

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY



CIRCULAR NO.SU/Sci./M.Sc.Comp.Sci.& IT/62/2021

It is hereby inform to all concerned that, the syllabus prepared by the Ad-hoc Board in Computer Science & IT and recommended by the Dean, Faculty of Science & Technology the Hon'ble Vice-Chancellor has accepted the **Syllabus of M.Sc.Computer Science and Information Technology Ist to IVth semester with Bridge Course for affiliated Colleges and University Department** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

This shall be effective from the Academic Year 2021-22 and onwards.

All concerned are requested to note the contents of this circular and bring notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.

REF.NO. SU/SCI/2021/4825-34
Date:- 30-11-2021.

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[Signature]
**Deputy Registrar,
Academic Section.**

Copy forwarded with compliments to :-

- 1] **The Principal of all concerned affiliated Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
- 2] **Head of the Department, Department of Computer Science & IT,**
Dr.Babasaheb Ambedkar Marathwada University, Aurangabad.
- 3] **The Director, University Network & Information Centre, UNIC,**
with a request to upload this Circular on University Website.

Copy to :-

- 1] The Director, Board of Examinations & Evaluation, Dr.BAMU, A'bad.
- 2] The Section Officer, [M.Sc.Unit] Examination Branch, Dr.BAMU, A'bad.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU, A'bad.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU, A'bad.
- 5] The In-charge, [E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU, A'bad.
- 6] The Public Relation Officer, Dr.BAMU, A'bad.
- 7] The Record Keeper, Dr.BAMU, A'bad.

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD



M.Sc. (Information Technology)

Faculty of Science and Technology

w.e.f. ACADEMIC YEAR JUNE, 2021-2022


29/11/21



Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

Department of Computer Science and Information Technology, Dr. B. A. M. University and affiliated colleges adopted a credit-based system. It is a flexible, cafeteria-type learning system with an inbuilt horizontal mobility for students to all desire units of education in the Department/colleges with provision for even inter Departmental mobility for students. CBCS operates on modular pattern based on module/units called “credits”, wherein ‘credit’ defines the quantum of contents/syllabus prepared for a course/paper and determines the minimum number of teaching-learning hours required

OBE & CBCS permits students to:

- Learn at their own pace,
- Choose electives from a wide range of elective courses offered by the department,
- Undergo additional/value added courses and acquire more than the required number of credits, depending upon the learner aptitude,
- Adopt an interdisciplinary approach in learning,
- Make best use of the expertise of faculty across the Department, beside the particular department faculty
- Acquire knowledge, skill and attitude of learning outcomes through participatory teaching and learning and continuous evaluation process

This provides the flexibility to make the system more responsive to the changing needs of our students, the professionals and society. The credit-based system also facilitates the transfer of credits.

Admission/ Promotion: M. Sc. Information Technology

Duration: Four Semesters means Two Academic Years

Eligibility:

- i) Any Science Graduate with at least one optional subject as Computer Science/ Information Technology/ Mathematics/ Electronics/ Physics OR
- ii) Any Science graduate having Mathematics as one of the subject in XII Standard OR
- iii) B.E./ B. Tech.

Course Objective: [OBE]

***Fees likely to be modified as per the university rule and regulation from time to time and will be applicable to the concern students**

Admission to the M. Sc. Information Technology course in the department will be done on the performance of their performance in the qualifying ~~gate~~ level examination.

The student will apply on the application form of the University / affiliated college provided with the prospectus/e- prospectus. Once the student is admitted to the concern department/ course, he/she will be promoted to next semester with full carryon; subject to the registration of student in every consecutive semester. Dropout student will be allowed to register for respective semester as and when the concerned courses are offered by the department, subject to the condition that his/her tenure should not exceed more than twice the duration of course from the date of first registration at parent department. The admission of concern student will be automatically get cancelled if he/she fails to complete the course in maximum period (Four years/Eight semesters)

Credits and Degrees

- i) A candidate who has successfully completed all the core courses, Elective/ Specialized courses and, seminars and project prescribed and or optional service courses approved by the University for the program with prescribed CGPA shall be eligible to receive the degree.
- ii) One Credit shall mean 15 hours teaching one semester (of 15 weeks) for theory courses and two practical/laboratory/field/demonstration hours/ week for one semester.
- iii) Every student will have to complete at least 100 credits to obtain the master's degree of M. Sc. Information Technology (Post graduate degree) out of which 96 credits should be from this Department and four or eight credits of service courses from this or other Department.

Courses

- (i) **Core Course:** - A core course is a course that a student admitted to M. Sc. Computer Science/ M. Sc. Information Technology program must successfully completed to receive the degree. Normally no theory course shall have more than 4 credits.
- (ii) **Elective Course:** Means optional course from the basic subject or specialization. The elective course defined specialization that student want to perceive. The horizontal learning path is to be followed by the student for selection of elective course. Department may offer more than one specialization depending availability of resources.
- (iii) **Service course (SC):** The service courses will be offered in third and fourth semesters in the department. Student should complete one service course in each semester.
- (iv) Each Course shall include lectures / tutorials / laboratory or field work / Seminar / Practical training / Assignments / midterm and term end examinations/ paper / Report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.
- (iv) **Bridge Course:** This course specially designed to provide subject prerequisites / skills required by the student prior to learning the defined course in curricula.

Course Code	Course Title
T1	C++
T2	Data Structure
T3	DBMS

T4	Software Engineering
T5	Operating System
T6	Computer Organization
T7	Fundamentals of mathematics and Statistics
CS	Communication Skill
P1	Practical on C++(T1)
P2	Practical on DS(T2)
P3	Practical on DBMS(T3)
P4	Practical on OS(T5)
P5	Practical on CO(T6)

(v)Attendance: - Students must have 75% of attendance in each Core and Elective course for appearing the examination. However student having 65% attendance with medical certificate may apply to the H.O.D. for commendation of attendance.

Registration for Service Course:

- i) The student will register the service course of his interest after the start of semester in the concerned department on official registration form. The teacher in-charge of the respective course will keep the record of the students registered. Maximum fifteen days period will be given from the date of admission for completion of registration procedure. The Departmental / college department Committee shall follow a selection procedure after counselling to the students etc. to avoid overcrowding to particular course(s) at the expense of some other courses.
- ii) No student shall be permitted to register for more than one service course in a semester.
- iii) The University department / affiliated college department shall decide the maximum number of students in each service course taking into account the teachers and Physical facilities available in the Department/college.
- iv) The University / college may make available to all students a listing of all the courses offered in every semester specifying the credits, the prerequisites, a brief description or list of topics the course intend to cover, the instructor who is giving the courses, the time and place of the classes for the course. This information shall be made available on the University website.

- v) Normally no service course shall be offered unless a minimum of 10 Students are registered.
- vi) The student shall have to pay the prescribed fee per course per semester/year for the registration as decided by the University/college.

Departmental Committee:

Every P.G. program of the University/College shall be monitored by a committee constituted for this purpose by the Department. The Committee shall consist of H.O.D. as a Chairman and some/all the teachers of the Department as its members.

Results Grievances Redressal Committee:

The department shall form a Grievance Redressal Committee for each course with the Course Teacher and the HOD. This Committee shall solve all grievances relating to the Assessment of the students.

Awards of Grades

- (i) A ten point rating scale shall be used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Program. Grade points are based on the total number of marks obtained by him/her in all the heads of examination of the course. These grade points and their equivalent range of marks are shown separately in Table-I.

Sr. No	Equivalent Percentage	Grade Points	Grade	Grade Description
1.	90.00 – 100	9.00 – 10	O	Outstanding
2.	80.00 – 89.99	8.00 – 8.99	A++	Excellent
3.	70.00 – 79.99	7.00 – 7.99	A+	Exceptional
4.	60.00 – 69.99	6.00 – 6.99	A	Very Good
5.	55.00 – 59.99	5.50 – 5.99	B+	Good
6.	50.00 – 54.99	5.00 – 5.49	B	Fair
7.	45.00 – 49.99	4.50 – 4.99	C+	Average
8.	40.01 – 44.99	4.01 – 4.49	C	Below Average
9.	40	4.0	D	Pass
10.	<40	0.00	F	Fail

Table I: Ten Point Grades and Grade Description

ii) Non-appearance in any examination/ assessment shall be treated as the students have secured zero mark in that subject examination/assessment.

iii) Minimum D grade (4.00 grade points) shall be the limit to clear /pass the course/subject. A student with F grade will be considered as ‘failed’ in the concerned course and he/she has to clear the course by reappearing in the next successive semester examinations. There will be no revaluation or recounting under this system.

iv.) Every student shall be awarded Grade points out of maximum 10 points in each subject (based on 10

Point Scale). Based on the Grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and cumulative Grade card with CGPA will be given on completion of the course.

Computation of SGPA (Semester grade point average) &CGPA (Cumulative grade point average)

The computation of SGPA &CGPA, will be as below:

- a. **Semester Grade Point Average (SGPA)** is the weighted average of points obtained by a

student in a semester and will be computed as follows:

$$SGPA = \frac{\text{Sum}(\text{CourseCredit} * \text{Number of Points in concern gained by student})}{\text{Sum}(\text{CourseCredits})}$$

The Semester Grade Point Average (SGPA) for all the four semesters will be mentioned at the end of every semester.

- b. **The Cumulative Grade Point Average (CGPA)** will be used to describe the overall performance of a student in all semesters of the course and will be computed as under:

$$CGPA = \frac{\text{Sum}(\text{All Four Semester Credits gained by the student})}{\text{Sum}(\text{Credits of All Semesters})}$$

The SGPA and CGPA shall be rounded off to the second place of decimal.

Evaluation method:

Each theory course will be of 100 Marks and be divided in to internal examination (Sessional) of 20 Marks and Semester end examination of 80 Marks. (20+80 = 100 Marks). Each Practical course will be of 50 marks. Research project / Internship / field projects if any, will be of 100 marks.

a. Internal Evaluation Method

There shall be two mid semester examinations, first based on 40 percent syllabus taught and second based on 60 percent syllabus taught. The setting of the question papers and the assessment will be done by the concerned teacher who has taught the syllabus. Average score obtained out of two mid semester examinations will be considered for the preparation of final sessional marks/grade.

b. Term end examination and evaluation

- i. Semester end examination time table will be declared by the departmental committee and accordingly the concern course teacher will have to set question paper, conduct theory examination, practical examination with external expert, evaluate, satisfy the objection / query of the student (if any) and submit the result to DC.
- ii. The semester end examination theory question paper will have two parts (20+60 = 80 Marks)
- iii. Template of question paper is designed in light of Outcome based education method and determine the attainment level of students. The pattern of question paper is as below
 - a. Q1 will be based on (fill in the blanks/ multiple choice questions/ match columns / state true or false / answer in one sentence) as compulsory questions and it should cover entire syllabus and carries 20 Marks.
 - b. Student will require to solve any five questions from Q2 to Q8 where Q2 of type **comprehension**, Q3 and Q4 are **application oriented**, Q5 based on **analysis**, Q6 will be on **synthesis**, Q7 checks **evaluation** ability of student, and Q8 on **Comprehension** ability.
- iv. Semester end Practical examinations will be of 50 marks each and students will be examined by one external and one internal examiner. Seminar and Project work (if any) will be evaluated by the external examiners along with guide.

- v. At the end of each semester the Committee of Department shall assign grade points and grades to the students.
- vi. The Committee of Department shall prepare the copies of the result sheet in duplicate. Every student shall have the right to scrutinize answer scripts of Mid semester/Term end semester examinations and seek clarifications from the teacher regarding evaluation of the scripts immediately thereafter or within 3 days of receiving the evaluated scripts.
- vii. The Head of the department shall display the grade points and grades for the notice of students. The head of the department shall send all records of evaluation for Safekeeping to the Controller of Examinations as soon as all the formalities are over.

Grade Card

The University shall issue at the beginning of each semester a grade card for the student, containing the

Grades obtained by the student in the previous semester and his Semester Grade Point Average (SGPA).

The grade card shall list:

- (a) The title of the courses along with code taken by the student
- (b) The credits associated with the course,
- (c) The grade and grade points secured by the student,
- (d) The total credits earned by the student in that semester.
- (e) The SGPA of the student,
- (f) The total credits earned by the students till that semester and
- (g) The CGPA of the student (At the end of the IVth Semester).

Cumulative Grade Card

At the end of the IVth semester, the University shall issue Cumulative Grade Card to the Students showing details of Grades obtained by the student in each subject in all semesters along with CGPA and total credits earned.

Course Curriculum Abstract of M Sc. Information Technology

Semester I	Semester II	Semester III	Semester IV
Programming 1	Programming 2	Web Analysis & Development	• Field Work & Internship Program • Seminar
Analysis of algorithms	Relational Database Management System using SQL	Artificial Intelligence	
Advance Computer Network	Network Security	Cyber Forensics	
Advance Operating System	Fundamentals of Compiler Design	Advance Software Engineering	
Computational Mathematics			
Constitution of India	Elective 1	Elective 2	
Research Methodology	Technical Report Writing		

Program Specific Outcomes (PSOs) and Program Outcomes (POs)

M. Sc. Information Technology

1. Be able to fundamentally strong in Information Technology concepts.
2. Be able to design, implement and evaluate a technology – based system, process and components.
3. Be competent in engineering software for industrial applications.
4. An ability to identify opportunities for establishing an enterprise.
5. Be able to apply computational knowledge for information theory.
6. Ability to understand and apply fundamental research concepts.
7. Be able to provide services in the areas of communication technology.
8. An ability to get detail insight of advanced tools and technology for information processing.
9. To discover patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems.
10. Understand professional, ethical, legal, security, social issues and responsibilities.
11. Engage in independent and life-long learning for continued professional development.

Course Structure of M.Sc. Information Technology Course

Semester I					
Course Code	Course Title	No. of Credits	Marks		Total
			Internal	External	
CSI401	Constitution of India	2	20	30	50
CSI402	Research Methodology	2	10	40	50
CSI403	Programming 1	3	20	80	100
CSI404	Analysis of Algorithms	3	20	80	100
CSI405	Advance Computer Network	3	20	80	100
CSI406	Advance Operating System	3	20	80	100
CSI407	Computational Mathematics	3	20	80	100
CSI451	Practical based on CSI403	2	-	50	50
CSI452	Practical based on CSI404	2	-	50	50
CSI453	Practical based on CSI405	2	-	50	50
CSI454	Practical based on CSI406	2	-	50	50
CSI455	Practical based on CSI407	2	-	50	50
Total No. of Credits		29			

Semester II					
Course Code	Course Title	No. of Credits	Marks		Total
			Internal	External	
CSI408	Research proposal and Review writing	1	10	40	50
CSI409	Programming 2	3	20	80	100
CSI410	Relational Database Management Systems using SQL	3	20	80	100
CSI411	Network Security	3	20	80	100

CSI412	Fundamentals of Compiler Design	3	20	80	100
CSI481	Elective 1	3	20	80	100
CSI456	Practical based on CSI409	2	-	50	50
CSI457	Practical based on CSI410	2	-	50	50
CSI458	Practical based on CSI411	2	-	50	50
CSI459	Practical based on CSI412	2	-	50	50
CSI460	Practical based on CSI481-490	2	-	50	50
Total No. of Credits		26			

Semester III					
Course Code	Course Title	No. of Credits	Marks Internal	Marks External	Total
CSI413	Web Analysis & Development	3	20	80	100
CSI414	Artificial Intelligence	3	20	80	100
CSI415	Cyber forensic	3	20	80	100
CSI416	Advanced Software Engineering	3	20	80	100
CSI491	Elective 2	3	20	80	100
CSI417	Service Course	4	20	80	100
CSI461	Practical based on CSI413	2	-	50	50
CSI462	Practical based on CSI414	2	-	50	50
CSI463	Practical based on CSI415	2	-	50	50
CSI464	Practical based on CSI416	2	-	50	50
CSI465	Practical based on CSI491-499	2	-	50	50
Total No. of Credits		29			

Semester IV (Industrial Internship / Field Work Projects)

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC471	Dissertation Review 1	-	3	50	-	50
CSC472	Dissertation Review 2	-	3	50	-	50
CSC473	Dissertation Review 3	-	3	50	-	50

CSC474	Final Dissertation	-	5	-	100	100
CSC475	Seminar	-	2	-	50	50
			16			

Programming Group

Programming Group	Semester I	Semester II
	Programming 1 (CSI403)	Programming 2 (CSI409)
Java Group	Core Java	Advance Java
Microsoft Group	Advance C++	VB.NET
Open Group	Python	Advance Python

Elective Group

Elective Group	Elective 1(CSI481-490)	Elective 2 (CSI491-499)
Data Science	Data mining & Data Warehousing	Big Data Analytics
Remote Sensing and Geospatial Technology	Remote sensing & GIS	Geospatial Technology
Pattern Analysis	Digital Image processing	Pattern Recognition
Advance Technologies	Internet of things	Cloud Computing

(CSI 417)Service Courses

Course Title
• Communication Skill
• Intellectual Property Rights
• Development of Soft Skill and Personality
• R-Tool
• Android Programming

Total Number of Credits

Semester	Credit
Semester I	29
Semester II	26
Semester III	29
Semester IV	16
Total Number of Credits	100

Detailed Syllabus

Semester – I

1. Constitution of India

Course Code	CSI401	Course title	Constitution of India
Number of Credits	2 Credits	Internal / External	20/30
Total Contact Hours	2 Hrs/week	Total Contact Hours	-
(Th)		(Pr)	

Prerequisite: there is no prerequisite for the course

Course Objectives:

- ☐ Student will be able to understand the constitution of India
- ☐ Student will be able to know the constitutional and fundamental rights.

Course Outline:

Unit 1: History of Making of the Indian Constitution: History & Drafting committee, (composition & Working)

Unit 2: Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 3: Contours of constitutional Rights & duties: Fundamental Rights - Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and educational rights, Right To Constitutional Remedies, Directive Principles of State Policy, Fundamental duties

Unit 4: Organs of Governance: Parliament – Composition, Qualification and disqualification, Power and function, Executive – President, Governor, Council of Ministers, Judiciary - Appointment and Transfer of Judges, Qualifications, Power and Function

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.

2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian constitution, 1st Edition, 2015.
3. M. P. Jain, Indian constitution Law, 7th Edn, Lexis Nexis, 2014.
4. D. D. Basu, Introduction to India, Lexis Nexis, 2014.
5. M. P. Jain, outline of Indian Legal and Constitutional history, Lexis Nexis, 2014.
6. गॅनव्हिल ऑव्टाइन ,संघिना राष्ट्रचौ कोनशीला , डायमंड प्रकाशन , पुणे , २०१३.
7. भारताचे शासन आणण राजकारण , विद्या प्रकाशन , नागप .

Note:

1. All latest volumes of above mentioned books must be preferred. The above list of Books is not an exhaustive one.
2. This Course is bilingual (English & Marathi), The Examination Will also be bilingual

2. Research Methodology

Course Code	CSI402	Course title	Research Methodology
Number of Credits	2 Credits	Internal / External	10/40
Total Contact Hours (Th)	2 Hrs/week	Total Contact Hours (Pr)	-

Prerequisite: There are no prerequisites required for attending this course.

Course Objectives: following are the objectives of the course

- ☐ Foundations and principals behind engaging research are inculcated.
- ☐ Student will be able to understand various methods/mechanism involved in problem solving, reviewing and testing of hypothesis

Course Outline:

Unit 1: Introduction: Meaning, Concept, nature steps types and characteristics of research, Identification & formulation of Research Problem, Hypothesis, Research Design & Research Ethics.

Unit 2: Review of literature: Need for Reviewing Literature, what to Review and for what purpose, Literature search Procedure, Sources of Literature, Planning of Review work, Note Taking.

Unit 3: Types and Methods of Research: Classification of Research, Pure and Applied Research, Exploring or Formulative Research Descriptive Research, Diagnostic Research / Study, Evaluation Research / studies, Action Research, Experimental Research, Analytical study of statistical Method, Historical Research, Surveys, Case Study, Field Studies.

Unit 4: Methods & tools of data collection: Concept of sampling and other concepts related to sampling. Probability and non - probability samples, their characteristics and implications. Tools of data collections, their types, attributes and uses. Redesigning, research tools - like questionnaire, opinnaere, observation, interviews, scales and tests etc.

Unit 5: Methods of data analysis: Editing, Classification and Coding, Transcription, Statistical Analysis, Measures of Central Tendency Measures of Dispersion, Measures of Association/ Relationship, Regression and Correlation Analysis, Hypothesis Testing (For Proportion and Means), Test of Significance.

Reference Books:

1. Briony J. Oates., (2006), Researching Information Systems and Computing, SAGE Publications, New Delhi.
2. Kothari C.R., (2004), Research Methodology Methods & Techniques, New Age International Publishers, New Delhi.
3. Bajpai S. R., (1975), Methods of Social Survey and Research, Kitabghar, Kanpur.
4. Bhattacharya D. K., (2004), Research Methodology, New Delhi, Excel Books.
5. Brymann Alan and Carmer D., (1995), Qualitative data analysis for social / scientist, New York, Routledge publication.
6. Best J. W. and Khan J. V., (2005), Research in Education New Delhi, Prentice Hall India. Hans Raj (19gg) Theory and practice in Social Research, Surjeet publication, Kolhapur.
7. Chandra A. and Saxena T. P., (2000), Style Manual, New Delhi, Metropolitan Book Comp. Ltd.
8. Krishnaswami O. R., (1988), Methodology of Research in Social Science, Himalaya pub House.
9. Kothari, C. R., (2005), Quantitative Technique, New Delhi, Vikas publication House.
10. Gautam N. C., (2004), Development of Research tools, New Delhi, Shree Publishers.
11. Gupta, Santosh, (2005) Research Methodology and statistical Techniques, Deep and Deep publications.
12. Shukla J. J., (1999) Theories of Knowledge, Ahmadabad, Karnavati Publication

E-References:

1. <https://www.slideshare.net/annakittystefen/researchmethodologymethodsandtechniquesbycrkothari>
2. <https://www.wisdomjobs.com/e-university/research-methodology-tutorial-355.html>

Course Outcomes:

- ☐ Critically analyze research methodologies identified in existing literature.
- ☐ Choose appropriate quantitative or qualitative method to collect data.
- ☐ Propose and distinguish appropriate research designs and methodologies to apply to a specific

research project.

- ☐ Develop a comprehensive research methodology for a research question.
- ☐ Apply the understanding of feasibility and practicality of research methodology for a proposed project.

3. Programming 1

Course Code	CSI403	Course title	Programming 1
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

The Department has adopted the horizontal format for programming group which will help the students to become master regarding that programming group. Regarding 2018-19 the Department has selected the Java group.

Prerequisites:

- ☐ The student (s) should holds good skills on functional programming concepts, fundamental object oriented concepts.
- ☐ Student(s) should select wither group prior so that there are of expertise nurtured by the department by providing them training on the selected platform.

Course Objectives: following are the objectives of the course

- ☐ Provide student an opportunity to learn and develop basic skills required in writing programs
- ☐ Student will be provided horizontal learning path where they will be able to select the technology trends such as Java Group, Microsoft Group, and Open System Group.
- ☐ Programming 1 will help to develop the foundation for programming 2 and programming 3 course Student will be able to write programs for generating solutions.

3. Programming 1

Course Code	CSI403	Course title	Programming 1
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisites:

- The student (s) should holds good skills on functional programming concepts, fundamental object oriented concepts.
- Student(s) should select wither group prior so that there are of expertise nurtured by the department by providing them training on the selected platform.

Course Objectives: following are the objectives of the course

- Provide student an opportunity to learn and develop basic skills required in writing programs
- Student will be provided horizontal learning path where they will be able to select the technology trends such as Java Group, Microsoft Group, and Open System Group.
- Programming 1 will help to develop the foundation for programming 2 and programming 3 course Student will be able to write programs for generating solutions.
- **A. Course Outline: Java Group (Core Java)**

Unit 1: Basics of Java programming, Data types, Variables, Operators, Control structures including selection, Looping, Java methods, Overloading, Math class, Arrays in java.

Unit 2: Basics of objects and classes in java, Constructors, Finalizer, Visibility modifiers, Methods and objects, Inbuilt classes like String, Character, String Buffer, File, this reference.

Unit 3: Inheritance in java, Super and sub class, Overriding, Object class, Polymorphism, Dynamic binding, Generic programming, Casting objects, Instance of operator, Abstract class, Interface in java, Package in java, UTIL package.

Unit 4: Event handling in java, Event types, Mouse and key events, GUI Basics, Panels, Frames, Layout Managers: Flow Layout, Border Layout, Grid Layout, GUI components like Buttons, Check Boxes, Radio Buttons, Labels, Text Fields, Text Areas, Combo Boxes, Lists, Scroll Bars, Sliders, Windows, Menus, Dialog Box, Applet and its life cycle, Introduction to swing.

Unit 5: Text and Binary I/O, Binary I/O classes, Object I/O, Random Access Files. Thread life cycle and methods, Runnable interface, Thread synchronization, Exception handling with try-catch-finally, Collections in java, Introduction to JavaBeans and Network Programming

Reference Books:

1. Introduction to Java Programming (Comprehensive Version), Daniel Liang, Seventh Edition, Pearson.
2. Programming in Java, Sachin Malhotra & Saurabh Chaudhary, Oxford University Press.
3. Murach's Beginning Java 2, Doug Lowe, Joel Murach and Andrea Steelman, SPD.
4. Core Java Volume-I Fundamentals, Eight Edition, Horstmann & Cornell, Pearson Education.
5. The Complete Reference, Java 2 (Fourth Edition), Herbert Schild, TMH.
6. Java Programming, D. S. Malik, Cengage Learning

Web References:

- 1) <https://www.tutorialspoint.com/java/index.htm>
- 2) https://www.tutorialspoint.com/java/java_tutorial.pdf

List of experiments:

1. Program to define a structure of a basic JAVA program.
2. Program to define the data types, variable, operators, arrays and control structures.
3. Program to define class and constructors. Demonstrate constructors.
4. Program to define class, methods and objects. Demonstrate method overloading.
5. Program to define inheritance and show method overriding.
6. Program to demonstrate Packages.
7. Program to demonstrate Exception Handling.
8. Program to demonstrate Multithreading.
9. Program to demonstrate I/O operations.
10. Program to demonstrate Network Programming.
11. Program to demonstrate Applet structure and event handling.
12. Program to demonstrate Layout managers

Course Outcome:

- ☐ On successful completion of this course, the student should be able to:
- ☐ Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard.
- ☐ Understand the basic principles of the object-oriented programming.
- ☐ Demonstrate an introductory understanding of graphical user interfaces, multithreaded programming, and event-driven programming.

B) Course outline: Microsoft Group (Advanced C++)

Unit 1: Fundamentals, types, constants, and Variables, using functions, input, output streams, Operators and fundamental types, control flow – while, for, do-while, if-else, conditional expressions, selecting switch, jumps, breaks, continue and goto, Symbolic constant and Macros – Macros, Macros with parameters, working with #define directive, conditional inclusions, standard macros for character manipulations.

Unit 2: Writing Functions and Classes: Functions – Significance, defining function, return value of function, passing arguments. Writing classes – defining classes, defining methods, defining objects, using objects, pointers to objects, constructors, constructor calls, destructors, this pointer, passing objects as arguments, structs, unions, Inline

functions, overloading functions, Storage classes and namespaces – static, extern, auto and register, using keyword. Abstract Classes – pure virtual methods, abstract and concrete classes, virtual assignment,

Unit 3: Arrays and Pointers: Arrays – Defining, initializing, Class array, multidimensional array, Member arrays, Arrays and Pointers, Pointer Arithmetic, Arrays as arguments, pointer version of function, read-only pointers, returning pointers, pointers and reference to abstract classes, .

Unit 4: Overloading & Dynamic memory Allocations: Generals, operator functions, using overloaded operators, global operator function, friend function, friend classes, overloading script operators, overloading shift operators for I/O, type conversion for classes, Dynamic Memory allocation – new Operator, delete operator, dynamic storage allocation for classes, dynamic storage allocation for arrays, Inheritance – Member access, redefining members, constructing and destroying derived classes, objects of derived classes, Protected Members, Multiple Inheritance.

Unit 5: Exception handling, Templates: Traditional Error Handling, exception handling, exception handlers, throwing and catching exception, nesting exception, defining you own error classes, standard exception classes, Templates – function and class templates, defining templates, template parameter, template argument, specialization, default arguments of templates, explicit instantiation, containers – container types, sequences, declaring sequences, inserting – deleting in sequence, iterators, accessing objects, length and capacity, list operations, associative containers, sets and multisets, maps and multi-maps

Reference Books:

1. A complete guide to programming in C++ by Ulla Kirch-Prinz, Peter Prinz
2. C++ by Dissection by Ira Pohl
3. C++ Complete Reference by Herbert Schildt

Lab Exercise:

Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

C) Course Outline : Open Group (Python)

Unit 1: Getting started with python: Python features, python environment, configuration and installation, python interpreter, interactive mode. **Data types and Operations:** Core data types, Numbers, Strings, Lists, Dictionaries, Tuples, files and others.

Unit 2: Statement and Syntax: python statements, assignments, expression and prints, conditional statements if, multiway branching, **Looping Controls:** while, for, loop coding techniques, **Iterations and Comprehension.** Iterators, Lists Comprehension, Range iterators, the map, zip and filter iterators, multiple vs single iterator, generators, timing iterators. **Functions:** scope, arguments, types of functions, recursion, function objects, anonymous function, Modules

Unit 3: Exception Handling: exceptions, default exception handler, catching exception, raising exception, user defined exceptions, termination action. **Exception coding details:** try/except/else statement, try statement, try else clause, try/finally statement, unified try/except/finally statement, raise statement, assert statement. **Exception Objects:** exception hierarchy, built-in exceptions, nesting exceptions, designing exceptions.

Unit 4: Classes and OOP: class statement, constructors and expressions, methods, Inheritance, Multiple inheritance (Is-a, Has-a), static, decorators, metaclasses, Namespaces. **Operator overloading:** indexing and slicing, memberships, attribute reference. Delegation, Extending Built-in types, User Defined Modules.

Unit 5: Wrappers in Python: Reflections, Isinstance, Duck typing, callable, Dir, Getattr, **Regular expression:** overview, matching and searching, replacing, splitting, escaping, flags, pattern objects.

Reference Book:

1. Learning Python, 5th Edition, powerful Object-Oriented Programming, By Mark Lutz, and Publisher: O'Reilly Media, Final Release Date: June 2013

E-books:

1. Python Book (http://upload.wikimedia.org/wikipedia/commons/9/91/Python_Programming.pdf)
2. <http://pythonbooks.revolunet.com/>

Lab Exercise:

Students are required to complete minimum 2 practical's on each unit in addition to the assignments published by the teacher on notice board / during practical's etc..

Course Outcomes:

- ☐ On successful completion of this course, the student should be able to:
- ☐ Show competence in the use of the Java programming language in the development of small to medium-sized application programs that demonstrate professionally acceptable coding and performance standard.
- ☐ Understand the basic principles of the object-oriented programming.
- ☐ Demonstrate an introductory understanding of graphical user interfaces, multithreaded programming, and event-driven programming.

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4. Analysis of Algorithms

Course Code	CSI404	Course title	Analysis of Algorithms
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: to have basic knowledge of mathematics.

Course Objectives: following are the objectives of the course

- ☐ To teach techniques for effective problem solving in computing.
- ☐ To study efficient ways to solve a problem.

Course Outline:

Unit 1: Introduction to Analysis of Algorithm, Design & analysis fundamental, Space and time complexities, Growth of function (Notation Omega and Theta), Asymptotic (alpha, beta, gamma) Analysis. Linear and non linear data structure like stack, queues, linked lists, trees, graph, searching algorithms linear and binary searching. Sorting algorithms like bubble, selection, insertion, quick, merge, radix.

Unit 2: Randomized (Quick sort) and Recursive algorithm, Divide and concurrent method e.g. binary search, Merge sort, quick sort etc... Partition algorithm, Select and radix sort, Greedy method, Single source shortest path.

Unit 3: Graph :representation, types, Dijkstra's algorithm, Bellman ford algorithm, BFS,DFS, Travelling salesman problem, All pair shortest path, Single source shortest path, Trees: Representation, types, binary tree, BST, threaded binary tree, extended binary tree Spanning tree: Kruskal's and Prim's algorithm.

Unit 4: String The String abstract data type, String Matching Algorithm, Navie Bayes ,Brute-Force Algorithm, Robin-Karp Algorithm, Morris-Pratt Algorithm, Boyer-Moore String algorithm.

Unit 5: NP Completeness, Basic concept:-non deterministic algorithm, NP hard and NP complete classes.

Reference Books:

1. Introduction to Algorithms “Thomson Coremen”
2. Data Structures and algorithms “Alfred U. Aho”
3. Fundamental of data structure using Java.
4. Tutorialspoint.com/datastructure/java

Lab Exercise: CSI452 Practical based on CSI404:

Find worst case, best case and average case for linear searching algorithm.

1. Write a program for Quick sort method to find time complexity for given n numbers.
2. Write a program to find space complexity for bubble sort and insertion sort method.
3. Create a binary search algorithm with recursion.
4. Write a program to sort the number using radix sort algorithm.
5. Find single source shortest path algorithm using Dijkstra's algorithm and justify how it is a greedy algorithm.
6. Write a program for BFS.
7. Write a program for BFS.
8. Write a program for String matching using Navie Bayes algorithm.
9. Write a program for different operations of binary tree.

Course Outcomes:

- After completing this course, students will be able to: Understand structure and behaviour of Algorithms, Better scope to write effective programs, the course content helpful in the preparation of UGC- SET/NET, DRDO entry level Examinations.
- This course will be the basic course for learning Algorithms and Approximation of Algorithms related research.
- This course is designed for the students to learn principals of Data structure, Algorithms and understand issues related to allocation of memory, optimization of Algorithms, Time and Space Complexity associated with Algorithms, Sorting, Searching Algorithms applied on data structures.
- The students will be able to understand the fundamental of data structure and analysis of algorithms.

5. Advance Computer Network

Course Code	CSI405	Course title	Advanced Computer Network
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: to have basic knowledge of computer networking.

Course Objectives: following are the objectives of the course

- To provide the student with a top down approach of networking starting from :
- To Study various structure and topologies of communication mediums.
- Topics covered include: network protocols, Network architecture, network security, and some special topics like wireless and sensor networks.
- The focus is on both: the existing technologies as well as the current and emerging research topics in computer networking.

Course Outline:

Unit 1: Introduction: Data Communication, Network Protocols and Standards, Point to Point and Multi Point line configuration, Network Topologies: Mess, Star, Tree, Bus, Ring, concept of frequency, bandwidth, and modes of communication.

Data Communications and Networking Overview: A Communication Model - Data Communications - Data Communication Networking, Protocol Architecture: Need - A Simple Protocol Architecture - OSI - TCP/IP Protocol Architecture, Guided Transmission Media - Wireless Transmission, Signals: Analog and Digital signals, Periodic and Aperiodic signal.

Unit 2: Digital Data Communication Techniques: Asynchronous and Synchronous Transmission - Types of Errors - Error Detection - Error Correction, Data Link Control Protocols: Flow Control - Error Control – High - Level Data Link Control. Multiplexing: Frequency division, Wave division and Time division multiplexing.

Unit 3: Circuit Switching and Packet Switching: Switched Communication Networks - Circuit - Switching Networks - Concepts - Packet-Switching Principles - X.25 - Frame Relay, Routing in

Networks. Congestion in Data Networks: Effects of Congestion - Congestion Control - Traffic Management.

Unit 4: Local Area Network Overview - LAN Protocol Architecture - Bridges. High-Speed LANs - The Emergence - Ethernet - Token Ring - Fiber Channel. IEEE 802 standards, Ethernet, Token Bus, Token Ring, FDDI, Wireless LAN Technology.

Unit 5: Internet Protocols: Basic Protocol Functions - Principles of Internetworking - Connectionless Internetworking - Internet Protocol, IP Addressing, DNS, Network Security - Security Requirements and Attacks - Confidentiality with Symmetric Encryption - Message Authentication and Hash Function - Public - Key Encryption and Digital Signatures, Firewalls.

Reference Books:

1. William Stallings, "Data Computer Communications", Seventh Edition, Pearson Education Pte. Ltd., New Delhi: 2004.
2. Behrouz and Forouzan, "Introduction to Data Communication and Networking", Tata McGraw Hill Publishing Company Ltd., New Delhi: 1999.
3. Tannenbaum A.S "Computer Networks" PHI.

Web References:

1. <http://nptel.ac.in/downloads/106105080/>
2. <https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-829-computer-networks-fall-2002/>

Lab Exercise: CSI453 Practical based on CSI405:

Network Settings, Network connections Troubleshooting, Study of various networking devices, Crimping of cables, identifying color codes, Sharing and its types, Remote Access of a PC, Creating LAN and its settings, Creating Wi-Fi and its settings; etc. along with some case studies.

1. Study and identify various networking devices.
2. Identify topologies.
3. Crimping technique and color codes.
4. Sharing data and various types of it.
5. Design and Implement your own cipher using any programming language.
6. Using Ethernet to connect two systems.
7. Implement following classical encryption techniques.
8. Intrusion Detection/Prevention Systems (case study)
9. Firewalls -Case Study
10. Wireless network security -Case Study
11. Web and DNS security Techniques
12. Install any Proxy Server and configure an application gateway.
13. Study and identify various networking devices.
14. Identify topologies.
15. Crimping technique and color codes.

16. Sharing data and various types of it.
17. Design and Implement your own cipher using any programming language.
18. Using Ethernet to connect two systems.
19. Implement following classical encryption techniques.
20. Intrusion Detection/Prevention Systems (case study)
21. Firewalls -Case Study
22. Wireless network security -Case Study
23. Web and DNS security Techniques
24. Install any Proxy Server and configure an application gateway.

Course Outcome:

The student will be well acquainted with how computer network works, what are the architectures and protocols required for it, as well as some special topics.

6. Advance Operating System

Course Code	CSI406	Course title	Advanced Operating System
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: to have basic knowledge of disk operating system.

Course Objectives:

This course introduces basic issues in operating systems. Topics include Threads, processes, concurrency, memory management, I/O Control and case studies.

- To make students able to learn different types of operating systems along with concept of file systems and CPU scheduling algorithms used in operating system.
- To provide students' knowledge of memory management and deadlock handling algorithms.
- To provide Hands-on study of Linux operating system design and kernel internals, Thread Programming.

Course Outline:

Unit 1: Overview: Introduction, history of operating system, **Memory Management:** Processes in memory, Logical addresses, **Partitions:** static versus dynamic, free space management, external fragmentation, Segmented memory, **Paged memory:** concepts, internal fragmentation, page tables, Demand paging/segmentation, **Replacement strategies:** FIFO, LRU (and approximations), NRU, LFU/MFU, MRU, **Cache Management:** Allocation and de-allocation techniques, coherence technique,

Unit 2: Processes and Scheduling: Job/process concepts, Scheduling basics: CPU-I/O interleaving, (non-)preemption, context switching, Scheduling algorithms: FCFS, SJF, SRTF, priority scheduling, round robin, Combined schemes Process details like creation PCB, process view, Thread and inter-process Communication,

Unit 3: Lower Process Management, Synchronization Primitives: Atomic instructions, locks,

spinlocks, mutex semaphores, counting semaphores, and their use in solutions to Producer Consumer synchronization. **Classic Synchronization Problems:** Classic synchronization problems: Producer Consumer, Dining Philosophers, Readers and Writers, Sleeping Barber. **Monitors and Message Passing:** Monitors, condition variables, message passing, and their use in solutions to classic synchronization problems: Producer Consumer, Dining Philosophers, Readers and Writers, Sleeping Barber. **Deadlock:** Definition, Characteristics A resource Allocation graph, live lock, Deadlock prevention, Deadlock avoidance: Banker's Algorithm, Deadlock Detection and Recovery.

Threads: Overview of threads, thread basics and its advantages, Multicore Programming: Introduction, Amdahl's law, multicore programming challenges, types of parallelism, Multithreading Models, **Thread Libraries:** OpenMP: shared memory architecture, fork-join model, OpenMP directives ,schedule and programming constructs. Pthread: introduction, basic programming constructs of Pthreads, Aspect of implicit and explicit threading and threading issues.

Unit 4: I/O Management: I/O buffering, Single and Double Buffer schemes, Disk Organization. **File Management:** File Concepts, File descriptor, Access methods: Sequential, indexed and direct, File sharing, Protection, Access rights, File System structure, Byte Sequence, Record sequence and Tree-based, Recovery and Disk formatting. **Secondary Storage Management:** File allocation methods: Contiguous Allocation and Non Contiguous allocation, Chained, Indexed allocation, free space management, Disk Scheduling: FCFS, SSTF, SCAN and C- SCAN, Disk Cache. Protection and Security: System performance, protection and security, policies and methods, Access Matrix.

Unit 5: Introduction: History of Linux, Features of Linux, Drawbacks of Linux, Components of Linux, Memory Management Subsystems, Linux Process and Thread Management, File Management System, Device Drivers **Linux Commands and Utilities:** cat, tail, cmp, diff, wc, sort, mkdir, cd, rmdir, pwd, cp, more, passwd, who, whoami, mv, chmod, kill, write, wall, merge, mail, pipes, filters and redirection utilities. **Shell Scripts:** Creating and executing simple shell programs, variables, and special characters, comparison of expressions, iteration statements, and conditional statements functions. **System Administration:** Installing Linux, Booting the system, Maintaining user accounts, File systems and Special Files, Backups and Restoration.

Books:

- Operating Systems Concepts, 8th edition, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne; Wiley, ISBN 0-470-12872-0, 2010.

Reference Books:

1. Operating Systems: Internals and Design Principles, 6th edition, William Stallings; Prentice Hall, ISBN-10: 0136006329, Operating Systems, 3rd edition
2. Modern Operating Systems, Andrew S. Tanenbaum; Prentice Hall, ISBN-10: 0-13-600663-9, 2008, 3rd edition.
3. Using OpenMP, Portable Shared Memory Parallel Programming, Barbara Chapman, Gabriele Jost and Ruud van der Pas, MIT Press, ISBN: 9780262533027, 2007

Web:

1. <http://codex.cs.yale.edu/avi/os-book/OS8/os8c/slide-dir>
2. <http://openmp.org/wp/resources/>
3. http://www.compunity.org/training/tutorials/3%20Overview_OpenMP.pdf

Lab Exercise: CSI454 Practical based on CSI406:

At least five experiments should be carried out on each unit.

By considering the sample experiment list as guidelines:

- Implementing a CPU scheduling policy in a Linux OS.
- Implementing a memory management policy in a Linux OS.
- Implementing a file system in a Linux OS.
- Process control system calls: The demonstration of fork, execve and wait system calls along with zombie and orphan states.
- Thread management using OpenMP API: Thread execution, Static scheduling, Dynamic scheduling, Synchronization Constructs in OpenMP, Data Handling, Library function, Environment variables.

- Thread synchronization using counting semaphores and mutual exclusion using mutex. Application to demonstrate: producer consumer problem with counting semaphores and mutex.
- Deadlock Avoidance Using Semaphores
- Implement the deadlock free solution to Dining Philosophers problem to illustrate the problem of deadlock and/or starvation that can occur when many synchronized threads are competing for limited resources.
- Demonstrate the following CPU Scheduling Algorithms
 - a. FCFS b. SJF c. Priority d. Round Robin
- Demonstrate all Page Replacement Algorithms
 - a. FIFO b. LRU c. MRU
- Simulate Bankers algorithm for Deadlock Avoidance
- Simulate Bankers Algorithm for deadlock Prevention

Course Outcomes:

Students who complete this course successfully are expected to:

- Gain extensive knowledge on principles and modules of operating systems
- understand key mechanisms in design of operating systems modules
- Understand process management, concurrent processes and threads, memory management, virtual memory concepts, deadlocks.
- Compare performance of processor scheduling algorithms.
- Produce algorithmic solutions to process synchronization problems.
- Use modern operating system calls such as Linux process and synchronization libraries.
- Learn thread and multicore programming

Computational Mathematics and statistics

Course Code	CSI407	Course title	Computational Mathematics
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: Some basic foundations of Matrices and set theory is required to be known to the student before attending this course.

Course Objectives:

- ☐ To create the basic foundation of mathematical techniques largely used in Computer Science and Information technology.
- ☐ This course covers possibly required mathematics for application development

Course Outline:

Unit 1: Sets- Elements of a set, methods of describing a set, types of sets, Operations on sets-- union, intersection and difference of sets, Venn diagrams, statement problems, Associative Laws, Distributive laws, DeMorgans laws, duality, partitioning of a set. Relation -Basic definition of relation and types of relations, graphs of relations, properties of relations, recurrence relations, Matrix representation of a relation.

Least

Unit 2: Descriptive Statistics: Measures of Central Tendency, Mean, Median, Mode, Other Averages, Measures of Dispersion, Range, Mean Deviation, Standard Deviation, Measures of Skewness, Kurtosis, Measures of Relationship, Covariance, Karl Pearson's Coefficient of Correlation, Rank Correlation, Association in Case of Attributes, Other Measures, Index Numbers, Time Series.

Unit 3: Sampling and Statistical Inference: Parameter and Statistic, Sampling and Non-sampling Errors, Sampling Distribution, Sampling Distribution of Mean, Sampling Distribution of Proportion, Student's t-Distribution, Statistical Inference, Point Estimation, Interval Estimation, Sample Size and its Determination, Tests of Significance

(Hypothesis Testing). **Analysis of Variance:** The ANOVA Technique, The Basic Principle of ANOVA, One Way ANOVA, Analysis of Variance Table

Unit 4: Linear Regression Analysis: Dependent and Independent Variables, Simple Linear Regression Model, Least Squares Estimation, Coefficient of Determination, Standard Error, Assumptions or Conditions Required, Testing the Hypothesis about the Slope and Correlation Coefficient (t-test for slope, f-test for ANOVA, t-test for correlation coefficient), Multiple Linear Regression Model, Least Squares Estimation

Unit 5: Discriminant Analysis: Introduction, Two Group Discriminant Analysis, Methodology, Assumptions, Predicting Group Membership, Multiple Discriminant Analysis, Methodology, **Cluster Analysis:** Introduction, Distance Measures, Clustering Algorithms, Non-hierarchical Clustering, Hierarchical Clustering.

Text Book:

1. Kenneth H Rosen (Indian Adaptation By Kamala Krithivasan), Discrete Mathematics And Its Applications With Combinatorics And Graph Theory, seventh edition, Mc Graw Hill Education. (Unit 1)
2. C L Liu, D P Mohapatra, "Elements of Discrete Mathematics" 3rd edition, McGraw Hill, 2008. (Unit 1)
3. Kothari C. R. & Garg Gaurav, (2019), Research Methodology Methods & Techniques (fourth Edition), New Age International Publishers, New Delhi. (Unit 2-5)

Reference Books:

1. Alan Doerr, Applied Discrete Structures for Computer Science, Galgotia Publications.
2. Kolman and Busby —Discrete Mathematical structures for Computer Sciences PHI.

E-Reference:

<https://web.stanford.edu/class/cs103/notes/Mathematical%20Foundations%20of%20Computing.pdf>

Lab Experiment:

Students are required to solve at least one problems based on various methods stated in the syllabus. To solve the problems students may use any spreadsheet software like MS Excel.

Course Outcome:

- Students are able to perform Mathematical operations based on Sets theory and statistical analysis.
- The theoretical component of the course treats fundamental concepts, as well as some necessary topics in set theory and statistical analysis. The practical component of the course addresses the computer implementation of these methods.
- In this way, students can develop a solid foundation for employment or further study in a wide range of scientific and engineering fields that rely on set theory and statistical modelling.

Semester II

1. Technical Report Writing

Course Code	CSI408	Course title	Technical Report Writing
Number of Credits	1 Credits	Internal / External	10/40
Total Contact Hours (Th)	1 Hrs/week		

Prerequisite: The student should be able to identify the problem in respective domain. The student should be cleared with the fundamental of research methodology

Course Objectives:

- To understand the genre and manipulated structure of the selected document.
- To convey clearly cogently and correctly through written media, the technical aspects.
- To work collaborately and individually to research to analyze and to write about public debates regarding the conduct of science & technology

Course Outline:

Unit 1: Introduction: Meaning, Concept, nature steps types and characteristics of research, Identification & formulation of Research Problem, Hypothesis, Research Design & Research Ethics.

Review of literature: Need for Reviewing Literature, what to Review and for what purpose, Literature search Procedure, Sources of Literature, Planning of Review work, Note Taking.

Unit 2: Development of research proposal: Research proposal and its elements, Formulation of research problem: criteria of sources and definition, Development of objectives and characteristics of objectives, Development hypotheses and applications.

Unit 3: Methods & tools of data collection: Concept of sampling and other concepts related to sampling. Probability and non - probability samples, their characteristics and implications. Tools of data collections, their types, attributes and uses. **Redesigning, research tools:** like questionnaire,

opennaere, observation, interviews, scales and tests etc. **Field Work:** The Nature of Field Work, Selection and Training of Investigators, Sampling Frame and Sample Selection, Field Operation, Field Administration.

Unit 4: Methods of data analysis: Editing, Classification and Coding, Transcription, Statistical Analysis, Measures of Central Tendency Measures of Dispersion, Measures of Association / Relationship, Regression and Correlation Analysis, Hypothesis Testing (For Proportion and Means), Test of Significance. **Report writing and evaluations:** Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Documentation, Data and Data Analysis reporting in a Thesis, Writing of Report, Typing of Report, Briefing. Use of Anti-plagiarism software and its importance.

Unit 5: Case study formats of research proposal writing.

Reference Books:

1. Briony J. Oates. (2006), Researching Information Systems and Computing, SAGE Publications, New Delhi.
2. Kothari C.R., (2004), Research Methodology Methods & Techniques, New Age International Publishers, New Delhi.
3. Bajpai S. R., (1975), Methods of Social Survey and Research, Kitabghar, Kanpur.
4. Bhattacharya D. K., (2004), Research Methodology, New Delhi, Excel Books.
5. Brymann Alan and Carmer D., (1995), Qualitative data analysis for social / scientist, New York, Routledge publication.
6. Best J. W. and Khan J. V., (2005), Research in Education New Delhi, Prentice Hall India. Hans Raj (19gg) Theory and practice in Social Research, Surjeet publication, Kolhapur.
7. Chandra A. and Saxena T. P., (2000), Style Manual, New Delhi, Metropolitan Book Comp. Ltd.
8. Krishnaswami O. R., (1988), Methodology of Research in Social Science, Himalaya pub House.
9. Kothari, C. R., (2005), Quantitative Technique, New Delhi, Vikas publication House.
10. Gautam N. C., (2004), Development of Research tools, New Delhi, Shree Publishers.
11. Gupta, Santosh, (2005) Research Methodology and statistical Techniques, Deep and Deep publications.
- 1) Shukla J. J., (1999) Theories of Knowledge, Ahmadabad, Karnavati Publication

E-References:

1. <https://www.slideshare.net/annakittystefen/researchmethodologymethodsandtechniquesbycrkothari>
2. <https://www.wisdomjobs.com/e-university/research-methodology-tutorial-355.html>

Course Outcomes:

- Critically analyze research methodologies identified in existing literature.
- Choose appropriate quantitative or qualitative method to collect data.
- Propose and distinguish appropriate research designs and methodologies to apply to a specific research project.

- Develop a comprehensive research methodology for a research question.
- Apply the understanding of feasibility and practicality of research methodology for a proposed project.

2. Programming 2

Course Code	CSI409	Course title	Programming 2
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

The Department has adopted the horizontal format for programming group which will help the students to become master regarding that programming group. Regarding 2018-19 the Department has selected the Java group.

Prerequisites:

- The student (s) should holds good skills on functional programming concepts, fundamental object oriented concepts.
- Student(s) should select wither group prior so that there are of expertise nurtured by the department by providing them training on the selected platform.
- Student(s) should have basic knowledge of core Java.

Course Objectives:

- Objective of this course is to provide the ability to design console based, GUI based and web based applications.
- Students will also be able to understand integrated development environment to create, debug and run multi-tier and enterprise-level applications.

2. Programming 2

Course Code	CSI409	Course title	Programming 2
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: The student (s) should holds good skills on object oriented concepts. Student(s) should select the paper from program group in continuation of last semester.

Course Objective: the objective of this paper is to

- Provide student an opportunity to learn and develop basic skills required in writing programs

- Student will be provided horizontal learning path where they will be able to select the technology trends such as Java Group, Microsoft Group, and Open System Group.
- Programming 1 will help to develop the foundation for programming 2 and programming 3 course
- Student will be able to write programs for generating solutions.

A) Course Outline : Java Group (Advance Java)

Unit 1: Collections : Collection Interfaces, Concrete Collections, The Collections Framework **Multithreading :** Creating thread and running it, Multiple Thread acting on single object, Synchronization, Thread communication, Thread group, Thread priorities, Daemon Thread, Life Cycle of Thread, **Networking -** Internet Addressing, InetAddress, Factory Methods, Instance Methods, TCP/IP Client Sockets, URL, URL Connection, TCP/IP Server Sockets, Datagrams

Unit 2: Java Database Connectivity - Merging Data from Multiple Tables: Joining, Manipulating Databases with JDBC, Prepared Statements, Transaction Processing, Stored Procedures C. **Remote Method Invocation:** Defining the Remote Interface, Implementing the Remote Interface, Compiling and Executing the Server and the Client

Unit 3: Servlets: Servlet Overview and Architecture, Interface Servlet and the Servlet Life Cycle, Handling HTTP get Requests, Handling HTTP post Requests, Redirecting Requests to Other Resources, Session Tracking, Cookies, Session Tracking with HttpSession

Unit 4: Java Server Pages (JSP): Introduction, JavaServer Pages Overview, A First JavaServer Page Example, Implicit Objects, Scripting, Standard Actions, Directives, Custom Tag Libraries

Unit 5: Introduction Smart Phone Application Development: Introduction to android platform, Creating application template, adding activity, intent, services to application, using Google map API

Reference Books:

1. "Advanced Java 2 Platform HOW TO PROGRAM" by H. M.Deitel, P. J. Deitel, S. E. Santry – Prentice Hall
2. "Beginning Java™ EE 6 Platform with GlassFish 3 From Novice to Professional" by Antonio Goncalves – Apress publications

B) Course Outline : Microsoft Group (VB.NET)

Unit 1: Getting Started: Microsoft Visual Studio .NET Architecture, Application in Visual Basic .NET, Basic .NET Concepts, Exploring the Development Environment, Creating a Visual Basic .NET Projects. **Using Variables and Arrays:** Introduction to Data Types, Using Variables, Variable Scope, Converting Data Types, Creating and Using Structures, Storing Data in Arrays

Unit 2: Working with Procedures: Creating Procedures, Using Procedures, Using Predefined Functions, **Decision Structures and Loops:** Using Conditional Expressions, Using Decision Structures, Using Conditional Loop Structures. **Validating User Input:** Restricting User Input, Validating Field Data, Validating Form Data

Unit 3: Object-oriented Programming in Visual Basic .NET: Understanding Classes, Working with Classes, Using Shared Members, Inheritance, Polymorphism, and Namespaces **Handling Errors and Exceptions:** Types of Errors, Using the Debugger and Handling Exceptions.

Unit 4: Working with Forms and Controls: Understanding Programming Concepts, Working with Windows Forms Working with Controls, Styling Your Code. **Enhancing the User Interface:** Creating Menus, Creating Status Bars, Creating Toolbars.

Unit 5: Using ADO.NET: Database Concepts, Overview of ADO.NET, Overview of MySQL, Working with Database using MySQL, Create Insert, delete Table commit etc. Deploying Applications: Introduction to Deployment, Deploying a Windows-based Application

Reference Books:

1. Steven Holzner, Visual basic .net programming black book, Wiley publishing.
2. Heinrich Gantenbein, Microsoft Visual Basic .NET 2003 Unleashed

E-Book:

http://www.tutorialspoint.com/mysql/mysql_tutorial.pdf

C) Course Outline : Open Group (Advanced Python)

Unit 1: Threads: Introduction to Threads, thread organization, thread architectures, starting new thread, thread modules, Creating thread using Threading module, Synchronising threads. Controlling access to resources,

Unit 2: GUI Design using TkInter or jython: Introduction, Layout Management, Widgets, Menus and Toolbars, Dialog boxes, Drawings, Nibbles. Database Programming using python (MySQL): Python Database Interfaces and

APIs, Database Connections, Creating Table, Insert Operation, Read operation, Update and Delete Operation, Performing Transactions, Commit & Rollback Operations, Handling Errors.

Unit 3: Web Framework using Web.py: Introduction, URL Handling, GET and POST method, difference between GET and POST, Configuring server, starting server, Templating, Forms, Databashing, development

Unit 4: Web socket programming and Web services: Introduction, About Sockets, socket module, types of sockets, Server Socket Methods, Client Socket Method, Design of simple server and client, python internet modules, HTTP web services: features of HTTP, using web services, debugging web services, setting user agents, handling redirects, handling compressed data.

Unit 5: FLASK framework: Introduction, Exploring FLASK, Coding Conventions, Environment, configuration, organizing project, handling templates, files, handling forms, deployments.

Reference Book:

1. Python 3 Web Development Guide, Michel Anders, Beginners guide, PACKT Publishing, open source.

E-books: -

1. Python Threading:

- o http://www.tutorialspoint.com/python/python_multithreading.htm

- o <http://pymotw.com/2/threading/>

- o <http://www.python-course.eu/threads.php>

2. GUI:

- o <https://wiki.python.org/moin/TkInter>

- o <https://wiki.python.org/jython/LearningJython>

- o http://www.tutorialspoint.com/python/python_gui_programming.htm

3. Database:

- o Python MySQL API <https://wiki.python.org/moin/DatabaseInterfaces>

- o http://www.tutorialspoint.com/python/python_database_access.htm

4. Web Framework: <http://webpy.org/docs/0.3/tutorial>

5. Python webSocket:

- o http://www.tutorialspoint.com/python/python_networking.htm

- o <https://docs.python.org/2/howto/sockets.html>

- o <https://docs.python.org/3.0/library/socket.html>

o http://www.diveintopython.net/http_web_services/index.html

6. FLASK framework,

o <http://www.fullstackpython.com/flask.html>

3. Relational Database Management System Using SQL

Course Code	CSI410	Course title	Relational Database Management System
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: It is just assumed to have a familiarity with basic data structures, computer organization and any high level programming language.

Course Objective:

- To make the students aware of the basic knowledge of the relational database management which will include the aspects of database design, query languages and database system implementation.

Course Outline:

Unit 1: Overview of Database Concepts: Introduction, Basic Concepts, View of data, Data models, E-R diagrams, DBA, DB Users, Mapping Cardinalities, Keys, Database Languages, **Relational Model:** Structure of relational database models, Relational Algebra, Modification of database, Views, **SQL:** Background, Basic Structure, Different Operations, Functions, Queries, Relations, Views, **Indexing and Hashing:** Basic Concepts, Indexing, Types of Indexing, Hashing, B+, B- Trees, Static Hashing, Dynamic Hashing.

Unit 2: Relational Database Design: Functional Dependencies, Normalization, Types of Normalization, **Query Processing:** Overview, Transformation of relational expressions, evaluation of expressions, measures of query cost, architecture of query processing model, distributed query processing

Unit 3: Transactions: Concept, Transaction States, ACID property, Concept of Serializability, testing

for serializability, analysis of different types of schedules like: conflict equivalent, conflict serializable, concept of conflict serializability, etc. **Concurrency Control:** Protocols for Concurrency control, Timestamp, Lock-based, granting of locks, two phase locking protocol, graph based protocol, etc, Concept of multiple granularity, Deadlock handling.

Unit 4: Database Recovery: Failure Classification, Storage structure, recovery and atomicity, check points, types of recovery like, log based recovery, shadow paging etc. **Database System Architectures:** Centralized Systems, Client-Server systems, Parallel and distributed systems, Network types, **Distributed Databases:** Distributed data storage, data replication, data fragmentation.

Unit 5: New Applications: DSS, MIS, Data Mining, Data Warehousing, Types of Databases, New Trends in databases, Introduction to RDBMS: Concept, types, examples, applications.

Reference Books:

1. Silberschatz, Korth, & Sudarshan, Database System Concepts, 5th edition, McGraw-Hill (2005).
2. Elmasri & Navathe, Fundamentals of Database Systems.
3. Introduction to Database Systems, Bipin C. Desai
4. <http://www.bell-labs.com/topic/books/db-book>
5. www.mit.ocw.edu/

Lab Exercise: CSI457 Practical based on CSI410

At least two experiments should be carried out on each unit.

Course Outcomes: The course aims to give the students both the theoretical and practical foundation in Data Base Management Systems. Student will also learn advanced concepts as well as new trends in the field. This to course has two main objectives:

- Provide students with an understanding of the relational model, relational database design, and SQL.
- Students will construct SQL queries using SQL.
- To provide students with a working knowledge of the underlying architecture and implementation of modern database systems.
- Students will study different concepts like, Integrity Constraints, indexing methods, transaction management, query processing, etc.

4. Network Security

Course Code	CSI411	Course title	Network Security
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: Student must know basics of data communications, protocols, and concepts of computer networks

Course Objective: To learn various techniques to secure information while traveling through different communication mediums

Course Outline:

Unit 1: Overview, Classical Encryption Techniques, Block Ciphers.

Unit 2: Advanced Encryption Standard, Confidentiality Using Symmetric Encryption, Number Theory

Unit 3: Public- Key Cryptography and RSA, Public- Key Cryptosystems, Hash Algorithms

Unit 4: Digital Signatures, Authentication Applications, Electronic Mail Security

UNIT 5: Web Security, Intruders, Malicious Software, Firewalls

Book:

1. The official course text is Cryptography and Network Security: Principles and Practice; Second Edition . By William Stallings, Prentice Hall, Hardcover
2. Network Security Essentials: Applications and Standards by William Stallings. Prentice Hall, Hardcover, Published November 1999, 366 pages, ISBN 0130160938

References:

1. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press, hardcover.
2. Secrets and Lies: Digital Security in a Networked World by Bruce Schneier John Wiley, Published August 2000, 412 pages, ISBN 0471253111.

3. A Course in Number Theory and Cryptography (Graduate Texts in Mathematics),(Hardcover) by Neal Koblitz Number theory with computer applications, by Ramanjuachary Kumandari and Christina Romero (1998)
4. Get details of threats to information and system security. Discuss Virus, worms, Trojans etc in details.
5. Study any library for packet tearing and packet sniffing.
6. Implement Generic Cipher, Fiestal Cipher and DEC
7. Implement Packet Sniffing using the library studied in Assg No 2
8. Study of Firewall
9. Implementing firewall in Windows server/ Linux Server

Lab Exercise: CSI458 Practical based on CSI411:

At least two experiments should be carried out on each unit.

Course Outcomes: At the end of the course students should be able to:

- Analyze the vulnerabilities in any computing system and hence be able to design a security solution.
- Identify the security issues in the network and resolve it.
- Evaluate security mechanisms using rigorous approaches, including theoretical.
- Compare and Contrast different IEEE standards and electronic mail security.

5. Fundamental of Compiler Design

Course Code	CSI412	Course title	Fundamental of Compiler Design
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: Good programming skills and ability to reason well.

Course Objective:

- To explore the principles, algorithms and data structures involved in the design and construction of compilers

Course Outline:

Unit 1: Introduction: Translation and Interpretation, tasks of compiler, Data management in compiler, compiler structure. **Properties of Programming Language:** Overviews, Syntax, Semantics and Pragmatics, Data Objects and operations, Expressions, control structures.

Unit 2: Properties of Real and Abstract Machine: Basic characteristics, representation of language elements, **Storage management:** static and dynamic storage management, mapping specifications, **Abstract Program Representations:** Intermediate language, Token sequence, structure tree, computation graph, target tree, Global tables, Symbol table, Constant table, Definition table.

Unit 3: Elements of Formal Systems : Lexical System, Module and interfaces, decomposition of grammar, lexical analyser and interface, construction, Extraction and representation, state minimization, Descriptive tools, Strings and rewriting grammars, grammars, derivation and parse tree, Regular Grammar and Finite Automata, Context free Grammar

Unit 4: Parsing : Design, Parser Interface, Selection of parsing algorithm, parser construction, top down and bottom up parsers, sentential forms, LR parser, general Shift reduce, SLR, LR(1), LR(k). LL (1) parser, Computation of FIRST and FOLLOW sets, Left Factoring, Left Recursion elimination, Operator Precedence Parsing

Unit 5: Code Optimization and Generation: Computation graph, local optimization, local optimization. Code generation, Memory Mapping, Target Attribution, Code Selection.

Reference Book:

1. Compiler Construction by William Waite and Gerhard Goos

Online Book:

1. <https://www.cs.cmu.edu/~aplatzer/course/Compilers/waitegoos.pdf>

Lab Exercise: CSI459 Practical based on CSI412

At least two experiments should be carried out on each unit.

Course Outcomes:

- Fluency in describing the theory and practice of compilation, in particular, the lexical analysis, syntax, and semantic analysis, code generation and optimization phases of compilation.
- Ability to create lexical rules and grammars for a programming language

6. Elective 1

Course Code	CSI481	Course title	Elective -1
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

The Department has adopted the horizontal format for elective group which will help the students to become master regarding that programming group.

DATA MINING AND WAREHOUSING

COURSE OVERVIEW:

This course helps the students to understand the overall architecture of a data warehouse and methods for data gathering and data pre-processing using OLAP tools. The different data mining models and techniques will be discussed in this course.

COURSE OBJECTIVES:

1. To teach the basic principles, concepts and applications of data warehousing and data mining.
2. To familiarize Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment.
3. To develop an understanding of the strengths and limitations of popular data mining techniques and to be able to identify promising business applications of data mining.
4. Acquire hands-on experience with key components of an integrated data warehousing

COURSE OUTCOMES:

After undergoing the course, Students will be able to understand

1. Design a data mart or data warehouse for any organization
2. Develop skills to write queries using Data Mining Query Language (DMQL)
3. Extract knowledge and adapt to new data mining tools for processing and analyzing.
4. Apply the techniques of clustering, classification, association finding, feature selection and visualization to real world data

Unit I

Data Mining: What is Data? Attribute Values, Measurement of Length, Types and Properties of Attributes, Discrete and Continuous Attributes, Types of data sets, Data Quality, Data Preprocessing, Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation, Discretization and Binarization, Attribute Transformation, Density.

Data Exploration : Data Exploration Techniques, Summary Statistics, Frequency and Mode, Percentiles, Measures of Location: Mean and Median, Measures of Spread: Range and Variance, Visualization, Representation,

Arrangement, Selection, Visualization Techniques: Histograms, Box Plots, Scatter Plots, Contour Plots, Matrix Plots, Parallel Coordinates, Other Visualization Techniques, OLAP : OLAP Operations.

Unit II

Data Warehousing Concepts: Data Warehouse Architectures, **Logical Design in Data Warehouses:** Logical Versus Physical Design in Data Warehouses, Data Warehousing Schemas, Data Warehousing Objects. **Physical Design in Data Warehouses:** Physical Design, Data Segment Compression, Integrity Constraints, Indexes and Partitioned Indexes, Materialized Views, Dimensions. **Indexes:** Bitmap Indexes, Benefits for Data Warehousing Applications, Cardinality, Bitmap Join Indexes, Bitmap Join Index Restrictions, B-tree Indexes, Local Indexes Versus Global Indexes. **Integrity**

Constraints: Overview of Constraint States, Typical Data Warehouse Integrity Constraints, UNIQUE Constraints in a Data Warehouse, FOREIGN KEY Constraints in a Data Warehouse, RELY Constraints, Integrity Constraints and Parallelism, Integrity Constraints and Partitioning.

Unit III

Dimensions: Creating Dimensions, Viewing Dimensions, Using Dimensions with Constraints, Validating Dimensions, Altering Dimensions, Deleting Dimensions, Using the Dimension Wizard, Efficient Methods for Data Cube Computation, Exploration and Discovery in Multidimensional Databases.

Overview of Extraction, Transformation, and Loading: Overview of ETL, ETL Tools

Managing the Warehouse Environment: Overview of Extraction, Transformation and Loading,

Extraction in Data Warehouses Transportation in Data Warehouses, Loading and Transformation, Maintaining the Data Warehouse, Change Data Capture, Summary Advisor

Loading and Transformation: Overview of Loading and Transformation in Data Warehouses, Loading Mechanisms, Transformation Mechanisms, Loading and Transformation Scenarios

Maintaining the Data Warehouse: Using Partitioning to Improve Data Warehouse Refresh, Optimizing DML Operations During Refresh, Refreshing Materialized Views, Using Materialized Views with Partitioned Tables

Unit IV

Classification: Basic Concepts, Decision Tree Induction, Bayesian Classification Methods, Rule-Based Classification, Model Evaluation and Selection, Techniques to Improve Classification Accuracy: Ensemble Methods, Handling Different Kinds of Cases in Networks, Classification by Neural Networks, Support Vector Machines, Pattern-Based Classification, Lazy Learners (or Learning from Your Neighbors), Other Classification Methods.

UNIT – V

Cluster analysis: Basic Concepts of Cluster Analysis, Clustering structures, Major Clustering Approaches , Partitioning Methods, Hierarchical Methods, Density-Based Methods, Model- Based Clustering - The Expectation-Maximization Method, Other Clustering Techniques, Clustering High-Dimensional Data, Constraint-Based and User-Guided Cluster Analysis, Link-Based Cluster Analysis, Semi-Supervised Clustering and Classification, Bi-Clustering, Collaborative Clustering.

Outlier analysis: Why outlier analysis, Identifying and handling of outliers, Distribution-Based Outlier Detection: A Statistics-Based Approach, Classification-Based Outlier detection, Clustering-Based Outlier Detection, Deviation-Based Outlier Detection, and Isolation-Based Method: From Isolation Tree to Isolation Forest.

TEXT BOOKS:

1. Jiawei Han, Micheline Kamber, Jian Pei (2012), Data Mining: Concepts and Techniques, 3rd edition, Elsevier, United States of America.
2. Arun K Pujari, Data Mining Techniques, University Press, Tenth edition 2006, ISBN 81 7371 3804
3. Gupta, S., Mourya, S. K. (2013). Data Mining and Data Warehousing. United Kingdom: Alpha Science International Limited.
4. Nagabhushana, S. (2006). Data Warehousing Olap And Data Mining. India: New Age International (P) Limited.
5. Bhatia, P. (2019). Data Mining and Data Warehousing: Principles and Practical Techniques. Singapore: Cambridge University Press.

REFERENCE BOOKS:

1. Margaret H Dunham (2006), Data Mining Introductory and Advanced Topics, 2nd edition, Pearson Education, New Delhi, India.
2. Amitesh Sinha (2007), Data Warehousing, Thomson Learning, India.
3. Xingdong Wu, Vipin Kumar (2009), the Top Ten Algorithms in Data Mining, CRC Press, UK.

4. Oracle9i Data Warehousing Guide Release 2 (9.2) Part Number A96520-01 by Oracle Press.
5. Data Mining: Concepts and Techniques by Jiawei Han, Micheline Kamber, Morgan Kaufmann Publishers.

Lab Exercise:

At least two experiments should be carried out on each unit.

Remote Sensing and GIS

Course Objective: The course is designed to fulfill the following objectives

- To acquire skills in storing, managing digital data for planning and development.
- To provide exposure to students in gaining knowledge on basic concepts and applications leading to modeling of natural resources management using Remote Sensing

Learning Outcomes:

- At Course Completion Students can go for research in Remote Sensing and GIS or work in industry allied in this field.

Course Outline

Unit-1:

Introduction

Map as Model, Spatial Elements, Terminology, Classification of Maps, Map Scale, Spatial Referencing System, Map Projections, Grouping of Map Projections, Introduction to Remote Sensing?, Electromagnetic Radiation, Electromagnetic Spectrum, Interactions with the Atmosphere, Radiation – Target, Passive vs. Active Sensing, Characteristics of Images

Unit-II

Sensors

On the Ground, In the Air, In Space, Satellite Characteristics, Pixel Size, and Scale, Spectral Resolution, Radiometric Resolution, Temporal Resolution, Geometric Distortion, Weather Satellites, Land Observation Satellites, Marine Observation Satellites

Unit-III

Fundamentals of GIS

Introduction, Roots of GIS, Overview of Information System, Contribution Disciplines, GIS Definitions and Terminology, GIS Queries, GIS Architecture, Theoretical Models of GIS, Theoretical Framework for GIS, GIS Categories, Levels/Scales of Measurement

Unit-IV

Spatial Data Modelling

Introduction, Stages of GIS Data Modelling, Graphic Representation of Spatial Data, Raster GIS Models, Vector GIS Models, Comparison of Raster and Vector Models **GIS Data Management** Introduction, Data Base Management Systems, GIS Data File Management, Database Models, Storage of GIS Data, Object Based Data Models, Organizational Strategy of DBMS in GIS **Data Quality Issues:** Introduction, Components of Data Quality, Accuracy, Precision and Resolution, Completeness, Sources of Error in GIS

Unit-V

Image Analysis

Introduction, Visual interpretation, Digital processing, Preprocessing, Enhancement, Transformations, Classification,

Integration of Remote Sensing and GIS

Textbook:

- Fundamentals of Remote sensing Tutorial, natural resources Canada
- M. ANJI REDDY , Remote Sensing and Geographical Information Systems BSP BS Publication
- Campbell, James B. 2011. Introduction to Remote Sensing, 5th edition. New York. The Guilford Press. ISBN 978-1609181765

Lab Exercise:

CSC568 Practical based on CSC532: At least two experiments should be carried out on each unit.

Prerequisite: To learn this course basic knowledge of Digital Signal Processing, Mathematics and Statistical Techniques is must.

Course Objective:

- To introduce the student to various image processing techniques.

Course Outline: Digital Image Processing

Unit 1: Image Processing Fundamentals: Digital image, digital image processing, History of digital image processing, State of the art examples of digital image processing, Key stages in digital image processing, The human visual system, Light and the electromagnetic spectrum, Image representation, Image sensing and acquisition, Sampling, quantisation and resolution.

Unit 2: Image Enhancement (Histogram Processing, Point Processing and Spatial Filtering): image enhancement, Different kinds of image enhancement, Histogram processing, Point processing, Neighbourhood operations, Negative images, Thresholding, Logarithmic transformation, Power law transforms, Grey level slicing, Bit plane slicing, Neighbourhood operations, spatial filtering, Smoothing operations, Correlation and convolution, Sharpening filters, 1st derivative filters, 2nd derivative filters, Combining filtering techniques

Unit 3: Image Restoration (Noise Removal): image restoration, Noise and images, Noise models, Noise removal using spatial domain filtering, Periodic noise, Noise removal using frequency domain filtering,

Unit 4: Image Segmentation: Thresholding and thresholding algorithms, Performance evaluation and

ROC analysis Connected components labeling, Region growing and region adjacency graph (RAG), Split and merge algorithms, Morphological algorithms, Erode and dilate as max and min operators on binary images Open, close, thinning and other transforms Medial axis transform Introduction to grey-level morphology

Unit 5: Color Image Processing : Fundamentals of colour image processing, Secondary colours, Colour Image Models, Basics of full colour image , Pseudo-color image processing, Colour Image Segmentation.

Book:

1. Digital Image Processing, 3/e, Rafael C. Gonzalez, Richard E. Woods. Pearson Education, ISBN: 9788131726952

Reference Books:

1. S. Sridhar "Digital Image Processing", Oxford Publishers, 2011.
2. S. Jayaraman, S. Esakkirajan, T. Veerakumar "Digital Image Processing", McGraw Hill Publishers, 2009.
3. Chanda and D. Dutta Majumdar "Digital Image Processing and Analysis", Prantice Hall of India.
4. Anil K. Jain "Fundamentals of Digital Image Processing", Prantice Hall of India, 2012.
5. Milan Sonka, Hlavac & Boyel, "Digital Image Processing and Computer Vision", Cengage Learning Publishers, 2010.

E-book:

1. Digital Image Processing, 3/e, Rafael C. Gonzalez, Richard E. Woods. Pearson Education, ISBN: 9788131726952

Lab Exercise: CSI460 Practical based on CSI481:

At least two experiments should be carried out on each unit.

1. Viewing digital images, bits and bytes, raster scan format, quantization
2. Scaling, translation and rotation, sums and differences
3. Histograms and stretches, convolutional filters
4. Fourier transforms and the frequency domain, filters

5. FFTs, Image filtering: smoothing and sharpening
6. 2D convolution and correlation
7. Application of above algorithms for Brain Tumor detection, character detection, etc.

Internet of things

Course Outcome:

- At the completion of course the student have preliminary knowledge about Digital Image Processing.

Course: Internet of Things

Unit -1: Introduction and Concepts: Definition and Characteristics of Introduction to IoT, Physical design of IoT, Things in IoT, IoT protocols, Logical Design of IoT, IoT functional blocks, IoT communication Model, IoT Communication API, IoT Enabled Technologies.

Unit -2: Developing IoT : IoT platform and design methodology – Purpose & requirement specification, process specification, Domain Model specification, Information Model Specification, service specification, IoT level specification, functional view specification, Operational view specification, Device & Component Integration, Application Development.

Unit -3: IoT Physical Device Endpoints – Basic building blocks of an IoT Device, Exemplary Device Raspberry Pi, Raspberry Pi Interfaces, Programming Raspberry Pi with Python.

Unit -4: IoT and M2M – Machine 2 Machine, Difference between IoT and M2M, Web of Things, Applications – Remote Monitoring and Sensing, Remote Controlling, Performance Analysis. Security aspects of IoT.

Unit -5: Application of IoT with Domain Specific tools: Case studies on Intrusion Detection, Smart Parking, Smart Roads, Surveillance, Emergency response, Air/Noise Pollution Monitoring Systems, Prognostics, Smart Irrigation, Green House Controls and Wearable Electronics.

Reference Book

1. Internet of Things (A Hands-on-Approach) , Vijay Madisetti , Arshdeep Bahga
2. Getting Started with Internet of Things : Connecting Sensors and Microcontrollers to the cloud by Cuno Pfister, O'Reilly Publications

1. Web Analysis and Development

Course Code	CSI413	Course title	Web Analysis and Development
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: Student must possess the basics: Markup language HTML, Java Script, VB Script and overview of CSS.

Course Objective:

- In this course, students will learn the fundamentals of Web Development and will also get hands-on to the recent technologies and tools.
- In addition to this, students will learn Web Analytics, with methods and tools that are widely used.

Course Outline: Web Analysis and Development

Unit 1: Introduction to Website design and development, Structure of Website, Web Development Process, how website works, types of website (Static and Dynamic), Websites Publishing, Websites URL Registration, Client-Server communication, revising Markup and Scripting languages, Frameworks, etc.

Unit 2: Using jQuery, Responsive Web Design, PHP Overview, PHP File Includes, PHP functions and forms, validations, PHP Web Applications, Uniform Resource Identifier (URI)

Unit 3: XML: Introduction to XML, Defining XML tags, their attributes and values, Document Type Definition, XML Schemes, Document Object Model, XHTML Parsing XML Data, Common Gateway Interface (CGI), Reading Servlet parameters, Reading Initialization parameters.

Unit 4: Server Side, HTTP and Web Server, HTTP Overview, HTTPS / TLS HTTP request message-response message-Web Clients Web Servers-Case Study, Cookies, Server-Side: Dynamic Content, Web Content Management Systems (Web CMS).

Unit 5: How Web Analytics Works – Basic Concepts Section 3 Basic Segmentation, How Web Analytics collects Web Data and other types of data, How Web Analytics Visualizes Data, Acquisition and Conversions Section 9 How Web Analytics Tracks Mobile Visitors, other Web Analytics Reports and Visualizations, Web Analytics Case Studies Knowledge discovery from web data, Introduction to analytics tools.

Reference Books:

1. Web Programming, building internet applications, Chris Bates 2nd edition, Wiley Dreamtech
2. Java Script, D. Flanagan, O'Reilly, SPD.
3. Beginning Web Programming-Jon Duckett WROX.
4. Web Technologies, Uttam K Roy, Oxford University Press

Web/E- References:

1. https://www.tutorialspoint.com/internet_technologies/websites_development.htm
2. <https://www.w3schools.com/html/default.asp>
3. <https://bigdataanalytics.mit.edu/>
4. <http://news.mit.edu/topic/web-development>

Lab Exercise: CSI461 Practical based on CSI413

Students are required to complete minimum 2 practical's on each unit in addition to this case studies and assignments given by course in charge.

Course Outcome:

- At the end of the course, students will be able to develop dynamic web site using current tools and technologies.
- They will be aware of some Web Analytics and different analytics tools.

2. Artificial Intelligence

Course Code	CSI414	Course title	Artificial Intelligence
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisite: The student should have knowledge of computer science / cognitive science, basic programming, data structure and algorithms.

Course Objective:

- To study the concepts of Artificial Intelligence.
- To learn the methods of solving problem using AI.
- Introduce the concept of experts system and its applicability.
- To be familiar with the basic knowledge representation, problem solving and knowledge acquisition.

Course Outline: Artificial Intelligence

Unit 1: Introduction: Introduction to AI, Types of AI applications, Issues in the design of search problems, State space , production rule and Problem space , , Breadth First Search, Depth First Search, Hill climbing, A* and AO* algorithms

Unit 2: Knowledge Representation: Representations and mapping, Propositional Logic, Predicate Logic, Resolution, Representing Instance and Isa relationship, Representing simple fact in logic.

Unit 3: Natural Language Processing and Expert System: Introduction to NLP, Syntactic analysis, Semantic analysis, Discourse Integration and Pragmatic Processing, Architecture of Expert Systems, Knowledge acquisition

Unit 4: Learning and Game Playing: Introduction to learning, learning by taking advice, learning from examples, Induction Learning, Min max search procedure, alpha beta cutoffs

Logic Programming: Procedural versus Declarative knowledge, forward and backward reasoning, Non-monotonic reasoning, Bayesian Networks, Fuzzy Logic.

Unit 5: Current trends of AI: The rise of AI-enabled chips, Convergence of IoT and AI at the edge,

Interoperability among neural networks, automated machine learning.

Ethics of AI: Ambient Intelligence Challenges, Machine Ethics, Computer Power and Human Reason, Artificial Consciousness, Artificial Moral Agents, Robot Ethics and Rights

Reference Books:

1. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", 2nd Edition, Tata McGraw-Hill, 2003.
3. George F. Luger, "Artificial Intelligence-Structures and Strategies For Complex Problem Solving", Pearson Education / PHI, 2002.
4. Stefan Edelkamp and Stefan Schroedl. Heuristic Search: Theory and Applications, Morgan Kaufmann, 2011.

Lab Exercise: CSI462 Practical based on CSI414

Course Outcome:

- Understand the basics of AI and how these technology are redefining the AI industry.
- Understand the various searching techniques, constraint satisfaction problem and example problems- game playing techniques
- Apply these techniques in applications which involve perception, reasoning and learning.
- Acquire the knowledge of real world Knowledge representation.

3. Cyber forensic

Course Code	CSI415	Course title	Cyber forensic
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours	3	Total Contact Hours	4 Hrs/Week
(Th)	Hrs/week	(Pr)	

Prerequisite:

Course Objective:

-

Course Outline: Cyber forensic

Unit 1: Information security and Network Forensics **Information security:** Information Security IT Managers,(Scope, Domains, Common Attacks, Impact of Security Breaches) Protecting Critical Systems (Information Risk Management, Risk Analysis etc) Information Security in Depth Physical security (Data security Systems and network security , Business communications security, Wireless security, Web and application security, Security policies and procedures, Security employee training and awareness) **Program Security:** Secure programs, Non-malicious program errors, Viruses and other malicious code, Targeted malicious code, Controls against program threats Operating System Security: Protected objects and methods of protection, Memory address protection, Control of access to general objects, File protection mechanism, Authentication: Authentication basics, Password, Challenge-response, Biometrics.

Unit 2: Database Security: General Database Security Concepts, Understanding Database Security Layers, Server-Level Security, Network-Level Security, Operating System Security, Understanding Database-Level Security, Database Administration Security, Database Roles and Permissions, Object-Level Security, Using Other Database Objects for Security, Using Application Security, Limitations of Application-Level Security, Supporting Internet Applications, Database Backup and Recovery, Determining Backup Constraints, Determining Recovery Requirements, Types of Database Backups, Keeping Your Servers Up to Date, Database Auditing and Monitoring, Reviewing Audit Logs, Database Monitoring

Network Security: Introduction to Secure Network Design, Wireless Impact on the Perimeter, Compliance with Standards ,Network Device Security : Switch and Router Basics, MAC Addresses, IP Addresses, and ARP, Switches, Routing Protocols, Network Hardening, Switch Security Practices, Access Control Lists, Simple Network Management Protocol (SNMP), Firewalls, Virtual Private Networks, Intrusion Detection and Prevention Systems

Unit 3: Network forensic: Ethernet analysis, Network interface card analysis, wireless forensic, attackers footprints, firewall logs, IDS/IPS, web proxies, traffic captures, DHCP log examination, sniffing traffic, analyzing proxy cache, tools like tcpdumps, Snort, ngrep, tcpextract, and Wireshark. Emailtrackerpro, analyzing index.dat, input debugging, controlled flooding, ICMP trace back, packet marking techniques, honeypots and honeynets, source path isolation engine (SPIE).

Collecting Network Based Evidence - Investigating Routers - Network Protocols - Email Tracing - Internet Fraud. Systems Investigation And Ethical Issues.

Internet Forensic: Obfuscation: Anatomy of URLs, IP Addresses in URLs, Usernames in URLs, Encoding the Entire Message, Similar Domain Names, Making a form look like a URL, Bait and Switch-URL Redirection, JavaScript, Browsers and Obfuscation

Websites: Capturing Web Pages, Viewing HTML Source, Comparing Pages, Non-Interactive Downloads Using wget, Mapping out the entire website, Hidden Directories, In Depth Example- Directory Listing, Dynamic WebPages, Filling Out Forms, In depth Example-Server side Database, Opening the Black Box

Web Servers: Viewing HTTP Headers, Understanding Header Information, Cookies, Redirection, Web Server Statistics, Controlling HTTP Headers.

Reference Books:

1. The Complete Reference 'Information Security' Second Edition by Mark Rhodes-Ousley
2. Digital forensic for network internet and cloud computing client garrison
3. Wireless crime and forensic investigation by Gregory kipper
4. Digital image forensic by husrev taha, nasir memon
5. Eoghan Casey, "Handbook Computer Crime Investigation's Forensic Tools and Technology", Academic Press, 1st Edition, 2001.
6. Skoudis. E., Perlman. R. Counter Hack: "A Step-by-Step Guide to Computer Attacks and Effective Defenses", .Prentice Hall Professional Technical Reference. 2001.
7. Norbert Zaenglein, "Disk Detective: Secret You Must Know to Recover Information From a Computer", Paladin Press, 2000.
8. Bill Nelson, Amelia Philips and Christopher Steuart, "Guide to computer forensics and investigations", course technology, Cengage Learning; 4th edition, ISBN: 1-435-49883-6, 2009.

Lab Exercise: CSI462 Practical based on CSI414

Course Outcome:

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4. Advance Software Engineering

Course Code	CSI416	Course title	Advance Engineering	Software
Number of Credits	3 Credits	Internal / External	20/80	
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week	

Prerequisite: The student must aware of software development paradigms

Course Objective:

- To understand and apply the concepts of Software Process and process Models.
- To Analyze and specify the requirements for efficient Project Management.
- To understand the steps in Software Requirements Specification and Design.
- To apply the steps involved in Program Verification and Validation.
- To apply various Software testing Strategies.
- To understand and apply the procedures for Software Quality Assurance and Cost and project Estimation.

Course Outline: Advance Software Engineering

Unit 1: The Nature of Software, Defining Software, Legacy Software, Software Engineering, Software characteristics, Application software. Waterfall model, Incremental and Evolutionary models. 4TH Generation Techniques.

Project Management Concepts, Process and project– metrics, Process Metrics and Software Process Improvement, Project Metrics, Software Measurement, Size-Oriented Metrics, Function-Oriented Metrics, Object-Oriented Metrics, Use-Case Oriented Metrics. Project Planning Process: Software Scope and Feasibility, Resources, Software Project Estimation, Decomposition Techniques, Empirical Estimation Models, Scheduling, Risk analysis, monitoring and management. Software Configuration Management.

Unit 2: Software Requirements and Analysis: System Engineering, Product Engineering: Characteristics of a Good SRS, Requirement analysis, Principal, Software prototyping, Specification and its review. Analysis modeling: data modeling, mechanics for structured analysis, system analysis tools and techniques, Data Flow Diagram, ER- Diagrams. Data Dictionary.

The Design Process, Design Concepts, Design Model. Architectural Design: Software Architecture,

Architectural Genres, Architectural Styles Architectural Design, Assessing Alternative Architectural Designs, Component Level Design: Designing Class-Based Components, Conducting Component-Level Design, Cohesion and Coupling. User Interface Design: The Golden Rules, Interface Analysis and Design, Interface Analysis Interface Design Steps.

Unit 3: Software Quality Assurance: Definition of Quality and factors, QA, SQA, Software Quality Metrics, Process and Product Quality, The SEI Process Capability Maturity Model (CMM), ISO ,Six-Sigma. Software Quality Assurance, Need for SQA, SQA Activities, Building blocks of SQA, SQA Planning & Standards, Software Reliability, Reliability Measures.

Introduction to Software Testing: Need of s/w testing, Error, fault and failure Testing fundamentals, Testing objectives, test information flows, Testing lifecycle, Test Cases – Test case designing,

Unit 4: Black Box And White Box Testing, Functional Testing, Equivalence partitioning, BVA, Decision table based testing, Cause-Effect graphing, Syntax testing, Structural Testing, Coverage testing, Statement coverage, Branch and decision coverage, Path coverage, Cycloramic Complexity Validation testing Activities, Low level testing, High level testing, Black box Vs. White Box Object Oriented Testing: Issues in OO testing, class testing, GUI testing.

Unit 5: Validation and Verification, Levels of Testing Unit Testing, Integration Testing, System Testing, Acceptance Testing, Alpha testing, Beta testing, Static vs. Dynamic testing, Manual vs. Automatic testing, Testers workbench, 11 steps of testing process . Types of Testing: Installation Testing, Usability testing, Regression testing, Performance testing, Load testing, stress testing, Security testing, Static and Dynamic testing, Static testing techniques, . Computer Aided Software testing tools (CAST): Static Testing Tools, Dynamic Testing Tools, and Characteristics of Modern Tools. e.g. Win Runner, Load Runner, Rational ROBO. Review types: Informal Review, Technical or peer review, Walkthrough, Inspection, static analysis, Review meeting and reporting, Review guidelines, Review checklist.

Reference Books:

1. Software Engineering – A Practitioners Approach Roger S. Pressman, 4th /7th Edition,
2. Mcgraw Hill, International Education.
3. An Integrated Approach To S/w Engineering, Pankaj Jolote, 1st / 2nd Edition, Narosa.
4. Software Engineering – A Programming Approach, D. Belie I. Moray, J. Rough, PHI.
5. Software Testing Techniques, Barrios Bier, 2nd Edition, Van N Ostrand Reinhold.
6. Software Engineering Concepts-Richard Fairley, CDAC. Tata McGraw-Hill Series.

7. ISO-9000 Standards (Relevant To Software).
8. IEEE Standard For Software User Documentation, Std. 1063-1987.
9. Introducing Software Testing by Louise Tamres (Pearson pub)
10. Effective Methods for software Testing by William Perry Software Testing in Real World by Edward Kit
11. Software Testing Techniques by Boris Beizer (Dreamtech pub)
12. Boris Beizer, "Software System Testing and Quality Assurance", Van Nostrand Reinhold, New York, 1984.
13. Glenford Myers, "The Art of Software Testing", John Wiley & Sons Inc., New York

Lab Exercise: CSI464 Practical based on CSI416

Course Outcome:

- Apply new software models, techniques and technologies to bring out innovative and novelistic solutions for the growth of the society in all aspects and evolving into their continuous professional development.
- Deliver quality software products by possessing the leadership skills as an individual or contributing to the team development and demonstrating effective and modern working strategies by applying both communication and negotiation management skill.
- Plan and deliver an effective software engineering process, based on knowledge of widely used development lifecycle models.
- Formulate a testing strategy for a software system, employing techniques such as unit testing, test driven development and functional testing

Elective 2

Course Code	CSI	Course title	Elective -2: Big Data Analytics
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Prerequisite: Student must have Understanding of Relational database normalization techniques,

Physical design of a database, Concepts of algorithm design and analysis, Basic understanding of Software engineering principles and techniques, Probability and statistics – correlations, Bayesian theory, regression, hypothesis testing etc. Recommended: Student must have programming experience in C, C++, Python.

Course Objective:

- To understand the structure of Data Warehouse.
- To understand different data pre-processing techniques.
- To understand basic descriptive and predictive data mining techniques.
- To use data mining tool on different data sets.
- To understand Classification algorithms.
- To understand Prediction algorithms.
- To understand Clustering algorithms.
- To use data mining tool on different data sets

Course Outline: Big Data Analytics

Unit 1 : Introduction to Data Warehousing and Mining Basic: concepts of data mining, Types of Data to be mined, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Discovery in Databases, Data Mining Issues, Applications of Data Mining, Data Warehouse and DBMS Architecture of Data Warehouse, Multidimensional data model, Concepts of OLAP and Data Cube, OLAP operations, Dimensional Data Modelling- Star, Snow flake schemas.

Unit 2: Data Processing: Need Data pre-processing, Attributes and Data types, Statistical descriptions of Data, Handling missing Data, Data sampling, Data cleaning, Data Integration and transformation, Data reduction, Discretization and generating concept hierarchies Association Rule Mining: Basic idea: item sets, Frequent Item-sets, Association Rule Mining, Generating item sets and rules efficiently, FP growth algorithm

Unit 3: Classification, Prediction and Clustering: Classification: Definition of Classification, Decision tree Induction: Information gain, gain ratio, Gini Index, Issues: Over-fitting, tree pruning methods, missing values, continuous classes, Classification and Regression Trees (CART), Bayesian Classification: Bayes Theorem, Naïve Bayes classifier, Bayesian Networks, Linear classifiers, Least squares, SVM classifiers, Lazy Learners (or Learning from Your Neighbors) Prediction: Definition of Prediction Linear regression, Non-linear regression, Logistic regression Clustering: Definition of Clustering Partitioning Methods, Hierarchical Methods, Distance Measures in Algorithmic Methods, Density Based Clustering.

Unit 4: Parallel and Distributed Computing: Introduction, Benefits and Needs, Programming Environment, Theoretical Foundations- Parallel Algorithms Parallel Models and Algorithms Sorting- Matrix Multiplication- Convex Hull- Pointer Based Data Structures. Synchronization- Process Parallel Languages- Architecture of Parallel and Distributed Systems- Consistency and Replication- Security- Parallel Operating Systems.

Unit 5: Introduction to HADOOP: Introduction to distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce. Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands, Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce Paradigm, Map and Reduce tasks, Job, Task trackers – Cluster Setup – SSH &Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

Reference Books:

1. Data Mining: Concepts and Techniques, Han, Elsevier ISBN: 9789380931913 / 9788131205358
2. Margaret H. Dunham, S. Sridhar, Data Mining – Introductory and Advanced Topics, Pearson Education
3. Data warehousing: fundamentals for IT professionals 3rd edition , Kimball, Wiley Publication
4. Ian H. Witten, Eibe Frank Data Mining: Practical Machine Learning Tools and Techniques, Elsevier/(Morgan Kauffman), ISBN:9789380501864
5. Introduction to Data Mining (2005) By Pang-Ning Tan, Michael Steinbach, Vipin Kumar Addison Wesley ISBN: 0-321-32136-7
6. Jacek Błażewicz, et al., “Handbook on parallel and distributed processing”, Springer Science & Business Media, 2013.
7. Andrew S. Tanenbaum, and Maarten Van Steen, “Distributed Systems: Principles and Paradigms”. Prentice-Hall, 2007.
8. George F.Coulouris, Jean Dollimore, and Tim Kindberg, “Distributed systems: concepts and design”, Pearson Education, 2005.
9. Gregor Kosec and Roman Trobec, “Parallel Scientific Computing: Theory, Algorithms, and Applications of Mesh Based and Meshless Methods”, Springer, 2015
10. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, “Professional Hadoop Solutions”, Wiley, ISBN: 9788126551071, 2015.
11. Chris Eaton, Dirk deroos et al. “Understanding Big data”, McGraw Hill, 2012.
12. Tom White, “HADOOP: The definitive Guide”, O Reilly 2012.

13. MapReduce Design Patterns (Building Effective Algorithms & Analytics for Hadoop) by Donald Miner & Adam Shook

Lab Exercise: CSI Practical based on CSI: At least two experiments should be carried out on each unit.

Course Outcome:

- Data processing and data quality.
- Modelling and design of data warehouses.
- Write parallelize programs and use basic tools like MPI and POSIX threads.
- Apply core ideas behind parallel and distributed computing.
- Use methodologies adopted for concurrent and distributed environment.

Elective 2

Course Code	CSI	Course title	Elective -2: Geospatial Technology
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Prerequisites:

The students must have the theoretical and practical knowledge of Digital Image Processing, Digital Signal Processing, Neural Networks and Pattern Recognition.

Course Objective

- Introducing to Geospatial Technology & its components.
- To inculcate the skills for handling, processing & analyzing the geospatial data related to various applications through Remote Sensing and GIS techniques and tools.

Course Outcomes:

Upon successful completion of this course, students be able to:

- Understand the basic concepts of geospatial technology and its related fields, Specifically Remote Sensing and Cartography.

- Critically evaluate and analyze data quality and its applicability.
- Interpret the various Remote Sensing and GIS data models, data processing techniques and tools.
- Develop various applications in the field of Geospatial Technology through open source tools.

Unit I: Introduction to Geospatial Technology Introduction, Components of Geospatial Technology, Global Positioning System (GPS), Coordinate Systems, Projection & Re-Projection, Spatial & Non-Spatial Datatypes and data Sources.

Unit II

Fundamentals of Remote Sensing Definition and Objectives, Historical Background, Electronic Spectrum, Types of Sensors, Terms and Units of Measurement, Scales and Resolutions, Visual & Digital Interpretation, Classification and Accuracy Assessment.

Unit III:

Data Modals: Vector Data Modal, Elements of Vector Data Modal, Raster Data Modal, Elements of raster Data Modal, Elements of Data Quality, Data Formats and Spatial Databases.

Unit IV:

Data Preprocessing and Visualization: Raster Data input, Image Registration, Spectral Transform, Spatial Transform, Image Enhancement and Visual Interpretation. Vector Data input, Geometric transformation, Spatial Data Editing, Attribute Data Input and Management, Data Display and Cartography.

Unit V

Data Processing, Analysis & Modeling: Spatial Interpolation, Geocoding & Dynamic Segmentation, Path Analysis and Network Applications, GIS Model and Modelling, View sheds, Watersheds, Terrain Mapping & Analysis, DEM and TIN.

Practical (P5:CS1464):

- Practical's based on Unit-I to Unit-V will be performed using Python Programming and Open Source Tools (i.e. QGIS and SAGA).

Text Books

1. Fundamentals of Satellite Remote Sensing, Emilio Chuvieco, and Alfredo Huete
2. Geographic Information System, Kang-tsung Chang, fourth edition Tata McGraw-Hill.
3. An Introduction to Geographic Information Technology, Sujit Choudhary, Deepankar Chakrabarty, Suchandra Choudhary, IK international.

Reference Books

1. Digital Analysis of Remotely sensed Imagery, Jay Gao, McGraw Hill
2. Remote sensing models & methods for image processing, third edition, Robert's A. Schowengerdt
3. Remote sensing Digital image Analysis An Introduction, John A. Richards, Xiuping Jia
4. An introduction to geographical information systems, Ian Heywood, Sarah Cornelius, Steve Carver

Web Resources

1. <http://www.gis.com/whatisgis/index.html>
2. <http://www.gis.nic.in>
3. <http://www.esriindia.com>
4. <http://www.qgis.org>
5. <http://www.exelisvis.com/ProductsServices/ENVI.aspx>
6. <http://rst.gsfc.nasa.gov/start.html>
7. <http://www.isro.org>
8. <http://www.usgs.gov>

Elective 2

Course Code	CSI	Course title	Elective -2: Pattern Recognition
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Prerequisite: Student must have knowledge of Digital image processing, neural networks, function analysis and Statistical analysis.

Course Objective:

- To provide the general mechanism and design of Automatic system recognition.

Course Outline: Pattern Recognition

Unit 1: Introduction to Pattern Recognition, Bayesian decision theory: Classifiers, Discriminant functions, Decision surfaces, Normal density and Discriminant functions, discrete features

Unit 2: Maximum Likelihood and Bayesian Estimation: Parameter estimation methods, Maximum-Likelihood estimation, Bayesian estimation, Bayesian Parameter Estimation, Gaussian Case, General Theory, Problem of Dimensionality, Accuracy, Dimension, and Training Sample Size, Computational Complexity

and Overfitting.

Unit 3: Component Analysis and Discriminants: Principal Component Analysis (PCA), Expectation Maximization (EM), Hidden Markov models for sequential pattern classification, First-Order Markov Models, First-Order Hidden Markov Models, Hidden Markov Model Computation, Evaluation, Decoding and Learning.

Unit 4: Nonparametric: Density estimation, Parzen-window method, Probabilistic Neural Networks (PNNs), K-Nearest Neighbour, Estimation and rules, Nearest Neighbour and Fuzzy Classification.

Unit 5: Linear Discriminant function based classifiers: Perceptron, Linear Programming Algorithm, Support Vector Machines (SVM)

Recommended Books:

1. R. O. Duda, P. E. Hart and D. G. Stork, "Pattern Classification 2nd Edition", John Wiley, 2007
2. Christopher M. Bishop, "Neural Network for Pattern Recognition", Oxford Ohio Press.

Reference Books:

1. E. Gose, R. Johansonbargh, "Pattern Recognition and Image Analysis", PHI
2. Ethen Alpaydin, "Introduction to Machine Learning", PHI
3. Satish Kumar, "Neural Network- A Classroom Approach", McGraw Hill.
4. Dr. Rao & Rao, Neural Network & Fuzzy Logic
5. S. Theodoridis and K. Koutroumbas, "Pattern Recognition", 4th Ed., Academic Press,
6. C. M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006

Web/E- References:

1. <http://www.rii.ricoh.com/~stork/DHS.html>

Lab Exercise: CSI Practical based on CSI: At least two experiments should be carried out on each unit.

Course Outcome:

- Students can go for research in Pattern Recognition
- Work in atomization industry

- Work as statistical analyser of data of any filed.
- Work as predictor based on statistical data analysis of any organization
- Can able to do classification and clustering of data

Elective 2

Course Code	CSI	Course title	Elective -2: Cloud Computing
Number of Credits	3 Credits	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Prerequisite:

Course Objective:

- The course will useful to learn from the basics of cloud computing to the advancements of it and also help to develop your own cloud.
- It will cover from definition, architecture, how services and application will correlate with cloud.
- It will also cover the platform and services along with the amazon and Microsoft cloud services.
- This course will also highlight the security mechanism of cloud.
- At last it will touch to the storage, software's, webmail services, communicating with the cloud, media and streaming and use of cloud in mobile technology.
- This course will be useful for one semester in the PG degree.

Course Outline: Cloud Computing

Unit 1: Examining the Value Proposition, Defining Cloud Computing, Assessing the Value Proposition, Understanding Cloud Architecture, Understanding Services and Applications by Type.

Unit 2: Using Platforms, Understanding Abstraction and Virtualization, Capacity Planning, Exploring Platform as a Service, Using Google Web Services, Using Amazon Web Services, Using Microsoft Cloud Services.

Unit 3: Exploring Cloud Infrastructures, Managing the Cloud, Understanding Cloud Security.

Unit 4: Understanding Services and Applications, Understanding Service Oriented Architecture, Moving Applications to the Cloud, Working with Cloud-Based Storage, Working with Productivity Software, Using Webmail Services, Communicating with the Cloud, Using Media and Streaming.

Unit 5: Using the Mobile Cloud, Working with Mobile Devices, Working with Mobile Web Services.

Reference Books:

1. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wiley, 2011
2. Enterprise Cloud Computing - Technology, Architecture, Applications, Gautam Shroff, Cambridge University Press, 2010
3. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley- India, 2010

Lab Exercise: CSI Practical based on CSI

Course Outcome:

- The learner will know the basics of cloud computing and some of the advanced areas of it.
- At the completion of this course the learner can develop their own cloud.
- It will also be helpful to understand the definition, architecture, how services and application will correlate with cloud.
- It will also help the learner to get the practical information about the platform and services along with the Amazon and Microsoft cloud services.
- This course will be helpful to implement their own security mechanism of cloud.
- Learner will also do the efficient management of the storage, software's, webmail services, communicating with the cloud, media and streaming and hands-on of cloud in mobile technology.
- Learner will get flavor of Abstraction and Virtualization for cloud

Semester IV (Industrial Internship / Field Work Projects / Research Projects)

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC416	Dissertation Review 1	-	3	50	-	50
CSC417	Dissertation Review 2	-	3	50	-	50
CSC418	Dissertation Review 3	-	3	50	-	50
CSC419	Final Dissertation	-	5	-	100	100
CSC420	Seminar	-	2	-	50	50
			16			

Dissertation

Course Objectives:

1. To provide comprehensive learning platform to students where they can enhance their employ ability skills/research skills and become job/research ready along with real corporate/field work/research exposure.
2. To enhance students' knowledge in implementing learned concepts.
3. To increase self-confidence of students and helps in finding their own proficiency.
4. To cultivate student's leadership, problem solving and self-learning abilities and responsibility to perform or execute the given task.
5. To provide learners hands on practice within a real job situation.

Course Outline

1. Final Year Dissertation includes any one of either industrial Internship/field work project/Research Project representing the culmination of study towards the Master of Computer Science. Internship/Projects offer the

opportunity to apply and extend material learned throughout the program. Projects are undertaken individually or in small groups of not more than two students.

2. The projects undertaken span a diverse range of topics, including theoretical, simulation and experimental studies. The emphasis is necessarily on facilitating student learning in technical, project management and presentation spheres. This necessarily introduces the dimension of workload management into the program to enable completion of a large, relatively unstructured "assignment" over the course of the semester.
3. Assessment will be done by means of three internal reviews and one external examination in the form of presentation, submission of a dissertation, and a demonstration of work undertaken.
4. 14 credits will be awarded to the dissertation work.
5. 2 credits for the seminar. Seminar topic must be relevant and as per the current trends in research and technology development.

Course Outcomes:

1. Capability to acquire and apply fundamental principles of Computers Science.
2. Become master in one's specialized technology.
3. Ability to communicate efficiently.
4. Capacity to be a multi-skilled Computer Science professional with good technical knowledge, management, leadership and entrepreneurship skills.
5. Ability to identify, formulate and model problems and find solution based on a systems approach.
6. Capability and enthusiasm for self-improvement through continuous professional development and life-long learning.

Seminar

Course Objectives

1. To study research papers for understanding of a new field, in the absence of a textbook, to summarise and review them.
2. To identify promising new directions of various cutting edge technologies.
3. To impart skills in preparing detailed report describing the topic.
4. To effectively communicate by making an oral presentation before an evaluation committee

Course Outline

1. The students are expected to choose a topic either in cutting edge technologies or current trends in research. Seminars are to be carried out individually.
2. Students should make in-depth study of the topic chosen and prepare a technical report on the same.

3. In terms of content of the report, students should show competence in identifying relevant information, defining and explaining topics under discussion.
4. They should demonstrate depth of understanding. and make use of primary and secondary sources.
5. Assessment of this course will be done externally and 2 credits will be awarded on successful completion.

Course Outcomes

1. Ability to evaluate information and use and apply relevant theories.
2. Ability to organize and show competence in working with a methodology, structuring their oral work, and synthesizing information.
3. Ability to deliver, and make use of visual, audio and audio-visual material to support their presentation.
4. Ability to speak cogently with or without notes and present and discuss either works as an individual.

Guidelines:

- Each student must individually complete desired Industrial training / Institutional project in the 4th semester.
- Group project will be not more than two students.
- College should assign a student mentor to every student. The mentor will monitor the progress of the student throughout the semester for continuous assessment.
- Student should submit a valid offer letter and synopsis within two weeks of starting the internship.
- There will be continuous assessment of the work done by the student during the internship period.
- Continuous assessment guidelines:
 1. Student should submit a weekly report in the college to the mentor.
 2. The report should contain the following details: Name of student, project title, company name, company mentor, daily activities and results/output, proposed work for next week.
 3. The weekly report should be duly signed by the student and company mentor/ institute guide.
 4. Student Mentor should maintain weekly attendance record for every student.
 5. Three presentations should be conducted for each student (after each month)
 6. Student Mentor should take feedback from the Company mentor regarding overall performance of the student.
- At the end of the internship period, each student should prepare a report.
- The report should follow the style in academic journals and books, with contents such as: abstract, background, aim, design and implementation, testing, conclusion and full references, Tables and figures should be numbered and referenced to in the report.

Examination and Evaluation guidelines

- The final presentation and documentation will be evaluated by three examiners:
 1. Student mentor (appointed by respective college)
 2. External examiner (appointed by the University)
 3. IT expert (appointed by respective college)

Recommended Documentation contents:

Title page Company / Institute certificate Internship completion certificate

Abstract Introduction

-motivation-problem statement-purpose/objective and goals-literature survey-project scope and limitations

System analysis

-Comparative study of Existing systems -scope and limitations of existing systems -project perspective, features -stakeholders -Requirement analysis -Functional requirements, performance requirements, security requirements etc.

System Design

-Design constraints-System Model: UML diagrams-Data Model
-User interfaces

Implementation details

-Software/hardware specifications, etc.

Reports Testing

Test Plan, Black Box Testing or Data Validation Test Cases, White Box Testing or Functional Validation Test cases and results

Conclusion and Recommendations Future Scope

Bibliography and References

Paper Code	Course Title Communication Skill	Total Theory Credits	Total Practical Credits	Internal Marks	External Marks	Total Marks
CSC535	Intellectual Property Rights	3	-	20	80	100
CSC536	Development of Soft Skill and Personality.	3	-	20	80	100
CSC537	R-Tool	3	-	20	80	100

CSC538	Communication Skills	3	-	20	80	100
CSC539	Introduction to MATALB	3	-	20	80	100

INTELLECTUAL PROPERTY RIGHTS

Objectives:

- To introduce fundamental aspects of Intellectual property Rights to students who are going to play a major role in development and management of innovative projects in industries.
- To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
- To disseminate knowledge on copyrights and its related rights and registration aspects
- To disseminate knowledge on trademarks and registration aspects
- To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects
- To aware about current trends in IPR and Govt. steps in fostering IPR

Unit-1:

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967, the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

Unit-2:

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

Unit-3:

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

Unit-4:

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

Unit-5:

Design

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection

Geographical Indication (GI)

Geographical indication: meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

Course Outcomes:

- The students once they complete their academic projects, shall get an adequate knowledge on patent and copyright for their innovative research works
- During their research career, information in patent documents provide useful insight on novelty of their idea from state-of-the art search. This provide further way for developing their idea or innovations
- Pave the way for the students to catch up Intellectual Property(IP) as an career option
- R&D IP Counsel
- Government Jobs – Patent Examiner
- Private Jobs
- Patent agent and Trademark agent
- Entrepreneur

Text book:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

Reference book:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

E-resources:

1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from <http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf>

2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

Reference Journal:

1. Journal of Intellectual Property Rights (JIPR): NISCAIR

Useful Websites:

1. Cell for IPR Promotion and Management (<http://cipam.gov.in/>)

2. World Intellectual Property Organisation (<https://www.wipo.int/about-ip/en/>)

3. Office of the Controller General of Patents, Designs & Trademarks (<http://www.ipindia.nic.in/>)

Development of Soft Skills and Personality Development

The course aims to cause a basic awareness about the significance of soft skills in professional and inter-personal communications and facilitate an all-round development of personality. Hard or technical skills help securing a basic position in one's life and career. But only soft skills can ensure a person retain it, climb further, reach a pinnacle, achieve excellence, and derive fulfilment and supreme joy. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills.

Unit 1: Introduction: A New Approach To Learning,

Planning And Goal-Setting

Human Perceptions: Understanding People

Types Of Soft Skills: Self-Management Skills

Aiming For Excellence: Developing Potential And Self-Actualisation

Need Achievement And Spiritual Intelligence

Conflict Resolution Skills: Seeking Win-Win Solution

Inter-Personal Conflicts: Two Examples

Inter-Personal Conflicts: Two Solutions

Types Of Conflicts: Becoming A Conflict Resolution Expert

Types Of Stress: Self-Awareness About Stress

Regulating Stress: Making The Best Out Of Stress

Unit 2: Guiding Principles

Identifying Good And Bad Habits

Habit Cycle

Breaking Bad Habits

Using The Zeigarnik Effect For Productivity And Personal Growth

Forming Habits Of Success

Communication: Significance Of Listening

Communication: Active Listening

Communication: Barriers To Active Listening

Telephone Communication: Basic Telephone Skills

Telephone Communication: Advanced Telephone Skills

Telephone Communication: Essential Telephone Skills

Unit 3 Technology And Communication: Technological Personality

Technology And Communication: Mobile Personality?

Topic: Technology And Communication: E-Mail Principles

Technology And Communication: How Not To Send E-Mails!

Technology And Communication: Netiquette

Technology And Communication: E-Mail Etiquette

Communication Skills: Effective Communication

- Barriers To Communication: Arising Out Of Sender/Receiver's Personality
- Barriers To Communication: Interpersonal Transactions
- Barriers To Communication: Miscommunication
- Non-Verbal Communication: Pre-Thinking Assessment-1
- Non-Verbal Communication: Pre-Thinking Assessment-2

Unit 4 Nonverbal Communication: Introduction And Importance

- Non-Verbal Communication: Issues And Types
- Non-Verbal Communication: Basics And Universals
- Non-Verbal Communication: Interpreting Non-Verbal Cues
- Body Language: For Interviews
- Body Language: For Group Discussions

Unit 5 : Presentation Skills: Overcoming Fear

- Presentation Skills: Becoming A Professional
- Presentation Skills: The Role Of Body Language
- Presentation Skills: Using Visuals
- Reading Skills: Effective Reading
- Human Relations: Developing Trust And Integrity

Books and references

- Dorch, Patricia. *What Are Soft Skills?* New York: Execu Dress Publisher, 2013.
- Kamin, Maxine. *Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders*. Washington, DC: Pfeiffer & Company, 2013.
- Klaus, Peggy, Jane Rohman & Molly Hamaker. *The Hard Truth about Soft Skills*. London: HarperCollins E-books, 2007.
- Petes S. J., Francis. *Soft Skills and Professional Communication*. New Delhi: Tata McGraw-Hill Education, 2011.
- Stein, Steven J. & Howard E. Book. *The EQ Edge: Emotional Intelligence and Your Success*. Canada: Wiley & Sons, 2006.

R-Tool

About the Course: In this course you will learn how to program in R and how to use R for effective data analysis. You will learn how to install and configure software necessary for a statistical programming environment and describe generic programming language concepts as they are implemented in a high-level statistical language. The course covers practical issues in statistical computing which includes programming in R, reading data into R, accessing R packages, writing R functions, debugging, profiling R code, and organizing and commenting R code. Topics in statistical data analysis will provide working examples.

Unit-1:

This unit covers the basics to get you started up with R. The Background Materials lesson contains information about course mechanics and installation of R. This unit cover the history of R, go over the basic data types in R, and describe the functions for reading and writing data. Operator Introduction, Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Miscellaneous Operators.

Unit-2:

Welcome to unit 2 of R Programming. This unit, will take the gloves off, and the lectures cover key topics like control structures and functions. Will also introduce the first programming assignment for the course. Decision Making Introduction, if statement, if...else statement, switch statement, if...else Ladder, ifelse() function, Loop Introduction, for loop, while Loop, repeat Loop, Break Statement, Next Statement.

Unit-3:

We have now entered the third unit of R Programming, which also marks the halfway point. The lectures in this unit cover loop functions and the debugging tools in R. These aspects of R make R useful for both interactive work and writing longer code, and so they are commonly used in practice. Matrix Introduction, Matrix Construction, Addition & Subtraction, Multiplication

& Division.

Unit-4:

This unit covers how to simulate data in R, which serves as the basis for doing simulation studies. It also cover the profiler in R which lets you collect detailed information on how your R functions are running and to identify bottlenecks that can be addressed. Data Frame Introduction, Data Frame details, filtering and subletting data, Aggregate function.

Unit-5:

This unit covers the profiler which is a key tool in helping you optimize your programs. Finally, we cover the str function, which is the most useful function in R. Types of Input, CSV Files, Excel file, Reading and writing data, Graphical Procedures Introduction, plot function, Plot using base graphics, Plot using ggplot2.

References:

1. R in Action By - Robert I. Kabacoff, Latest Edition – Second, Formats Available - Paperback, Publisher - Dreamtech Press, Reading Level - Beginner/Intermediate.
2. R for Data Science, By - Hadley Wickham and Garrett Gorlemund, Latest Edition - First, Formats Available - Kindle and Paperback, Publisher - O'Reilly, Reading Level – Beginner.

Communication Skills

Course Objective:

1. To make the students aware of the importance of grammar and vocabulary in written and spoken communication which will lead to enhance interpersonal and social interaction.
2. To enable them to reflect and improve on their communicative behavior.
3. To train them to use language effectively to face interviews, group discussions and public speaking.

Prerequisite:

It is just assumed to have the basic knowledge of English language with an urge to develop it more effectively.

At Course Completion:

The student will be able to improve his writing and reading skills and will be having improved clarity of communication.

Course Outline

Unit-1:

Effective Communication:-Concept and meaning of communication, types of communication, attributes of effective communication, barriers to effective communication.

Tools of English: Spoken Vs. Written communication, Basic Grammar: parts of speech: Noun, Pronoun, Verb, Adjectives, Adverbs, prepositions, Conjunction and Interjection.

Unit-2:

Skill Enhancement:

Listening Skills: Understanding assignments to resolve problems and answer questions to understand the hidden meaning what people say.

Presentation Skills: Components of good presentation, group dynamics, speeches.

Fifteen principles to increase clarity of communication, effective speaking guidelines, pronunciation etiquettes.

Body language: Importance, concept, nine emotions displayed through body language, zones of intimacy and desirable/undesirable body language in professional institutes.

Unit-3:

Technical Communication:

Writing of memos, e-mail, letter writing, business letters, cover letters, social and goodwill letters, adjustment letters, bank and insurance letters, resumes, memos e-mail etiquettes, reports, basics of report writing, technical proposal and comprehension.

Unit-4:

Career Skills: Applying for job, interviews, types of interviews, group discussions, key steps to succeed in group discussion, resume profiling, strategy of resume writing, difference between a resume and curriculum vitae.

Unit-5:

Soft skills: Classification of soft skills, Communication and networking, Empathy (Understanding other person's view), Intrapersonal skills, Interpersonal skills, Negotiation skills.

Books:

- Effective Communication by Urmila Rai and S.M.Rai.

Reference Books:-

- 1) "Communication skills" by Meenakshi Raman and Sangeeta Sharma
- 2) "Technical Communication-Principles and Practice" by Meenakshi Raman and Sangeeta Sharma.
- 3) Personality Development and Soft Skills by Barun K. Mitra

Course Objective:

To provide the general basic flavor of MATLAB Environment to the students so that they can apply it for their specific domain.

Prerequisite:

Basic knowledge of any programming environment

At Course Completion:

Students can develop good GUI based application to solve their mathematical, statically or any data processing applications in MATLAB.

Course Outline

Unit-1:

Introduction: What is MATLAB? Advantages and Disadvantages, MATLAB Architecture, MATLAB System, Typical Uses of the MATLAB, Application Areas.

Starting with MATLAB: Introduction, Development Environment, MATLAB search path, Typing Commands, Variables and Numbers, Vectors and Matrices

Unit-2:

Data Types, Operators & Control Statements: Introduction, Data Types, Operator, Flow Control Statements.

M-file Programming: Introduction, Program Development, M-file programming, M-file Types, Function Arguments, Function Types, Function Handle, P-Code, MATLAB Expression and Regular Expression, Error Handling.

Unit-3:

Advanced capabilities in MATLAB: Introduction, Cell Array, Structure, Sparse Array

Mathematics: Introduction, Matrices, Linear Equation, Factorization, Eigenvalues, Polynomial, Interpolation, Data Analysis, Polynomial Regression, Fourier Approximation, Integration and Differentiation, Differential Equation.

Unit-4:

Graphics: Introduction, 2-D Plotting, Plot style option, How to edit plot, Basic Statistics of the Graph, The Plots Creating, Animation, Graphics Object Handling, 3-D visualization.

Graphical User Interface: Introduction, GUI layout tools, Dialog box, List Box, Accessing variables from workspace, GUI Components, Solved Example.

Unit-5:

Application Program Interface (API) or External Interfaces: Introduction, Import and Export Data, Low level File I/O Functions, Calling C-programs from MATLAB, Calling Java from MATLAB.

References:

1. www.mathworks.com (MATLAB Toolbox)
2. "Understanding MATLAB" by Shroff Publications, 2013, Authors: K V Kale, R R Manza, V T Humbe, P L Yannawar and G. R. Manza, Shroff Publications