

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	MSE	CA	ESE	
Semester V									
1	BTCOC501	Database Systems	3	1	-	20	20	60	4
2	BTCOC502	Theory of Computations	3	1	-	20	20	60	4
3	BTCOC503	Machine Learning	3	1	-	20	20	60	4
4	BTCOE504	Elective-III (A) Introduction to Research (B) Cyber Laws (C) Open Elective offered by other departments	2	-	-	20	20	60	2
5	BTCOE505	Elective-IV (A) Economics & Management (B) Business Communication	2	-	-	20	20	60	2
6	BTCOC506	Competitive Programming-I	1	-	2	-	60	40	2
7	BTCOL507	Database System Laboratory	-	-	2	-	60	40	1
8	BTCOL508	Machine Learning Laboratory	-	-	2	-	60	40	1
9	BTCOS509	Seminar	-	-	2	-	60	40	1
10	BTCOF411	Internship/Industrial Training	-	-	-	-	60	40	1
TOTAL			14	3	8	100	400	500	22

Sr. No.	Course Code	Course Title	Weekly Teaching hrs			Evaluation Scheme			Credit
			L	T	P	MSE	CA	ESE	
Semester VI									
1	BTCOC601	Compiler Design	3	1	-	20	20	60	4
2	BTCOC602	Computer Networks	3	1	-	20	20	60	4
3	BTCOE603	Elective-V (A) Human Computer Interaction (B) Artificial Intelligence (C) Object-Oriented Analysis Design	2	1	-	20	20	60	3
4	BTCOE604	Elective-VI (A) Geographic Information System (B) Biology (C) Internet of Things	2	-	-	20	20	60	2
5	BTCOE605	Open Elective-VII (A) Development Engineering (B) National Social Service (C) Consumer Behaviour	2	-	-	20	20	60	2
6	BTCOC606	Competitive Programming-II	1	-	2	-	60	40	2
7	BTCOL607	(A) Mobile Application Development	1	-	2	-	60	40	2
		(B) Internet of Things Laboratory							
8	BTCOL608	Computer Networks Laboratory	-	-	2	-	60	40	1
9	BTCOF609	Filed Training / Internship / Industrial Training (Credit to be evaluated in VII Sem.)	-	-	-	-	-	-	*
TOTAL			14	3	6	100	280	420	20

BTCOC501 Database Systems

[Unit 1] **6 Hrs**

Database system architecture: Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML).

Data models: Entity-relationship model, Relational integrity constraints, data manipulation operations.

[Unit 2] **6 Hrs**

Relational query languages: Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS – MYSQL, ORACLE, DB2, SQL server.

[Unit 3] **6 Hrs**

Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

[Unit 4] **6 Hrs**

Query processing: Evaluation of relational algebra expressions, Query equivalence, Join strategies.

[Unit 5] **6 Hrs**

File Organization and Indexing: Indices, B-trees, hashing.

[Unit 6] **6 Hrs**

Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Text Books:

1. Henry Korth, Abraham Silberschatz & S. Sudarshan, *Database System Concepts*, McGraw-Hill Publication, 6th Edition, 2011.
2. Raghu Ramakrishnan, Johannes Gehrke, *Database Management Systems*, McGraw-Hill Publication, 3rd Edition, 2003.

Reference Books:

1. Joel Murach, *Murach's Oracle SQL and PL/SQL for Developers*, Mike Murach & Associates, 2nd Edition, 2014.
2. Wiederhold, *Database Design*, McGraw-Hill Publication, 2nd Edition, 1983.
3. Navathe, *Fundamentals of Database System*, Addison-Wesley Publication, 6th Edition, 2012.
4. Mark L. Gillenson, *Fundamentals of Database Management System*, Wiley Publication, 2nd Edition, 2011.
5. J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1, Computer Science Press.
6. Serge Abiteboul, Richard Hull, Victor Vianu, "Foundations of Databases", Reprint by Addison-Wesley.

BTCC502 Theory of Computations

[Unit 1] **6 Hrs**
Finite Automata and Regular Expressions: Definition of deterministic finite automata, Non-deterministic finite automata, Moore and Mealy machines and their conversions, Regular expressions, Recursive definition, NFA with e-moves, Inter-conversion between NFA and DFA, Regular expression and FA, Pumping lemma.

[Unit 2] **6 Hrs**
Context Free Grammars: Definition, Production rules, Ambiguous grammar, Removal of ambiguity, Chomsky hierarchy, Context Free Grammar (CFG) – definition, Simplification of CFG.

[Unit 3] **6 Hrs**
Context Free Languages: Definition of context free languages, Regular grammar definition, Left linear, Right linear grammar, Inter-conversion between left linear and right linear regular grammar, Regular grammar and finite automata, CNF, GNF, Derivation graphs, Type 0 and Type 1 grammars.

[Unit 4] **6 Hrs**
Pushdown Automata: Formal definition, Pushdown automata (PDA), Deterministic Pushdown automata (DPDA) – definition, Non-deterministic Pushdown automata (NPDA) - definition, relative powers of DPDA and NPDA.

[Unit 5] **6 Hrs**
Turing Machines and Undecidability: Definition, Computing with Turing machine, Extensions of Turing machines, Random access Turing machines, Non-deterministic Turing machines, Grammars, The Church's Turing hypothesis, Universal Turing machines, The Halting problem, Unsolvability problems about Turing machines.

Reference Books:

1. John C. Martin, *Introduction to Languages and Theory of Computation*, McGraw-Hill Publication, 4th Edition, 2010.
2. Krithivasan Kamala, *Introduction to Formal Languages, Automata Theory and Computation*, Pearson Education, 1st Edition, 2009.
3. Papadimitriou, Lewis, *Elements of the Theory of Computations*, PHI Publication, 2nd Edition, 1997.
4. E. V. Krishnamurthy, *Introductory Theory of Computer Science*, Springer-Verlag New York Inc., 1st Edition, 1985.

Text Books:

1. Hopcroft, Ullman, Motwani, *Introduction to Automata Theory, Languages, and Computation*, Addison Wesley Publication, 2nd Edition, 2001.
2. Daniel I. A. Cohen, *Introduction to Computer Theory*, Wiley Publication, 1st Edition, 1986.

BTCOC503 Machine Learning

[Unit 1]	6 hrs
Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation, Linear regression, Decision trees, overfitting.	
[Unit 2]	6 hrs
Instance based learning, Feature reduction, Collaborative filtering based recommendation, Probability and Bayes learning.	
[Unit 3]	6 hrs
Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM.	
[Unit 4]	6 hrs
Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.	
[Unit 5]	6 hrs
Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning.	
[Unit 6]	6 hrs
Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model.	

Reference Books:

1. Machine Learning, Tom Mitchell, First Edition, McGraw Hill, 1997.
2. Introduction to Machine Learning, 2nd Edition, by Ethem Alpaydin.

Dr. Babasaheb Ambedkar Technological University
BTCOE504(A) Introduction to Research

[Unit 1]

What is research; Overview of research.

[Unit 2]

Literature survey, Conducting Systematic Research Survey.

[Unit 3]

Experimental skills; Data analysis; modelling skills.

[Unit 4]

Technical writing, Technical Presentations, Creativity in Research.

[Unit 5]

Technical writing, Technical Presentations, Creativity in Research, Research plagiarism.

[Unit 6]

Conducting a sample Research Survey on a given topic

Reference Books:

1. Research Methodology, Methods and Techniques by C.R Kothari, 2nd Edition.

BTCOE504(B) Cyber Laws

[Unit 1]

Internet, E-Commerce And E-Governance With Reference To Free Market Economy Understanding Computers, Internet and Cyber Laws, Conceptual Framework of E-commerce: E-governance, The Role of Electronic Signatures in E-commerce with Reference to Free Market Economy in India.

[Unit 2]

Law Relating To Electronic Records And Intellectual Property Rights In India Legal Aspects of Electronic Records/Digital Signatures, The Rules and Regulations of Certifying Authorities in India, Protection of Intellectual Property Rights in Cyberspace in India.

[Unit 3]

International Efforts Relating To Cyberspace Laws And Cyber Crimes International Efforts Related to Cyberspace Laws, Council of Europe (COE) Convention on Cyber Crimes.

[Unit 4]

Penalties, Compensation And Offences Under The Cyberspace And Internet In India Penalties, Compensation and Adjudication of Violations of Provisions of IT Act and Judicial Review Some Important Offences under the Cyberspace Law and the Internet in India, Other Offences under the Information Technology Act in India.

[Unit 5]

Miscellaneous Provisions Of It Act And Conclusions The Role of Electronic Evidence and the Miscellaneous Provisions of the IT Act, Information Technology Act as Amended up to 2008, The Information Technology (Certifying Authorities) Rules, 2000, The Information Technology (Certifying Authorities) Rules, 2000, Ministerial Order on Blocking of Websites.

Reference Books:

1. Harish Chander, Cyber Laws and It Protection, PHI Publication.
2. Faiyaz Ahamad, KLSI, Cyber Law and Information Security, Dreamtech Press.
3. Murray, Information Technology Law: Law and Society, 3rd Edition, Oxford University Press Oxford 2016.
4. Sunit Belapure Nina Godbole, Cyber Security, Wiley India Pvt. Ltd.
5. Vivek Sood, Cyber Law Simplified, McGraw-Hill Publication.

BTCOE505(A) Economics and Management

[Unit 1]

Introduction, Market Equilibrium: Demand and Supply, Elasticity of Demand Demand Forecasting, Production, Exercises on Economics, Cost-Volume-Profit Relationships, Cost Management Systems and Activity Costing System

[Unit 2]

Relevant Information and Decision Making, Cost Allocation, Exercises on Economics, Double-Entry Bookkeeping, Job Casting, Process Costing, The Master Budget, Flexible Budgets and Variance Analysis.

[Unit 3]

Financial Statements, Analysis of Financial Statements, Time Value of Money, Comparison of Alternatives.

[Unit 4]

Depreciation Accounting, Evolution of Management Thoughts, Functions of Management Directing.

[Unit 5]

Product Development, Forecasting Revisited, Capacity Planning, Product / Services Strategies and Plant Layout, Production Planning and Control.

[Unit 6]

Inventory Management, Supply Chain Management, Marketing Management, Forms of Ownership, Starting a New Company and Small-Scale Industrial Understandings, Capital Financing, Entrepreneurship.

BTCOE505(B) Business Communication

[Unit 1]

Introduction, Definitions & Concepts, Communicative Competence.

[Unit 2]

Intercultural Communication, Nonverbal Communication, Thought and Speech, Translation as Problematic Discourse.

[Unit 3]

Barriers to Communication, Listening, Communication Rules, Communication Style.

[Unit 4]

Interpersonal Communication, Relational Communication, Organizational Communication.

[Unit 5]

Collaboration, Communication in Groups and Teams, Persuasive Communication.

[Unit 6]

Negotiation and Conflict Management, Leadership, Written Communication in International Business, Role of Technology in international Business Communication, Moving to Another Culture, Crisis Communication, Ethics in Business Communication.

BTCOC506 Competitive Programming-I

[Unit 1]

Introduction

Online Judge The Programming Challenges Robot Judge, Understanding Feedback From the Judge, Choosing Programming Languages, Reading Our Programs, Standard Input/Output, Programming Hints, Elementary Data Types.

Challenging Problems

(1) The $3n + 1$ Problem (2) Minesweeper (3) The Trip, (4) LCD Display (5) Graphical Editor (6) Interpreter (7) Check the Check (8) Australian Voting.

[Unit 2]

Elementary Data Structures

Data Structures: Elementary Data Structures, Stacks, Dictionaries, Priority Queues Sets, Object Libraries, The C++ Standard Template Library, The Java java.util Package, Program Design Example: Going to War, Hitting the Dec, String Input/Output, Winning the War, Testing and Debugging.

Challenging Problems

(1) Jolly (2) Poker Hands (3) Hartals (4) Crypt Kicker (5) Stack 'em Up (6) Erdős Numbers (7) Contest Scoreboard (8) Yahtzee.

[Unit 3]

Strings

Character Codes, Representing Strings, Program Design Example: Corporate Renamings, Searching for Patterns, Manipulating Strings, Completing the Merger, String Library Functions.

Challenging Problems

(1) WERTYU (2) Where's Waldorf? (3) Common Permutation (4) Crypt Kicker II (5) Automated Judge Script (6) File Fragmentation (7) Doublets (8) Fmt

[Unit 4]

Sorting

Sorting, Sorting Applications Sorting Algorithms, Program Design Example: Rating the Field, Sorting Library Functions, Rating the Field.

Challenging Problems

(1) Vito's Family (2) Stacks of Flapjacks (3) Bridge (4) Longest Nap (5) Shoemaker's Problem (6) CDVII (7) ShellSort (8) Football.

[Unit 5]

Arithmetic and Algebra

Machine Arithmetic, Integer Libraries, High-Precision Integers, High-Precision Arithmetic, Numerical Bases and Conversion, Real Numbers, Dealing With Real Numbers, Fractions, Decimals, Algebra, Manipulating Polynomials, Root Finding, Logarithms, Real Mathematical Libraries.

Challenging Problems

(1) Primary Arithmetic (2) Reverse and Add (3) The Archeologist's Dilemma (4) Ones (5) A Multiplication Game (6) Polynomial Coefficients (7) The Stern-Brocot Number System (8) Pairsumonious Numbers.

[Unit 6]

Combinatorics

Basic Counting Techniques, Recurrence Relations, Binomial Coefficients, Other Counting Sequences, Recursion and Induction Problems.

Challenging Problems

(1) How Many Fibs? (2) How Many Pieces of Land? (3) Counting (4) Expressions (5) Complete Tree Labeling (6) The Priest Mathematician (7) Self-describing Sequence (8) Steps

List of Practical:

At least twenty five problems solving on competitive programming platforms such as, <https://uva.onlinejudge.org>, <http://hackerrank.com/>, <http://codechef.com/>

Reference Books:

1. Steven S. Skiena Miguel A. Revilla, PROGRAMMING CHALLENGES The Programming Contest Training Manual, Springer.
2. Antti Laaksonen, Competitive Programmer's Handbook.
3. Steven Halim, Competitive Programming 3: The Lower Bounds of Programming Contests.
4. Gayle Lakaman Cracking the Coding Interview.
5. The Hitchhiker's Guide to the Programming Contests.

List of Experiments:

1. Defining schema for applications.
2. Creating tables, Renaming tables, Data constraints (Primary key, Foreign key, Not Null), Data insertion into a table.
3. Grouping data, aggregate functions, Oracle functions (mathematical, character functions).
4. Sub-queries, Set operations, Joins.
5. Creation of databases, writing SQL and PL/SQL queries to retrieve information from the databases.
6. Assignment on Triggers & Cursors.
7. Normal Forms: First, Second, Third and Boyce Codd Normal Forms.
8. Assignment in Design and Implementation of Database systems or packages for applications such as office automation, hotel management, hospital management.
9. Deployment of Forms, Reports Normalization, Query Processing Algorithms in the above application project.
10. Large objects – CLOB, NCLOB, BLOB and BFILE.
11. Distributed data base Management, creating web-page interfaces for database applications using servlet.

Dr. Babasaheb Ambedkar Technological University
BTCOL508 Machine Learning Laboratory

As a part of lab exercises for Machine Learning Laboratory, it is suggested that the student should get hands-on experience by solving data analysis problems available on Machine Learning competition platforms such as HackerEarth and Kaggle. Some of the suggestive list of problem solving is given below. The link address is as retrieved from www.hackerearth.com on 17 June 2019. Knowledge of R programming or Python is required to solve these problems, students get this prerequisite in Second Year.

1	Regression Analysis and Plot interpretation
2	Logistic Regression Analysis in R
3	Random Forest and Parameter Tuning in R
4	Clustering Algorithms and Evaluation in R
5	Machine Learning Project in Python on House Prices Data

BTCOC601 Compiler Design

[Unit 1] 6 Hrs

Introduction to Compiling

Definition, analysis of the source program, the phases of a compiler, the grouping of phases, Compiler Construction tools, A simple one-pass compiler,

[Unit 2] 6 Hrs

Lexical Analysis

The role of the Lexical analyzer, Input buffering, Specification of Tokens, A Language for Specifying Lexical Analyzers, Design of a Lexical Analyzer generator.

[Unit 3] 6 Hrs

Syntax Analysis

The role of the Parser, Context-free grammars, Writing a Grammar, Top-Down Parsing, Bottom-Up Parsing, Operator-precedence Parsing, LR Parsers, Using Ambiguous Grammars, Parser Generators.

[Unit 4] 6 Hrs

Syntax-Directed Translation

Definitions, Construction of Syntax Trees, Bottom-Up Evaluation of S- Attributed definitions, Top-Down Translation, Bottom-Up Evaluation of Inherited attributes.

Unit 5] 6 Hrs

Intermediate Code Generation

Intermediate Languages, Declarations, Assignment Statements, Boolean Expressions, Case Statements, Back patching, Procedure Calls.

[Unit 6] 6 Hrs

Code Generation

Issues in the Design of a Code Generator, The target Machine, Run-Time Storage Management, Basic Blocks and Flow Graphs, Next-Use Information, Simple Code Generator, Register allocation and Assignment, The DAG Representation of Basic Blocks, Generating Code from DAGs, Dynamic Programming, Code-Generation Algorithm, Code-Generators.

Text Books:

1. Aho, Sethi, Ullman, *Compilers Principles, Techniques and Tools*, Addison Wesley, 1st Edition, 1987.
2. Hopcroft, Motwani and Ullman, *Introduction to Automata Theory, Languages and Computation*, Pearson Publication, 2nd Edition, 2001.
3. Dick Grune, Kees van Reeuwijk, Henri E. Bal, Cerial J. H. Jacobs and Koen Langendoen, *Modern Compiler Design*, Springer, 2nd Edition, 2012.

BTCOC602 Computer Networks

[Unit 1] 6 Hrs

Introduction: Applications of computer networks, Network hardware, Network software: Protocol Hierarchy, Design Issue, connection oriented vs. connectionless, Service Primitives, Reference models: OSI and TCP/IP, Example networks: Internet, Network standardization, Performance: Bandwidth and Latency, Delay and bandwidth product, High-Speed Network, Application Performance Needs.

[Unit 2] 6 Hrs

LAN Technologies: X.25, Frame relay, ATM, Ethernet (802.3), FDDI, Token Rings, Resilient Packet Rings, Wireless LANs: Wi-Fi (802.11), Cell Phone Technologies, Broadband Wireless: Wi-MAX (802.16), Bluetooth (802.15.1), RFID.

[Unit 3] 6 Hrs

Data Link Layer: Data Link Layer Design Issues: Service provided to network layer Framing, Error Control, Flow Control, Error Detection and Correction: error correcting codes, error detecting codes.

[Unit 4] 6 Hrs

Network Layer and Congestion Control: IPv4/IPv 6, Routers and Routing Algorithms distance vector link state. TCP UDP and sockets.

Congestion Control and QOS: General principles, Congestion prevention policies, Load shading, Jitter control, Quality of service: Packet scheduling, Traffic shaping, integrated Services.

[Unit 5] 6 Hrs

Application Layer Protocols: DNS, SMTP, POP, FTP, HTTP.

[Unit 6] 6 Hrs

Network Security: Authentication, Basics of public key and private key cryptography, digital signatures and certificates, firewalls.

Reference Books:

1. S. Keshav, *An Engineering Approach to Computer Networking*, Addison-Wesley Professional, 1st Edition, 1997.
2. D. Comer, *Computer Networks and Internet*, Pearson Education, 6th Edition, 2014.
3. M. Gallo, W. Hancock, *Computer Communications and Networking Technologies*, Brooks/Cole Publisher, 2001.
4. Natalia Olifer, Victor Olifer, *Computer Networks: Principles, Technologies and Protocols for Network Design*, Wiley Publication, 2005.

Text Books:

1. Tanenbaum, *Computer Networks*, PHI Publication, 5th Edition, 2011.
2. B. Forouzan, *Data Communications and Networking*, McGraw Hill Publication, 5th Edition, 2013.
3. Larry Peterson and Bruce Davie, *Computer Networks: A Systems Approach*, Morgan Kufman Publication, 5th Edition, 2012.

BTCOE603(A) Human Computer Interaction

[Unit 1] **6 Hrs**

Introduction: Course objective and overview, Historical evolution of the field, The Human, The Computer, The Interaction.

[Unit 2] **6 Hrs**

Design processes: Interaction Design basics, Concept of usability – definition and elaboration, HCI in the Software Process, Design Rules.

[Unit 3] **6 Hrs**

Implementation and Evaluation: Implementation Support, Evaluation Techniques, Universal Design, Use Support.

[Unit 4] **6 Hrs**

Models: Cognitive Models, Socio – Organizational Issues and Stakeholders Requirements, Communication and Collaboration models.

Theories: Task Analysis Dialog notations and Design Models of the system Modeling Rich Interactions.

[Unit 5] **6 Hrs**

Modern Systems: Group ware, Ubiquitous Computing and Augmented Realities, Hypertext, Multimedia and World Wide Web.

Reference Books:

1. Jenny Preece, Helen Sharp, Yvonne Rogers, *Interaction Design: Beyond Human-Computer Interaction*, Wiley Publication, 4th Edition, 2015.
2. Gerard Jounghyun Kim, *Human–Computer Interaction: Fundamentals and Practice*, CRC Press, 2015.
3. Jenifer Tidwell, *Designing Interfaces, Patterns for Effective Interaction Design*, O’Reilly Media, 2nd Edition, 2010.

Text Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, *Human Computer Interaction*, Pearson Education, 3rd Edition, 2003.
2. B. Shneiderman, *Designing the User Interface*, Addison-Wesley Publishing Company.

BTCOE603(B) Artificial Intelligence

[Unit 1]

Introduction

Introduction, What Is AI?, The Foundations of Artificial Intelligence, The History of Artificial Intelligence, The State of the Art.

Intelligent Agents

Agents and Environments Good Behavior: The Concept of Rationality, The Nature of Environments, The Structure of Agents.

[Unit 2]

Problem-solving

Solving Problems by Searching, Problem-Solving Agents, Example Problems, Searching for Solutions, Uninformed Search Strategies, Informed (Heuristic) Search Strategies, Heuristic Functions.

[Unit 3]

Constraint Satisfaction Problems

Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems.

[Unit 4]

Game Playing

Adversarial Search, Games, Optimal Decisions in Games, Alpha–Beta Pruning.

[Unit 5]

Logical Agents

Knowledge-Based Agents, The Wumpus World, Logic, Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic

First-Order Logic

Representation Revisited Syntax and Semantics of First-Order Logic, Using First-Order Logic, Knowledge Engineering in First-Order Logic, Inference in First-Order Logic, Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution.

[Unit 6]

Uncertainty

Quantifying Uncertainty, Acting under Uncertainty, Basic Probability Notation, Inference Using Full Joint Distributions, Independence, Bayes' Rule and Its Use, The Wumpus World Revisited, Probabilistic Reasoning, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks, Relational and First-Order Probability Models, and Other Approaches to Uncertain Reasoning.

Reference Books:

1. Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition.

BTCOE603(C) Object Oriented Analysis Design

[Unit 1]

Introduction Overview of object oriented system, Object orientation, Objects, attributes, object behavior, Object respond to messages, encapsulation, Inheritance, Polymorphism, object relationships and association, aggregation, Object identity static and dynamic binding, Object persistence, meta classes. Object oriented system development life cycle.

[Unit 2]

Object oriented modeling Modeling, UML Modeling, class diagram, activity diagram, Sequence diagram, collaboration diagram state chart diagram, interaction diagram, Implementation diagram, use case diagram.

[Unit 3]

Object oriented analysis Use case analysis, CRC card analysis.

[Unit 4]

Object Oriented Design, Design Patterns.

[Unit 5]

Implementation from Design to Implementation, Programming Style, Object-Oriented languages, Non-Object-Oriented languages, Object Oriented Databases, Computer animation, Electrical Distribution design System, Future of Object-Oriented Technology.

Text Books:

1. Grady, Booch, Object Oriented analysis and design with applications, 2nd Edition, PHI.
2. James Rumbaugh, Object-Oriented Modeling And Design, 1st Edition, PHI Publication.
3. Ali Bahrami, Object Oriented Systems Development, 1st Edition, McGraw-Hill Publication.
4. Robert Lafore, Object Oriented Programming, Galgotia Publication.
5. Dan Pilone, Neil Pitman, UML 2.0 in a Nutshell: A Desktop Quick Reference, O'Reilly Media.
6. E. Balagurusamy, Object Oriented Programming, McGraw-Hill Publication.
7. S. Koshafian, Object Orientation, Wiley Publication.
8. Mike O'Docherty, Object-Oriented Analysis Design: Understanding System Development with UML 2.0, Wiley Publication.

BTCOE604(A) Geographic Information System

[Unit 1]

What is Geographic Information Systems?, Different components of GIS, Different types of vector data, Raster data models and their types TIN data model.

[Unit 2]

Advantages and disadvantages associated with vector, raster and TIN Non-spatial data attributes and their type Raster data compression techniques Different raster data file formats Spatial database systems and their types.

[Unit 3]

Pre-processing of spatial datasets Different map projections, Spatial interpolation techniques Different types of resolutions Digital Elevation Model (DEM).

[Unit 4]

Quality assessment of freely available DEMS GIS analysis-1 GIS analysis-2 and applications Errors in GIS Key elements of maps

Reference Books:

1. An Introduction to Geographical Information Systems (4th Edition) by Ian Heywood, Sarah Cornelius and Steve Carver, 2012.
2. Introduction to Geographic Information Systems by Chang Kang-tsung (Karl), 2006
3. Geographic Information Systems: An Introduction.

[Unit 1]

Introduction

Introduction, Different Fields of Biology.

[Unit 2]

Origin of Life and Evolution

Different theories of origin of life, Experimental evidences supporting different theories. Lamarck, Darwinism and other theories of evolution, Documentary evidences supporting different evolution theories.

[Unit 3]

Ecology

Ecosystem, Food Chain, Pollution

[Unit 4]

Physiology

Process of Food intake and Digestion, Nerves conduction and electrophysiology, Muscle contraction and locomotion, Different Methods of Reproduction in prokaryotic and eukaryotic system

[Unit 5]

Cell Biology and Sub-Cellular Structures

Structure and function of eukaryotic and prokaryotic cells

[Unit 6]

Biological System

Structure-function of biological macromolecules, Central Dogma of Life, Replication, Transcription, Translation,

Reference Books:

1. J. L. Tymoczko, J. M. Berg and L. Stryer, Biochemistry, 5th Ed, W. H. Freeman & Co.
2. D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, Macmillan Worth, 2000.
3. N. Hopkins, J. W. Roberts, J. A. Steitz, J. Watson and A. M. Weiner, Molecular Biology of the Gene, 4th Ed, Benjamin Cummings, 1987.
4. C. R. Cantor and P. R. Schimmel, Biophysical Chemistry (Parts I, II and III), W.H. Freeman & Co., 1980.

[Unit 1] 8 Hrs

Introduction to IoT

Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

[Unit 2] 9 Hrs

Elements of IoT

Hardware Components Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces, Software Components Programming API's (using Python / Node.js / Arduino) for Communication Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

[Unit 3] 18 Hrs

IoT Application Development

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

[Unit 4] 10 Hrs

IoT Case Studies

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

Reference Books:

1. Vijay Madiseti, Arshdeep Bahga, Internet of Things, "A Hands on Approach", University Press
2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs
3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi
5. Adrian McEwen, "Designing the Internet of Things", Wiley
6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media.

BTCOE605(A) Development Engineering

[Unit 1]

Introduction, Various Definitions of Development Engineering.

[Unit 2]

World Poverty and Development, Poverty in the India, Sustainable Development, Culture and Global Competence, The Engineer's Role.

[Unit 3]

Social Justice, Social Justice and Engineering, Religious Perspectives, Secular Perspectives.

[Unit 4]

Development Strategies: Society, Technological Change, and Development, Development Economists' Perspectives, Global Health Perspective, International Education Perspective, Social Business Perspectives.

[Unit 5]

Engineering for Sustainable Community Development: The Engineer as a Helper Participatory Community Development, Teamwork and Project Management, Community Assessment: Learning About a Community, Project Selection, Humanitarian Technology, Participatory Technology Development, Humanitarian STEM Education.

[Unit 6]

ICT for Development, AI for Humanitarian purposes, Blockchain and Social Development.

Reference Books:

1. Kevin M. Passino, Humanitarian Engineering: Advancing Technology for Sustainable Development.

BTCOE605(B) National Social Service

[Unit 1] **6 Hrs**
Introduction and Basic Concepts of NSS: History, Philosophy, Aims & objectives of NSS
Organizational structure, Concept of regular activities, Special camping, Day Camps, Basis of
adoption village/slums, Methodology of conducting Survey.

[Unit 2] **6 Hrs**
Youth and community mobilization: Definition, Profile of youth, Categories of youth,
Issues, Challenges and opportunities for youth, Youth as an agent of social change, Youth-
adult partnership, Mapping of community stakeholders, Identifying methods of mobilization,
Needs & importance of volunteerism.

[Unit 3] **6 Hrs**
Importance and Role of Youth Leadership: Meaning and types of leadership, Qualities of
good leaders; Traits of leadership, Importance and role of youth leadership.

[Unit 4] **6 Hrs**
Life Competencies and skill: Definition and importance of life competencies,
Communication, Inter Personal, Problem solving and decision making, Positive thinking,
Self-confidence and self-esteem, Life goals, Stress and time management.

[Unit 5] **6 Hrs**
Social Harmony and National Integration: Indian history and culture, Role of youth in
peace-building and conflict resolution, Role of youth in Nation building.

[Unit 6] **6 Hrs**
Youth Development Programmes in India: National Youth Policy, Youth development
programmes at the National Level, State Level and voluntary sector, Youth-focused and
Youth-led organizations.

Reference Books:

1. *National Service Scheme Manual (Revised)*, Government of India, Ministry of Youth Affairs and Sports, New Delhi, 2006.
2. University of Mumbai National Service Scheme Manual, 2009.
3. Avhan Chancellor's Brigade – NSS Wing, *Training camp on Disaster Preparedness Guidelines*, March 2012.
4. *Rashtriya Seva Yojana Sankalpana* – Prof. Dr. Sankay Chakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
5. *National Service Scheme Manual for NSS District Coordinators*, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya.
6. *Annual report of National Service Scheme (NSS)* published by DTE, Mantralaya.
7. *NSS Cell*, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.
8. *Case material as a Training Aid for Field Workers*, Gurmeet Hans.
9. *Social service opportunities in hospitals*, Kapil K. Krishnan, TISS.
10. *New Trends in NSS*, Research papers published by University of Pune.
11. *ANOOGUNJ Research Journal*, published by NSS Unit C. K. Thakur College.

BTCOE605(C) Consumer Behavior

[Unit 1]

Introduction to the Study of Consumer Behavior

Defining Consumer Behavior, Scope and Application of Consumer Behavior, Why Study Consumer Behavior, Evolution of Consumer Behavior as a Field Of Study and its relationship with Marketing: Behavioral Dimension, The Interdisciplinary Nature of Consumer Behavior.

Market Research and Consumer Behavior

Relevance of Market Research with Consumer Behavior, Approaches to Consumer Behavior Research, Quantitative Research, Qualitative Research.

[Unit 2]

Market Segmentation and Positioning, Market Segmentation, Basis for Segmentation, Alternatives available for Segmentation, Positioning.

[Unit 3]

The Consumer Decision Making Process

Buying Motives, Buying Roles, Consumer Decision Making Process, Levels of Consumer Decision Making, Perspectives to Consumer Decision Making, Consumer Decision Making Process.

[Unit 4]

Models of Consumer Behavior

The Economic model, Learning model, Psychoanalytic model, The sociological model. The Howard Sheth model of Buying Behaviour, The Nicosia model, The Engel - Kollat - Blackwell Model, Engel, Blackwell and Miniard (EBM) model.

Psychological Influences on Consumer Decision Making

Consumers Needs & Motivation, Emotions and Mood, Consumer Involvement, Consumer Learning, Personality, Self-concept and Self-image, Consumer Perception, Risk and Imagery. Consumer Attitude: Belief, Affect, Attitude and Intention, Attitude Formation and Attitude Change, Consumer Communication.

[Unit 5]

Sociological Influences on Consumer Decision Making

Consumer groups, Consumer reference groups, Family and Life cycle, Social class and mobility, lifestyle analysis, Culture; Sub-Culture, Cross Culture, Interpersonal Communication and influence, Opinion Leadership.

Diffusion of innovation Diffusion Process, Adoption Process, Consumer Innovators, Multiplicative innovation adoption (MIA) model.

[Unit 6]

Organizational Buying

Differences between Industrial Markets and Consumer Markets, Differences between Organizational and Consumer Buying, Buying Decisions in Organizational Buying Process, Types of Decision Making, Organization Buyer's Decision Making Process, and Factors

Dr. Babasaheb Ambedkar Technological University
influencing Organizational Buying Behaviour, Decision Makers in Organizational Buying,
Webster and Wind model of Organizational buying behaviour, The Sheth model of Industrial
buying, The Sheth model of Industrial buying.

Consumer Behavior Analysis and Marketing Strategy

Consumer Behavior and Product Strategy, Consumer Behavior and Pricing Strategy,
Consumer Behavior and Distribution Channel Strategy, Consumer Behavior and Promotion
Strategy.

Reference Books

1. Consumer Behavior, Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.
2. Consumer Behavior, Concepts and Applications, Loudon, D.L. and Bitta, A.J.D, Tata McGraw Hill.
3. Consumer Behavior and Marketing Strategy, Peter, J.P. and Olson, J.C., Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.

BTCOC606 Competitive Programming-II

[Unit 1]

Number Theory

Prime Numbers, Finding Primes, Counting Primes, Divisibility Greatest Common Divisor, Least Common Multiple, Modular Arithmetic, Congruence's Operations on Congruence's, Solving Linear Congruence's, Diophantine Equations, Number Theoretic Libraries.

Challenging Problems

(1) Light, More Light (2) Carmichael Numbers (3) Euclid Problem, (4) Factovisors, (5) Summation of Four Primes (6) Smith Numbers (7) Marbles (8) Repackaging.

[Unit 2]

Backtracking

Backtracking, Constructing All Subsets, Constructing All Permutations, Program Design Example: The Eight-Queens Problem, Pruning Search.

Challenging Problems

(1) Little Bishops (2) 15-Puzzle Problem (3) Queue (4) Servicing Stations (5) Tug of War (6) Garden of Eden (7) Color Hash (8) Bigger Square Please

[Unit 3]

Graph Traversal

Flavors of Graphs, Data Structures for Graphs, Graph Traversal: Breadth-First, Breadth-First Search, Exploiting Traversal, And Finding Paths Graph Traversal: Depth-First Finding Cycles Connected Components Topological Sorting.

Challenging Problems

(1) Bicoloring (2) Playing With Wheels (3) The Tourist Guide (4) Slash Maze (5) Edit Step Ladders (6) Tower of Cubes (7) From Dusk Till Dawn (8) Hanoi Tower Troubles Again!

[Unit 4]

Graph Algorithm

Graph Theory, Degree Properties, and Connectivity, Cycles in Graphs, Planar Graphs, Minimum Spanning Trees, Shortest Paths, Dijkstra's Algorithm, All-Pairs Shortest Path, Network Flows and Bipartite Matching

Challenging Problems (1) Freckles The Necklace (2) Fire Station (3) Railroads (4) War (5) Tourist Guide (6) The Grand Dinner (7) The Problem With the Problem Setter

[Unit 5]

Dynamic Programming

Don't Be Greedy, Edit Distance, Reconstructing the Path, Varieties of Edit Distance, Program Design Example: Elevator Optimization

Challenging Problems

(1) Is Bigger Smarter? (2) Distinct Subsequences (3) Weights and Measures (4) Unidirectional TSP (5) Cutting Sticks (6) Ferry Loading (7) Chopsticks (8) Adventures in Moving: Part IV.

[Unit 6]

Grids

Rectilinear Grids, Traversal, Dual Graphs and Representations, Triangular and Hexagonal Grids, Triangular Lattices, Hexagonal Lattices, Program Design Example: Plate Weight, Circle Packings, Longitude and Latitude.

List of Practical:

At least twenty five problems solving on competitive programming platforms such as, <https://uva.onlinejudge.org>, <http://hackerrank.com/>, <http://codechef.com/>

Reference Books:

1. Steven S. Skiena Miguel A. Revilla, Programming Challenges The Programming Contest Training Manual, Springer.
2. Antti Laaksonen, Competitive Programmer's Handbook.
3. Steven Halim, Competitive Programming 3: The Lower Bounds of Programming Contests.
4. Gayle Lakaman Cracking the Coding Interview.
5. The Hitchhiker's Guide to the Programming Contests.

BTCOL607 Mobile Application Development for iOS / Android

Note: The course on mobile application development can be taught for two different mobile OS platforms either iOS or Android.

The students can opt any one either iOS or Android for studying mobile application development. Either Part (A) or Part (B) of the following syllabus needs to be completed. It is not required to complete both parts i.e. Part(A) and Part(B)

Part (A) Mobile Application Development with SWIFT for iOS

Build a foundation in Swift, UI Kit and networking through hands-on labs and guided projects. Students can build an app of their own design by the end of the course.

1. Get Started with App Development. Learn about the basics of data, operators, and control flow in Swift, as well as documentation, debugging, Xcode, building and running an app, and Interface Builder. They then apply this knowledge to the guided project, Light, to create a simple flashlight app.

2. Introduction to UI Kit. Explore Swift strings, functions, structures, collections, and loops. Learn about UIKit—the system views and controls that make up a user interface—and how to display data using Auto Layout and stack views. Put this knowledge to practice in the guided project, Apple Pie, to build a word-guessing game app.

3. Navigation and Workflows. Discover how to build simple workflows and navigation hierarchies using navigation controllers, tab bar controllers, and segues. Also examine two powerful tools in Swift, optionals and enumerations. Put this knowledge into practice with the guided project, Personality Quiz, a personalized survey that reveals a fun response to the user.

4. Tables and Persistence. Learn about scroll views, table views, and building complex input screens. Explore how to save data, share data to other apps, and work with images in the user's photo library. Use new skills in the guided project, List, a task-tracking app that allows the user to add, edit, and delete items in a familiar table-based interface. Students can customize the app to keep track of any type of information, such as a collection, tasks, or playlists.

5. Working with the Web Learn about animations, concurrency, and working with the web. Apply learning in the guided project, Restaurant, a customizable menu app that displays the available dishes from a restaurant and allows the user to submit an order. This app uses a web service that allows students to set up the menu with their own menu items and photos.

6. Prototyping and Project Planning. Design, prototype, and architect a project of your own design.

List of Experiments: (Guided Projects)

1. Create a simple Flashlight app
2. Apple Pie Game - Word-guessing game app

3. Personality Quiz - a personalized survey that reveals a fun response to the user.
4. List – a task tracking app that allows the user to add, edit and delete items in a familiar table-based interface. Customize the app to keep track of any type of information, such as a collection, tasks or playlists.
5. Restaurant Menu - a customizable menu app that displays the available dishes from a restaurant and allows the user to submit an order.

Reference Books:

1. Matt Neuburg, *iOS 12 Programming Fundamentals with Swift*, O'Reilly Media, Fifth Edition, 2018.
2. Craig Clayton, *iOS 12 Programming for Beginners*, 3rd Edition, 2018.
3. App Development with Swift - #iBooks
<https://books.apple.com/in/book/app-development-with-swift/id1465002990>
4. Intro to App Development with Swift - #iBooks
<https://books.apple.com/in/book/intro-to-app-development-with-swift/id1118575552>

Part (B) Mobile Application Development for Android

1. Introduction to mobile computing, installing of required software and preparing the working environment, creating your first Android Application.
2. Layouts, Views, Resources, Activities, Intents, Background tasks, Connecting to the Internet, Fragments, Preferences.
3. User Interaction – input, menu items, custom views.
4. User Experience – themes and styles, material design, adaptive layouts, accessibility, localization, debugging the UI.
5. Storing Data, SQLite database, Sharing Data, content resolver and providers, loaders to load data Services, background work, alarms, broadcast receivers.
6. Notification, widgets, transferring data efficiently, publishing app, Multiple form factors, sensors, Google cloud messaging, monetizing your app.

List of Experiments:

1. Install the Android SDK and developer tools and build a test project to confirm that those tools are properly installed and configured.
2. Write a program using a Table Layout for our restaurant data entry form; add a set of radio buttons to represent the type of restaurant.
3. Write a program using activity class to show different events.
4. Write a program to send user from one application to another. (For example redirection to map).
5. Write a program to play audio files.
6. Write a program to play video files.
7. Write a program to capture image using built in camera.
8. Write a program to send SMS.

9. Write a program to convert text to speech.
10. Write a program to call a number.

Reference Books:

1. Brian Fling, *Mobile Design & Development*, O'Reilly Media, 1st Edition, 2009.
2. Meier, *Professional Android 4 Application Development*, Wrox Publication, 2012.
3. Lee, *Beginning Android™ 4 Application Development*, Wrox Publication, 2011.
4. J. F. DiMarzio, *Android A Programmers Guide*, McGraw-Hill Publication, 1st Edition, 2008.
5. Ian F. Darwin, *Android Cookbook*, O'Reilly Media, 2nd Edition, 2016.
6. Dawn Griffiths, David Griffiths, *Head First Android Development*, O'Reilly Media, 2nd Edition, 2015.

BTCOL607(B) Internet of Things Laboratory

1. Study of Raspberry-Pi, Beagle board, Arduino and other micro controller.
2. Study of different operating systems for Raspberry-Pi. Understanding the process of OS installation on Raspberry-Pi.
3. Study of Connectivity and configuration of Raspberry-Pi circuit with basic peripherals, LEDS. Understanding GPIO and its use in program.
4. Understanding the connectivity of Raspberry-Pi circuit with temperature sensor. Write an application to read the environment temperature. If temperature crosses a threshold value, the application indicated user using LEDSs.
5. Understanding the connectivity of Raspberry-Pi circuit with IR sensor. Write an application to detect obstacle and notify user using LEDs.
6. Understanding and connectivity of Raspberry-Pi with camera. Write an application to capture and store the image.
7. Study of different CPU frequency governors. Write an application to change CPU frequency of Raspberry-Pi.
8. Write an application using Raspberry-Pi to control the operation of a hardware simulated traffic signal.
9. Write an application using Raspberry-Pi to control the operation of a hardware simulated lift elevator.
10. Write a server application to be deployed on Raspberry-Pi. Write client applications to get services from the server application.
11. Create a small dashboard application to be deployed on cloud. Different publisher devices can publish their information and interested application can subscribe.
12. Develop a Real time application like smart home with following requirements: When user enters into house the required appliances like fan, light should be switched ON. Appliances should also get controlled remotely by a suitable web interface. The objective of this application is student should construct complete Smart application in group.

BTCOL608 Computer Networks Laboratory

1. Simulate and Understand IP forwarding within a LAN and across a router.
2. Study the working of spanning tree algorithm by varying the priority among the switches.
3. Understand the working of “Connection Establishment” in TCP using a network simulator.
4. Study how the Data Rate of a Wireless LAN (IEEE 802.11b) network varies as the distance between the Access Point and the wireless nodes is varied.
5. Study the working and routing table formation of Interior routing protocols, i.e. Routing Information Protocol (RIP) and Open Shortest Path First (OSPF).
6. Plot the characteristic curve throughput versus offered traffic for a Slotted ALOHA system.
7. Understand the impact of bit error rate on packet error and investigate the impact of error of a simple hub based CSMA / CD network.
8. Study the performance of networks based on Star, Bus and Ring topologies
9. TCP/IP Sockets: Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
10. Write a program for calculating the shortest path using Link State Routing Algorithms

Experiments can be done using NS2, NETSIM, NCTU etc.