



University of Engineering & Management, Kolkata
Department of Computer Science

Syllabi of 2019-2023 Batch
(6th Semester)

List of Program Outcomes (POs) for Computer Science Department are given below.

PO NUM BER	SUMMARY	DESCRIPTION
PO1	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of the complex engineering problems.
PO2	Problem analysis	Identify, formulate, research literature, and analyze complex engineering problems reaching substantial conclusion using first principal of mathematics, natural science and engineering sciences.
PO3	Design /development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems	Use research-based knowledge and research methods including designs of experiments analysis and interpretation of data and synthesis of information to provide valid conclusions.
PO5	Modern tool usage	Create, select, and apply appropriate techniques, resources and modern engineering and IT tools including prediction and modelling to complex engineering values activities with an understanding of the limitation.
PO6	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability	Understand the impact of professional engineering solutions in societal and environmental contexts, demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics	Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
PO9	Individual and team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
P010	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
P011	Project management and finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team,
P012	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

List of Program Educational Objectives (PEOs)

PEO 01: High Quality Engineering Design and Development Work:

Graduates of the program will engage in the effective practice of computer science to identify and solve important problems in a diverse range of application areas.

PEO 02: Real Life Problem Solving:

To educate students with proficiency in core areas of computer science and related engineering so as to comprehend engineering trade-offs, analyze, design, and synthesize data and technical concepts to create novel products and solutions for the real life problems.

PEO 03: Leadership:

Graduates of the program will engage in successful careers in industry, academia and attain positions of importance where they have impact on their business, profession and community.

PEO 04: Lifelong Learning:

Graduates of the program will adapt to contemporary technologies, tools and methodologies to remain at the frontier of computer science practice with the ability to respond to the need of a challenging environment.

UEM, KOLKATA
STRUCTURED SYLLABUS FOR ADMISSION BATCH 2019
Department: - CS

Semester : 6			
Sr. No	Course Code	Course Title	
			Credit Point
1	PCC-CS601	Compiler Design	3
2	PCC-CS691	Compiler Design Laboratory	2
3	PCC-CS602	Software Engineering	2
4	PCC-CS692	Software Engineering Laboratory	1
5	HSMC601	Management - I (Finance & Accounting)	3
6	PEC-CS601	Professional Elective-II (Soft Computing)	3
7	PEC-CS602	Professional Elective-III (Data Analytics)	3
8	OEC-CS601	Open Elective-I (Human Resource Development and Organizational Behavior)	3
9	PROJ-CS601	Project – I	3
10	HSMC602	Essential Studies for Professionals – VI (GATE syllabus of Computer Science to be covered)	2
11	HSMC682	Skill Development for Professionals – VI	1
12	MC681	Mandatory Additional Requirements (MAR)	0
13	MOOC 6	Massive Open Online Courses [Mandatory for B.Tech (Honours)]	3
Total Credit Points of Semester [for B.Tech]			26
Total Credit Points of Semester [for B.Tech (Hons.)]			29

Compiler Design

Code: PCC-CS601

Contracts: 3L

Credits: 3

Pre-Requisite: -

- Formal Language & Automata Theory
- Data Structures & Algorithms

Course Outcome: -

The students will be able to:

- To understand how compiler works.
- To understand the inner mechanism of compiler.
- To introduce the major concept areas of language translation and compiler design.
- To develop the knowledge of application of basic data structures and automata theory in different phases of compiler design.
- To enrich the knowledge in various phases of compiler and its use.
- To extend the knowledge of parser by parsing LL parser and LR parser.

Topic: -**Module I****Introduction to Compiling [2L]**

Compilers, Analysis-synthesis model, The phases of the compiler, Cousins of the compiler.

Lexical Analysis [5L]

The role of the lexical analyzer, Tokens, Patterns, Lexemes, Input buffering, Specifications of a token, Recognition of tokens, Finite automata, From a regular expression to an NFA, From a regular expression to NFA, From a regular expression to DFA, Design of a lexical analyzer generator (Lex).

Module II**Syntax Analysis [8L]**

The role of a parser, Context free grammars, writing a grammar, Top down Parsing, Non-recursive Predictive parsing (LL), Bottom up parsing, Handles, Viable prefixes, Operator precedence parsing, LR parsers (SLR, LALR), Parser generators (YACC). Error Recovery strategies for different parsing techniques.

Syntax directed translation [4L]

Syntax directed definitions, Construction of syntax trees, Bottom-up evaluation of S attributed definitions, L attributed definitions, Bottom-up evaluation of inherited attributes.

Module III**Type checking [3L]**

Type systems, Specification of a simple type checker, Equivalence of type expressions, Type conversions

Run time environments [4L]

Source language issues (Activation trees, Control stack, scope of declaration, binding of names), Storage organization (Subdivision of run-time memory, Activation records), Storage allocation strategies, Parameter passing (call by value, call by reference, copy restore, call by name), Symbol tables, dynamic storage allocation techniques.

Module IV**Intermediate code generation [3L]**

Intermediate languages, Graphical representation, Three-address code, Implementation of three address statements (Quadruples, Triples, Indirect triples).

Code optimization [4L]

Introduction, Basic blocks & flow graphs, Transformation of basic blocks, Dag representation of basic blocks, The principle sources of optimization, Loops in flow graph, Peephole optimization.

Code generations [3L]

Issues in the design of code generator, a simple code generator, Register allocation & assignment.

Text Books

- Aho, Sethi, Ullman - “Compiler Principles, Techniques and Tools” - Pearson Education.
- Chattopadhyay, S- Compiler Design (PHI)

Reference Books

- Holub - “Compiler Design in C” – PHI
- Liebowitz Tremblay and Sorenson Compiler Writing-Mcgraw Hill International

Compiler Design Laboratory

Code: PCC-CS691

Contracts: 2L

Credits: 2

Pre-Requisite: -

- Formal Language & Automata Theory
- Data Structures & Algorithms

Course Outcome: -

The students will be able:

- To introduce the major concept areas of language translation and compiler design.
- To develop the knowledge of application of basic data structures and automata theory in different phases of compiler design
- To enrich the knowledge in various phases of compiler and its use.
- To extend the knowledge of parser by parsing LL parser and LR parser.

Topic: -

1. Implementation of Symbol Table
2. Develop a lexical analyzer to recognize a few patterns in C. (Ex. identifiers, constants, comments, operators etc.)
3. Implementation of Lexical Analyzer using Lex Tool
4. Generate YACC specification for a few syntactic categories.
 - a) Program to recognize a valid arithmetic expression that uses operator +, -, * and /.
 - b) Program to recognize a valid variable, which starts with a letter followed by any number of letters or digits.
 - c) Implementation of Calculator using LEX and YACC
5. Convert the BNF rules into Yacc form and write code to generate Abstract Syntax Tree.
6. Implement type checking
7. Implement control flow analysis and Data flow Analysis
8. Implement any one storage allocation strategies (Heap, Stack, Static)
9. Construction of DAG
10. Implement the back end of the compiler which takes the three address code and produces the 8086 assembly language instructions that can be assembled and run using a 8086 assembler. The target assembly instructions can be simple move, add, sub, jump. Also simple addressing modes are used.

Text Books

- Modern compiler implementation in C, Andrew w.Appel, Revised Edn, Cambridge University Press
- Principles of Compiler Design. – A.V Aho, J.D Ullman ; Pearson Education.
- lex&yacc , -John R Levine, Tony Mason, Doug Brown; O'reilly.
- Compiler Construction,- LOUDEN, Thomson.
- Engineering a compiler – Cooper& Linda, Elsevier
- Modern Compiler Design – Dick Grune, Henry E.Bal, Criel TH Jacobs, Wiley Dreatech

Software Engineering

Code: PCC-CS602

Contracts: 2L

Credits: 2

Pre-Requisite: -

- Knowledge of 12th standard mathematics.
- Basic knowledge of programming in any language.
- Basic knowledge of HTML, Java Script and CSS.
- Knowledge of Database Management Systems.
- Knowledge of flowchart, data-structure, algorithm, graph and tree.

Course Outcome: -

The students will be able:

- To get a professionally guided education in software engineering that prepares graduates to transition into a broad range of career options: industry, government, computing graduate program, and professional education.
- To demonstrates agility in solving software and system challenges with a comprehensive set of skills appropriate to the needs of the dynamic global computing-based society.
- To capable of diverse team and organizational leadership in computing project settings.
- To demonstrates ethical principles in the application of computing-based solutions to societal and organizational-problems.
- To continually acquires skills and knowledge to support a professional pathway, including (but not limited to) communication, analytic, and technical skills.

Topic: -

Module-1:

1. Software Engineering –Objectives, Definitions, Software Process models – Waterfall Model, Prototype model, RAD, Evolutionary Models, Incremental, Spiral.
2. Software Project Planning- Feasibility Analysis, Technical Feasibility, Cost- Benefit Analysis, COCOMO model.

Module-2:

1. Structured Analysis, Context diagram and DFD, Physical and Logical DFDs, Data Modelling, ER diagrams, Software Requirements Specification

Module-3:

1. Design Aspects: Top-Down and Bottom-Up design; Decision tree, decision table and structured English, Structure chart, Transform analysis Functional vs. Object- Oriented approach.

Module-4:

1. Unified Modelling Language, Class diagram, interaction diagram: collaboration diagram, sequence diagram, state chart diagram, activity diagram, implementation diagram

Module-5:

1. Coding & Documentation – Structured Programming, Modular Programming, Module Relationship- Coupling, Cohesion, OO Programming, Information Hiding, Reuse, System Documentation.
2. Testing – Levels of Testing, Integration Testing, System Testing.
3. Software Quality, Quality Assurance, Software Maintenance, Software Configuration Management, Software Architecture.

Text Books

- Software Engineering: A practitioner's approach– Pressman (TMH)
- Software Engineering- Rajib Mall (PHI)

Reference Books

- Software Engineering- Pankaj Jalote (Wiley-India)
- Software Engineering –Agarwal and Agarwal (PHI)

Software Engineering Laboratory

Code: PCC-CS692

Contracts: 2L

Credits: 1

Pre-Requisite: -

- Knowledge of 12th standard mathematics.
- Basic knowledge of programming in any language.
- Basic knowledge of HTML, Java Script and CSS.

- Knowledge of Database Management Systems.
- Knowledge of flowchart, data-structure, algorithm, graph and tree.

Course Outcome: -

The students will be able:

1. To get a professionally guided education in software engineering that prepares graduates to transition into a broad range of career options: industry, government, computing graduate program, and professional education.
2. To demonstrates agility in solving software and system challenges with a comprehensive set of skills appropriate to the needs of the dynamic global computing-based society.
3. To capable of diverse team and organizational leadership in computing project settings.
4. To demonstrates ethical principles in the application of computing-based solutions to societal and organizational problems.

Topic: -

Module 1: Software Engineering Basics

Develop requirements specification for a given problem, Develop DFD Model (Level 0, Level 1 DFD and data dictionary) of the sample problem (Use of a CASE tool required), Develop Structured design for the DFD model developed, Develop UML Use case model for a problem (Use of a CASE tool any of Rational rose, ArgoUML, or Visual Paradigm etc. is required), Develop Sequence Diagrams, Develop Class diagrams.

Module 2: Java Database Connectivity (JDBC)

Overview of RDBMS, Introduction to JDBC, JDBC Architecture, Types of JDBC Drivers, Establishing a JDBC Connection, Using Statement, Using Prepared Statement, Using Callable Statement.

Module 3: Java Servlets

What is a Web-Container,Servlet Life Cycle / Architecture, HTTP GET and POST Request Methods, Processing Html Forms, s Name-Value pair, Content Types and MIME, Configuration of Web Application, Understanding the Deployment Descriptor (DD) / web.xml, Servlet URL Pattern Mapping, g HTTP Session, Cookies.

Module 4: Java Server Pages (JSP)

JSP Architecture, JSP Standard / Implicit Objects, Request, Reponse, Out, config, Application, session, page, page Context, exception, JSP Basic syntax, Tags (Directive Tags, Action Tags, Script related Tags, Scriptlet Tag, Expression Tag, Declaration Tag, setProperty Tag....).

Text Book

- “JDBC, Servlet and JSP Black Book” by Santosh Kr. K. (DreamTech)

Management-I (Finance & Accounting)

Code: HSMC601

Contracts: 2L

Credits: 3

Pre-Requisite: -

Concept of accounting and financial management.

Course Outcome: -

The students will be able:

- To discuss the concept of depreciation accounting.
- To discuss the concept of cost accounting.
- To discuss the concept of budgeting.

Topic: -

Module 1: Depreciation Concept: (4 L)

Concept of depreciation; Causes of depreciation; depletion;

Module 2: Depreciation Accounting (6L): Depreciation accounting; Methods of recording depreciation; Straight line and diminishing balance method.

Module 3: Final Accounts for sole proprietorship business (Sums and Theory) (8L) Manufacturing account; Trading account; Profit and Loss Account; Balance Sheet; Adjustment entries Closing stock, outstanding, prepaid Expenses, Pre received, Depreciation, Provision, Stock lost by Fire, Goods withdrawal by proprietors, Free sample.

Module 4 Cost Accounting (6L): Essentials of a good cost accounting system: Difference between cost and Management accounting, LIFO/ FIFO, Materials (EOQ & Store Ledger) Preparation of Advanced cost sheet & estimation.

Module 5 Capital Budgeting 2 (6L): Time value of money; Methods- Profitability Index, Net Present Value and Internal Rate of Return

Text Books:

- Hanif, Mukherjee: Financial Accounting-1, Mcgrawhill.
- Basu, Das: Cost & Management Accounting-1, Rabindra Library.
- Dey, Dutta, Mukherjee: Cost & Management Accounting-1, Bhattachrjee Brothers.
- Kar, Bagchi: Financial Management, Dey Book Concern.

Soft Computing

Code: PEC-CS601

Contracts: 3L

Credits: 3

Pre-Requisite: -

Artificial Intelligence.

Course Outcome: -

The students will be able:

- To apply basics of Fuzzy logic and neural networks.
- To relate with neural networks that can learn from available examples and generalize to form appropriate rules for inference systems.
- To describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.
- To develop some familiarity with current research problems and research methods in Soft Computing Techniques.

Topic: -

1. Introduction to Soft Computing

- Concept of computing systems.
- "Soft" computing versus "Hard" computing
- Characteristics of Soft computing
- Some applications of Soft computing techniques

2. Fuzzy logic

- Introduction to Fuzzy logic.
- Fuzzy sets and membership functions.
- Operations on Fuzzy sets.
- Fuzzy relations, rules, propositions, implications and inferences.
- Defuzzification techniques.
- Fuzzy logic controller design.

- Some applications of Fuzzy logic.

3. Genetic Algorithms

- Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques
- Basic GA framework and different GA architectures.
- GA operators: Encoding, Crossover, Selection, Mutation, etc.
- Solving single-objective optimization problems using GAs.

4. Multi-objective Optimization Problem Solving

- Concept of multi-objective optimization problems (MOOPs) and issues of solving them.
- Non-Pareto approaches to solve MOOPs
- Pareto-based approaches to solve MOOPs
- Some applications with MOEAs.

5. Artificial Neural Networks

- Biological neurons and its working.
- Simulation of biological neurons to problem solving.
- Different ANNs architectures.
- Training techniques for ANNs.
- Applications of ANNs to solve some real life problems.

Text Books:

- Fuzzy Logic: A Practical approach, F. Martin, , Mc neill, and Ellen Thro, AP Professional, 2000.
- Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.

Reference Books

- Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.
- Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elsevier Press, 2004.
- An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
- Genetic Algorithms In Search, Optimization And Machine Learning, David E. Goldberg, Pearson Education, 2002.
- Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.

Data Analytics

Code: PEC-CS602

Contracts: 3L

Credits: 3

Pre-Requisite: -

- Knowledge of Boolean algebra, matrix, statistics.
- Basic knowledge of programming in any language (PYTHON is preferable).
- Knowledge of Database Management Systems.
- Knowledge of flowchart, data-structure, algorithm, graph and tree.

Course Outcome: -

The students will be able:

- To learn, understand, and practice data analytics and machine learning approaches, which include the study of modern computing big data technologies and scaling up machine learning techniques focusing on industry applications.
- To conceptualize and summarize the big data and machine learning, trivial data versus big data, big data computing technologies, machine learning techniques, and scaling up machine learning approaches.

Topic: -

1. Descriptive Statistics Introduction to the course Descriptive Statistics Probability Distributions

2. Inferential Statistics Inferential Statistics through hypothesis tests Permutation & Randomization Test 3. Regression & ANOVA Regression ANOVA (Analysis of Variance)
4. Machine Learning: Introduction and Concepts Differentiating algorithmic and model based frameworks Regression Ordinary Least Squares, Ridge Regression, Lasso Regression, K Nearest Neighbours Regression & Classification
5. Supervised Learning with Regression and Classification techniques -1 Bias-Variance Dichotomy. Model Validation approaches Logistic Regression Linear Discriminant Analysis Quadratic Discriminant Analysis Regression and classification Trees Support Vector Machines
6. Supervised Learning with Regression and Classification techniques -2 Ensemble Methods: Random Forest Neural networks deep learning
7. Unsupervised Learning and Challenges for Big Data Analytics Clustering Associative Rule Mining Challenges for big data analytics.
8. Prescriptive analytics Creating data for analytics through designed experiments. Creating data for analytics through active learning Creating data for analytics through Reinforcement learning.

Text Books:

- "Probability" Jim Pitman. Springer
- "Mathematics for Machine Learning" Faisal, Ong, Deisenroth. Cambridge University Press
- Probability and Statistics for Computer Science, David Forsyth
- "Statistics in a Nutshell" Boslaugh
- "Python for Data Analysis" McKinney. O'Reilly

Reference Books

- "Python Data Analytics" Nelli. Apress
- "Data Analysis" Bishnu, Bhattacharjee
- "Principles of Data Mining" Brammer
- "Data Mining" Han, Kamber
- "Data Mining" Tan, Kumar, Steinbach
- An Introduction to Statistical Learning: With Applications in R, Gareth M. James, Trevor Hastie, Daniela Witten, R J Tibshirani
- Beginning R: The Statistical Programming Language, Mark Gardener

Human Resource Development and Organizational Behavior

Code: OEC-CS601

Contracts: 2L

Credits: 3

Pre-Requisite: -

Basic knowledge of management is helpful, Case study videos

Course Outcome: -

The students will be able:

- To learn about organizations, their structure, purpose and theories concerning organizations.
- To understand employee behavioural dynamics in organizations.
- To understand individual and group behaviours in organizational context
- To learn about developmental aspect of human resources.
- To learn the fundamentals of team building, organizational culture building, competency building.
- To develop concepts on Human Capital.

Topic: -

1. Organizational Behaviour: Definition, Importance, Historical Background, Fundamental Concepts of OB, Challenges and Opportunities for OB.
2. Personality and Attitudes: Meaning of personality, Personality Determinants and Traits, Development of Personality, Types of Attitudes, Job Satisfaction.
3. Perception: Definition, Nature and Importance, Factors influencing Perception, Perceptual Selectivity, Link between Perception and Decision Making.

4. Motivation: Definition, Theories of Motivation - Maslow's Hierarchy of Needs Theory, McGregor's Theory X & Y, Herzberg's Motivation-Hygiene Theory, Alderfer's ERG Theory, McClelland's Theory of Needs, Vroom's Expectancy Theory.
5. Group Behaviour: Characteristics of Group, Types of Groups, Stages of Group Development, Group Decision Making.
6. Communication: Communication Process, Direction of Communication, Barriers to Effective Communication.
7. Leadership: Definition, Importance, Theories of Leadership Styles.
8. Organizational Politics: Definition, Factors contributing to Political Behaviour.
9. Conflict Management: Traditional vis-a-vis Modern View of Conflict, Functional and Dysfunctional Conflict, Conflict Process, Negotiation – Bargaining Strategies, Negotiation Process.
10. Organizational Design: Various Organizational Structures and their Effects on Human Behaviour, Concepts of Organizational Climate and Organizational Culture.

Text Books:

- Robbins, S. P. & Judge, T.A.: Organizational Behavior, Pearson Education, 15th Edn.
- Luthans, Fred: Organizational Behavior, McGraw Hill, 12th Edn.

Reference Books:

- Shukla, Madhukar: Understanding Organizations – Organizational Theory & Practice in India, PHI
- Fincham, R. & Rhodes, P.: Principles of Organizational Behaviour, OUP, 4th Edn.

Essential studies for Professionals- VI

Code: HSMC602

Contracts: 2L

Credits: 2

Pre-Requisite: -

A student is required to possess a basic knowledge various subjects related to Engineering and Science along with the awareness of current national and international happenings. He/she should be aware of the types of questions being asked in GATE examination.

Course Outcome: -

The students will be able:

- To get success in GATE examination.

Topic: -

- GATE syllabus of Computer Science.
- Questions from GATE to be solved by students. (6000 + questions).

Text Books:

- NONE

Skill Development for Professional- VI

Code: HSMC682

Contracts: 2L

Credits: 1

Pre-Requisite: -

A student is required to possess a basic knowledge related to mathematics, reasoning.

Course Outcome: -

The students will be able:

- To polish and enhance various aptitude skills and cognitive knowledge of the students and prepare them to be successful in the fields different competitive examinations like GATE,CAT, MAT,GMAT,UPSC, WBCS, Banking services, Indian Defence Services ,Combined Graduate Level etc.
- To prepare themselves for private sectors and also for the public sectors to secure a fulfilling career.

Topic: -

- CAT previous years' question solved.
- Banking Services questions solved.

Text Books:

- NONE