Dr. Babasaheb Ambedkar Marathwada Univeristy

Aurangabad

Department of Computer Science & Information Technology

Reaccredited with 'A' Grade

Curriculum Book

M.Sc. Computer Science

2018-2019

Outcome Based Education Curriculum

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, AURANGABAD

DEPARTMENT OF COMPUTER SCIENCE AND
INFORMATION TECHNOLOGY

Syllabus Book of

M.Sc. (Computer Science)

Faculty of Science and Technology

w.e.f. ACADEMIC YEAR JUNE, 2018-19

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad
Department of Computer Science and Information Technology

Outcome Based Education Curriculum
M.Sc. Computer Science
(2018-2019)

SCHEME FOR CHOICE BASED CREDIT SYSTEM (CBCS)
w.e.f. JUNE, 2018 (ACADEMIC YEAR, 2018-19 Onwards)

Index

M.Sc. (Computer Science) 2018-19

About the Revised Syllabus

- This version came into effect in June 2016. There have been many advancements in Computer Science and Information Technology and consequent changes in needs of society, industry in respect in which the syllabus was required to be updated.
- This document present the revised version of M.Sc. Information Technology syllabus which becomes effective for teaching with immediate effect. It is designed to facilitate students in the development of concept based approach for problem solving using IT as a tool. The self-learning approach is built in the syllabus thereby training the candidate to update themselves on the changing technologies in their area of work. The outstanding syllabus has been designed to produce junior programmers, EDP Assistants, web designers, etc. equipped with latest knowledge and skills.

About Admission Procedure

Department of Computer Science and Information Technology adopted a credit-based system under the Academic Flexibility Program of the University from the academic year 2011-12.

It is a flexible, cafeteria-type learning system with an inbuilt horizontal mobility for students to all desire units of education in the Department/Departments 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 offered by the Department
1. M. Sc. Computer Science
2. M. Sc. Information Technology
3. M. Phil. Computer Science

Admission/ Promotion in M.Sc. Computer Science Program
Program: M. Sc. Computer Science
Duration: (Four Semesters means Two Academic Years)
Intake: 32
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.

Fees

Sr. No	Head	Fees
1	Tuition	3,500/-
2	Registration	50/-
3	Admission	200/-
4	Library	100/-
5	Laboratory	1,250/-
6	Medical Exam	100/-
7	MKCL	50/-
8	Avishkar, Indradhanushya and Other Students Activities	200/-
	Total	**5,450/-***

***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 and M. Sc. Information Technology course in the department will be done on the performance of CET score and on their performance in the qualifying graduate level examination.

The student will apply on the application form of the University 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 and fourth semesters in the department. Student should complete one service course in each semester.

(iv) Each Course shall include lectures / tutorials / laboratory or field work / Seminar / Practical training / Assignments / midterm and term end examinations/ paper / Report writing or review of literature and any other innovative practice etc., to meet effective teaching and learning needs.

(iv) Bridge Course: This course specially designed to provide subject prerequisites / skills required by the student prior to learning the defined course in curricula. According to the need of the student department may arrange/schedule the bridge course at the begging of semester.

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

Registration for Service Course:

i) The student will register the service course of his interest after the start of semester in the concerned department on official registration form. The teacher in-charge of the respective course will keep the record of the students registered. Maximum fifteen days period will be given from the date of admission for completion of registration procedure. The Departmental 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.

iv) The University 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.

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

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

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

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

Table I: Ten Point Grades and Grade Description

ii) Non-appearance in any examination/ assessment shall be treated as the students have secured zero mark in that subject examination/assessment.
iii) Minimum D grade (4.00 grade points) shall be the limit to clear /pass the course/subject. A student with F grade will be considered as 'failed' in the concerned course and he/she has to clear the course by reappearing in the next successive semester examinations. There will be no revaluation or recounting under this system.
iv.) Every student shall be awarded Grade points out of maximum 10 points in each subject (based on 10 Point Scale). Based on the Grade points obtained in each subject, Semester Grade Point Average (SGPA) and then Cumulative Grade Point Average (CGPA) shall be computed. Results will be announced at the end of each semester and cumulative Grade card with CGPA will be given on completion of the course.

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

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

a. **Semester Grade Point Average (SGPA)** is the weighted average of points obtained by a student in a semester and will be computed as follows:

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

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	Programming Group	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	

Semester 1

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

Semester 2

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 3

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

Semester 4 (Industrial Internship / Field Work 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			

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

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

Detailed Syllabus

Semester – I

1. Constitution of India

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

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

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

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

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian constitution, 1st Edition, 2015.
3. M. P. Jain, Indian constitution Law, 7th Edn, Lexis Nexis, 2014.
4. D. D. Basu, Introduction to India, Lexis Nexis, 2014.
5. M. P. Jain, outline of Indian Legal and Constitutional history, Lexis Nexis, 2014.
6. ग्रॅनव्हिल ऑस्टिन ,संघटना राष्ट्राची कोनशीला , डायमंड प्रकाशन , पुणे , २०१३.
7. भारताचे शासन आणि राजकारण , विद्या प्रकाशन , नागपूर.

Note:

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

2. Research Methodology

Course Code	**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 Outline:

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

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

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

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

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

Reference Books:

1. Briony J. Oates., (2006), Researching Information Systems and Computing, SAGE Publications, New Delhi.
2. Kothari C.R., (2004), Research Methodology Methods & Techniques, New Age International Publishers, New Delhi.
3. Bajpai S. R., (1975), Methods of Social Survey and Research, Kitabghar, Kanpur.
4. Bhattacharya D. K., (2004), Research Methodology, New Delhi, Excel Books.
5. Brymann Alan and Carmer D., (1995), Qualitative data analysis for social / scientist, New York, Routledge publication.

6. Best J. W. and Khan J. V., (2005), Research in Education New Delhi, Prentice Hall India. Hans Raj (19gg) Theory and practice in Social Research, Surjeet publication, Kolhapur.
7. Chandera A. and Saxena T. P., (2000), Style Manual, New Delhi, Metropolitan Book Comp. Ltd.
8. Krishnaswami O. R., (1988), Methodology of Research in Social Science, Himalaya pub House.
9. Kothari, C. R., (2005), Quantitative Technique, New Delhi, Vikas publication House.
10. Gautam N. C., (2004), Development of Research tools, New Delhi, Shree Publishers.
11. Gupta, Santosh, (2005) Research Methodology and statistical Techniques, Deep and Deep publications.
12. Shukla J. J., (1999) Theories of Knowledge, Ahmadabad, Karnavati Publication

E-References:

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

Course Outcomes:

- Critically analyze research methodologies identified in existing literature.
- Choose appropriate quantitative or qualitative method to collect data.
- Propose and distinguish appropriate research designs and methodologies to apply to a specific research project.
- Develop a comprehensive research methodology for a research question.
- Apply the understanding of feasibility and practicality of research methodology for a proposed project.

3. Programming 1

Course Code	**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**

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

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.

Course Objectives: 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, do-while, foreach and branching statements (break, continue). Creating and using packages.

Unit 3: Object Oriented Principles 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:
https://docs.oracle.com/javase/tutorial/tutorialLearningPaths.html

Reference 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

Reference Books:

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

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

C) Course Outline : Open Group (Python)

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

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

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

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

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

Reference Book:

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

E-books:

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

Lab Exercise:

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

Course Outcomes:

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

4. Introduction to Algorithms

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

Unit 2: 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 3: Data structures: Elementary data structures – stacks, queues, linked list, trees, hash tables, Binary search Tree, Red black tree.

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

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 Books:

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 Outcomes:

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

5. Relational Database Management System

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**

Prerequisite: 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 Outline:

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 Book:

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

Additional Reference:

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

Lab Exercise:

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

Course Outcomes:

- To make the students aware of the basic knowledge of the relational database management which will include the aspects of database design, query languages and database system implementation.
- To provide a sound introduction to the discipline of the basics of database management system.
- To give a good formal foundation on the relational model of data.
- To apply the various relational database concepts for solving real life problems.

6. Mathematical Foundation and Statistical Method

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 Outline:

Unit 1: Numerical Analysis : Floating point representation, arithmetic operations with normalized floating point numbers, errors in numbers, iterative methods, bisection method, false position method, Newton Raphson iterative method, secant method, Numerical integration, Simpson's rule, Trapezoidal Rule, Range Kutta method.

Unit 2: Set theory and relations : 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 3: Algebra Of Logic, Mathematical Induction: Propositions and Logic operations, truth tables, arguments and validity of arguments, propositions generated by a set, equivalence and implication laws of logic, Quantifiers, Principle of Mathematical Induction, the rules of sum and products, permutations, combinations, generation of permutation and combinations, discrete probability, conditional probability.

Unit 4: Graph Theory, Various types of graphs- Simple and multi graphs, directed and undirected graphs, Eulerian and Hamiltonian graphs, Graph connectivity, graph traversals, graph optimizations, graph coloring, Trees, spanning trees.

Unit 5: Linear System Linear System of equations, pivoting strategies, determinant of matrix, matrix factorization, norms of vector and matrices, Eigenvalues and Eigenvectors.

Reference Books:

1. Alan Doerr, Applied Discrete Structures for Computer Science, Galgotia Publications.
2. Kolman and Busby ―Discrete Mathematical structures for Computer Sciences PHI.
3.C L Liu, D P Mohapatra, " Elements of Discrete Mathematics" 3rd edition, McGraw Hill, 2008
4. E balguruswami, "Numerical Methods" Tata McGraw Hill, 2009
5. G.D. Smith, "Numerical Solution of Partial Differential Equations: Finite Difference Methods", 3rdedition, Oxford University Press, 1985

E-Reference:

1. 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 Outcome:

Students are able to perform Mathematical operations based on crisp Sets, Numerical Analysis and

- Probability.
- The theoretical component of the course treats fundamental concepts, as well as some necessary topics in numerical linear algebra. 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 numerical modeling.

7. Modern Operating System

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**

Prerequisite: 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.

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

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

Unit 3: Lower Process Management: Synchronization Primitives: Atomic instructions, locks, spinlocks, mutex semaphores, counting semaphores, and their use in solutions to Producer Consumer synchronization. **Classic Synchronization Problems**: Classic synchronization problems: Producer Consumer, Dining Philosophers, Readers and Writers, Sleeping Barber. **Monitors and Message Passing**: Monitors, condition variables, message passing, and their use in solutions to classic synchronization problems: Producer Consumer, Dining Philosophers, Readers and Writers, Sleeping Barber. **Deadlock**: Definition, Characteristics A resource Allocation graph, live-lock, Deadlock prevention, Deadlock avoidance: Banker's Algorithm, Deadlock Detection and Recovery. **Threads**: Overview of threads, thread basics and its advantages, **Multicore Programming**: Introduction, 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 4: I/O Management: I/O buffering, single and Double Buffer schemes, Disk Organization. **File Management:** File Concepts, File descriptor, Access methods: Sequential, indexed and direct, File

sharing, Protection, Access rights, File System structure, Byte Sequence, Record sequence and Tree-based, Recovery and Disk formatting. **Secondary Storage Management:** File allocation methods: Contiguous Allocation and Non Contiguous allocation, Chained, Indexed allocation, free space management, **Disk Scheduling**: FCFS, SSTF, SCAN and C- SCAN, Disk Cache. Protection and Security: System performance, protection and security, policies and methods, Access Matrix.

Unit 5: Introduction : History of Linux , Features of Linux, Drawbacks of Linux , Components of Linux, Memory Management Subsystems , Linux Process and Thread Management, File Management System, Device Drivers **Linux Commands and Utilities:** cat, tail, cmp, diff, wc, sort , mkdir, cd, rmdir, pwd, cp, more, passwd, who, whoami, mv, chmod, kill, write, wall, merge, mail, pipes, filters and redirection utilities. **Shell Scripts:** Creating and executing simple shell programs, variables, 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"

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

Reference B**ooks:**

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

Web/E- References:

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

Lab Exercise:

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

Course Outcomes:

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.

Semester – II

1. Technical Report Writing

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)**	**-**

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

Course Objectives:

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

Course Outline:

Unit 1: Introduction: Meaning, Concept, nature steps types and characteristics of research, Identification & formulation of Research Problem, Hypothesis, Research Design & Research Ethics. Review of literature Need for Reviewing Literature, what to Review and for what purpose, Literature search Procedure, Sources of Literature, Planning of Review work, Note Taking.

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

Unit 3: Methods & tools of data collection: Concept of sampling and other concepts related to sampling. Probability and non - probability samples, their characteristics and implications. Tools of data collections, their types, attributes and uses. Redesigning, research tools - like questionnaire, 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-4: Methods of data analysis: Editing, Classification and Coding, Transcription, Statistical Analysis, Measures of Central Tendency Measures of Dispersion, Measures of Association / Relationship, Regression and Correlation Analysis, Hypothesis Testing (For Proportion and Means), Test of Significance. **Report writing and evaluations:** Types of Reports, Planning of Report Writing, Research Report Format, Principles of Writing, Documentation, Data and Data Analysis reporting in a Thesis, Writing of Report, Typing of Report, Briefing. Use of Anti-plagiarism software and its importance.

Unit 5: Case study formats of research proposal writing.

References Books:

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

E-References:

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

Course Outcomes:

- Critically analyze research methodologies identified in existing literature.
- Choose appropriate quantitative or qualitative method to collect data.
- Propose and distinguish appropriate research designs and methodologies to apply to a specific research project.
- Develop a comprehensive research methodology for a research question.
- Apply the understanding of feasibility and practicality of research methodology for a proposed project.

2. Programming 2

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**

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

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

Course Objective: the objective of this paper is to

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

A) Course Outline : Java Group (Advance Java)

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

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

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

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

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

Reference Books:

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

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

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

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

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

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

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

Reference Books:

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

E-Book:

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

C) Course Outline : Open Group (Advanced Python)

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

Unit 2: GUI Design using TkInter or jython: Introduction, Layout Management, Widgets, Menus and Toolbars, Dialog boxes, Drawings, Nibbles. Database Programming using python (MySql): Python Database Interfaces and APIs, Database Connections, Creating Table, Insert Operation, Read operation, Update and Delete Operation, Performing Transactions, Commit & Rollback Operations, Handling Errors.

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

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

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

Reference Book:

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

E-books: -

1. Python Threading:
    - http://www.tutorialspoint.com/python/python_multithreading.htm
    - http://pymotw.com/2/threading/
    - http://www.python-course.eu/threads.php
2. GUI:
    - https://wiki.python.org/moin/TkInter
    - https://wiki.python.org/jython/LearningJython
    - http://www.tutorialspoint.com/python/python_gui_programming.htm
3. Database:
    - Python MySQL API https://wiki.python.org/moin/DatabaseInterfaces
    - http://www.tutorialspoint.com/python/python_database_access.htm
4. Web Framework: http://webpy.org/docs/0.3/tutorial
5. 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
6. FLASK framework,
    - http://www.fullstackpython.com/flask.html

3. Data Communication

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**

Prerequisite: Student should have fundamental knowledge of operating system concepts, simple data communication principle, types of data communication.

Course 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 principles and mechanism required for exchange of data among computers, workstations, servers and data processing devices.

Course Outline:

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.

Reference Books:

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

Lab Exercise:

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

Course Outcomes:

- Describe the components of a data communications system.
- Identify key considerations in selecting various transmission media innetworks.
- Explain the role of line codes in a data communications network.
- Explain the role of digital communications devices in a data communications network.
- Describe the various types of signals and their features.
- Identify and de.ne roles and features of various data transmission protocols.
- Describe the features and functions of multiplexing and modulation.
- Describe the various error detection and correction schemes.

4. Software Engineering

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**

Prerequisites:

- 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:

- Our mission is to prepare students for successful careers in software engineering and graduate education with a thorough understanding of software engineering and experiential learning opportunities to apply that knowledge to solve real-world problems

Course Outline:

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

Reference Books:

1. Rajib Mall, Fundamentals of Software Engineering, Prentice Hall India.
2. Pankaj Jalote, An integrated approach to Software Engineering, Springer/Narosa.
3. Roger S. Pressman, Software Engineering: A practitioner's approach, McGraw Hill.
4. Ian Sommerville, Software Engineering, Addison-Wesley.
5. Heineman, G.T., and Councill, W.T., "Component-Based Software Engineering: Putting the Pieces Together", Pearson Higher Education/Addison Wesley
6. Pressman, R. S. and Lowe, D., "Web Engineering: A Practitioner's Approach", Special Indian Edition, Tata McGraw-Hill.
7. Martin, R.C., Agile Software Development: Principles, Patterns, and Practics, Pearson Education Publisher.

Lab Exercise:

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

Course Outcomes:

- 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.

5. Elective 1

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**

The Department has adopted the horizontal format for elective group which will help the students to become master regarding that elective group. In the academic year 2018-19 the Department has selected the Pattern Analysis and Machine Intelligence Elective group.

Prerequisites:

- 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 Objectives:

- 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 : 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 Lucy-Richardson 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.

Reference Book:

1. 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:

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

Lab Exercise:

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: 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.

Reference Book:

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

Other Materials:

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

Web:

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

C) Course Outline : 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.

Lab Exercise:

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

Reference Materials:

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

Online Resources:

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

D) Course Outline : 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-to-Decimal 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:

1. Microelectronics Circuits, A.S Sedra, K.C. Smith, Oxford University Press.
2. Electronics Fundamentals and Applications, D Chattopadhyay and P. C. Rakshit, New Age International
   Publications.

Reference Books:

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

6. Elective 2

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**

The Department has adopted the horizontal format for elective group which will help the students to become master regarding that elective group. In the academic year 2018-19 the Department has selected the Pattern Analysis and Machine Intelligence Elective group.

Prerequisites:

- 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 Objectives:

- 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 : Artificial Intelligence

Unit 1: Background and history of AI in outline: fundamental problems and challenges realism, brittleness, scalability, real-time requirements, the frame problem the homunculus problem, the substrate problem symbol grounding, common sense knowledge and common sense reasoning.

Unit 2: Fundamentals of search: problem, solution, state space, breadth-first, depth-first, heuristics, A*, local search and optimization

Unit 3: Knowledge representation: logic as form of expression (syntax and semantics of propositional logic and predicate logic). Agent paradigms: the hierarchical paradigm, the reactive paradigm and the hybrid paradigm.

Unit 4: Classical planning and execution, STRIPS, Shakey. reactive agents, braitenberg vehicles, subsumption architecture. Potential fields architecture. The physical structure of robots. Teleoperation and semi-autonomous robots.

Unit 5: Embodied cognition and situatedness. **Neural networks:** background and fundamentals. Artificial evolution, genetic algorithms short introduction. Multiple autonomous agents, swarm intelligence, stigmergy. Emergence. Learning short introduction.

Reference Books:

1. Artificial intelligence : a modern approach, S.Russell and P.Norvig, prentice hall, ISBNO 13-080302-2
2. 2. Qiangfu ZHAO and Tatsuo higuchi, artificial intelligence: from fundamentals to intelligent searches, kyoritsu, 2017,ISBN: 978-4-320-12419-6(in Japanese).
3. 3. Introduction to Artificial intelligence, shinji araya, KYORITSU SHUPPAN ISBN4-274-13179
4. 4. New artificial Intelligence (Fundamental),Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-2747-13179(in Japanese)
5. 5 New Artificial intelligence (advanced), Takashi Maeda and Fumio Aoki, Ohmsha, ISBN4-274-13198-x (in Japanese)

Web:

1. http://nptel.ac.in/syllabus/106105077/
2. http://ocw.mit.edu/ciyrses/electrical-engineering-and-computer-science/6-034-artificial intelligence -fall-2010/syllabus/
3. http://web.cs.ncsu.edu/~stamant/411syllabus.html
4. http://web-ext.u-aizu.ac.jp/~qf=zhao/REACHING/AI/AI.html

Lab Exercise:

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.

IQAC Cell

DEPARTMENT OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY

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