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/
Date:- 30-11-2021.

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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.(Computer Science)

Faculty of Science and Technology

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

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

Department of Computer Science and Information Technology 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.

Masters programs for university Department and affiliated colleges in

1. M. Sc. Computer Science

Admission/ Promotion in M.Sc Computer Science Program

Program: M. Sc. Computer Science

Duration: (Four Semesters means Two Academic Years)

Eligibility: i) B.Sc. Computer Science OR B.Sc. IT OR B. Sc. Computer Application OR B.E/B. Tech. in Computer Science and Engineering/IT.OR ii). Any Science Graduate with at least one Optional Subject as Computer Science.

Program Outcomes: The overall objective of this course is to cater the need of computational field. The content of this course is according to the current trends of research in Computer Science and requirements of industry expectations. Some courses of this program are exclusively designed towards development of analytical, presentation and personality development skills among the students, through which the students get prepared and trend for building their carrier in computer science and its related applied technology, research and development. In line with Outcome based education the program specific outcomes for M.Sc Computer Science programs are as follows

- To be fundamentally strong at core subjects of computer science.
- An ability to apply programming and computational skills for industrial solutions.
- Realizes the importance of lifelong learning and continuous professional development.
- Broad understanding of latest technological trends.
- An ability to identify opportunities for establishing an enterprise for immediate Employment.
- Ability to understand and apply fundamental research concepts.
- An ability to use efficient soft skills for professional development.
- To be rational in professional ethics and attitude.
- Able to use current tools and technologies to cater multidisciplinary needs.
- An ability to indulge in lifelong learning for professional development.
- Ability to sustain in the areas of Data Science and Analytics.

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Fees

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. Computer Science course in the department/college will be done on the performance in the qualifying graduate level examination.

The student will apply on the application form of the University/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 one teaching period of one hour per week for 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.

Computer Science/ 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. However the Department can design the curriculum of more credits and it will be compulsory for the students of this Department to complete the credits accordingly

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 or fourth semesters in the department/college. Student should complete at least one service course.

(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 is specially designed to provide subject prerequisites / skills required by the student prior to learning of the defined course in curricula. According to the need of the student department/college may arrange/schedule a 15-hour bridge course at the beginning of Semester-I. The department/college should conduct an internal examination for the same. This evaluation will not be reflected in

their final credits. The syllabus for the bridge course should be designed by the department/college keeping in mind the students coming from diverse learning backgrounds/ UG courses.

(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 or affiliated college 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 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 shall decide the maximum number of students in each service course taking into account the teachers and Physical facilities available in the Department/affiliated colleges.

iv) The University / affiliated 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 intends 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.

Results Grievances Redressal Committee:

The grievances about the result of the students will be addressed by the Exam Section of the University.

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

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

iv) 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:

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

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:

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

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.

Curriculum Course Abstract of M.Sc. Computer Science (Core Course + Elective Course)

Semester-I	Semester-II	Semester-III	Semester-IV
		Programming Group	Industrial Internship / Field Work Projects
Introduction to Algorithms	Data Communication	Compiler Design	
Relational Databases Management Systems	Software Engineering	Computer Graphics	
Mathematical foundations and Statistical Methods	Elective 1	Elective 3	
Modern Operating System	Elective 2	Elective 4	

Bridge Course

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

Semester I

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC401	Constitution of India	2	-	20	30	50
CSC402	Research Methodology	2	-	10	40	50
CSC403	Programming 1	3	2	20	80	100
CSC404	Introduction to Algorithms	3	2	20	80	100
CSC405	Relational Databases Management Systems	3	2	20	80	100
CSC406	Mathematical foundations and Statistical methods	3	2	20	80	100
CSC407	Modern Operating System	3	2	20	80	100
		19	10			

Practical Code

CSC461 Practical based on CSC403,

CSC462 Practical based on CSC404,

CSC463 Practical based on CSC405

CSC464 Practical based on CSC406,

CSC465 Practical based on CSC407

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Semester II

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC408	Technical Report Writing	1	-	10	40	50
CSC409	Programming 2	3	2	20	80	100
CSC410	Data communication	3	2	20	80	100
CSC411	Software Engineering	3	2	20	80	100
CSC421 - 430	Elective 1	3	2	20	80	100
CSC431 - 440	Elective 2	3	2	20	80	100
		16	10			

Practical Code

CSC466 Practical based on CSC409,

CSC467 Practical based on CSC410,

CSC468 Practical based on CSC411

CSC426 - 430 Practical based on CSC421-425, CSC431-435

Practical based on CSC436-440

Semester III

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC412	Programming 3	3	2	20	80	100
CSC413	Compiler Design	3	2	20	80	100
CSC414	Computer Graphics	3	2	20	80	100
CSC441 - 450	Elective 3	3	2	20	80	100
CSC451 - 460	Elective 4	3	2	20	80	100
CSC415	Service Course/Audit Group	4	-	20	80	100
		19	10			

Practical Code

CSC470 Practical based on CSC412,

CSC471 Practical based on CSC413,

CSC472 Practical based on CSC414

CSC446 - 450 Practical based on CSC441-445,

CSC455-460 Practical based on CSC451-460

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

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			

Programming Group

Programming Group	Programming 1 (CSC403)	Programming 2 (CSC409)	Programming 3 (CSC412)
Java Group	Core Java	Advance Java	Android
Microsoft Group	Advanced C++	VB.NET	C# NET
Open Group	Python	Advanced Python	Open Web Programming

Elective Group

Elective Group	Elective 1 (CSC421-430)	Elective 2 (CSC431-440)	Elective 3 (CSC441-450)	Elective 4 (CSC451-460)
Pattern Analysis & Machine Intelligence	Image Processing	Artificial Intelligence	Pattern Recognition	Neural Networks & Deep Learning
Data Science	Data Mining	Machine Learning	Data Warehousing	Big Data Analytics
Remote Sensing and Geospatial Technology	Fundamental of Satellite Remote Sensing	GIS	Remote sensing digital image Analysis	Hyperspectral Image Analysis
Sensor Technology	Foundations of Electronics	Digital Signal Processing	Microcontroller Programming	Internet of Things

Service Course

Paper Code	Course Title	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

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SEMESTER – I

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC401	Constitution of India	2	-	20	30	50
CSC402	Research Methodology	2	-	10	40	50
CSC403	Programming 1	3	2	20	80	100
CSC404	Introduction to Algorithms	3	2	20	80	100
CSC405	Relational Databases Management Systems	3	2	20	80	100
CSC406	Mathematical foundations and Statistical methods	3	2	20	80	100
CSC407	Modern Operating System	3	2	20	80	100
		19	10			

Practical Code

CSC461 Practical based on CSC403,
CSC462 Practical based on CSC404,
CSC463 Practical based on CSC405
CSC464 Practical based on CSC406,
CSC465 Practical based on CSC407

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Detailed Syllabus of Courses

Course Code	CSC401	Course title	Constitution of India
Number of Credits	2	Internal / External	20/30
Total Contact Hours (Th)	2 Hrs/week	Total Contact Hours (Pr)	-

Prerequisites: 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 I: History of Making of the Indian Constitution: History & Drafting committee, (composition &Working)

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

Unit III: 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 IV: 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.
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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

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2. Research Methodology (Sem-I)

Course Code	**CSC402**	**Course title**	**Research Methodology**
Number of Credits	**2**	**Internal / External**	**10/40**
Total Contact Hours (Th)	**2 Hrs/week**	**Total Contact Hours (Pr)**	**-**

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

Course Objectives: following are the objectives of the course

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

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.

Course Outline:

Unit 1: Research Methodology: Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research. **Defining the research problem**: What is a Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem

Unit 2: Research Design: Meaning of Research Design, Need for Research Design, Features of a Good Design, Important Concepts Relating to Research Design, Dependent and Independent Variables, Extraneous Variable, Control, Confounded Relationship, Research Hypothesis, Experimental and Non-Experimental Hypothesis-Testing Research, Experimental and Control Groups, Treatments, Experiment, Experimental Unit(s), Different Research Designs, Research Design in Case of Exploratory Research Studies, Research Design in Case of Descriptive and Diagnostic Research Studies, Research Design in Case of Hypothesis-Testing Research, Basic Principles of Experimental Designs.

Unit 3: Design of Sample Surveys: Introduction, Sample Design, Sampling and Non-Sampling Errors, Sampling Errors, Non-sampling Errors, Sample Survey Vs. Census Survey, Types of Sampling Designs, Non-probability Sampling, Probability Sampling, Complex Random Sampling Designs, **Measurement and Scaling,** Quantitative and Qualitative Data, Classifications of Measurement Scales Goodness of Measurement Scales, Sources of Error in

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Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Techniques, Comparative Scaling Techniques, Non-comparative Scaling Techniques.

Unit 4: Data Collection: Introduction, Experiments and Surveys, Collection of Primary Data, Difference between Questionnaire and Schedule, Guidelines for Constructing Questionnaire/Schedule, Some Other Methods of Data Collection, Collection of Secondary Data, Selection of Appropriate Method for Data Collection, Case Study Method.

Unit 5: Data Preparation Process: Questionnaire Checking, Editing, Coding, Classification, Tabulation, Graphical Representation, Data Cleaning, Data Adjusting, Some Problems in Preparation Process, Missing Values and Outliers, Types of Analysis, Statistics in Research

Text Book:

1. Kothari C. R. & Garg Gaurav, (2019), Research Methodology Methods & Techniques (fourth Edition), New Age International Publishers, New Delhi.

Reference Books

1. Chawla Deepak &, Sondhi Neena, (2016), Research Methodology: Concepts and Cases (Second Edition), Vikas Publishing House, India.
2. Briony J. Oates., (2006), Researching Information Systems and Computing, SAGE Publications, New Delhi.

E-References:

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

Course Code	CSC403	Course title	Programming 1
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 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.

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 (Core Java)

Unit 1: Java Basics: Introduction to Java, Features & Properties, Program Structure, IDE platforms available for writing & Compiling java programs, Define the scope of variable, Define structure of Java Classes, executing java program from command line, Writing classes, declaring members and behaviors of class. Variable Scope. Working with Java Data types.

Unit 2: Working with Data Types : Declare and Initialize Java variables, Primitive Data types, Number Classes, Operators – classification of operators, type of operators, arithmetic, assignment, unary Operators, equality, relational, conditional operators, bitwise, bit shift operators, expressions, statements and blocks.

Creating and using arrays, vectors. Conditional and Looping Constructs – *if, if-else, switch, for, while, dowhile, foreach* and branching statements (*break, continue*). Creating and using packages.

Unit 3:Object Oriented Principals in java - **Encapsulation** – create methods with arguments and return values, including overloaded methods, use of static keyword to members and methods, **Polymorphism** - create overloaded methods, define constructor, default and user defined constructors, constructor overloading, inner classes, nested classes, passing information to method or constructor. **Inheritance** – Hiding methods, controlling access to members of class, method overriding, use of *super* and *this* keyword to access object and constructors, defining and using abstract class, abstract methods and interfaces, *final* and *finalize*.

Unit 4: Exception Handling – defining exception, exceptions and errors, advantages of exceptions, using try-catch block, nesting of try-catch, catching and handling exception, recognizing common exception and categories (such as NullPointerException, ArithmaticException, ArrayIndexOutofBoundsExceptions, ClassCastException), **Java Files I/O** – File operations, checking file or directory, performing operations (copy, delete, rename), managing metadata, walking with file tree, finding files, watching directory for changes.

Unit 5: Working with AWT – Applet, AWT class hierarchy, applet life cycle, Event and Listeners, Event Hierarchy, Listener Hierarchy. Working with all AWT components, Graphics – drawing and using fonts.

Web Resource https://docs.oracle.com/javase/tutorial/tutorialLearningPaths.html

Books:

1. Core Java, Vol I & II, Sun Press
2. Java 2 Complete Reference by Herbert Schildt, McGraw Hill Publications
3. Java How to Program by Dietal & Dietal
4. Java Certification Guide - Symon Roberts
5. Java Programming Language – James Gosling

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 **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 Schieldt

Practical's: 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 Books:

- 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)http://pythonbooks.revolunet.com/

Practical's: 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 Code	CSC404	Course title	Introduction to Algorithms
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisites

- Student should know the conventions and significance of writing algorithm, its contribution towards writing effective algorithms
- Student should be aware with algorithm testing mechanism
- Student should be able to write algorithms as well as exposed with foundation of data structures.

Course Objectives: the course objectives includes

- To offer current and comprehensive introduction to the study of computer algorithms
- Study and implement simple as well as complex data representation system
- Estimate the performance of algorithms for selection of best suitable structures.

Course Outline

Unit 1: Data structures: Elementary data structures – Stacks, Stacks and Recursion, Queues, Queue Types, , Linked List, Types of List, List Representations, Trees, Binary search Tree, Red black tree, Graphs, types of graphs, graph property & its representation using lists, Hash tables

Unit 2: Role of Algorithm in computing, Growth of function & Asymptotic notations, recurrences, recursion-tree method, random variables and randomized algorithms

Unit 3: Sorting and Order statistics: Heaps – maintaining, building heap, heap sort, priority queues, Quicksort – building quick sort, performance evaluation, analysis of quicksort, sorting in linear times – radix sort, bucket sort, lower bounds of sorting, order statistics – maximum and minimum, selection expected in linear time , selection expected in worst-case linear time.

Unit 4: Advance Design & Analysis Techniques – B-trees, Binomial heap, Fibonacci heap, Minimum spanning tree Dynamic Programming, greedy algorithms, amortized analysis,

Unit 5: Graph Algorithms: Elementary graph algorithms (BFS, DFS), Single source shortest path algorithm – Bellman Ford, Dijkstra algorithms, all pair shortest path – Shortest path & Matrix multiplication, Floyd - Warshall algorithm, Maximum Flow networks – ford Fulkerson algorithm, String matching algorithms

Reference Book:

1.Introduction to Algorithms by Thomas Corman, PHI publications

E-Books

1. Design & Analysis of computer Algorithms by Alfred Aho, John Hopcroft and Jeffery Ullman (Link)
2. Introduction to Algorithms by Thomas Corman et.al (Link)

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 Code	CSC405	Course title	Relational Database Management System
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisites: Student must have basic foundations of database management system, various databases tools and exposed with the mechanism of retrieving information from the databases.

Course Objectives

- Student will be able to understand the basic difference between databases and relational databases
- Student will be trained on using SQL queries for retrieving information from the databases. The student will pursue for comprehensive database certification program on the foundation of course
- Student will be provided mechanism for representation of database in to XML for data mining studies.

Course Contents:

Unit 1: Introduction to Databases, Relational Databases, and Data Models – Relational Data Models, Design of Relational Databases, Structured Query Language -

Unit 2: **SQL :** - Data Definition Language (DDL), Data Manipulation Language (DML), Data Control Language commands, working with database objects like vies, indexes, sequences, synonyms and data dictionary.

Unit 3: Data normalization: E-R Diagrams and their transformations, relational data design, normalizations – 1 NF, 2NF, 3 NF, BCNF and 4NF, Limitations of BCNF and 4NF.

Unit 4: **Object Based Databases and XML:** Complex Data types and Object Orientations, Structured data types and inheritance in SQL, Table Inheritance, Array and multi set types in SQL, Object Identity and reference types in SQL Implementing O-R features, Persistent Programming Language, Structure of XML Data, XML Document Schema, Querying and Transformation, Application Program Interface to XML, Storage of XML Data and XML Applications.

Unit 5: **Data Storage and Querying**: Storage and File structures, Indexing & Hashing, Query Processing and Query optimization, Transaction Management: Transaction, Concurrency control and Recovery systems **Reference Books**

1. Database System Concepts by Avi Silberschatz, Henry F Korth and S Sudarshan

Additional Reference: http://codex.cs.yale.edu/avi/db-book/db5/slide-dir/index.html

Practical's: 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..

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

6. Mathematical Foundation and Statistical Method (Sem-1)

Course Code	CSC406	Course title	Mathematical Foundation and Statistical Method
Number of Credits	3	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 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.

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.

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 ByKamala Krithivasan), DiscreteMathematicsAnd Its ApplicationsWith Combinatorics And Graph Theory, seventh edition, McGrawHillEducation. (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 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 Code	CSC407	Course title	Modern Operating System
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs/week	Total Contact Hours (Pr)	4 Hrs/Week

Prerequisites: student must possess fundamental skills of operating systems, computer organizations and threading programming.

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.

Learning 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.

Course Outline

UNIT -I: 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, page replacement strategies: FIFO, LRU (and approximations), NRU, LFU/MFU, MRU, cache Management: Allocation and de-allocation techniques, coherence technique,

UNIT -II: 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 -III: 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, Amdhal'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 -IV: 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 - V: 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, 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.

Text Book

- Operating Systems Concepts, 8th edition, Abraham Silberschatz, Peter Baer Galvin, Greg Gagne; Wiley, ISBN 0-470-12872-0,2010. **Reference books**
- Operating Systems: Internals and Design Principles, 6th edition, William Stallings; Prentice Hall, ISBN-10: 0136006329, Operating Systems, 3rd edition
- Modern Operating Systems, Andrew S. Tanenbaum; Prentice Hall, ISBN-10: 0-13-600663-9, 2008, 3rd edition.
- Using OpenMP,Portable Shared Memory Parallel Programming ,Barbara Chapman, Gabriele Jost and Ruud van der Pas, MIT Press,ISBN: 9780262533027 ,2007

Web/E- References:

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

Practical's: 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..

SEMESTER - II

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC408	Technical Report Writing	1	-	10	40	50
CSC409	Programming 2	3	2	20	80	100
CSC410	Data communication	3	2	20	80	100
CSC411	Software Engineering	3	2	20	80	100
CSC421 - 430	Elective 1	3	2	20	80	100
CSC431 - 440	Elective 2	3	2	20	80	100
		16	10			

Practical Code

CSC466 Practical based on CSC409,

CSC467 Practical based on CSC410,

CSC468 Practical based on CSC411

CSC426 - 430 Practical based on CSC421-425,

CSC431-435 Practical based on CSC436-440

Detailed Course Contents

Course Code	CSC408	Course title	Technical Report Writing
Number of Credits	1	Internal / External	10/40
Total Contact Hours (Th)	1 Hrs/week	Total Contact Hours (Pr)	-

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.

Contents

Unit-I: 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-II: 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-III: 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.

Field Work The Nature of Field Work, Selection and Training of Investigators, Sampling Frame and Sample Selection, Field Operation, Field Administration.

Unit-IV: 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-V: Case study formats of research proposal writing.

References:

- BrionyJ.Oates., (2006), Researching Information Systems and Computing, SAGE Publications, New Delhi.
- Kothari C.R., (2004), Research Methodology Methods & Techniques, New Age International Publishers, New Delhi.
- Bajpai S. R., (1975), Methods of Social Survey and Research, Kitabghar, Kanpur.
- Bhattacharya D. K., (2004), Research Methodology, New Delhi, Excel Books.
- Brymann Alan and Carmer D., (1995), Qualitative data analysis for social / scientist, New York, Routledge publication.
- 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.
- Chandera A. and Saxena T. P., (2000), Style Manual, New Delhi, Metropolitan Book Comp. Ltd.
- Krishnaswami O. R., (1988), Methodology of Research in Social Science, Himalaya pub House.
- Kothari, C. R., (2005), Quantitative Technique, New Delhi, Vikas publication House.
- Gautam N. C., (2004), Development of Research tools, New Delhi, Shree Publishers.
- Gupta, Santosh, (2005) Research Methodology and statistical Techniques, Deep and Deep publications.

Shukla J. J., (1999) Theories of Knowledge, Ahmadabad, Karnavati Publication **E-References:**

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

Course Code	CSC409	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.

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 Book:

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-Books:

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 Books:

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

E-books: -

- Python Threading:
  - http://www.tutorialspoint.com/python/python_multithreading.htm
  - http://pymotw.com/2/threading/
  - http://www.python-course.eu/threads.php
- GUI:
  - https://wiki.python.org/moin/TkInter
  - https://wiki.python.org/jython/LearningJython
  - http://www.tutorialspoint.com/python/python_gui_programming.htm
- Database:
  - Python MySQL API https://wiki.python.org/moin/DatabaseInterfaces
  - http://www.tutorialspoint.com/python/python_database_access.htm
- Web Framework: http://webpy.org/docs/0.3/tutorial
- Python webSocket:
  - http://www.tutorialspoint.com/python/python_networking.htm
  - https://docs.python.org/2/howto/sockets.html
  - https://docs.python.org/3.0/library/socket.html
  - http://www.diveintopython.net/http_web_services/index.html
- FLASK framework, http://www.fullstackpython.com/flask.html

Course Code	CSC410	Course title	Data Communication
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Prerequisites

- Student should have fundamental knowledge of operating system concepts, simple data communication principal, types of data communication.

Objectives

- To provide an introduction to the range of topics in data communication and networking, protocols, and protocol suites.
- Concerned with exchange of data between directly connected devices, aspects of transmission, interfacing, link control, multiplexing.
- To Explore architectural principals and mechanism required for exchange of data among computers, workstations, servers and data processing devices.

Course Contents

Unit 1: Overview

Data communications, components, data representations, data flows. Networks: Distributed processing, network criteria, physical structures, network models, interconnection of networks. Protocol and standards: Protocol, standards, standard organization, internet standards.

Unit 2

Layered tasks: sender, receiver, carrier and hierarchy. Models: OSI, Layer in OSI Model, TCP/IP protocol suite, addressing. Data and Signals: Analog and Digital Signal, Periodic analog signal, Digital Signal, Data rate limits, performance: bandwidth, throughputs, latency (delay), bandwidth-delay, Jitter. *Digital Transmission*: digital to digital conversion - Line coding scheme, block coding, analog-to-digital conversion – pulse code modulation, delta modulation. Transmission mode – parallel and serial transmission. *Analog Transmission*: digital to analog conversion – amplitude shift keying, frequency shift keying, phase shift keying. Analog to analog conversion – Amplitude modulation, frequency modulation, phase modulation,

Unit 3

Transmission media: guided media – twisted pair, coaxial cable, fiber optic cable, un-guided media – radio waves, microwaves, infrared. Switching – circuit switched networks, datagram networks, virtual circuit networks. Error detection and correction: type of errors, redundancy, detection versus correction, forward error correction versus retransmission. Block coding, linear block coding, cyclic codes, checksum. Data link controls – framing, flow and error control, protocols – noisy channel, HDLC, point-to-point protocol. Random Access – ALOHA, CSMA, CSMA/CD, CSMA/CA, Controlled Access – reservation, polling, token passing. Channelization – FDMA, TDMA, CDMA

Unit 4

Network Layer : Logical addressing, IPV4 Addressing, IPV6 Addressing, Internet Protocol – transition from IPv4, IPv6, Address mapping, Error reporting and multicasting – ICMP, IGMP, ICMPv6. Delivery Forwarding and routing – delivery, forwarding, Unicast routing protocol, multicast routing protocol. Transport Layer – Process to process delivery, User datagram protocol, Congestion control and quality of service – open and closed loop congestion.

Unit 5

Application layer – Domain Name system - Name space, domain name space, Distribution of name space, DNS messages, types of records, Remote login, Electronic mail and File transfer protocol – Telnet, Email Architecture – agents, SMTP, POP and IMAP. WWW and HTTP – architecture, web documents. Security in the internet – IPSec, SSL/TLS, PGP, VPN and Firewalls.

Text Books

- Data Communication and networking by Behrouz A Forouzan, McGrawHill Publications
  Data and Computer Communications by William Stallings, LPE Publications.

Practical's:

Students are required to implement programs for data transmission (Chat) applications using socket programming, file transfer application, error detection and correction

Course Code	CSC411	Course title	Software Engineering
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 must possess good knowledge of writing good programs, algorithms, processes etc.
- Student must have good skills towards requirement gathering and process identifications
  - Student must have good skills for defining process flows and process interactions

Course outcome:

- Student be able to analyze processing, draw actor interactions and optimization processes
  - Student decides process models, ensure proper software testing, versioning of software Student able to identify the cost of designed software products and services etc. Course contents

Unit 1:

Product Metrics: Software Quality, Framework for product metrics, metrics for analysis model, metrics for design model, metrics for source code, metrics for testing, metrics for maintenance

Unit 2:

Web Engineering: Engineering Layers, Engineering Process, Formulating web based systems, Planning, Team, Project Management, Metrics for Web Engineering and WebApps, Analysis model for WebApps, Content Model, Interaction Model, Functional model, Configuration model, Navigation analysis, WebApp Design and Testing. Cleanroom software engineering: Clean Room approach, functional specification, Cleanroom design, Cleanroom testing

Component based Development: The CBSE Process, Domain engineering, Component based development, Classifying and Retrieving

Unit 3: Components, Economics of CBSE Formal Methods: Basics, Mathematics in Software Development, mathematical preliminaries, applying mathematical notations for formal specification, Object Constraint language, Formal Specification: Formal Specification in the Software process, Sub-system interface specification, Behavioral Specification

Unit 4: Agile Development: Agile practices, extreme programming, planning, testing, refactoring, Agile design basics. Software process models and metrics for evolving technologies

Unit 5: Design patterns: introduction to design patterns, behavioral design patterns, Working with design pattern and anti-patterns

Text and Reference Book

- Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India.
- Pankaj Jalote, An integrated approach to Software Engineering, Springer/Narosa.
- Roger S. Pressman, Software Engineering: A practitioner's approach, McGraw Hill.
- Ian Sommerville, Software Engineering, Addison-Wesley.

- Heineman, G.T., and Councill, W.T., "Component-Based Software Engineering: Putting the Pieces Together", Pearson Higher Education/Addison Wesley
- Pressman, R. S. and Lowe, D., "Web Engineering: A Practitioner's Approach", Special Indian Edition, Tata McGraw-Hill.
- Martin, R.C., Agile Software Development: Principles, Patterns, and Practics, Pearson Education Publisher.

Practical's: Student is required to complete mini-project implementing the learning objectives of the course through one mini projects.

Course Code	CSC421-430	Course title	Elective -1
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Course Prerequisite

- Student must have fundamental knowledge data representation, data structure, and open source programming skills using pythons.
- Student must have good foundations of numerical methods, discrete mathematical structures and basic statistical functions.

Course Objective:

- The course offers excellent learning opportunity for the student select research verticals ranging from Pattern analysis and machine intelligence, Data Science, Remote Sensing and Geospatial technology and sensor technology.
- Student should get expertise in the area of elective – 1
- Student will be able to apply the concepts for implementation of concepts for innovative products.

A)Course Outline : CSC 421 - Image Processing

Unit 1: Introduction, Fundamentals, Digital Image Representation, Image Types, Converting between Classes, Array Indexing.

Unit 2: Intensity Transformations and Spatial Filtering, Intensity Transformation Functions, Histogram Processing and Function Plotting, Spatial Filtering, Using Fuzzy Techniques for Intensity Transformations and Spatial Filtering.

Unit 3: Filtering in the Frequency Domain, The 2-D Discrete Fourier Transform, Obtaining Frequency Domain Filters from Spatial Filters, Generating Filters Directly in the Frequency Domain, Highpass (Sharpening) Frequency Domain Filters, Selective Filtering.

Unit 4: Image Restoration and Reconstruction, A Model of the Image Degradation/Restoration Process, Noise Models, Restoration in the Presence of Noise Only—Spatial Filtering, Periodic Noise Reduction Using Frequency Domain Filtering, Modeling the Degradation Function, Direct Inverse Filtering, Wiener Filtering, Constrained Least Squares (Regularized) Filtering, Iterative Nonlinear Restoration Using the LucyRichardson Algorithm, Blind Deconvolution, Image Reconstruction from Projections.

Unit 5: Geometric Transformations and Image Registration, Transforming Points, Affine Transformations, Projective Transformations, Applying Geometric Transformations to Images, Image Coordinate Systems, Image Interpolation, Image Registration.

References:

- Digital Image Processing Using MATLAB®, Second Edition, Rafael C. Gonzalez, Richard E. Woods, Steven

L. Eddins, The MathWorks, Inc. ISBN number 9780982085400, Publisher: Gatesmark Publishing, 2009.

Web Link:

http://imageprocessingplace.com/DIPUM-2E/dipum2e_main_page.htm

Practical: Students are required to implement at least two practical on each unit. Similarly, students are required to complete small mini project on Image Processing and application covering all units.

B)Course Outline: CSC 422 - Data Mining

Unit-1: Introduction to Data Mining, Related technologies - Machine Learning, DBMS, OLAP, Statistics, Data Mining Goals, Stages of the Data Mining Process, Data Mining Techniques, Knowledge Representation Methods, Applications, Example: weather data.

Unit-2: Data Warehouse and OLAP, Data Warehouse and DBMS, Multidimensional data model, OLAP operations, Example: loan data set, Data preprocessing, Data cleaning, Data transformation, Data reduction, Discretization and generating concept hierarchies, Installing Weka 3 Data Mining System, Experiments with Weka - filters, discretization

Unit-3: Data mining knowledge representation, Task relevant data, Background knowledge, Interestingness measures, Representing input data and output knowledge, Visualization techniques, Experiments with Weka – visualization.

Unit-4: Attribute-oriented analysis, Attribute generalization, Attribute relevance, Class comparison, Statistical measures, Experiments with Weka - using filters and statistics

Unit-5: Data mining algorithms: Association rules, Motivation and terminology, Example: mining weather data, Basic idea: item sets, Generating item sets and rules efficiently, Correlation analysis, Experiments with Weka - mining association rules.

Textbook / Reference Book:

- Han, J. and Kamber, M., Data Mining: Concepts and Techniques, 2nd Edition, Morgan Kaufmann, 2006

Other Materials:

- P. Tan, M. Steinbach and V. Kumar, Introduction to Data Mining, Addison Wesley, 2006.
- Related papers from various conferences and journals will be provided by the instructor.

Web Link:

- http://academic.csuohio.edu/fuy/EEC%20525/syllabus.html
- http://academic.csuohio.edu/fuy/ECE 525
- http://www.cs.ccsu.edu/~markov/ccsu_courses/580Syllabus.html
- http://academic.csuohio.edu/fuy/EEC%20525/syllabus.html

C)Course Outline : CSC423 Fundamentals of Satellite Remote Sensing

Unit 1 Introduction:

Definition and Objectives, Historical Background, International Space Law, Advantages of Space Based Observations, Sources of Information on Remote Sensing. Fundamentals of Remote Sensing Signals, the Electromagnetic Spectrum, Terms and Units of Measurement, Electromagnetic Radiation Laws, Atmospheric Interactions.

Unit 2 Sensors and Remote Sensing Satellites:

Types of Sensors, Resolutions of a Sensor System, Passive Sensors, Active Sensors, Satellite Remote Sensing Missions.

Unit 3 Basics for Interpretation of Remote Sensing Images:

Constraints in Using Remote Sensing Data, Types of Interpretation, Interpretation Phase.

Unit 4 Visual Interpretation:

Characteristics of Photographic Images, Feature Identification, Criteria for Visual Interpretation, Elements of Visual Analysis.

Unit 5 Remote Sensing Image Enhancements and Corrections:

Structure of Digital Image, Media and Data Organization, Digital Image Processing Equipment, Visual Enhancements, Image Corrections.

Practical:

Demonstration, Illustration and implementation of various algorithms for remotely sensed data through ENVI/ Erdas / Open-Source Technologies. : Unit I to Unit IV

Reference Material:

- Fundamentals of Satellite Remote Sensing, Emilio Chuvieco, and Alfredo Huete.
- Remote sensing models & methods for image processing, third edition, Robert's A. Schowengerdt.

Online Resources:

- http://www.nrsc.co.uk/
- http://earthobservatory.nasa.gov/Library/RemoteSensing/
- http://noaasis.noaa.gov/NOAASIS/ml/education.html
- http://www.colorado.edu/geography/gcraft/notes/remote/remote_f.html
- http://www.crisp.nus.edu.sg/~research/tutorial/rsmain.htm
- http://www.nrcan.gc.ca/node/9309

D)Course Outline : CSC 424 - Foundation of Electronics

Unit 1

Introduction to Electronics: Signals, frequency Spectrum of Signals, Analog and Digital Signals, Linear Wave

Shaping Circuits: RC LPF, Integrator, RC HPF, Differentiator. Properties of Semiconductors: Intrinsic, Extrinsic Semiconductors, Current Flow in Semiconductors, Diodes: p-n junction theory, Current-Voltage characteristics, Analysis of Diode circuits, Rectifiers, Clippers, Clampers, Special diodes

Unit 2

Bipolar junction Transistor (BJTs): Physical Structures & Modes of Operation, Transistor Characteristics, DC analysis, Introduction to Small Signal Analysis, Transistor as an amplifier, The RC coupled amplifier, Introduction to Power Amplifiers, Transistor as switch.

Unit 3

Field Effect Transistors (FETs): Physical Structures & Modes of Operation of MOSFETs, MOSFET Characteristics, DC Analysis. Feedback Amplifiers & Oscillators: General Principles, Different types of feedback amplifier (block diagram only), Properties of Negative Feedback, Barkhausen criteria for Oscillation. Operational Amplifiers (OP-Amps): Ideal OP-AMP, Inverting Amplifier, Non-Inverting Amplifier. Adder, Subtractor, Integrator, Differentiator.

Unit 4

Digital Fundamentals: Binary Numbers, Signed-binary numbers, Decimal-to-Binary & Binary-toDecimal Conversion, Binary Addition, Subtraction, Multiplication and Division, Hexadecimal Number Systems, Logic Gates, Boolean Algebra, De Morgan's Theorems, Laws of Boolean Algebra, Basics of Flip flops, Shift Resistors, Counters.

Unit 5

Introduction to Electronic Instruments: CRO, Multimeter, Signal Generators. Principles of Communication: Fundamentals of AM & FM, Transmitters & Receivers

TEXT BOOKS:

- Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press.
- Electronics Fundamentals and Applications, D Chattopadhyay and P.C. Rakshit, NewAge International Publications.

REFERENCE BOOKS:

- Integrated Electronics, Millman and Halkias, Mc.Graw Hill Publications.
- Electronic Devices & Circuit Theory, R.L Boylestad and L. Nashelsky, Pearson Education

Course Code	CSC431-440	Course title	Elective -2
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3 Hrs /week	Total Contact Hours (Pr)	4 Hrs / Week

Course Prerequisite

- Student must have fundamental knowledge required for understanding of the subject such as data representation mechanism, writing algorithms, assessment of complexities, mathematical and statistical foundations.

Course Objective:

- The course offers excellent learning opportunity for the student select research verticals ranging from Pattern analysis and machine intelligence, Data Science, Remote Sensing and Geospatial technology and sensor technology.
- Student should get expertise in the area of elective – 1
- Student will be able to apply the concepts for implementation of concepts for innovative tools and products.

A)Course Outline : CSC431 – Artificial Intelligence

Prerequisite

To be admitted you must have knowledge of Computing Science/ Cognitive Science, basic programming, Data Structures and Algorithms, Application Programming in Python

Unit 1: Introduction: What Is AI, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art, **Intelligent Agents**: Agents and Environments, Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

Unit 2: Problem-solving: Solving Problems by Searching: Problem-Solving Agents, Example Problems, searching for Solutions, Uninformed Search Strategies, informed (Heuristic) Search Strategies, Heuristic Functions.

Unit 3: Knowledge, reasoning, and planning: Logical Agents, Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic.

Unit 4: Classical Planning: Definition of Classical Planning, Algorithms for Planning as State-Space Search, Planning Graphs, Other Classical Planning Approaches, Analysis of Planning Approaches.

Unit 5: Learning:Learning from Examples: Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, The Theory of Learning, Regression and Classification with Linear Models.

Text Book

1. Artificial Intelligence: a modern approach, S. Russell and P. Norvig, Third Edition, Prentice Hall, ISBN0-13-080302-2

Web Links:

1. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-034-artificial-intelligence-fall-2010/syllabus/

3. http://web-ext.u-aizu.ac.jp/~qf-zhao/TEACHING/AI/AI.html

Expected learning outcomes

After having completed the course the student will be able to: - give an overview of the field of artificial intelligence, its background, history, fundamental issues, challenges and main directions - interpret and formulate knowledge representations in the form of logic expressions - explain basic concepts, methods and theories for search - account for classical planning of proactive agents - describe methods and theories for reactive agents, architectures based on subsumption, and potential fields - describe the physical structure of robots - account for different degrees of autonomy of robots - explain concepts, methods and theories of embodied cognition and situatedness - explain basic concepts, methods and theories of sensing - explain basic concepts, methods and theories of neural networks and learning - explain basic concepts, methods and theories of artificial evolution, genetic algorithms, multiple autonomous agents and swarm intelligence - demonstrate the ability to apply a given subset of the theories, methods and principles discussed during the course.

B)Course Outline : CSC432 - Machine Learning

Unit 1: Algorithmic models of learning - Learning classifiers, functions, relations, grammars, probabilistic models, value functions, behaviors and programs from experience. Bayesian, maximum a posteriori, and minimum description length frameworks.

Unit 2: Parameter estimation : sufficient statistics, decision trees, neural networks, support vector machines, Bayesian networks, bag of words classifiers, N-gram models; Markov Chains and Hidden Markov models, probabilistic relational models, association rules, nearest neighbor classifiers, locally weighted regression, ensemble classifiers.

Unit 3: Computational learning theory, mistake bound analysis, sample complexity analysis, VC dimension, Occam learning, accuracy and confidence boosting. Dimensionality reduction, feature selection and visualization.

Unit 4: Data Visualization and Reinforcement learning: Clustering, mixture models, k-means clustering, hierarchical clustering, distributional clustering. Reinforcement learning; Learning from heterogeneous, distributed, data and knowledge.

Unit 5: Selected applications - data mining, automated knowledge acquisition, pattern recognition, program synthesis, text and language processing, internet-based information systems, human-computer interaction, semantic web, and bioinformatics and computational biology.

Text Book

- Pattern Recognition and Machine Learning. By Bishop, C. (2006). Berlin: Springer-Verlag,
  - Pattern Classification by Duda, R., Hart, P., and Stork, D. (2001). New York: Wiley.
- The elements of Statistical Learning - Data Mining, Inference, and Prediction. Berlin: Hastie, T., Tibshirani, R., and Friedman, J. (2001). Springer-Verlag

Online Web Reference

http://web.cs.iastate.edu/~cs573x/syllabus.html

Study Guide http://web.cs.iastate.edu/~cs573x/studyguide.html

C)Course Outline : CSC433 – GIS

Unit 1 Introduction to Geospatial Technology:

Introduction, Components of Geo-spatial Technology, Global positioning system, Coordinate system, Projection, Geo-Relational Vector Data model, Object based vector Data model, Raster Data model.

Unit 2 Data Models:

Non- Spatial Data Models, Database concepts, Spatial Data Models Data formats and structures

Unit 3 Data input, transformation, editing & Cartography:

Data input, Geometric transformation, Spatial Data Editing Attribute Data input & Management, surveying & mapping, Data display & Cartography.

Unit 4 Data Exploration & Analysis:

Data Exploration, Vector Data Analysis, Raster Data Analysis, Terrain Mapping & analysis, DEM, TIN.

Unit 5 Spatial interpolation, Geocoding & Modelling:

Spatial interpolation, Geocoding & Dynamic segmentation, Path analysis & Network Application, GIS model & modelling.

Practical:

Illustration of open source technology and demonstration of Geospatial Data through GIS for all units Implementation of the algorithms in open source technology

Reference Material:

Text Books:

- Chang, K. T. (2015). Introduction to geographic information systems. McGraw-Hill Science/Engineering/Math.
- An Introduction to Geographic Information Technology, Sujit Choudhary, Deepankar Chakrabarty, Suchandra Choudhary, IK international.
- An introduction to geographical information systems, Ian Heywood, Sarah Cornelius, Steve Carver

Web Resources:

- http://www.gis.com/whatisgis/index.html
- http://www.gis.nic.in
- http://www.esriindia.com
- http://www.qgis.org
- http://www.exelisvis.com/ProductsServices/ENVI.aspx
- http://rst.gsfc.nasa.gov/start.html
- http://www.isro.org
- http://www.usgs.gov

D)Course Outline : CSC440 - Digital Signal Processing

Unit 1: Introduction Discrete-time signals and systems -Discrete-time signals as sequences, Properties of discrete-time systems, linear time-invariant systems, Difference equations, Frequency domain and Fourier transforms

Unit 2 Sampling continuous-time signals, Frequency domain representation of sampling, Reconstruction, Multirate signal processing, A/D and D/A conversion z-Transforms

Unit 3 Transforms Basics - Definition of the z-transform, Convergence, Inverse z-transform, Properties, Transform analysis of LTI systems, Frequency response, System functions, Analysis of magnitude and phase Structure for d-t systems

Unit 4 Fourier Transform, Discrete Fourier Transform, Fast Fourier Transform, Discrete cosine transform

Unit 5 Structures for FIR and IIR filters, Quantization and noise Filter design, IIR systems FIR windowing methods FIR optimal approximation methods, Discrete Fourier Transforms

Text Book:

Oppenheim, Schafer and Buck, Discrete-Time Signal Processing, 2nd ed., Prentice Hall, 1999

Recommended: Ingle and Proakis, Digital Signal Processing using Matlab, 2nd ed., Thomson-Engineering, 2006

DSP web sites:

- DSP tutorial with Java applets: http://www.dsptutor.freeuk.com
- Frequently asked questions: http://www.bdti.com/faq/
- DSP Guru: http://www.dspguru.com/
- http://www.redcedar.com/learndsp.htm **Sampling:**
- http://ptolemy.eecs.berkeley.edu/eecs20/week13/

Aliasing:

- http://ptolemy.eecs.berkeley.edu/eecs20/week13/aliasing.html
- http://ptolemy.eecs.berkeley.edu/eecs20/week13/moire.html
- http://cnx.rice.edu/content/m10793/latest/
- http://www.physlink.com/Education/AskExperts/ae490.cfm
- http://www.telacommunications.com/nutshell/pixelation.htm
- http://www.earlevel.com/Digital%20Audio/Aliasing.html **Z-transform:**
- http://mathworld.wolfram.com/Z-Transform.html
- http://www-ccrma.stanford.edu/~jos/filters/Z_Transform.html
- http://dspcan.homestead.com/files/idxpages.htm

FIR filters

- Introduction: http://www.dsptutor.freeuk.com/dfilt1.htm
- http://www-ccrma.stanford.edu/~jos/filters/filters.html
- DSP & speech: http://mi.eng.cam.ac.uk/~ajr/SA95/SpeechAnalysis.html
- Linear filters : http://mi.eng.cam.ac.uk/~ajr/SA95/node12.html
- http://www.filter-solutions.com/FIR.html

Analog SP

- http://cnyack.homestead.com/files/idxpages.htm

Semester III

Paper Code	Course	Total Theory Credits	Total Practical Credits	Internal	External	Total
CSC412	Programming 3	3	2	20	80	100
CSC413	Compiler Design	3	2	20	80	100
CSC414	Computer Graphics	3	2	20	80	100
CSC441 - 450	Elective 3	3	2	20	80	100
CSC451 - 460	Elective 4	3	2	20	80	100
CSC415	Service Course/Audit Group	4	-	20	80	100
		19	10			

Practical Code

CSC470 Practical based on CSC412,

CSC471 Practical based on CSC413, CSC472 Practical based on CSC414 CSC446 - 450 Practical based on CSC441-445, CSC455-460 Practical based on CSC451-460

Detailed Syllabus of Courses under Semester III

Course Code	CSC412	Course title	Programming 3
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3Hrs/week	Total Contact Hours (Pr)	-

Prerequisite: The student (s) should holds good skills on functional programming concepts, fundamental object oriented concepts. Student(s) should select either group prior so that there are of expertise nurtured by the department by providing them training on the selected platform. The effort were taken towards providing horizontal specialization/technical skill in the programming group offered to the student in the semester I. It is advised to student to select the specialized learning path of the group selected in semester I for semester II and semester III also.

Objective: the objective of this paper is to

- Provide student an opportunity to learn and develop basic skills required in writing programs in advanced framework.
- 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 3 will help student to learn advance technology and apply this technology for building useful applications.
- Student will be able to write programs for generating solutions.

Course Outline

A)Android

Unit 1: Introduction: Introduction to Android, Setting up development environment, Dalvik Virtual Machine

& .apk file extension, Fundamentals- Basic Building blocks - Activities, Services, Broadcast Receivers & Content providers, UI Components - Views & notifications, Components for communication -Intents &

29/11/21

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

Intent, Filters, Android API levels (versions & version names), Application Structure - AndroidManifest.xml,

Uses-permission & uses-sdk Resources & R.java, Assets, Layouts & Drawable Resources, Activities and Activity lifecycle, First sample Application

Unit 2: Android Virtual Device: Emulators, Launching emulator, Editing emulator settings, Emulator shortcuts, Logcat usage, Introduction to DDMS, Hello World App, Creating your first project, The manifest file, Layout resource, Running your app on Emulator, Second App:- (switching between activities) Develop an app for demonstrating the communication between Intents. Form widgets, Text Fields, Layouts, [dip, dp, sip, sp] versus px, Preferences - Shared Preferences, Preferences from xml, Examples, Menu - Option menu, Context menu, Sub menu, menu from xml, menu via code.

Unit 3: Intents and UI Designs: Explicit Intents and Implicit intents, Time and Date, Images and media, Composite, Alert Dialogs & Toast, Popup, Tabs & Tab Activity, Styles & Themes, styles.xml, drawable resources for shapes, gradients (selectors), style attribute in layout file, Applying themes via code and manifest file. Adapter and Widgets: - Adapters - ArrayAdapters & BaseAdapters, ListView and ListActivity, Custom listview, GridView using adapters, Gallery using adapters. Notifications - Broadcast Receivers, Services and notifications, Toast, Alarms.

Unit 4: Custom Components, Threads & Services – Custom tabs, custom animated popup panel, other components, Threads - Threads running on UI thread (runOnUiThread), Worker thread, Handlers & Runnable, AsynTask (in detail), Services - Overview of services in Android, Implementing a Service, Service lifecycle, Inter Process Communication (AIDL Services), Location based services and Maps - Using Location Based Services, Finding current location and listening for changes in location, Proximity alerts, Working with Google Maps, Showing google map in an Activity, Map Overlays, Itemized overlays, Geocoder, Displaying route on map.

Unit 5: Content Providers - SQLite Programming, SQLiteOpenHelper, SQLiteDatabse, Cursor, Reading and updating Contacts, Reading bookmarks. Sensors – basics, Using Orientation and Accelerometer sensors, Best practices for performance, Telephony Services - Making calls, Monitoring data connectivity and activity, Accessing phone properties and status, Controlling the phone, Sending messages. Camera - Taking pictures, Media Recorder, Rendering previews. Bluetooth - Controlling local Bluetooth device, Discovering and bonding with Bluetooth devices, Managing Bluetooth connections, communicating with Bluetooth.

Books

- Professional Android 2 Application Development by Reto Meier, WROX Programmar to Programmar series
- Android Programing for Beginners, John Horton, PACKT open source publications Android Programing The Big Nerd Rench Guide, 3rd Edition.

References:

- https://developer.android.com/
- Documentation https://developer.android.com/docs/
- Samples https://developer.android.com/samples/

B)C#. NET

Unit 1: DOTNET Framework: Introduction to DOTNET, DOT NET class framework, Common Language Runtime – Overview, Elements of .NET application, Memory Management, Garbage Collector : Faster

Memory allocation, Optimizations, Common Language Integration, Common type system, Reflection API, User and Program Interface

Unit 2: Introduction to C#: Language features, Variables and Expressions, type conversion, Flow Control, Functions, Delegates, Debugging and error handling, exception handling (System Defined and User Defined), Object Oriented Concepts, Defining classes, class members, Interfaces, properties, . Access modifiers, Implementation of class, interface and properties, Concept of hiding base class methods, Overriding, Event Handling, Collections, Comparisons and Conversions, Defining and using collections, Indexers, iterators. Type comparison, Value Comparison. Overloading Conversion operators, as operator. Generics- Using generics, Defining Generics, generic Interfaces, Generic methods, Generic Delegate, Arrays – Single Dimensional, Multi Dimensional, Jagged Array, Implicitly typed Array

Unit 3: Window Programming: Window Controls, Common Controls, Container Controls, Menus and Toolbars, Printing, Dialogs, Deploying Window Application - Deployment Overview, Visual studio setup and Deployment project types, Microsoft windows installer architecture, Building the project : Installation

Unit 4: Database Programming using C#: Data Access, File System Data, XML, Databases and ADO.NET - Data Binding, Web Programming, Basic Web programming, Advanced Web programming, Web Services, Deployment Web applications,

Unit 5: NET Assemblies – Components, NET Assembly features, Structure of Assemblies, Calling assemblies, private and shared assemblies, Networking - Networking overview, Networking programming options, Webclient, WebRequest and WebResponse, TcpListener &TcpClient, Introduction to GDI+ - Overview of Graphical Drawing, Pen Class, Brush Class, Font Class, Using Images, Clipping, Drawing2D, Imaging.

Books

- Beginning Visual C#, Wrox Publication
- Professional Visual C#, Wrox Publication
- Inside C#, by Tom Archer ISBN: 0735612889 Microsoft Press Â© 2001, 403 pages

Web References

- https://docs.microsoft.com/en-us/dotnet/csharp/programming-guide/
- C# Guide https://docs.microsoft.com/en-us/dotnet/csharp/
- Web Application C# https://msdn.microsoft.com/en-IN/library/dd492132.aspx

C)Open Web Programming

Unit 1: Introduction to Web Programming: Introduction, Creating a Website, Web Page Example ,HTML Tags, Structural Elements, title Element, meta Element, HTML Attributes, body Elements: hr, p, br, div, Cascading Style Sheets Preview, History of HTML, HTML Governing Bodies, Differences Between Old HTML and HTML, How to Check Your HTML Code, Case Study: History of Electric Power.

Unit 2:Coding Standards, Block Elements, Text Elements, and Character References, Introduction, HTML Coding Conventions, Comments, HTML Elements Should Describe Web Page Content Accurately, Content Model Categories, Block Elements, blockquote Element, Whitespace Collapsing, pre Element, Phrasing Elements, Editing Elements, q and cite Elements, dfn, abbr, and time Elements, Code-Related Elements, br and wbr Elements, sub, sup , s , mark , and small Elements, strong, em, b, u, and i

Elements, span Element, Character References, Web Page with Character References and Phrasing Elements, Case Study: A Local Hydroelectric Power Plant.

Unit 3: Cascading Style Sheets (CSS): Introduction, CSS Overview, CSS Rules, Example with Type Selectors and the Universal Selector, CSS Syntax and Style, Class Selectors, ID Selectors, span and div Elements, Cascading, style Attribute, style Container, External CSS Files, CSS Properties, Color Properties, RGB Values for Color, Opacity Values for Color, HSL and HSLA Values for Color, Font Properties, line-height Property, Text Properties, Border Properties, Element Box, padding Property, margin Property, Case Study: Description of a Small City's Core Area.

Unit 4: Organizing a Page's Content with Lists, Figures, and Various Organizational Elements: Introduction, Unordered Lists, Descendant Selectors, Ordered Lists, Figures, Organizational Elements, Section, article, and aside Elements, nav and a Elements, header and footer Elements, Child Selectors, CSS Inheritance, Case Study: Microgrid Possibilities in a Small City, **Tables and CSS Layout:** Introduction, Table Elements, Formatting a Data Table: Borders, Alignment, and Padding, CSS Structural Pseudo-Class Selectors, thead and tbody Elements, Cell Spanning, Web Accessibility, CSS display Property with Table Values, Absolute Positioning with CSS Position Properties, Relative Positioning, Case Study: A Downtown Store's Electrical Generation and Consumption.

Unit 5: Introduction to JavaScript: Functions, DOM, Forms, and Event Handlers, Introduction, History of JavaScript, Hello World Web Page, Buttons, Functions, Variables, Identifiers, Assignment Statements and Objects, Document Object Model, Forms and How They're Processed: Client-Side Versus Server-Side, form Element, Controls, Text Control, Email Address Generator Web Page, Accessing a Form's Control Values, reset and focus Methods, Comments and Coding Conventions, Event-Handler Attributes, onchange, onmouseover, onmouseout, Using noscript to Accommodate Disabled JavaScript.

Text Book

- John Dean (2019), Web Programming with HTML5, CSS, and JavaScript, Jones & Bartlett Learning, LLC, an Ascend Learning Company, Burlington, MA 01803.

Course Code	CSC414	Course title	Compiler Design
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3Hrs/week	Total Contact Hours (Pr)	-

Course Objective:

- Introducing students to the concepts and principles of compiler design.
- Providing students with basic understanding of grammars and language definition.
- Introducing students to the various phases of designing a compiler.
- Introducing students to the various programming techniques and structures used in compiler construction.
  - Providing students with practical programming skills necessary for constructing a compiler.

Prerequisite:

Knowledge of automata theory, context free languages, computer architecture, data structures and simple graph algorithms, logic or algebra.

At Course Completion:

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

Course Outline Unit-1:

Introduction:

Translator Issues, why to write a Compiler, what is a Compiler, what is the Challenge, Compiler Architecture, Front end and Back end model of compiler, Cross compiler, Incremental compiler, Boot strapping, Lexical Analysis: Concept of Lexical Analysis, Regular Expressions, Deterministic finite automata (DFA), Non-Deterministic finite automata (NFA), Converting regular expressions to DFA, Converting NFA to DFA, Hand coding of Lexical analyzer, Introduction to LEX Tool and LEX file specification, Error detection and recovery in LEX.

Unit-2:

Syntax Analysis:

Context Free Grammars(CFG), Concept of parsing, Parsing Techniques, Top-Down Parsers: Introduction, Predictive Parsing - Removal of left recursion, Removal of left factoring, Recursive Descent Parsing, Predictive LL(k) Parsing Using Tables, Bottom Up parsing: Introduction, Shift-Reduce Parsing Using the ACTION/GOTO Tables, Table Construction, SLR(1), LR(1) and LALR(1) Grammars, Practical Considerations for LALR(1) Grammars, Introduction to YACC Tool & YACC file specification, Error detection and recovery in YACC.

Unit-3: Semantic Analysis

Need of semantic analysis, Abstract Parse trees for Expressions, variables, statements, functions and class declarations, Syntax directed definitions, Syntax directed translation schemes for declaration processing, type analysis, scope analysis, Symbol Tables (ST),Organization of ST for block structure and non-block structured languages, Symbol Table management, Type Checkers: type checking for expressions, declarations (variable, type, function, recursive), statements,

Unit-4 Intermediate code generation: Intermediate languages, Design issues, Intermediate representations: three address, postfix & abstract syntax trees, Intermediate code generation for declaration, assignment, iterative

statements, case statements, arrays, structures, conditional statements, Boolean expressions, procedure/function definition and call.

Unit-5:

Run-Time Memory Management & Code generation:

Model of a program in execution, Stack and static allocation, Activation records, Issues in the design of code generation, Target machine description, Basic blocks & flow graphs, Expression Trees, Unified algorithms for instruction selection and code generation, Sethi Ullman algorithm for expression trees, Aho Johnson algorithm, Different models of machines , order of evaluation, register allocation, Code generator-generator concept .

Text Books:

- Alfred V. Aho, A. V. R. Sethi and J.D. Ullman "Compiler Principle, Techniques and Tools" Addison Wesley.

Reference Books:

- Barrent W. A., J. D. Couch, "Compiler Construction Theory and Practice", Computer Science series, Asian student edition.
- Dhamdhere D.M., "Compiler Construction Principle and Practice", Mac. Millan India, New Delhi. Manish Kumar Jhas, "Compiler Construction –An advance course".
- Ravendra Singh, Vivek Sharma, Manish Varshney, "Design and Implementation of Compiler", New Age Publications.
- Holub, A.J., "Compiler design in C" –Prentice Hall.
- John Levine, Tony Mason & Doug Brown, "Lex and Yacc", O Reilly

Course Code	CSC414	Course title	Computer Graphics
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3Hrs/week	Total Contact Hours (Pr)	-

Prerequisites: student must have good programming skills and System-Level Programming, or equivalent C programming experience.

Course Description: This course introduces fundamental concepts of computer graphics with an emphasis on interactive real-time graphics techniques. The focus is on 3D graphics programs using OpenGL. Basic C programming is required for this course. The course focuses on 3D graphics, and focus on model creation and 3D animation using OpenGL.

Course Objectives: By the end of the semester students are expected to have a general understanding of the following:

- Transformations, camera manipulation, frame buffer operations, etc.
- The basics of lighting and shading, texture mapping.
- The fundamentals of modelling and animation.
- The fundamentals of 3D graphics pipeline
- The current state of the art in computer graphics and expected near term advances.
- In the end, students will be able to develop relatively sophisticated 3D graphics programs.

Computer Graphics (Sem-III)

Unit I:

An Invitation to Computer Graphics: brief history of computer graphics, overview of graphics system. input devices, output devices, display types: random scan and raster scan, definitions: pixel, resolution, aspect ratio, aliasing and anti-aliasing, application of computer graphics. Theory of Transformation: Geometric Transformations in 2-Space, Affine Transformations, Geometric Transformations in 3-Space,

Unit II:

Convexity And Interpolation: Motivation , Convex Combinations, Interpolation, Convexity And The Convex Hull. Raster Algorithms : Dda And Bresenham's Line Rasterizers, Cohen-Sutherland Line Clipper, Sutherland-Hodgman Polygon Clipper, Scan-Based Polygon Rasterizer. Modeling In 3d Space: Curves, Specifying Plane Curves, Specifying Space Curves, Drawing Curves , Surfaces , Polygons , Swept Surfaces ,

Unit III:

Anatomy of Curves and Surfaces: Bezier Curves, Linear Bezier Curves, Quadratic Bezier Curves, Cubic Bezier Curves, General Bezier Curves . Bezier Surfaces, Problems with Bezier Primitives, Motivating B-Splines , B-Spline Curves, Spline Curves, First-Order B- Splines , Cubic B-Splines , General B-Splines and Non-uniform Knot Vectors.

Unit IV:

Color And Light: Vision And Color Models, RGB Color Model , CMY And CMYK Color Models , HSV Color Model, Phong's Lighting Model , Phong Basics, Specifying Light And Material Values , Calculating The Reflected Light , First Lighting Equation , Texture : Basics,

Texture Space, Coordinates And Map, Blending Theory , Opaque And Translucent Objects Together , Blending Textures, Bump Mapping, Shadow Mapping.

Unit V:

Fractals, Animation : Animation Technicals , Animation Code , Simple Orthographic Shadows, Selection And Picking, Advanced Animation Techniques: Frustum Culling By Space Partitioning , Space Partitioning, Occlusion , Conditional Rendering. Pipeline Operation: Ray Tracing Pipeline, Radiosity.

References:

1. Sumanta Guha, Computer Graphics Through OpenGL From Theory to Experiments, 3rd Edition, CRC Press, Taylor & Francis group, 2019.
2. Dave Shreiner, et al, OpenGL Programming Guide_ The Official Guide to Learning OpenGL, Version 4.3. 8th Edition, 2013.
3. D. Hearn and M. Pauline Baker, Computer Graphics (C Version), Pearson Education, 2nd Edition, 2004.
4. D. F. Rogers and J. A. Adams, Mathematical Elements for Computer Graphics, 2nd Edition, McGraw-Hill International Edition, 1990.

Course Code	CSC441-450	Course title	Elective 3
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3Hrs/week	Total Contact Hours (Pr)	-

1.CSC 441 – Pattern Recognition

Prerequisite: student should have prior knowledge of probabilities and statistics as well as good programming skills.

About Course

Pattern recognition techniques are concerned with the theory and algorithms of putting abstract objects, e.g., measurements made on physical objects, into categories. Typically the categories are assumed to be known in advance, although there are techniques to learn the categories (clustering). Methods of pattern recognition are useful in many applications such as information retrieval, data mining, document image analysis and recognition, computational linguistics, forensics, biometrics and bioinformatics

Course Outline

Unit-1: Basics of Probability, Random Processes and Linear Algebra (recap): Probability: independence of events, conditional and joint probability, Bayes theorem Random Processes: Stationary and non-stationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra. Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors, singular values, singular vectors.

Unit-2: Bayes Decision Theory: Minimum-error-rate classification. Classifiers, Discriminant functions, Decision surfaces. Normal density and discriminant functions. Discrete features.

Unit-3: Parameter Estimation Methods: Maximum-Likelihood Estimation: Gaussian case. Maximum a Posteriori estimation. Bayesian estimation: Gaussian case. Unsupervised learning and clustering - Criterion functions for clustering. Algorithms for clustering: K-Means, Hierarchical and other methods. Cluster validation. Gaussian mixture models, Expectation-Maximization method for parameter estimation. Maximum entropy estimation.

Sequential Pattern Recognition. Hidden Markov Models (HMMs). Discrete HMMs. Continuous HMMs. Nonparametric techniques for density estimation. Parzen-window method. K-Nearest Neighbour method.

Unit-4: Dimensionality reduction: Principal component analysis - it relationship to eigen analysis. Fisher discriminant analysis - Generalised eigen analysis. Eigen vectors/Singular vectors as dictionaries. Factor Analysis, Total variability space - a dictionary learning methods. Non negative matrix factorization - a dictionary learning method. Linear discriminant functions: Gradient descent procedures, Perceptron, Support vector machines - a brief introduction.

Unit-5: Artificial neural networks: Multilayer perceptron – feed forward neural network. A brief introduction to deep neural networks, convolutional neural networks, recurrent neural networks. Non-metric methods for pattern classification: Non-numeric data or nominal data. Decision trees: Classification and Regression Trees (CART).

Text Books:

- K. P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012.
- C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2006.
- R. O. Duda, P. E. Hart, D. G. Stork, Pattern Classification, 2nd edition, John Wiley & Sons, Inc., 2000.
- S. Theodoridis, K. Koutroumbas, Pattern Recognition, 3rd edition, Academic Press, 2006.
- D. Koller, N. Friedman, Probabilistic Graphical Models: Principals and Techniques, MIT Press, 2009.
- Webb, Statistical Pattern Recognition, 2nd edition, John Wiley & Sons, Inc., 2002.
- T. Hastie, R. Tibshirani, J. Friedman, The Elements of Statistical Learning, Springer, 2003.
- K. Fukunaga, Introduction to Statistical Pattern Recognition, Academic Press, 1990.
- R. Schalkoff, Pattern Recognition: Statistical, Structural and Neural Approaches, John Wiley & Sons, Inc., 1992.
- K. Jain, R. C. Dubes, Algorithms for Clustering Data, Prentice Hall, 1988.

Web Link:

- https://www.cse.iitm.ac.in/course_details.php?arg=Mjc=
- https://www.isip.piconepress.com/courses/temple/ece_8527/syllabus/current/

2.CSC 442 – Data Warehousing

Prerequisite: Student must have good knowledge of relational databases, database processes and different architecture of databases etc.

Course Description: This is the course in the Data Warehousing for Business Intelligence specialization. Ideally, the courses should be taken in sequence. In this course, you will learn exciting concepts and skills for designing data warehouses and creating data integration workflows. These are fundamental skills for data warehouse developers and administrators. You will have hands-on experience for data warehouse design and use open source products for manipulating pivot tables and creating data integration workflows. You will also gain conceptual background about maturity models, architectures, multidimensional models, and management practices, providing an organizational perspective about data warehouse development. If you are currently a

business or information technology professional and want to become a data warehouse designer or administrator, this course will give you the knowledge and skills to do that.

Couse Outcome: By the end of the course, you will have

- The design experience, software background, and organizational context that prepares you to succeed with data warehouse development projects.
- Student will be able to create data warehouse designs and data integration workflows that satisfy the business intelligence needs of organizations.
- Evaluate an organization for data warehouse maturity and business architecture alignment;
- Create a data warehouse design and reflect on alternative design methodologies and design goals;
- Create data integration workflows using prominent open source software;
- Reflect on the role of change data, refresh constraints, refresh frequency trade-offs, and data quality goals in data integration process design;
- Perform operations on pivot tables to satisfy typical business analysis requests using prominent open source software

Course Outline

Unit-1: Data Warehouse Concepts and Architectures: introduction of data warehousing, historical reasons for development of data warehouse technology, learning effects, business architectures, maturity models, project management issues, market trends.

Unit-2: Multidimensional Data Representation and Manipulation: multidimensional representation of a data warehouse used by business analysts. You'll apply what you've learned in practice and graded problems using Pivot4J, an open source tool for manipulating pivot tables. At the end of this module, you will have solid background to communicate and assist business analysts who use a multidimensional representation of a data warehouse.

Unit-3: Data Warehouse Design Practices and Methodologies: This module emphasizes data warehouse design skills. Now that you understand the multidimensional representation used by business analysts, you are ready to learn about data warehouse design using a relational database. In practice, the multidimensional representation used by business analysts must be derived from a data warehouse design using a relational DBMS. You will learn about design patterns, summarizability problems, and design methodologies. You will apply these concepts to mini case studies about data warehouse design. At the end of the module, you will have created data warehouse designs based on data sources and business needs of hypothetical organizations.

Unit-4: Data Integration Concepts, Processes, and Techniques: This Unit extends your background about data warehouse development. After learning about schema design concepts and practices, you are ready to learn about data integration processing to populate and refresh a data warehouse. The informational background in this unit covers concepts about data sources, data integration processes, and techniques for pattern matching and inexact matching of text. This unit provides a context for the software skills that you will learn in next Unit.

Unit-5: Architectures, Features, and Details of Data Integration Tools, this unit extends your background about data integration from unit-4. This unit covers architectures, features, and details about data integration tools to complement the conceptual background in unit-4. You will learn about the features of two open source data integration tools, Talend Open Studio and Pentaho Data Integration. You will use Pentaho Data Integration in guided tutorial in preparation for a graded assignment involving Pentaho Data Integration.

References:

- Data Warehousing Fundamentals, Paulraj Ponniah, John Wiley & Sons, 2006, ISBN 8126509198, 9788126509195
- Data Warehousing by Paperback, Bpb Publications, 15 November 2004, ISBN-10: 8176569283, ISBN-13: 978-8176569286

Web Link:

- https://www.coursera.org/learn/dwdesign
- http://www.iisastr.com/datawarehousing.html

3.CSC 443 – Remote Sensing

Course Pre-requisite: Theoretical and Practical knowledge of Digital Image processing and Remote Sensing is required.

Course Objectives:

- Interpretation and analysis of remotely sensed data.
- Understanding the various algorithms of digital image analysis and its accuracy assessment.
- Enhancing the students understanding in terms of data handling and quality.

Course Outcomes:

- Appraise the degree to which remote sensing data can be used efficiently and effectively.
- Student can able to classify, analyze and assess the remotely sensed data and able to design and develop remote sensing data analysis for various applications.
- Ability to develop the problem solving and research skill in this domain.

Course Outline

Unit 1 Sources and Characteristics of Remote Sensing Image Data: Introduction to Data Sources, Remote Sensing Platforms, Image Data Sources in the Microwave Region, Spatial Data Sources in General, A Comparison of Scales in Digital Image Dara.

Unit 2 Error Correction and Registration of Image Data: Sources of Radiometric Distortion, Corrections of Radiometric Distortion, Sources of Geometric Distortion, Corrections of Geometric Distortion, Image Registration.

Unit 3 Interpretation of Digital Image Data: Approaches to Interpretation, Forms of Imagery for Photointerpretation, An Introduction to Quantitative Analysis-Classification, Multispectral Space and Spectral Classes.

Unit 4 Classification: Pixel Vector and Labelling, Unsupervised Classification, Supervised Classification.

Unit 5 Accuracy Assessment: Relevance of Validating Results, Methods to Estimate Accuracy, Sources of Error, Sampling Design, Gathering Information, Measuring Error in Interval-Scale variables, Measuring Error in Classified Images, Verification of Multi-temporal Analysis.

Text Books:

- Remote sensing Digital image Analysis An Introduction, John A. Richards, Xiuping Jia
- Canty, M. J. (2014). Image analysis, classification and change detection in remote sensing: with algorithms for ENVI/IDL and Python. CRC Press.
- Digital Analysis of Remotely sensed Imagery, Jay Gao, McGraw Hill

Web Resources:

- http://www.isro.org/
- http://www.nrsc.co.uk/
- http://www.rspsoc.org/
- http://www.ccrs.nrcan.gc.ca/index_e.php
- http://rst.gsfc.nasa.gov/start.html
- http://www.usgs.gov

4.CSC 444 – Micro Controller Programming

Prerequisite: student must be aware with assembly level language, good programming skill on C

Course Description

This course is designed to provide an introduction to microcontroller assembly language programming. Students will be taught the basic use of a programming environment and how to convert the basic elements of the C programming language (including loops, control statements, and arrays) into a well-formed assembly language program. This course also highlights the general computer science concepts such as operating systems, computer organization, data representation, low-level input/output, and memory usage in the microcontroller environment. A program will also be written in C to emphasis the difference between microcontrollers and microprocessors.

Course Objectives

- Program microcontrollers with the C programming language.
- Use timer peripherals
- Use communication peripherals
- Use analog-to-digital converter peripherals
- Use a liquid crystal display (LCD)

Course Outcome

- Student will be able to independently work on Embedded System with 8051 and PIC Microcontrollers
- Electronic system design with 8051 microcontrollers
- Electronic system design with PIC microcontrollers
- Embedded Coding with 8051 microcontrollers

Couse Outline

Unit 1: Introduction to embedded systems, scope and use, examples of embedded systems - embedded applications, introduction to embedded C Programming with different tools

Unit 2: 8051 Architectures - block diagram, 8051 family microcontrollers, their peripherals - timers, interrupts, ports.

Unit 3: Interfacing with peripheral devices - LCD, keyboard, stepper motors etc

Unit 4: Introduction to PIC microcontrollers - PIC Architecture, family of PIC microcontrollers, Embedded C programming for PIC microcontrollers with MPLab

Unit 5: PIC Peripherals - Timers, Interrupts, ADC, Serial ports, LCD, Keyboards, and working with stepper motors

Recommended Hardware

- 8051 Microcontroller Kits
- PIC Development Kits
- PC, Interfacing boards
- Electronic components for assembly

Software's

- KIEL C or similar embedded C Compiler for 8051
- MPLab

Text Book

- The 8051 Microcontroller, Architecture, Programming, & Appliations, 2nd Edition, Kenneth J. Ayala
- Programming & Customizing 8051 Microcontroller, Myke Predko, 1999, Mcgraw-Hill
- Design with PIC microcontroller, Peatman, John B, Pearson Educations

Course Code	CSC451-460	Course title	Elective 4
Number of Credits	3	Internal / External	20/80
Total Contact Hours (Th)	3Hrs/week	Total Contact Hours (Pr)	-

1.CSC451 – Neural Network and Deep Learning

Prerequisites:

Expected: - Programming: Basic Python programming skills, with the capability to work effectively with data structures.

Recommended: - Mathematics: Matrix vector operations and notation. - Machine Learning: Understanding how to frame a machine learning problem, including how data is represented will be beneficial. If you have taken my Machine Learning Course here, you have much more than the needed level of knowledge.

Course Description: If you want to break into cutting-edge AI, this course will help you do so. Deep learning engineers are highly sought after, and mastering deep learning will give you numerous new career opportunities. Deep learning is also a new "superpower" that will let you build AI systems that just weren't possible a few years ago. In this course, you will learn the foundations of deep learning. When you finish this class. This course also teaches you how Deep Learning actually works, rather than presenting only a cursory

or surface-level description. So after completing it, you will be able to apply deep learning to your own applications. If you are looking for a job in AI, after this course you will also be able to answer basic interview questions.

Course Objectives: by end of the course student will be able to

- Understand the major technology trends driving Deep Learning
- Be able to build, train and apply fully connected deep neural networks
- Know how to implement efficient (vectorized) neural networks
- Understand the key parameters in a neural network's architecture

Course Outline

Unit-1: Introduction to deep learning, Be able to explain the major trends driving the rise of deep learning, and understand where and how it is applied today.

Unit-2: Neural Networks Basics, Learn to set up a machine learning problem with a neural network mindset. Learn to use vectorization to speed up your models.

Unit-3: Shallow neural networks, Learn to build a neural network with one hidden layer, using forward propagation and backpropagation.

Unit-4: Deep Neural Networks, Understand the key computations underlying deep learning, use them to build and train deep neural networks, and apply it to computer vision.

Unit-5: Case Study: Computer Vision, Neural Network, Pattern Recognition examples

References:

- Deep Learning, Ian Goodfellow and Yoshua Bengio and Aaron Courville, MIT Press ,2016 **Web Links**:

- https://www.coursera.org/learn/neural-networks-deep-learning
- http://cs230.stanford.edu/syllabus.html
- http://www.deeplearningbook.org/
- http://www.deeplearningbook.org
- http://www.bu.edu/eng/files/2017/03/DeepLearningSyllabusandSchedule.pdf

2.CSC452 – Big Data Analytics

Pre-requisites:

Expected : 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 Objectives:

- 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 Outcomes:

The student will get knowledge of:

- 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.

Course Outline

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

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

3.CSC453 – Hyperspectral Image Processing

Course Prerequisite: Theoretical and Practical knowledge of Remotely Sensed Digital Image Analysis.

Course Outcomes:

- Able to describe multispectral and hyperspectral remote sensing.
- Ability to design and extract the thematic information.
- Able to apply hyperspectral data in various field of applications.

- Able to design and develop hyperspectral data processing and analysis system.
- Able to frame advancements of research problems **Course Objectives:**
- Describing the principle of hyperspectral remote sensing.
- Recognize how to collect hyperspectral data.
- Process and Analyse hyperspectral data.
- Recognize the current research status of hyperspectral remote sensing.
- Project design using hyperspectral data.

Course Outline

Unit 1 Background of Hyperspectral Remote Sensing:

Concept of Imaging Spectroscopy, Historical background of Imaging Spectroscopy, Difference between Hyperspectral and Multispectral, HRS for Earth Observation, Present and Future Missions by worldwide agencies, Types of Data, Field Spectroradiometer, In situ spectral measurement, Characteristics of Imaging and Non Imaging data, Recording Format of imaging data, Levels of processing.

Unit 2 Geometric and Radiometric Corrections:

Basics of Pre-processing, Geometric error and corrections, Radiometric Error and Corrections, Atmospheric Corrections, Scene based empirical approach, Radiative Transfer Model based approach, Ancillary information necessary for atmospheric corrections.

Unit 3 Hyperspectral Data Pre-processing:

Spatial/Spectral Subset, bad band Removal, Bad Column Removal, DN to Radiance conversion, Atmospheric corrections using FLAASH and QUAC.

Unit 4 Dimensionality Reduction and Endmember Extraction:

Issue of Dimensionality in HRS data, Approaches to resolve the issues, Techniques of Dimensionality Reduction: Principle Component Analysis (PCA), Minimum Noise Fraction (MNF), Independent Component Analysis etc. Concept of End Members, reference spectra, Spectral Library, End member collection from Image, Endmember Extraction Techniques, Pixel Purity Index (PPI).

Unit 5 Classification and Mapping of Hyperspectral Data:

Classification, Classification Approaches, Supervised classification, unsupervised classification, Parametric Classifier, Non Parametric classifier, Per-pixel approach, Sub-Pixel approach, Spectral Unmixing, Spatial Spectral methods, commonly used Classification Techniques, Spectral Angle Mapper, Spectral Feature Fitting, Mixed tune Map Filtering etc.

Reference Material:

Text Books:

- Chang, C. I. (2013). Hyperspectral data processing: algorithm design and analysis. John Wiley & Sons.

- Chang, C. I. (2003). Hyperspectral imaging: techniques for spectral detection and classification (Vol. 1). Springer Science & Business Media.
- Varshney, P. K., & Arora, M. K. (2004). Advanced image processing techniques for remotely sensed hyperspectral data. Springer Science & Business Media.

Web Resources:

- http://www.isro.org
- http://www.usgs.gov

4.CSC454 – Internet of Things

Prerequisite: Students attending this course must have knowledge of python programming, digital electronics and micro controller programming.

Course Description: Internet of Things: an evolving technology than this course is for you. You will learn everything from high level controllers to interactive dashboard designing

Course Outcome

- Understand what Internet of Things are
- Controlling home appliances from anywhere in the world
- Use some of the physical devices like Arduino and Raspberry Pi
- Design some of the IoT applications

Course Outline

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'Rielly Publications

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.

Paper Code	Course Title	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 subsetting 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 L. 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

Introduction to MATALB

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

29/11/21

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