line arguments and parameterized applets.
2	To design java applications employing streams and exception handling mechanism in Java.
3	To explore different types of JDBC drivers for connecting and accessing data from different backend database management systems.
4	To design and develop networked applications in both connection-oriented and connectionless architecture in Java.
5	To design and implement event handling applications in Java using AWT and Swing.

Unit Number	**Contents**	**Number of Sessions**	
1	**OOPS and Exception Handling in JAVA** Objects and classes, Inheritance, Interfaces, inner classes, Packages. Introduction to Java Utility classes and collection classes - Date, DateFormat and Gregorian Calendar classes. Using ListInterface, ListIterator and LinkedList classes. Set, Iterator, SortedSet, Map interfaces. HashSet class.Using Vector class, stacks, queues, HashTable. Generating random numbers, Property class. Exception Handling: Exception class hierarchy, Exception Vs Error, try, catch, throw, throws, finally, checked Vs unchecked exceptions, creating custom exception classes.	**L= 12**	
		T= 2	**P= 2**
2	**I/O Streams and Multi threading in Java** Significance of streams, various types of Input & Output streams, accessing the file through streams, object serialization. Random Access File. Difference between multi tasking and multi threading, Need for multi threading, thread states and priorities, suspending and resuming threads, synchronization between threads. Inter thread communication and dead locks.	**L= 11**	
		T= 2	**P= 2**
3	**Java Database Connectivity and Networking in Java** JDBC overview , JDBC Architecture , Types of JDBC Drivers, DriverManager class, database connection statements , Resultset, transaction, Metadata and Aggregate functions , callable statements, Connection to various back ends Connectionless and Connection-oriented architectures, Client and Server programming, Socket, DatagramSocket and DatagramPacket classes, IP address classes. InetAddress, URL and URLConnection classes.	**L= 11**	
		T= 2	**P=2**
4	**Applets and Event Handling in Java** Applet and its life cycle, passing parameters to applets, font, color, image classes. ImageObserver.Image processing using PixelGrabber and MemoryImageSource classes.Difference between AWT and Swing. Light weight and heavy weight components. Pluggable Look and Feel. Swing package and its components., layout managers, various components for GUI. Delegation Event Model, different types of events, event handlers, and adapter classes	**L= 11**	
		T= 1	**P= 2**

Learning Resources

1	Text Books	1. aJava Complete Reference by Patric Norton 2. Java 8 Programming Black Book 3. Core Java Vol. I (Addison- Wesley) Sun Press ISBN – 981-405-861-0 4. Core Java Vol. II (Addison- Wesley) Sun Press ISBN – 981-4058-50-5 5. Java in a Nutshell, By Benjamin J Evans, David Flanagan, O'Reilly Media
2	Reference books	. Thinking in Java, Bruce Eckel,, Addison – Wesley, ISBN: 9814035750 **2.** Java 2 Programming Black Book by Steven Holzner, Dream Tech Publication 3. A Programmer's Guide to Java SCJP Certification: A Comprehensive Primer By Khalid Azim Mughal, Rolf Rasmussen . Inside Java 2 Virtual Machine by Venners Bill, Mcgraw Hill Education . Learning Java by Jonathan Knudsen, Patrick Niemeyer, O'Reilly Media.
3	Websites	https://www.w3schools.com/java/default.asp https://www.tutorialspoint.com/java/index.htm https://www.javatpoint.com/java-tutorial https://beginnersbook.com/java-tutorial-for-beginners-with-examples/ https://www.studytonight.com/java/ https://www.guru99.com/java-tutorial.html
4	Journals	Java Development Journal - www.javadevjournal.com https://www.journaldev.com/ https://ieeexplore.ieee.org/document/714612
5	Practical Component	Practical lab excercises based on Units I to IV

Semester	**II**	**Total Credit**	**4**
Course Code	DSE II (A)	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**Full Stack Web Development**		

Course Objectives

1	To provide complete knowledge of software development technologies such as JavaScript, Node.js, Express.js, Angular.js.
2	To familiarize application development targeted towards building an end-to-end application employing MongoDB as backend deploying on GitHub.
3.	To familiarize with responsive website development.

Course Outcomes: The students will able to

1.	Implementation of web development technologies in real life
2.	Build an end-to-end application from scratch
3.	Prepare for taking up full stack developer job in industry

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction to Full Stack Web Development** - Full stack JS. Popular stacks. Advantages and disadvantages of full stack web development. Get Started with Web development using HTML5 programming, Document Object Model (DOM) and HTML Entities and styling with CSS3. Regular Expressions Basic JavaScript concepts. Mastering client-side technologies for building dynamic sites using AJAX and JSON. jQuery programming techniques Twitter bootstrap programming	**L= 12**	
		T=3	**P= 0**
2	**MEAN stack web development** - Data persistence using distributed NoSQL database MongoDB . MongoDB data modeling, data types, creating database. Collection, querying documents, DML commands, projection, indexing, aggregation MVC architecture. Directives, Expressions, controllers, Filters, Tables, HTML DOM, Modules, forms, Views, Scopes, Services, Dependency Injection	**L=12**	
		T=3	**P=0**
3	**Backend programming with NodeJS** - Node package manager. Environment setup for NodeJS. Callback concept. Event loop. Event emitter. Buffers, streams, file system, global objects, utility modules, web module. Express framework, RESTFul API. ExpressJS routing, HTTP methods, URL Building, Middleware, Templating, Static files, form data, cookies, sessions, authentication, scaffolding, error handling.	**L= 12**	
		T= 3	**P= 0**
4	**MERN Stack Web Development** - ReactJS environment setup. JSX, components, state, Props validation, component API, component life cycle, forms, events, refs, keys, router, using flux	**L=12**	
		T=3	**P= 0**

Learning Resources

1	**Text Books**	• Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker by Frank Zammetti, Apress publications • Full-Stack JavaScript Development by Peter Forrest, CreateSpace Independent Publishing Platform (June 6, 2017)
2	**Reference books**	• The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer by Chris Northwood, Apress publications • Full-Stack React Projects: Learn MERN stack development by building modern web apps using MongoDB, Express, React, and Node.js, 2nd Edition, Shama Hoque • Full Stack Web Development: Round One - Begin! by Edwin Ross Torres
3	**Websites**	• https://www.geeksforgeeks.org/what-is-full-stack-development/ • https://www.w3schools.com/whatis/whatis_fullstack.asp • https://www.tutorialspoint.com/listtutorial/Learn-MEAN-Stack-Development/7966
4	**Journals**	• A 12 Week Full Stack Web Course in 2017. Share on ... web programming. Journal of Computing Sciences in Colleges, 26(5):116--121, 2011 • Mean: a full JavaScript stack for web development: conference tutorial ... Publication: Journal of Computing Sciences in CollegesMay 2016.
5	**Supplementary Reading**	• The New Era of Full Stack Development, IJERT, Volume 09, Issue 04 (April 2020) • https://www.geeksforgeeks.org/what-is-full-stack-development/ • https://www.upgrad.com/blog/full-stack-projects-github-beginners/
6	**Practical**	• List of experiments to be executed during laboratory hours

Semester	**II**	**Total Credit**	**4**
Course Code	**DSE II (B)**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**THEORETICAL COMPUTER SCIENCE (TCS)**		

Course Objectives	
1	To comprehend languages, grammars, and computation models
2	To learn regular languages and context free languages which are crucial to understand how compilers and programming languages are built
3.	To discuss the concepts of Push Down Automata and Turing Machines
4	To strengthen rigorous mathematical reasoning skills

Course Outcomes: The students will able to	
1.	Understand how compilers and programming languages are built
2.	Demonstrate knowledge of basic mathematical models of computation and describe how they relate to formal languages.
3.	Apply knowledge of computing and mathematics appropriate to the discipline

Unit Number	**Contents**	**Number of Sessions**	
1	**Basic concepts of Automata Theory** Introduction, Alphabets, Strings and Languages, Deterministic Finite Automata (DFA), Nondeterministic Finite Automata (NFA), Representation of NFA and DFA using Transition Tables and State Diagrams. NFA with ε-transitions, Equivalence of NFA and DFA, Minimization of DFA.	**L= 12**	
		T=3	**P= 0**
2	**Regular Expressions and Languages** Introduction, Definition of regular expression, Kleen's Theorem, Equivalence of regular expression and Finite Automata, Pumping Lemma for regular Languages, Closure properties of Regular Languages, Finite Automata with Output: Moore and Mealy Machine, Equivalence of Moore and Mealy Machines.	**L= 12**	
		T= 3	**P= 0**
3	**Context Free Grammars** Introduction, Definition of Grammar, Classification of Grammars, Chomosky's Hierarchy. Context Free Grammars (CFG) and Context Free Languages (CFL) - Definition, Examples, Parse trees, Ambiguous Grammars, Simplification of Grammars, Normal forms of CFGs: Chomsky Normal Form (CNF) and Greibach Normal Form (GNF), Closure properties of CFLs, Pumping lemma for CFLs.	**L= 12**	
		T= 3	**P= 0**
4	**Push Down Automata (PDA) and Turing Machines** Introduction, PDA - Definition and Description, Language of PDA, PDA and CFLs, Determinism and Non determinism in PDA, PDA applications. Introduction, Basic Features of a Turing Machine, Language of a Turing Machine, Variants of Turing Machine: Multitapes, Nondeterministic Turing Machine, Universal Turing Machine. Halting problem of Turing Machine.	**L=12**	
		T= 3	**P= 0**

Learning Resources		
1	**Text Books**	• J.E. Hopcraft, R. Motwani, and Ullman, Introduction to Automata theory, Languages and Computation, Pearson Education Asia, 2nd edition • J Martin, Introduction to languages and the theory of computation, Tata McGraw Hill, 3rd Edition
2	**Reference books**	• C Papadimitrou and C. L. Lewis, Elements and Theory of Computation, PHI • K.L.P. Mishra and N. Chandrashekharan , Theory of Computer Science, PHI • Daniel I.A. Cohen, Introduction to Computer Theory, Second Edition, John Wiley
3	**Websites**	• https://www.tutorialspoint.com/automata_theory/ • https://www.geeksforgeeks.org/theory-of-computation-automata-tutorials/ • https://www.javatpoint.com/automata-tutorial
4	**Journals**	• Theoretical Computer Science ISSN: 0304-3975 • Journal of Theoretical & Computational Science ISSN: 2376-130X • Theory of Computing ISSN: 1557-2862
5	**Supplementary Reading**	• NPTEL Course on Theory of Computation, https://nptel.ac.in/courses/106104028/1# • Automata Theory, https://online.stanford.edu/courses/soe-ycsautomata-automata-theory
6	**Practical**	• Practical based on implementation of Automata Theory

	Components		
Semester	**II**	**Total Credit**	**2**
Course Code	**AEC-II**	**Credit Pattern**	**L-22, T-8**
Course Title	**SOFT SKILL AND PERSONALITY DEVELOPMENT**		

Course Objectives	
1	Develop effective communication skills
3	Develop broad career plans

Course Outcomes	
After r completion of this course the student will be able to:	
1	Match the job requirements and skill sets.
3	Evaluate the employment market.

Unit Number	**Contents**
1	**Personality**, **Interpersonal and employability skills and Emotional Intelligence: (15)** Basic Interaction Skills –Within family, Society. Interpersonal and intrapersonal skills. Types of skills; Decision Making, Articulation Skills, Emotional Intelligence Human relations examples through role – play and cases
2	**Leadership Skills, Team work, Conflict Management ,Interview Skills, Time Management and Stress Management: (15)** **Leadership skills** – Leadership in groups, coaching, strategic management **Team work & Team building** - Characteristics of an effective team, Essentials of an effective team, Evolution Team. Activities – Team trust, team shape up. **Conflict Management** – Types of conflicts, how to cope with them Small cases including role – plays will be used as teaching methodology. **Interview skills –** Introduction, Types of interviews, process of interview, Preparation of the candidate, preparation of the interviewer, common interview questions. **Time Management –** Importance, Prioritizing tasks, Personal Goal Setting – SMART goals, delegation, Time management in meetings, barriers to time management, identifying and handling time consuming tasks. Activity – Games, role-play, case studies. **Stress Management** – Understanding stress, Types of stress, symptoms, causes of stress. Managing stress, Techniques of managing stress. Activity – questionnaire to find out the level of stress.

Learning Resources		
1	Reference Books	• Business Communication – Urmila Rai & S M. Rai, 12/e, Himalaya Publishing House, 2010. • Enhancing Soft Skills – Prof.Dipali Biswas, 1/e, Shroff Publishers & Distributors Pvt. Ltd., 2009. • The ACE of Soft Skills – Gopalaswamy Ramesh & Mahadevan Ramesh, 3/e, Pearson Eductaion, 2012. Successful Career, Soft Skills and Business English – • Varanasi Bhaskara Rao & Y. Kameswari, 1/e, BS Publications, 2010. • Perrsonality Development and Soft Skills - Barun K. Mitra • Emotional Intelligence by Daniel Goleman

Semester	**III**	**Total Credit**	**4**
Course Code	**CC 301**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**COMPUTER COMMUNICATION AND NETWORK**		

Course Objectives	
1	To learn technology behind network architecture with layered organization.
2	Gain in depth knowledge of network core and network edge
3.	Uniform coverage of principles, architecture, practical insights of networks
Course Outcomes: The students will able to	
1.	Present conceptual aspects of network applications such as web, file transfer, e-mail, and remote access, file sharing etc.
2.	Understand layered architecture of TCP/IP model and design network applications
3.	Build understanding and problem-solving skills required for network design

Unit Number	**Contents**	**Number of Sessions**	
1	**Computer Networks & Internet**: Introduction, Protocol, Network Core – Circuit Switching and Packet Switching, Network Edge – Connection oriented and Connection less Services, Access Network and Physical Media, Delay and Loss in Packet Switched Network, Protocol Layers and their Service Models, ISP's	**L= 12**	
		T=3	**P= 0**
2	**Network Applications and Application Layer:** Introduction, Principles of Network Applications, Process communication, Application Layer Protocols, The World Wide Web and HTTP – Connections, Message Formats , Cookies, Web Cache, File Transfer and FTP – Connections, Commands, Electronic Mail – Mail Servers, SMTP, Message Format, Mail Access Protocols, Domain Name System, Socket programming	**L= 12**	
		T= 3	**P= 0**
3	**Transport Layer and Network Layer:** Introduction, Transport Layer Services, Protocols, Multiplexing and Demultiplexing, Connectionless Transport: UDP, Checksum, Principles of Reliable Data Transfer, RDT Protocols, Go-Back-N, Selective Repeat, Connection Oriented Transport: TCP, Flow Control, Connection Management, Datagram Networks, Forwarding Table, Router Architecture, Internet Protocol, IP Datagram Format, Routing Algorithms, Routing in the Internet, IPv6, Broadcast and Multicast	**L= 12**	
		T= 3	**P= 0**
4	**Data Link Layer and Wireless Network:** Introduction, Data Link Layer Services, Adaptors Communicating, Error Detection and Correction, Cyclic Redundancy Check, Multiple Access Links and Protocols - Channel Partitioning, Random Access, Taking Turns, LAN Technologies, Link Layer Addressing, Ethernet, Switches, Introduction to Wireless Network, WiFi	L=12	
		T= 3	P= 0

Learning Resources		
1	**Text Books**	• James F. Kurose and K. W. Ross, Computer Networking: A Top Down Approach, Pearson, 5th Edition 2013 • Tanenbaum, A.S., Computer Networks, Prentice Hall of India Pvt. Ltd, 4th Edition 2005
2	**Reference books**	• Douglas E. Comer, Computer Network and Internets with Internet Applications, Pearson Education Inc., 4th Edition 2004 • Uyless Black, Computer Networks Protocols, Standards and Interfaces, Prentice Hall of

		India Pvt, Ltd, 2nd Edition • Prakash C. Gupta, Data Communication & Computer Network, Prentice Hall of India Pvt. Ltd.
3	**Websites**	• https://www.studytonight.com/computer-networks/ • https://www.javatpoint.com/computer-network-tutorial • https://www.tutorialspoint.com/data_communication_computer_network/index.htm
4	**Journals**	• The International Journal of Computer and Telecommunications Networking, Elsevier Publishing, ISSN: 1389-1286 • Journal of Computer Networks and Communications, Hindawi Publishing, ISSN: 2090-7141 • Computer Networks, ScienceDirect, ISSN 1389-1286
5	**Supplementary Reading**	• Web Course Developed for NPTEL, Computer Networks and Internet Protocol, https://nptel.ac.in/courses/106/105/106105183/#
6	**Practical Components**	• NS-3 Network Simulator, https://www.nsnam.org/

Semester	**III**	**Total Credit**	**4**
Course Code	**CC 302**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title		**SOFTWARE PROJECT MANAGEMENT AND QUALITY ASSURANCE**	

Course Objectives	
1	To introduce the tasks and concepts in project management.
2	To find out various metrics and its usage
3.	To understand various methods of quality assurance.
4.	To find out the activities in software maintenance and configuration management.

Course Outcomes: The students will able to	
1.	Understand the tasks and concepts in project management.
2.	Identify and apply project metrics.
3.	Evaluate and plan quality of software and the process
4.	Identify and decide activities in software maintenance and configuration management.

Unit Number	**Contents**	**Number of Sessions**	
1	Project Management Concepts & Project Metrics: : (15) The Management Spectrum, People, Product, Process, Project, The W5HH Principle, Metrics in the Process and Project Domains (FP & LOC), Software Measurement, Metrics for Project and Software Quality	**L= 12**	
		T=3	**P=0**
2	Software Project Planning, Scheduling and Tracking: : (15) Project Planning Objectives, Software Project Estimation using COCOMO Model, Software Scope and Resources, Empirical Estimation Models, Automated Estimation Tools, Basic Concepts and Relationship Between People and Effort, Defining a Task Set for the Software Project, Selecting Software Engineering Tasks, Defining a Task Network and Scheduling, Earned Value Analysis and Error Tracking. Reactive versus Proactive Risk Strategies, Software Risks (Risk identification, Risk Projection, Risk Refinement, Risk Mitigation), Risks Monitoring and Management.	**L= 12**	
		T=3	**P=0**
3	Software Quality Assurance and Configuration Management: (15) Quality Concepts and Software Quality Assurance, Quality Planning and Control, Software Reviews (Formal Technical Reviews), Software Reliability and Fault Tolerance, The ISO 9000 Quality Standards, The SCM Process, Identification of Objects in the Software Configuration, Six Sigma, Version Control and Change Control.	**L= 12**	
		T=3	**P=0**
4	Software maintenance: (15) Definition of maintenance, Maintenance characteristics, maintainability, maintenance tasks, maintenance side effects, reverse engineering and reengineering. Software configuration management, software reusability., Software Complexity & Reliability.	**L= 12**	
		T=3	**P=0**

Learning Resources		
1	Text Books	Software Project Management: Bob Hughes and Mike Cotterell-Tata McGraw Hill Software Engineering a Practitioner's approach – Roger S Pressman Tata McGraw Hill, Introduction to Software Project Management & Quality Assurance: By Ince, Dorrel,Helen Sharp & Mark Woodman
2	Reference books	Software Engineering – Ian Sommerville, Addison Wesley Norman E. Fenton and Shari Lawrence Pfleeger, "Software Metrics" Thomson Mordechai Ben – Menachem and Garry S.Marliss, "Software Quality", Thomson Asia Ltd Mary Beth Chrissis, Mike Konrad and Sandy Shrum, "CMMI", Pearson Education (Singapore) Pte Ltd. ISO 9000-3 "Notes for the application of the ISO 9001 Standard to software development".
3	Websites	• https://www.kandasoft.com/home/softwaredevelopment/project-management.html • https://www.gurock.com/testrail/fogbugz-test-management • https://kruschecompany.com/quality-assurance-in-projects/
4	Journals	• https://www.researchgate.net • https://www.clutejournals.com • https://ieeexplore.ieee.org

5	Supplementary Reading	• http://www.softwareqatest.com/ • https://www.guru99.com/software-quality-assurance-test-audit-review-makes-your-life-easy.html • https://www.tutorialspoint.com/software_testing_dictionary/quality_assurance.htm
6	**Practical Components**	Use of some free download tools for project management

Semester	**III**	**Total Credit**	**4**
Course Code	**CC 303**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title		**Ethical Hacking**	

Course Objectives	
1	To familiarize the student with ethical hacking concepts and tools
2	To introduce various ethical hacking skills and types of attacks
3.	To know how protect systems from hacking threats

Course Outcomes: The students will able to	
1.	Will be able to identify the type of hacking attack
2.	Will be acquainted with ethical hacking skills
3.	Will be able to use various ethical hacking tools

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction:** Introduction to Hacking, Hacking types , Cybercrime and its type, Introduction to basics of Ethical Hacking , ethical hacking terminologies, tools , Ethical hacking Process , Reconnaissance- active and passive, Foot printing- active and passive **(12)**	**L= 12**	**T=3** **P=0**
2	**Ethical Hackinglls** Fingerprinting and its type , steps involved , Sniffing , sniffing tools , ARP Poisoining,DNS Poisoning , Enumeration , Trojan Attacks, TCP/IP Hijacking, Email Hijacking , Password Hijacking, wireless hijacking. **(12)**	**L= 12**	**T=3** **P=0**
3	**Email Security and Intellectual Property treats** Email Security: types of threats, spam, countermeasures Intellectual Property Thefts: Introduction, Threats of Intellectual property theft, types of IP Theft attacks Identity attacks: types of identity thefts, Input validation attacks : Input validation threats, Types of input validation attacks, SQL injection attacks, Denial of Services(DOS) attacks: Introduction, threats of DOS attacks, different DOS attacks	**L= 12**	**T=3** **P=0**
4	**Web & Social engineering attacks** Buffer Overflows : different types, examples, counter measures. Software Engineering attacks: introduction, types of social engineering attacks, counter measures. Hacking Web Servers, Web Application Vulnerabilities, Web based Password Cracking Techniques, Hacking Wireless Networks, Hacking Mobile Platforms Evading IDS, Firewalls, and Honeypots	**L= 12**	**T=3** **P=0**

Learning Resources		
1	**Text Books**	1. An Ethical Hacking Guide to Corporate Security, AnkitFadia – Macmillan India Ltd. 2. Ethical Hacking and Penetration Testing Guide, RafayBaloch- Auerbach Publications
2	**Reference books**	1. Hacking For Dummies 5th Edition, Kevin Beaver - John Wiley & Sons 2. An Unofficial Guide to Ethical Hacking, AnkitFadia – Macmillan India Ltd. 3. Hands-On Ethical Hacking and Network Defense, Michael T. Simpson, Kent Backman, James Corley -Cengage Learning.
3	**Websites**	• http://www.ijcstjournal.org/volume-2/issue-6/IJCST-V2I6P2.pdf http://www.ijcstjournal.org/volume-2/issue-6/IJCST-V2I6P2.pdf ieeexplore.ieee.org
4	**Journals**	Ethical hacking - IBM Journals & Magazine - IEEE Xplore •
5	**Supplementary Reading**	• On Internet searching URLs
6	**Practical Component**	. Case study reports

Semester	**III**	**Total Credit**	**4**
Course Code	**CC 305**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**.Net Programming**		

Course Objectives	
1	To explore the knowledge on different types of applications of .net
2	To know about the design methodologies with concentration on object oriented concepts
3	Giving the students a complete knowledge on .net framework and .net environment.
4	To introduce a student to an entirely a new way to build distributed, desktop and mobile applications

Course Outcomes: The students will able to	
1	The syntax and semantics of C# and procedural programming including variable definitions, arithmetic and boolean expressions, control structures, methods, subroutines, arrays, and references.
2	Event-based programming and GUI design.
3	An idea of what objects are how to design programs using object-oriented design.

Unit Number	**Contents**	**Number of Sessions**	
1	Overview of .net framework. Overview of .NET binaries and .NET architecture. The role of MSIL and metadata. Understanding CLR, CTS and CLS, .NET base classes , Assemblies- Components of Assembly, Private and Shared Assembly, Visual Studio .NET IDE	**L= 12**	
		T=3	**P= 0**
2	C# Programming constructs, C# looping and Conditional constructs, Primitive types, operators and expressions, C# object oriented concepts, Object lifecycle, Initializer, Constructor, Garbage Collector, Interface, Inheritance, polymorphism, properties, Delegates, events, Exception handling in C#	**L= 12**	
		T= 3	**P= 0**
3	Type reflections and attribute based programming, review of traditional Win32 thread programming, System.Threading namespace. Introducing Windows Forms, GDI+ namespaces, Windows Form controls.	**L= 12**	
		T= 3	**P= 0**
4	ADO.net – ADO.net fundamentals, ADO.net architecture, Connection class, Command class, Data Reader class, Transactions, Data components and Data Set, Disconnected Data, Data Bindings	**L=12**	
		T= 3	**P= 0**

Learning Resources		
1	**Text Books**	1. Beginning Visual C#2010, K. Watson, C. Nagel, J.H. Padderson, J.D. Reid, M. Skinner, Wrox (Wiley)2010 2. Introducing Microsoft .NET – David S. Platt 3. Database Access with C# – Jeffrey P. McManus, Jackie goldstein and Kevin T. Price.
2	**Reference books**	1. Visual C#.NET, Vijay Nicoel, TMH 2. C#.Net Developers Guide- Greg Hack, Jason Werry, SaurabhNandu. (SyngRess)
3	**Websites**	https://dotnet.microsoft.com/learn/csharp https://guru99.com

		http://tutorialpoint.com
4	**Journals**	https://developersjournal.in/category/dotnet/dotnet-core
5	**Supplementary Reading**	C# 7.0 In A Nutshell: The Definitive Reference , Seventh Edition
6	**Practical Components**	• List of experiments to be executed during laboratory hours

Semester	**III**	**Total Credit**	**4**
Course Code	**DSE III (DS-I)**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**DATA WARE HOUSING AND DATA MINING**		

Course Objectives	
1	To provide students with basic concepts of data warehouse and data mining.
2	To develop abilities to solve real time problem by applying appropriate data mining algorithm.
2	To make students acquaint to different tools and techniques used for Knowledge Discovery in Databases.

Course Outcomes: The students will able to	
2.	Discover interesting patterns from large amounts of data to analyze and extract patterns to solve problems
3.	Evaluate and select appropriate data-mining algorithms
4.	Apply, and interpret and report the output appropriately

Unit Number	**Contents**	**Number of Sessions**	
1	**DATA WAREHOUSING** Overview and Concepts: Need for data warehousing, The building blocks of a Data warehouse, Data Warehouse Architecture, Extract Transform Load Cycle: ETL overview, Extraction, Loading, Transformation techniques. Reporting and Query tools and Applications, OLAP – the need, Design of the OLAP database, OLAP operations: slice, dice, rollup, drill-down etc.	**L= 12**	
		T=3	**P= 0**
2	**INTRODUCTION TO DATA MINING AND ASSOCIATION RULE MINING** Introduction – Data – Types of Data – Data Mining Functionalities – Classification of Data Mining Systems – Data Mining Task Primitives , Data Mining Applications, Integration of a Data Mining System with a Data Warehouse – Issues –Data Preprocessing. Mining Frequent Patterns, Associations and Correlations –Mining various Kinds of Association Rules – Market Basket Analysis, Apriori Algorithm, FP tree Algorithm, Correlation Analysis.	**L= 12**	
		T= 3	**P= 0**
3	**CLASSIFICATION** Classification and Prediction - Basic Concepts - Decision Tree Induction - Bayesian Classification – Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction.	**L= 12**	
		T= 3	**P= 0**
4	**CLUSTERING AND WEB MINING** Cluster Analysis - Types of Data – Categorization of Major Clustering Methods – K-means– Partitioning Methods – Hierarchical Methods -– Outlier Analysis – Web Mining: Web Content Mining, Web Structure Mining, Web Usage mining.	**L=12**	
		T= 3	**P= 0**

Learning Resources		
1	**Text Books**	• Alex Berson and Stephen J. Smith, " Data Warehousing, Data Mining & OLAP", Tata McGraw – Hill Edition. • Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier
2	**Reference books**	• Pang-Ning Tan, Michael Steinbach and Vipin Kumar, " Introduction To Data Mining", Person Education, 2007.

		• K.P. Soman, Shyam Diwakar and V. Ajay ", Insight into Data mining Theory and Practice", Easter Economy Edition, Prentice Hall of India • G. K. Gupta, " Introduction to Data Mining with Case Studies", Easter Economy Edition, Prentice Hall of India • Daniel T.Larose, "Data Mining Methods and Models", Wile-Interscience
3	**Websites**	• http://guidetodatamining.com/, "A Programmer's Guide to Data Mining" • https://www.classcentral.com/course/independent-data-mining-with-weka-1152, "Data Mining with Weka" • https://www.geeksforgeeks.org/data-mining/ • https://www.tutorialspoint.com/data_mining
4	**Journals**	• Inderscience Publisher "International Journal of Business Intelligence and Data Mining" • Inderscience Publisher "International Journal of Knowledge Engineering and Data Mining" • IEEE Transactions on Knowledge and Data Engineering • Wiley Interdisciplinary Reviews: Data Mining and Knowledge Discovery
5	**Supplementary Reading**	• https://www.techgig.com/webinar/Understanding-SVM-Support-Vector-Machine-Algorithms-1083 • https://www.searchtechnologies.com/blog/web-data-mining-tools-techniques
6	**Practical Components**	• Experimenting different mining algorithms on available datasets using Weka and R programming.

Semester	**III**	**Total Credit**	**4**
Course Code	**DSE III (NS- I)**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**NETWORK ADMINISTRATION**		
Course Objectives			
1	To expose students to introductory networking concepts in the information technology industry		
2	To expose students to the impact of network technology on a business operation		
2	To give students hands-on experience installing, configuring and operating computer hardware and software in a network environment.		
Course Outcomes: The students will able to			
2.	Understand Network Architecture.		
3.	Setup network Infrastructure		
4.	Implement user and group policies		

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction to Network** Introduction to Network Concepts, Identifying Characteristics of Network , Types of Network, Topologies, Peer to peer and Server-based networks, Networking devices- Hub, switch, Bridge, Routers, Repeaters, gateways, Modems, Access Point, Protocols (IP, TCP/IP, IPX; Ethernet, FTP, Telnet, SSH) transmission media : STP (Shielded Twisted Pair), UTP (Unshielded Twisted Pair) ,Coaxial Cable, Cabling Standards for LAN using UTP Cable, How to do Crimping, Building Straight Through Cable and Cross Cables, Testing Cable Continuity, Optical Fibers, Wireless Transmission, Microwave, Radio Waves, IEEE standard, Configuring the TCP/IP Protocol, Windows Networking..	**L= 12**	
		T=3	**P= 0**
2	**Server Administration** Introduction to Windows server, Network Operating Systems , Installation & configuration of Windows Server. Procedures and standards, Terminal services and remote administration. , Delegating administrative authority, Creating and Managing Accounts, User authentication, User profiles. , Creating, managing and troubleshooting user accounts. , Implementing Group and Computer Accounts , Group policy Management, Creating and managing computer accounts , Managing File Access , Introduction to file systems, Types of File System, Creating and managing shared folders. Managing shared folder permissions, NTFS permissions , Managing Disks and Data Storage , Disk management concepts, Managing partitions & volumes. Disk utilities , Disk quotas , Monitoring Server Performance and Disaster Recovery , Planning disaster recovery, Backing up data, Automated system recovery, The distributed file system, Implementing and Managing Printers, Installing and sharing	**L= 12**	
		T= 3	**P= 0**

	printers, Configuring and managing printer resources.		
3	**Active Directory Services and Network Monitoring** Introduction to Active Directory, Structure of Active Directory, Roles of Active Directory, DAP,LDAP,TREE,FOREST,SITES Create workgroup, Domain, child, Organizational Units, Users & Groups, Configure & Deploy network printers, Set-up & Manage File Sharing and Security, Implement Security, Remote Desktop Administration, Event Viewer, logs, Backup and Recovery, Server and Network Monitoring ,Managing System Reliability and Availability.	**L= 12** **T= 3**	**P= 0**
4	**Network Administration** Installing and Configuring Terminal Services. Managing servers remotely using terminal services (Remote desktop). Enterprise Network Implementation,IP addressing, features of IPv4, and IPv6, static and dynamic , Router components and functions, Routing Protocols, VLAN, Wi-Fi 802.11 Standards and Wi Max, Backup restoring data, Installing DNS, Implementing DNS in windows networks. Installing and configuring DHCP. Installing and Configuring the DHCP Relay Agent, Telnet Server , SSH Server , NAT, Types of NAT, ACL, Configuring & Implementing VPN, WINS Server.	**L=12** **T= 3**	**P= 0**

Learning Resources

1	**Reference books**	• James F. Kurose and K. W. Ross, Computer Networking: A Top Down Approach, Pearson, 5th Edition 2013 • Tanenbaum, A.S., Computer Networks, Prentice Hall of India Pvt. Ltd, 4th Edition 2005
3	**Websites**	• www.aboutdebian.com/network.htm • MTA: Windows Server Administration Fundamentals: 98-365 ...https://www.udemy.com › • www.tldp.org/LDP/Bash-Beginners-Guide/html/index.html
4	**Journals**	• The International Journal of Computer and Telecommunications Networking, Elsevier Publishing, ISSN: 1389-1286 • Journal of Computer Networks and Communications, Hindawi Publishing, ISSN: 2090-7141 • Computer Networks, ScienceDirect, ISSN 1389-1286
5	**Supplementary Reading**	• Web Course Developed for NPTEL, Computer Networks and Internet Protocol, https://nptel.ac.in/courses/106/105/106105183/#
6	**Practical Components**	• https://docs.microsoft.com/en-us/learn/certifications/exams/98-365

Semester	**IV**	**Total Credit**	**4**
Course Code	**DSE 1V DS-II**	**Credit Pattern**	**L-45, T-7, P-8**
Course Title	**R FOR DATA SCIENCE**		

Course Objectives	
1	To understand R environment setup
2	To explore, analyze and visualize data using R
3.	To use R for machine learning model construction
4	To develop Data Science solutions to Data Science problems

Course Outcomes: The students will able to	
1.	Program in R and use of R for effective data analysis
2.	Explore, analyze, visualize data and construct machine learning models using R
3.	Handle practical issues in programming, reading data into R, accessing R packages, writing R functions
4.	Apply R Programming for data science projects

Unit Number	**Contents**	**Number of Sessions**	
1	**Getting started with R** Overview of R, R Installation, Getting started with R interface, R Nuts and Bolts, Basic Syntax, R Data Types, Control Structures, Functions, Getting Data into R, Data Frames, R Packages	**L= 12**	
		T=2	**P= 2**
2	**Data Exploration and Visualization** Data Exploration in R, Basic Data Summaries, Basic plotting - Histograms, Bar Charts, Scatter Plots, Box Plots, Plot functions, Data Visualization using R packages, Plot using ggplot2	**L= 11**	
		T= 2	**P= 2**
3	**Practical Machine Learning** Introduction, Data Sampling, Data Preprocessing, Supervised Learning, Decision Trees, Artificial Neural Network, Model Selection and Evaluation, Unsupervised Learning, K Means Clustering, Hierarchical Clustering, Dimensionality Reduction, Reinforcement learning	**L= 11**	
		T= 2	**P= 2**
4	**Data Science** Introduction, Data Science Fundamentals, Statistical Foundations, Data Scientist Toolbox, Version Control, Data Science Problems, **Time Series and Web Analytics** Time Series – Data, Analysis, Visualization, Web Analytics Process, Key Metrics, Social Network Analysis	**L=11**	
		T= 1	**P= 2**

Learning Resources		
1	**Text Books**	• Roger D. Peng, R Programming for Data Science, Lulu.com, 2015 • Hadley Wickham, Garrett Grolemund, R for Data Science, O'Reilly First Edition, 2017
2	**Reference books**	• Michael J. Crawley, The R Book, Wiley, 2nd Edition • Hadley Wickham, Garrett Grolemund, R for Data Science: Import, Tidy, Transform, Visualize, and Model Data, O'Reilly Media; 1 edition • Murray Aitkin, Brian Francis, John Hinde, and Ross Darnell, Statistical Modelling in R, Oxford University Press; 1 edition, 2009 • Brian Everitt and Torsten Hothorn, A Handbook of Statistical Analyses Using R, Chapman and Hall/CRC; 2 edition
3	**Websites**	• https://www.analyticsvidhya.com/blog/2016/02/complete-tutorial-learn-data-science-scratch/ • https://r4ds.had.co.nz/introduction.html • https://data-flair.training/blogs/r-tutorial/
4	**Journals**	• International Journal of Data Science and Analytics, Springer, ISSN: 2364-

		4168 • Data Science - Methods, Infrastructure, and Applications, IOS Press, ISSN: 2451-8484 • International Journal of Data Science, INDERSCIENCE, ISSN 2053-0811
5	**Supplementary Reading**	• Data Science Specializationhttps://www.coursera.org/specializations/jhu-data-science • R Programming , https://www.datacamp.com/tracks/r-programming
6	**Practical Components**	• R Installation, R Programs based on Data Types, Loops and Functions, Data Visualization

Semester	**III**	**Total Credit**	**4**
Course Code	**DSE-IV NS-II**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**INFORMATION AND NETWORK SECURITY**		

Course Objectives	
1	To introduce the concept of network and information security.
2	To explain various message digest algorithms.
3	To introduce and explain various public key cryptography algorithms.
4	To explain techniques for securing email, network and information.

Course outcomes : After completion of course student will be able to	
1	Recognize the importance of network and information security.
2	Summarize various hashing techniques for data integrity.
3	Understand and select correct cryptography algorithm for information security.
4	Evaluate proper techniques for securing email.
5	Plan techniques for protecting network.
6	Evaluate techniques for making information more secure.

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction:** Attacks, Services and Mechanisms, Security Attacks, Security Services, Integrity check, digital Signature, authentication, Secret Key Cryptography: Block Encryption, Overview, comparison with DES, Key expansion, IDEA rounds, Uses of Secret key Cryptography; Multiple encryptions DES	**L= 12**	
		T=3	**P= 0**
2	**Hashing and Public key Cryptography:** Length of hash, uses, algorithms (MD2, MD4, MD5, SHS) MD2: Algorithm (Padding, checksum, passes.) Algorithm (padding, stages, digest computation.) Overview, padding, stages, **Public key Cryptography**: Algorithms, examples, Modular arithmetic (addition, multiplication, inverse, and exponentiation) RSA: generating keys, encryption and decryption. Other Algorithms: PKCS, Diffie-Hellman, El-Gamal signatures, DSS, Zero-knowledge signatures.	**L= 12**	
		T= 3	**P= 0**
3	**Authentication: Password Based, Address Based**, Authentication. Passwords in ddbs, Cryptographic Authentication: passwords as keys, protocols, Authentication of People: Verification techniques, passwords, length of passwords, PW distribution, smart cards, And biometrics. Security Policies and Security Handshake Pitfalls: security policy, user issues, Protocol - public key protocols,, use of timestamps, sequence numbers, session keys, one-and two-way public key based authentication.	**L= 12**	
		T= 3	**P= 0**
4	**System: Kerberos: purpose**, authentication, serer and ticket granting server, keys and tickets, names, inter-realm authentication, names, realms, delegation, ticket lifetimes,	**L=12**	
		T= 3	**P= 0**

	revoking tickets, multiple Realms, Network Security: Electronic mail security, IP security, Network management security. Security for electronic commerce: SSL, SET System Security: Intruders and Viruses, Firewalls, Intrusion Detection			
Learning Resources				
1	**Text Books**	1. AtulKahate, Cryptography and Network Security, McGraw Hill. 2. Kaufman, c., Perlman, R., and Speciner, M., Network Security, Private Communication in a public world, 2nd ed., Prentice Hall PTR., 2002.		
2	**Reference books**	1. Stallings, W.,Cryptography and Network Security: Principles and Practice, 3rd ed., Prentice Hall PTR.,2003. 2. Stallings, W. Network security Essentials: Applications and standards, Prentice Hall, 2000. 3. Cryptography and Network Security; McGraw Hill; Behrouz AForouzan. 4. Information Security Intelligence Cryptographic Principles and App. Calabrese Thomson. 5. Securing A Wireless Network Chris Hurley SPD		
3	**Websites**	• https://www.cisco.com/c/en_in/products/security/what-is-network-security.html • https://www.tutorialspoint.com/information_security_cyber_law/network_security.htm • https://www.edureka.co/blog/what-is-network-security/		
4	**Journals**	• https://www.journals.elsevier.com/network-security • https://www.sciencedirect.com/journal/network-security • https://www.springer.com/journal/10207		
5	**Supplementary Reading**	• https://www.win.tue.nl/~tozceleb/2IC60/lecture_notes.pdf • https://www.vssut.ac.in/lecture_notes/lecture1428550736.pdf		

Semester	**III**	**Total Credit**	**2**
Course Code	**AEC III**	**Credit Pattern**	**L-24, T-06, P-0**
Course Title	**SOFTWARE DESIGN PATTERNS**		

Course Objectives

1	To appreciate the idea behind Design Patterns in handling common problems faced during building an application
2	To introduce the learner different categories of design patterns.
3	To develop skills for proper selection of appropriate design pattern.

Course Outcomes: Students will be able to;

1	Create software designs that are scalable and easily maintainable
2	Use creational design patterns in software design for class instantiation
3	Use structural design patterns for better class and object composition
4	Use behavioral patterns for better organization and communication between the objects
5	• Use refactoring to compose the methods for proper code packaging

Unit Number	**Contents**	**Number of Sessions**	
1	Overview of Software design, Design Patters. History of design patterns. Refactoring. Testability,domain-specific languages, dependency injection, SOLID, Usage of design patterns. Types of Design Patterns. The Catalog of Design Patterns, Organizing the Catalog, How Design Patterns Solve Design Problems, How to Select a Design Pattern, Factory patter, Abstract Factory Pattern, Singleton pattern, Builder pattern, Prototype pattern, Adapter Pattern, Bridge pattern, Filter pattern, Composite pattern, Decorator pattern, Façade pattern, Flyweight pattern, Proxy pattern	**L= 12**	
		T= 3	**P= 0**
2	Chain of Responsibility, Command pattern, Interpreter pattern, Iterator pattern, Mediator pattern, Observer pattern, State pattern, Strategy pattern, Template pattern, MVC pattern, Business Delegate pattern, Front Controller Pattern, Intercepting Filter pattern, Service Locator pattern, Transfer Object pattern.	**L= 12**	
		T= 3	**P= 0**

Learning Resources

1	Text Books	1. Design Patterns, Elements of Reusable Object-Oriented Software, Erich Gamma, et. al., Addison-Wesley, 1994, ISBN 0-201-63361-2 2. Implementation Patterns, Kent Beck, Addison-Wesley, 2008

2	Reference books	1. Refactoring to Patterns, Joshua Kerievsky, Addison-Wesley, 2005 2. Patterns of Enterprise Application Architecture, Martin Fowler, Addison-Wesley, 2003 3. Enterprise Integration Patterns, Gregor Hohpe, Bobby Woolf, Addison-Wesley, 2004 4. Pattern-Oriented Software Architecture, Schmidt, et. al., Wiley, 2000 5. Pattern's in Java, Vol –I, Mark Grand, Wiley Dream Tech. 6. Patterns in Java, Vol-II, Mark Grand, Wiley Dream Tech. 7. Java Enterprise Design Patterns Vol-III, Mark Grand, Wiley Dream Tech. 8. Head First Design Patterns, Eric Freeman, O'reily publications
3	Websites	1. https://www.geeksforgeeks.org/software-design-patterns/ 2. https://www.tutorialspoint.com/design_pattern/index.htm 3. https://www.javatpoint.com/design-patterns-in-java 4. https://howtodoinjava.com/design-patterns/ 5. https://sourcemaking.com/design_patterns
4	Journals	1. https://www.journaldev.comJournal of Big Data – Springer Open Access – 2. ournal of Software Engineering and Applications, ISSN Online: 1945-3124ISSN Print: 1945-3116 3. https://journals.plos.org,

Semester	**IV**	**Total Credit**	**4**
Course Code	**CC401**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**ARTIFICIAL INTELLIGENCE**		

Course Objectives	
1	To endow with various disciplines of artificial intelligence and its applications
2	To learn knowledge representation techniques in AI.
3.	To understand of how to develop AI solutions to problems with data
4.	To explore AI application areas

Course Outcomes: The students will be able to	
1.	Apply problem solving by intelligent search approach.
2.	Represent knowledge using AI knowledge representation techniques.
3.	Design machine learning solution to real life problems.
4	Understand various disciplines of artificial intelligence and its applications

Unit Number	**Contents**	**Number of Sessions**	
1	**Foundations of AI** Introduction, AI related terms, Turing Test, Knowledge Representation - Propositional Logic, Predicate Calculus, Frames, Conceptual Dependency, Script, Semantic Net, and Rule Based Representation, Computational Thinking, Ethical Dilemmas	**L= 12**	
		T=3	**P= 0**
2	**Problem Solving by Intelligent Search** Introduction, Nature of AI Problems, State and Space Search, Depth First Search, Breadth First Search, Mean and Ends Analysis, Heuristic Search Techniques, Hill Climbing, Best First Search, Branch and Bound Search, A*and AO* Algorithm, Game Playing, Min-Max Search Procedure, ALPHA-BETA Pruning	**L= 12**	
		T= 3	**P= 0**
3	**Machine Learning** Introduction, Supervised Learning , Artificial Neural Network - Artificial Neuron Model, Activation Functions, Network Architectures, Back Propagation, Unsupervised Learning – K Means Clustering, Dimensionality Reduction, Reinforcement learning	**L= 12**	
		T= 3	**P= 0**
4	**AI Applied Areas** Introduction, Expert Systems – Characteristics, Knowledge Representation, Architecture, Natural Language Processing - NLP Phases, Parser, Chatbots, Autonomous Cars, Robotics	L=12	
		T= 3	P= 0

Learning Resources		
1	**Text Books**	• Dan W. Patterson, Artficial Intelligence & Expert Systems, Prentice Hall of India, 2005 • Mitchell, Machine Learning, Tata Mcgraw Hill Education Private Limited, 2013
2	**Reference books**	• Elaine Rich, Kerin Knight, Artificial Intelligence, Tata McGraw Hill Publishing Company, New Delhi, 2nd Ed, 2004 • AmitKonar, Artificial Intelligence & Soft Computing Behavioral & Cognitive Modeling of the Human Brain, CRC Press, New York, 2008 • Jiawei Han and Micheline Kamber, “Data Mining Concepts and Techniques”, Second Edition, Elsevier • S. Rajasekaran, G. A. VijayalakshmiPai, Neural networks, fuzzy logic, and genetic algorithms : synthesis and applications, Prentice-Hall of India, 2003
3	**Websites**	• https://towardsdatascience.com/ • https://www.moralmachine.net/ • https://www.youtube.com/watch?v=kiFfp-HAu64&feature=youtu.be&t=3128
4	**Journals**	• Frontiers in Artificial Intelligence

		https://www.frontiersin.org/journals/artificial-intelligence# • Artificial Intelligence, Elsevier Publishing, ISSN: 0004-3702 • Machine Learning, Springer Publishing, e-ISSN: 1573-0565
5	**Supplementary Reading**	• NPTEL Web Course, Artificial Intelligence, https://nptel.ac.in/courses/106/105/106105077/
6	**Practical Components**	• https://experiments.withgoogle.com/collection/ai • https://www.ibm.com/in-en/artificial-intelligence

Semester	**IV**	**Total Credit**	**4**
Course Code	**CC402**	**Credit Pattern**	**L-45, T-7, P-8**
Course Title	**MOBILE COMPUTING**		

Course Objectives	
1	To introduce challenges in app development for thin clients.
2	To provide acquaitance with popular Android editors such as Eclipse/Android Studio.
3	To familiarize the students about android stack, android sdk, application life cycle, and basic components.
4	To introduce Android's APIs for data storage, retrieval, user preferences, files, databases, and content providers
5	To introduce persistent data storage using SQLite

Course Outcomes: Students will be able to;	
1	Build android apps in Eclipse/Android Studio.
2	Design and develop useful Android applications using activities, intent and manifest
3	Design and develop useful Android applications Utilizing the power of background services, threads, and notifications
4	Develop applications for data storage and retrieval.
5	Sharing data between applications using Content Provider.

Unit Number	**Contents**	**Number of Sessions**	
1	**Basics and Building Bocks of Android** Android Overview and History.Android Stack.Android SDK Overview - Platforms, Tools, Versions.Android Project Structure.Creating first project.The manifest file. Layout resource Running your app on Emulator and real device. Introduction to Eclipse/Android Studio.Structure of android manifest file. Building blocks of Android - Activities, Activity lifecycle, Intents, Services, Content Providers, Broadcast Receivers.Views and layouts, Common UI components.Passing data between activities.	**L= 12**	
		T= 2	**P= 2**
2	**Leveraging Anroid UI Components** Handling User Events, Complex UI components, Building UI for performance, Menus and Dialogs	**L= 11**	
		T= 2	**P= 2**
3	**Android Services and Broadcast Receivers** Broadcast Receivers. What are Broadcast Receivers.Implementing broadcast receiver.System broadcasts and how to use them. Intent Filters.	**L= 11**	
		T= 2	**P=2**
4	**Data Persistence in Android** Data Persistence- Introducing SQLite, SQLiteOpenHelper and creating a database, Opening and closing a database, Working with cursors Inserts, updates, and deletes	**L= 11**	
		T= 2	**P= 2**

	Basic Content Providers Content provider MIME types, Searching for content, Adding, changing, and removing content Working with content files			
Learning Resources				
1	Text Books	a. 2. Ian F. Darwin, Android Cookbook, O'Reilly. 3. Marko Gargenta, Learning Android, O'Reilly 4. Pradeep Kothari (Android Application Development (With Kitkat Support), Black Book, Kogent Learning Solutions Inc. 5. W.Frank Ableson, Robi Sen, Chris King, C.Enrique Ortiz, Android in Action 6. Neil Smyth, Android Studio 4.0 Development Essentials - Java Edition: Developing Android Apps Using Android Studio 4.0, Java and Android Jetpack		
2	Reference books	a. **7.** G. Blake Meike, Laird Dornin, Masumi Nakamura, and ZigurdMednieks, Programming Android, O'Reilly Java 2 Programming Black Book by Steven Holzner, Dream Tech Publication 8. W.FrankAbleson, RobiSen, Chris King, Android In Action, published by dreamtech Press. 9. Wei-Meng Lee, Beginning Android 4 Application Development, Wrox Publication 10. Reto Meier, Professional Android 4 Application Development, Wrox Publication 11. OnurCinar, Android Apps with Eclipse, Apress 12. Ian G. Clifton, Android User Interface Design, 13. Dave Smith and Jeff Friesen, Android Recipes: A Problem-Solution Approach, Apress		
3	Websites	14. https://www.tutorialspoint.com/android/index.htm 15. https://www.javatpoint.com/android-tutorial 16. https://www.vogella.com/tutorials/android.html 17. https://www.studytonight.com/android/ 18. https://www.tutlane.com/tutorial/android		
4	Journals	a. 19. Journal of Information Technology & Software Engineering, ISSN: 2165- 7866 20. https://www.engpaper.com/android-system-research-papers.htm 21. SSRG International Journal of Mobile Computing and Application (IJMCA) – (Seventh Sense Research Group)ISSN 2393 – 9141 22. International Journal of Computer Science and Mobile Computing - ISSN: 2320-088X		
5	Practical Component	Practical lab excercises based on Units I to IV		

Semester	**IV**	**Total Credit**	**4**
Course Code	**CC-403**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**BIG DATA ANALYTICS**		

Course Objectives

1	To explore vital concepts and working of Blockchain
2	To introduce Hyperledger Fabric model and its Architecture
3	To introduce Hyperledger Composer
4	To Learn Solidity Programming
5	To Learn Ethereum smart contract

Course Outcomes: Students will be able to;

1	Be able to state core Blockchain concepts, benefits, and limitations of blockchain technologies.
2	Identify a use case for a Blockchain application
3	Make decisions about the selection of blockchain platform for various applications
4	Determine real world challenges that blockchain technologies may assist
5	Implement Smart Contracts
6	Work with Ethereum Wallet

Unit Number	**Contents**	**Number of Sessions**	
1	**Blockchain Overview and Introduction** **Introduction** to Blockchain, History and Origin of Blockchain, Properties of Blockchain (Immutability, Decentralized, Enhanced Security, Scalability, Distributed Ledgers, Faster Settlement). Fundamental terminologies (Block, Mining, Double Spending), Concept of Merkle Trees, Major Components of Blockchain, Structure of Block header, Types of Blockchain(Public, Private, Consortium), Public Key Infrastucture and Cryptography (Public Key, Private Key, Hashing, Digital Signature), Distributed systems, Decentralized networks, Consensus (Proof of Work, Proof of Stake, BFT), Blockchain Ecosystem (Blockchain exchanges, Blockchain miners, blockchain developers Mining and the Hashing Race), Working Phases in Blockchain, Application Areas	**L= 12**	
		T= 3	**P= 0**
2	**Concepts of Solidity and Ethereum:** Introducing Solidity, Global Variables and Functions, Expressions and Control Structures, Writing Smart Contracts; Functions, Modifiers, and Fallbacks; Exceptions, Events, and Logging; Truffle Basics and Unit Testing; Debugging Contracts. Test and debug smart contracts with Truffle, Ganache, Remix, and MetaMask. Maintaining code quality with different tools. History and Introduction of Ethereum, Concept of Dapps, DAOs, DACs and DASs, power of DAOs, Understaing Ethereum smart contracts, Ethereum wallet, Building Your First DAO, Future of DAOs	**L= 12**	
		T= 3	**P= 0**
3	**Introduction to Hyperledger Family** Introduction to Hyperledger and Composer, Problems with existing Blockchain technology, Basics of hyperledger Fabric, Hyperledger Fabric Architecture, Consensus in Hyperledger, Introduction to new consensus algorithm Sumeragi, Hyperledger Components, Chaincode, Exploring Key Projects of Hyperledger Family	**L= 12**	
		T= 3	**P=0**

4	**Use Cases and Future of Blockchain Technology:** Bletchley: The Modular Blockchain Fabric, Business Blockchain on Bluemix, Watson's Smart Blockchain, Future of Blockchain Technology and it's Industry Impacts	**L= 12**	
		T= 3	**P= 0**

Learning Resources

1	Text Books	1. "Blockchain For Dummies", Tiana Laurence, Publisher: Wiley, 1 January 2019 2. "Blockchain Basics: A Non-Technical Introduction in 25 Steps", Authors: Drescher, Daniel, ©2017, Publisher: Apress 3. "Blockchain: Blueprint for a New Economy", Melanie Swan, ©2015, Published by O'Reilly Media 4. "Blockchain for Business with Hyperledger Fabric", Nakul shah, ©2019, bpb publication
2	Reference books	1. "Basics of Blockchain: A guide for building literacy in the economics, technology, and business of blockchain" : 26 August 2019; by Tom Serres (Author), Bill Wagner (Author), Bettina Warburg (Author) 2. "Essentials of Blockchain Technology", Edited By Kuan-Ching Li, Xiaofeng Chen, Hai Jiang, Elisa Bertino; Copyright Year 2020 3. Solidity Programming Essentials: A beginner's guide to build smart contracts for Ethereum and Blockchain; by Ritesh Modi
3	Websites	1. https://www.blockchain-council.org/ 2. https://www.ibm.com/in-en/blockchain/getting-started 3. https://www.geeksforgeeks.org/ 4. https://hackernoon.com/
4	Journals	4. "Bitcoin: A Peer-to-Peer Electronic Cash System" Satoshi Nakamoto October 31, 2008 5. "Scope for the Application of Blockchain in the Public Healthcare of the Russian Federation", Koshechkin K.A., Klimenko G.S., Ryabkov I.V., Kozhin P.B. , ScienceDirect Procedia Computer Science 126 (2018), Pg. No. 1323–1328 , International Conference on Knowledge Based and Intelligent Information and Engineering Systems, KES2018, 3-5 September 2018, Belgrade, Serbia 6. "Reputation-based Byzantine Fault-Tolerance for Consortium Blockchain" Kai Lei∗, Qichao Zhang, Limei Xu, Zhuyun Qi † Shenzhen Key Lab for Information Centric Networking & Blockchain Technology (ICNLAB) School of Electronics and Computer Engineering (SECE) Peking University, Shenzhen 518055, P.R. China, 978-1-5386-7308-9/18/$31.00 ©2018 IEEE 7. "Identity Verification and Management of Electronic Health Records with Blockchain Technology", Yiheng Liang Department of Computer Science Bridgewater State University Bridgewater, Massachusetts, United States of America, 978-1-5386-9138-0/19/$31.00 ©2019 IEEE

		8. ComChain: Bridging the Gap Between Public and Consortium Blockchains Guillaume Vizier, Vincent Gramoli University of Sydney vincent.gramoli@sydney.edu.au, 978-1-5386-7975-3/18/$31.00 ©2018 IEEE
5	Practical Component	1. Implementation of Basic Blockchain Structure 2. Development of Smart Contracts

Semester	**IV**	**Total Credit**	**4**
Course Code	**CC404**	**Credit Pattern**	**L-45, T-8, P-7**
Course Title	**Web Development using ASP.net**		

Course Objectives	
1	To provide the knowledge on developing internet applications and how to design and implement complete applications over the web using web form and MVC technology.
2	Giving the students a quick review on web servers, client side programming, server side programming and various web technologies.
3	Giving the students depth knowledge about database management using ADO.net and entity framework technologies
4	Giving the students hands on exercise on developing ASP.net MVC applications.

Course Outcomes: The students will able to	
1.	Create web applications using different web application templates.
2.	Database management using ADO.net and entity framework technologies
3.	Use various ASP.net server controls like navigation and validation controls
4.	Implement web application using MVC architecture

Unit Number	**Contents**	**Number of Sessions**	
1	Introduction to web applications - Introduction, understanding role of web server and web browser, HTTP protocol working, Request processing life cycle, ASP.net introduction, ASP.net application life cycle, ASP.net page life cycle. ASP.net architecture, Introduction to various types of Asp.net web applications – web form application, ASP.net web site, MVC application, isvalid and auto postback properties of page. Creating web application in IIS, Converting file system application to IIS application, Using virtual directory	**L= 11**	
		T=2	**P= 2**
2	**ASP.net server controls –** Difference between HTML and ASP.net server controls, ASP.net server controls- button, Textbox, Labels, checkbox, RadioButton, list and other web server controls, web config and global.asax files. Introduction to MasterPage, ContentPlaceHolder and Content tags, Accessing controls of MasterPage in ContentPage, validation controls, Navigation controls, State management- Using view state, session state, application state, cache management	L= 12	
		T= 2	**P= 1**
3	**Managing Database with ADO.Net Entity Framework –** ADO.net with web applications, Entity data model, Data manipulation with Entity framework	**L= 11**	
		T= 2	**P= 2**
4	**ASP.net MVC-** overview, Architectural elements, Controllers, views and models, ASPX view engine, Razor view engine, HTML helpers, Annotations, Scaffolding	**L=11**	
		T= 2	**P= 2**

Learning Resources		
1	**Text Books**	• Murach's ASP.NET 4 Web Programming with C# 2010, 4th Edition, Anne Boehm, Joel Murach, SPD. • Beginning ASP.NET 4 in C# and VB, I. Spanjaars, Reprint 2011 • Addison Wesley –C# Developers Guide to ASP.Net
2	**Reference books**	• ASP.NET 4.0 programming, J. Kajilal, Tata McGaw-Hill • Programming ASP.net, D. Esposito, Microsoft Press (Dreamtech), Reprint 2011.
3	**Websites**	• tutorialspoint.com • cplusplus.com
4	**Journals**	• International Journal of Computer Science and Mobile Computing
5	**Supplementary Reading**	• ASP.NET projects- Building 10 Enterprise Projects- Eric A. Smith • Various MOOC courses material on ASP.net
6	**Practical Components**	• List of experiments to be executed during laboratory hours

Semester	**IV**	**Total Credit**	**4**
Course Code	**CC 405**	**Credit Pattern**	**L-45, T-7, P-8**
Course Title	**ADVANCED JAVA**		

Course Objectives	
1	To introduce a student to an entirely a new way to build distributed, desktop and mobile applications.
2	To provide a student with the solid foundation of the syntax and semantics of java Programming as well as application architecture, data access technology geared to facilitate the development of distributed systems.
3	To familiarize the student with the development of N-tier web-based applications
4	To inculcate the skills among student for developing application in par with industry standards.
5	To familialize student with MVC archiecture and OR mapping tools

Course Outcomes: Students will be able to;	
1	To design two-tier, three-tier and scalable N-tier web applications.
2	To design java applications employing various middle tier technolgies.
3	To design applications by integrating struts2 and hibernate technologies.
4	To explore dependendency injection and aspect oriented programming features of Spring framework.
5	To design applications by integrating struts2, hibernate and spring technologies.

Unit Number	**Contents**	**Number of Sessions**	
1	**Presentation Tier Technologies** Java Servlets: Servlet basics, servlet life cycle , Generic and HTTP servlets, The Servlet API, javax.servlet and javax.servlet.http package, session tracking using session and cookies, web deployment descriptor, web.xml. databases. Request dispatching. JSP(Java Server Pages: Introduction to JSP, Use of JSP, JSP Architecture, JSP tags, Implicit and Explicit objects, Request forward, Request –time include ,use of Beans in JSP and their scopes. Introduction to Eclipse IDE.	**L= 12** **T= 2**	**P= 2**
2	**RMI, XML and Java Beans** Remote Method Invocation–Introduction , architecture, defining remote objects, creating stubs and skeleton, object serialization, dynamically loaded classes, RMI activation, registrating remote objects, marshaled objects. Introduction to XML for Java, XML processors, costruction & generating XMLdocuments, manipulating DOM structure, Interfacing Databases & XML. Introduction to XSL and XSL syntax. Java Beans: Basics of designing JavaBeans, Java Bean design patterns, creating and using properties, using events to communicate with other components. Introduction to BDK. Parts of BDK. Deploying Java Beans in BDK.	**L= 11** **T= 2**	**P= 2**

3	**Struts MVC Framework** Struts Framework: An introduction to Struts, building a simple struts application. Action Servlet, Model, view and Controller layers, validator, declarative exception handling, Introduction to struts tag libraries and struts configuration files. Internationalization. AJAX with Struts 2.	**L= 11**	
		T= 2	**P=2**
4	**Hibernate and Spring Framework** Integrating and configuring hibernate. ObjRelation Mapping, Building a simple application. Persistence life cycle. Spring API libraries, Designing spring applications. Spring persistence using JPA. Spring web flow, Using spring MVC to build web pages. Spring plugins for Eclipse. Spring application development using Eclipse IDE.	**L= 11**	
		T= 1	**P= 2**

Learning Resources		
1	Text Books	1. Orfali, "The essential Distributed Object Survival Guide".Java 8 Programming Black Book 2. A Complete Reference Struts (Second Edition) - JamesHomes. Tata McGraw-Hill Edition. 3. Struts 2 - Black Book. (Second Edition). Kogent Solutions Inc. dreamtech press. 4. Craig Walls, Spring in Action, Manning Publications; 4th edition 5. Yogesh Prajapati, Vishal Ranapariya Java Hibernate Cookbook, Packt Publishing
2	Reference books	i. 6. Thinking in Java, Bruce Eckel,, Addison – Wesley, ISBN: 9814035750 7. Java 2 Programming Black Book by Steven Holzner, Dream Tech Publication 8. A Programmer's Guide to Java SCJP Certification: A Comprehensive Primer By Khalid Azim Mughal, Rolf Rasmussen 9. Inside Java 2 Virtual Machine by Venners Bill, Mcgraw Hill Education 10. Learning Java by Jonathan Knudsen, Patrick Niemeyer, O'Reilly Media.
3	Websites	11. https://www.javatpoint.com/servlet-tutorial 12. https://www.tutorialspoint.com/jsp/index.htm 13. https://www.journaldev.com/2310/struts-2-tutorial 14. https://www.tutorialspoint.com/hibernate/index.htm 15. https://www.javatpoint.com/spring-tutorial
4	Journals	16. https://www.journaldev.com/3557 17. International Journal of Computer Science and Mobile Computing - ISSN 2320–088X 18. https://www.pcmag.com 19. https://ieeexplore.ieee.org
5	Practical Component	a. b. Practical lab excercises based on Units I to IV

Semester	IV	**Total Credit**	**4**
Course Code	DSE- V DS- III	**Credit Pattern**	**L-48, T-4, P-8**
Course Title	**MACHINE LEARNING WITH PYTHON**		

Course Objectives	
1	Provide a concise introduction to the fundamental concepts in machine learning and popular machine learning algorithms
2	To familiarize various python data structures and python libraries for machine learning
3	To Provide a concise introduction to the fundamental concepts in machine learning and popular machine learning algorithms
4	To Provide working knowledge of neural networks and deep learning

Course Outcomes: After successful completion of the course, the students would be able to	
1.	Identify and explain various concepts of machine learning
2.	Use various python data structures and python libraries for machine learning
3.	Analyze and choose supervised and unsupervised machine learning algorithms.
4.	Students will learn to implement, construct, and validate their own neural network

Syllabus:

Unit Number	**Contents**	**Number of Sessions**	
1	**Fundamentals Data Analysis:** python libraries for machine learning – Numpy, matplotlib, Pandas, Scikit-learn, Scipy, Tensor –flow, Keras **Data Analysis**: Cleaning Data, Filtering Data, Advanced Grouping, Pivot Tables **Data Visualization** :Plotting with Matplotlib Scatter Plots Histograms & Bar Plots Custom Visualizations	**L= 12**	
		T=1	**P= 2**
2	**Fundamental of machine learning:Types of learning** – supervised, unsupervised and Reinforcement, Bias and variance hypothesis space and inductive bias, evaluation, cross-validation. **Regression** – Linear, Non-linear, Simple and Multiple regression, and their applications, model evaluation and accuracy Overfitting & Underfitting, Implementation of regression on dataset using python.	**L= 12**	
		T= 1	**P= 2**
3	**Classification and Clustering: Classification**: KNN, Decision trees, Random forest, Logistic Regression, Support Vector Machine, Neural Network as classifier, classification accuracy metrics. Implementation of classification algorithms in python. **Clustering:** Different clustering approaches- partition based clustering, hierarchical clustering and density based clustering. Implementation of clustering algorithms.	**L= 12**	
		T= 1	**P= 2**
4	**Deep Learning :** Neural Networks , Activation functions type of ANN: MLP's, CNN, RNN ,Activation functions, Shallow Neural Network , Deep Neural Network , Introduction to Tensor Flow, Keras Framework.	**L=12**	
		T= 1	**P= 2**

Learning Resources		
1	**Text Books**	1. Machine Learning. Tom Mitchell. First Edition, McGraw- Hill, 1997. 2. Introduction to Machine Learning Edition 2, by Ethem Alpaydin 3. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython Book by Wes McKinney 4. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016.
2	**Reference books**	• Python Machine Learning by Sebastian Raschka • Introduction to Machine Learning with Python - A Guide for Data Scientists, Publisher: Shroff Publishers & Distributors Pvt Ltd • Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.
3	**Websites**	• www.python.org • machinelearningmastery.com

		• tutorialspoint.com
4	**Journals**	1. IEEE xplore digital library 2. International journal of machine learning and computing
5	**Supplementary Reading**	1. Building Machine Learning Systems with Python - Willi Richert, Luis Pedro Coelho 2. Learning scikit-learn: Machine Learning in Python - Raúl Garreta, Guillermo Moncecchi
6	**Practical Components**	Implementation of supervised and unsupervised machine learning algorithms using python

Semester	**IV**	**Total Credit**	**4**
Course Code	**DSE-V NS-III**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**CLOUD COMPUTING**		

Course Objectives	
1	To understand the concept of Virtualization and design of cloud Services
2	To understand cloud computing technologies.
3.	To introduce the broad perceptive of cloud architecture and model To learn to design the trusted cloud Computing system
4.	To introduce the fundamental ideas of the cloud computing model and its origin
5.	To introduce the broad perceptive of cloud architecture and model To learn to design the trusted cloud Computing system
6.	To understand the features of cloud simulator

Course Outcomes: The students will able to	
1.	identify the architecture and delivery models of cloud computing.
2.	identify infrastructure.
3.	understand security, privacy and interoperability issues.
4.	select suitable cloud player
5.	apply suitable virtualization concept
6.	implement cloud services and set a private cloud

Unit Number	**Contents**	**Number of Sessions**	
1	**Introduction to cloud computing:** Cloud computing definitions, History of cloud, Characteristics and Principles of cloud, SaaS Maturity Model, commercial cloud offerings, cloud storage, live migration, ISO image, Layers and types of clouds, Challenges, Service Models, opportunities and challenges, advantages and disadvantages of cloud computing, Comparison of Cloud computing, Cluster computing and Grid computing; Applications: Technologies and process required when deploying Web services. Service Oriented Architecture (SOA), WSDL structure, protocols used in SOA, web service integration, service catalogs,. Cloud Computing Architecture: Cloud Interoperability and standards, Scalability and Fault tolerance, System Models for Distributed and cloud computing –NIST cloud computing reference model. Cloud Cube Model, Cloud Reference Model, Cloud Models – Service Model(Iaas, Paas, Saas), Deployment Model,	**L= 15** **L=12**	**T=3**
2	**Cloud Computing Costs** – Right sizing, auto scaling, vertical scaling Vs horizontal scaling, service level agreement, service credits, defining licensing models. Capacity planning, steps in capacity planning, baseline measurements, resource ceiling, server instance types, measuring network capacity. Virtualization: Introduction to Virtualization, Characteristics of virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Types of Virtualization- Implementation Levels of Virtualization - Virtualization Structures - Tools and Mechanisms - Virtualization of CPU, Memory, I/O Devices . Fundamental concepts of compute ,storage, networking, desktop and application virtualization, Virtualization benefits, server virtualization, Infrastructure Requirements , Virtual LAN(VLAN) and Virtual SAN(VSAN) and	**L= 15** **L=12**	**T= 3**

	their benefits ,Load balancing, benefits of load balancing, load balancing alrgorithms, hypervisor (virtual machine monitor), types of hypervisors, machine imaging, porting applications, challenges in porting applications, simple cloud API, AppZero virtual Application Appliance.		
3	**Cloud Infrastructure:** Cloud Application Platform: Aneka Framework Overview, Building Aneka Clouds: Infrastructure Organization, Logical Organization, Platform Deployment: Private Cloud Deployment Mode, Public Cloud Deployment Mode, Hybrid Cloud Deployment Mode, Resource provisioning, Inter cloud resource management. Layered Cloud Architecture development, Cloud Security, OSI standard for security model, role and rule mangement, access control list, specific attacks, sniffing, spoofing, phishing, pharming (DNS Spoofing), cryptography, encryption, decryption, types of cryptography. Format of digital certificate, working of digital signature, Electronic money (Digicash), security mechanism in Digicash, types of electronic money, double-spending problem..	**L= 15** **L=12**	**T=3**
4	**Programming Model:** Principles of Parallel and Distributed Computing, Paradigms: Map Reduce- Hadoop Library from Apache, Amazon Web Services (AWS), Parallel vs. Distributed Computing, centralized vs distributed systems, Difference between distributed and network operating system, Features and characteristics of distributed systems, distributed architectures, system models, Elements of Parallel Computing Hardware Architectures for Parallel Processing, Approaches to Parallel Programming ,Levels of Parallelism, classification of parallel computers, Flynn's classification, dependency conditions, Berstein conditions for detection of parallelism, parallelism based on grain size, Handler's classification, Components of a Distributed System , Architectural Styles for Distributed Computing , Models for Inter-Process Communication, Technologies for Distributed Computing: Remote Procedure Call.	**L=15** **L=12**	**T=3**

Learning Resources		
1	**Text Books**	• Kumar Saurabh,"Cloud Computing", Wiley Pub • Buyya Selvi,"Mastering Cloud Computing", TMH pub. • Soninky, "Cloud Computing", Wiley Pub. • Kurtz, Vines, "Cloud Security", Wiley Pub.
2	**Reference books**	• John W.Rittinghouse and James F.Ransome, "Cloud Computing: Implementation, Management, and Security", CRC Press, 2010. • Kumar Saurabh, "Cloud Computing – insights into New-Era Infrastructure", Wiley India, 2011. • George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud" O'Reilly • Katarina Stanoevska-Slabeva, Thomas Wozniak, Santi Ristol, "Grid and Cloud Computing – A Business Perspective on Technology and Applications", Springer. • James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann.
3	**Websites**	• https://www.javatpoint.com/cloud-computing-tutorial

		• https://www.w3schools.in/cloud-computing/cloud-computing/ • https://data-flair.training/blogs/cloud-computing-tutorial/ • https://www.tutorialride.com/cloud-computing/cloud-computing-tutorial.htm • https://www.edx.org/learn/cloud-computing • https://www.coursera.org/browse/information-technology/cloud-computing
4	**Journals**	• Global Journals – Cloud and Disributed, ISSN Online 0975-4172, ISSN Print 0975-4350, DOI 10.17406/gjcst • International Journal of Cloud Computing, ISSN online 2043-9997, ISSN print 2043-9989 • Journal of Cloud Computing Advances, Systems and Applications, ISSN: 2192-113X (Online) (Springer) • International Journal of Cloud Applications and Computing (IJCAC), ISSN: 2156-1834 | EISSN: 2156-1826 | DOI: 10.4018/IJCAC
5	**Supplementary Reading**	• https://en.wikipedia.org/wiki/Cloud_computing • https://www.geeksforgeeks.org/cloud-computing/ • https://www.tutorialspoint.com/cloud_computing/ • https://www.guru99.com/cloud-computing-for-beginners.html
6	**Practical Components**	• Case Studies • Lab Assignments Sample Case Studies: A case study on cloud storages, o OneDrive o Google Drive • A case study on Google App Engine • A case study on determining cloud computing cost. • A case study based on detection of parallelism Lab assignments based on virtualization Installing VMware Workstation Installing Oracle VM Virtual Box and creating virtual machines.

Semester	**IV**	**Total Credit**	**4**
Course Code	**DSE-VI DS- IV**	**Credit Pattern**	**L-45, T-8, P-7**
Course Title	**BIG DATA ANALYTICS**		

Course Objectives	
1	To master the concepts of HDFS and MapReduce framework
2	To introducerHadoop 2.x Architecture
3	To introduce data loading techniques using Sqoop and Flume
4	To familiarize the student with data loading and data analytics
5	To userstandHBase and MapReduce integration

Course Outcomes	
After completion of this course the student will be able to:	
1	Master data loading techniques using Sqoop and Flume.
2	Setup Hadoop Cluster and write Complex MapReduce programs
3	Perform data analytics using Pig, Hive and YARN
4	Implement best practices for Hadoop development
5	Implement Advanced Usage and Indexing
6	Schedule jobs using Oozie
7	Work on a real life Project on Big Data Analytics

Unit Number	**Contents**
1	Big Data Overview, data science, rising and importance of data sciences, big data analytics in industry verticals. Sources of Big Data, 3 V's of Big Data, Benefits of Big Data, Big Data Technologies, classes of Big Data Technologies, Challenges of Big Data, Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, Communicating results, Deployment.Overview & analytics life cycle, Need, Structured and multi-structured data analysis, Big-data analytics major components, Analytical models and approaches, Relational and non-relational Databases, Application areas, Design and analysis of Analytics model-Analytics design steps, Understanding different data processing models, Statistical models, Predictive models, Descriptive models**.** **(15)**
2	Introduction to MapReduce and HDFS. The Hadoop & Tez Ecosystems(Batch Processing)., Hadoop Architecture, Hadoop Modules, Advantages of Hadoop, Hadoop Operation Modes, HDFS Concepts, HDFS Data Node and Name Node images, HDFS Read Image and HDFS Write Image, Secondary Name Node, Hadoop configuration files, MapReduce& HDFS Framework, Yarn, Tez Framework & InternalsTask Parallelization for Hadoop (Models), Hadoop Physical & Logical Resource Requirements.Downloading and installing the Ubuntu12.x, Installing Java, Installing Hadoop, Verifying Hadoop Installation, Creating Cluster, Increasing Decreasing the Cluster size, Monitoring the Cluster Health, Starting HDFS, Starting and Stoppingthe Nodes. HDFS basic file operations.HDFS commands. The new multi-platform analytical ecosystem. Beyond the data warehouse – Hadoop, NoSQL and analytical RDBMSs, NoSQL DBMSs, Key Value stores, , introduction to MongoDB, Document DBMSs, Column Family DBMSs and Graph databases, Introduction to Hive, hive data types, hive partitioning, hive DDL commands, DML commandS **(15)**
3	Introduction to Apache PIG, Features of PIG, Introduction to PIG Data Flow Engine, MapReduce vs PIG, SQL vs PIG, PIG Architecture, Components of Apache Pig, Pig Latin Data Model, Pig Data Types, Basic PIG programming, Pig Operators, Pig Diagnostic Operators, Grouping by multiple columns, Co-group operator, join operator, types of joins, cross operator, union operator, split operator, filter operator, distinct operator, foreach operator, orderby operator, limit operator, Modes of Execution, Introduction to SQOOP, Connect to mySql database, SQOOP import and export commands and Joins in SQOOP, Export to MySQL and HBase. **(15)**
4	Introduction to HIVE, HIVE Meta Store, HIVE Architecture, Tables in HIVE, Managed Tables, External Tables, Hive Data Types, Primitive Types, Complex Types, Partition, Joins in HIVE, HIVE UDF's and UADF's with Programs. Introduction to HBASE, Limitations of Hadoop, HDFS vs HBase, Basic Configurationsof HBASE, Fundamentals of HBase, HBaseDataModel, Table and Row, Column Family and Column Qualifier, Cell and its Versioning, Categories of NoSQL Data Bases, KeyValue Database, Document Database, Column Family Database, HBASE Architecture, HMasterRegion Servers, Regions, MemStore, HDFS vsHBase, Client side buffering or bulk uploads, HBase Designing Tables, HBase

	Operations, HBase shell **(15)**

Learning Resources		
1	Text books	1. Baesens Bart, Analytics In A Big Data World: The Essential Guide To Data Science And Its Applications, Wiley Publisher.Java 8 Programming Black Book 2.. AmbigaDhiraj, Michael Minelli, and Michele Chambers, Big Data Big Analytics: Emerging Business, Wiley CIO Series.Core Java Vol. II (Addison- Wesley) Sun Press ISBN – 981-4058-50-5
2	References	1. Kord Davis, Ethics of Big Data: Balancing Risk and Innovation, O'Reilly. 2. Tom White, Hadoop – A Definitive Guide, O'Reilly. 3. Alan Gates, Programming Pig - Dataflow Scripting with Hadoop, O'Reilly. 4. JarekJarcecCecho and Kathleen Ting, Apache Sqoop Cookbook: Unlocking Hadoop for Your Relational Database, O'Reilly. 5. Lars George, HBase: The Definitive Guide, O'Reilly. 6. Dean Wampler, Edward Capriolo, and Jason Rutherglen, Programming Hive, O'Reilly. 7. FlavioJunqueira, Benjamin Reed, ZooKeeperDistributed Process Coordination, O'Reilly. 8. HariShreedharan, Using Flume - Flexible, Scalable, and Reliable Data Streaming, O'Reilly MediaJava 2 Programming Black Book by Steven Holzner, Dream Tech Publication

Semester	**IV**	**Total Credit**	**4**
Course Code	**DSE-VI NS-IV**	**Credit Pattern**	**L-45, T-8, P-7**
Course Title	**DATABASE AND WEB SECURITY**		

Course Objectives	
1	To understand the fundamentals of data models and conceptualize and depict a database system using ER diagram
2	To make a study of SQL and relational database design
3	To know about data storage techniques and query processing
4	To impart knowledge in transaction processing, concurrency control techniques and recovery procedures
5	To Understand the specialized Databases Course Outcome: At the end of the course, the students will be able to • Understand the basic concepts of the database and data models • Design a database using ER diagrams and map ER into Relations and normalize the relations • Evaluate the performance of DBMS using different types of Queries • Develop simple database applications using normalization • Analyze different special purpose databases and to critique how they differ from tradition

Course Outcomes	
1	Understanding the database concept and structure, data modeling and development process.
2	Construct and normalize conceptual data models.
3	Implement a relational database into a database management system
4	Use database management system(Oracle SQL Plus).
5	Become proficient in using query language(SQL).

Unit Number	**Contents**
1	Introduction to Database, Levels of Database Security - Human level, network/user interface, database application program, database system, operating system, and physical level, Authentication and Password Security, Application Security – SQL Injection.
2	Securing Database-to-Database Communication, Trojans, Encryption, Passwords in scripts, insider/outsider attacks, users, programmers, super users, information leakage.
3	Introduction to Web Applications and Security, Profiling, Hacking Web Servers, the Threats – Classes of threats, the Hacker's Workbench, Cryptography and the Web, Digital Identifications.
4	Privacy- protecting techniques, privacy- protecting technologies, Backups and antitheft. Web Server Security – Host security for servers, .. Securing web applications. Protecting an organization – Network layout, safe hosts in a hostile environment, Intrusion detection.

Learning Resources		
1	Text books	1. Baesens Bart, Analytics In A Big Data World: The Essential Guide To Data Science And Its Applications, Wiley Publisher.Java 8 Programming Black Book 2.. AmbigaDhiraj, Michael Minelli, and Michele Chambers, Big Data Big Analytics: Emerging Business, Wiley CIO Series.Core Java Vol. II (Addison- Wesley) Sun Press ISBN – 981-4058-50-5
2	References	Joel Scambray, Mike Shema, Caleb Sima, Hacking Exposed Web Applications, Second Edition • Simson Garfinkel, Gene Spafford, Web Security, Privacy & Commerce, Second Edition • Mike Shema, HackNotes(tm) Web Security Pocket Reference

		• William R. Cheswick , Steven M., Bellovin, Aviel D. Rubin ,Firewalls and Internet Security • Matt Bishop, "Computer Security: Art and Science", Pearson Education. • Fundamentals of Database Systems (3rd Ed.) - R.Elmasri, S. Navathe • An Introduction to database systems (5th Ed.) - C. J. Date • Database system concepts – H. Korth , A. Silberschatz 9.

Semester	**IV**	**Total Credit**	**2**
Course Code	**AEC - V**	**Credit Pattern**	**L-48, T-12, P-0**
Course Title	**INTERNET OF THINGS**		

Course Objectives	
1	Provide an overview of concepts, main trends and challenges of Internet of Things.
2	Get knowledge of IoT Key Technologies such as RFID, Wireless Networks etc.
3.	To make students aware of Internet of Things applications.
4	Develop skills related to the IoT technologies for practical IoT applications.
Course Outcomes: The students will able to	
1.	Explain and interpret the Internet of Things concepts and applications.
2.	Use the knowledge and skills acquired during the course for the design of simple IoT
3.	Analyze applications of IoT in real time scenario

Syllabus:

Unit Number	**Contents**	**Number of Sessions**	
1	**Fundamental IoT Mechanisms & Key Technologies** Introduction, IoT Frameworks, Enabling Technologies of IoT , Sensing and actuating Technology, Basic Nodal Capabilities, Identification of IoT objects and services, Structural aspects of the IoT- Traffic characteristics, Scalability, Interoperability, Security and Privacy, Open architecture, Key IoT Technologies - Device Intelligence, Communication Capabilities, Mobility support, Device Power, Sensor Technology, RFID technology, Satellite Technology	**L= 12** **T=3**	**P= 0**
2	**Radio Frequency Identification Technology and Wireless Sensor Networks:** RFID - Introduction, Principles of RFID, Components of an RFID System, Reader, RFID tags, RFID middleware Wireless Sensor Networks – Node communication, Node Computation, Node Sensing, Connecting Nodes, Networking Nodes, Securing Communication Technologies for IoT Connectivity	**L= 12** **T= 3** T= 3	**P= 0** P= 0

Learning Resources		
1	**Text Books**	• Hakima Chaouchi, The Internet of Things: Connecting Objects to the Web, Wiley Publications • Daniel Minoli, Building the Internet of Things with IPv6 and MIPv6 The Evolving World of M2M Communications, Wiley Publications
2	**Reference books**	• Bernd Scholz-Reiter, Florian Michahelles, Architecting the Internet of Things, Springer • Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, 2nd Edition, Willy Publications • Parikshit N. Mahalle& Poonam N. Railkar, "Identity Management for Internet of Things", River Publishers • Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence, 1st Edition, Academic Press, 2014.
3	**Websites**	• https://www.javatpoint.com/iot-internet-of-things • https://www.guru99.com/iot-tutorial.html • https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
4	**Journals**	• IEEE Internet of Things Journal, ISSN: 2327-4662 https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=6488907 • Internet of Things, Elsevier, ISSN: 2542-6605

		• Discover Internet of Things, ISSN: 2730-7239
5	**Supplementary Reading**	• Internet of Things (IoT) Tutorial, https://www.tutorialspoint.com/internet_of_things/index.htm • IoT Tutorial for Beginners, https://data-flair.training/blogs/iot-tutorial/
6	**Practical Components**	• https://developer.ibm.com/technologies/iot/tutorials/ • https://www.robolab.in/list-of-practicals-for-internet-of-things-iot/