B.E. IV Semester(Computer Technology) Scheme

R.T.M. Nagpur University, Nagpur
Four Year B.E. Course
(Revised Curriculum as per AICTE Model Curriculum)

S.N.	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
		L	T	P	CA	UE	Total		
1	Discrete Mathematics and Graph Theory (TH)	3	1	0	30	70	100	4	BSC
2	Social Ethics in Information Technology (TH)	2	0	0	15	35	50	2	PCC-CS
3	Object Oriented Programming using Java (TH)	3	0	0	30	70	100	3	PCC-CS
4	Object Oriented Programming using Java (P)	0	0	2	25	25	50	1	PCC-CS
5	Data Structures and Program Design (TH)	3	0	0	30	70	100	3	PCC-CS
6	Data Structures and Program Design(P)	0	0	2	25	25	50	1	PCC-CS
7	Computer Networks (TH)	3	1	0	30	70	100	4	PCC-CS
8	Operating Systems (TH)	3	1	0	30	70	100	4	PCC-CS
9	Computer Workshop-II (PR)	0	0	2	25	25	50	1	PCC-CS
10	Environmental Science	2	0	0	0	0	0	Audit	MC
11	Internship	-	-	-	50	-	50	1	PROJ-CS-Project
	Total	19	03	06	290	460	750	24	

PCC-CS-Professional Core Courses   **ESC-**Engineering Science Courses   **LC-**Laboratory Course
OEC-CS-Open Elective Courses   **MC-** Mandatory Course   **PROJ-CS-** Project (Min. one month internship is desirable)
BSC-Basic Science Courses   **PEC-CS-**Professional Elective Courses
HSMC- Humanities and Social Sciences including Management Courses

Dr. S. V. Sonekar

Total Credits: 04	**Subject Code: BECT401T**
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 1 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment: 30 Marks University Assesment:70 Marks

Course Objectives:

1.A primary objective is to provide a bridge for the student from lower-division mathematics courses to upper-divisionmathematics.

2.Obtain skills and logical perspectives in introductory (core) courses that prepare them for subsequentcourses.

3.Develop proficiency with the techniques of mathematics and/or computer science, the ability to evaluate logical arguments, and the ability to apply mathematical methodologies to solving real worldproblems.

Course Outcomes:

After completing the course, the students will be able to

1.Apply graph theory models of data structures and state machines to solve problems of connectivity and constraintsatisfaction.

2.Gain an introduction into how mathematical models for engineering are designed, analyzed and implemented in industry andorganizations.

3.Reason mathematically about basic data types and structures (such as numbers, sets, graphs, and trees) used in computer algorithms and systems; distinguish rigorous definitions and conclusions from merely plausibleones.

4.Analyze real world scenarios to recognize when Logic, sets, functions are appropriate, formulate problems about the scenarios, creatively model these scenarios (using technology, if appropriate) in order to solve the problems using multipleapproaches.

5.Apply knowledge of mathematics, physics and modern computing tools to scientific and engineeringproblems.

6.Apply their knowledge in life-longlearning.

Unit I : Set Theory, RelationsandFunctions (10 Hrs)

Sets: Review of propositions and logical operations, Principle of mathematical induction, Review of sets, Types and operations onsets.

Relations: Ordered pairs and n-tuples, Types of relations, Composite relation, Transitive closure of a relation, Partially ordered set, Hasse diagrams.

Functions: Definition, Composition of functions, Types of functions, Characteristics function and its properties.

Unit II : Fuzzy Set andFuzzy Logic (10 Hrs)

Fuzzy sets and systems, Crisp set, Operations and combinations on Fuzzy sets, Relation between Crisp

set and Fuzzy set, Fuzzy relations, Overview of Fuzzy logic and classical logic.

Unit III : Group Theory andRingTheory (10 Hrs)

Binary operation, Algebraic structure, Groupoid, Semigroup, Monoid, Group, Subgroup, Normal subgroup (Only definitions and examples), Ring, Commutative ring, Ring with unity, Zero divisor, Integral domain, Field (Only definitions and simpleexamples).

Unit IV :GraphTheory (10Hrs)

Basic concepts of graph theory, Digraphs, Basic definitions, Matrix representation of graphs, Subgraphs and quotient graphs, Isomorphic graphs, Paths and circuits, Reachability and connectedness, Node base, Euler's path & Hamilton's path, Tree, Binary tree, Undirected tree, Spanning tree, Weighted graphs (Only definitions and examples), Minimal spanning tree by Prim's algorithm &Kruskal's algorithm, Representation of algebraic expressions by Venn diagram and binary tree.

UnitV :Combinatorics (8 Hrs)

Permutations and combinations, Pigeonhole principle with simple applications, Recurrence relations (Concept and definition only), Generating functions, Solution of recurrence relations using generating functions.

Text/ Reference Books

1) Discrete Mathematical Structures (PHI), B. Kolman, R. Busby, S.Ross.
2) Discrete Mathematical Structures with Applications to Computer Science (TMH), Tremblay and Manohar.
3) Fuzzy Sets Uncertainty and Information, George, J. Klir, Tina A.Folger.
4) Discrete Mathematics for Computer Scientists & Mathematicians, J. Mott, A. Kandel, T.Baker.
5) Discrete Mathematics, S.Lipschutz.
6) Neural network and Fuzzy systems (PHI), BartKosko.

Total Credits: 02	Subject Code: BECT402T
Teaching Scheme : Lectures: 2 Hours/Week Tutorials: 0 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam : 02 Hrs. College Assessment: 15 Marks University Assesment:35 Marks

Course Objectives:
1. To teach students about Ethics for IT Professionals and IT Users, Freedom of Expression.
2. To provide information about Computer and Internet Crime, misuse of Intellectual Property.
3. To inform students about Privacy on Network, Impact of Information Technology on Productivity.

Course Outcomes:
After completing the course, students will be able to
1. Define and explain the concepts of ethics in business world as well apply in IT community.
2. Discuss the cyber crimes and privacy laws.
3. Define and understand the freedom of Expression .
4. Interpret and classify the intellectual property issues,understand the impact of IT on productivity,
health care, social networking issues as well as determine the concept of contingent workers, outsourcing.

Unit I   (4 Hrs)
Overview of Ethics:
Ethics in business world, Ethics in IT, Ethics for IT professionals and IT users, IT professionals, Ethical behavior, IT professional malpractices, IT users.

Unit II   (6 Hrs)
Computer and Internet Crime:
IT security incidents: Increasing Complexity Increases Vulnerability, Higher Computer user Expectations, Expanding and changing systems. Introduces new risks, Increased Reliance on Commercial Software with known Vulnerabilities, Types of Exploits, Perpetrators, Reducing Vulnerabilities, Risk Assessment, Establishing a Security Policy, Educating Employees, contractors and part-time Workers, Prevention, Detection, Response.

Unit III   (7 Hrs)
Privacy:
The right of Privacy, Recent History of Privacy Protection, Key Privacy and Anonymity issues, Governmental Electronic Surveillance, Data Encryption, Identity Theft, Consumer Profiling, Treating Consumer Data Responsibility, Workplace Monitoring, Advanced surveillance Technology, Defamation, Freedom of Expression: Key issues, Controlling Access to Information on the Internet, Anonymity, National, Security Letters, Defamation and Hate Speech.

Unit 4

Intellectual Property :

Copyrights, Patents, Trade Secret Laws, Key Intellectual Property Issues, Plagiarism, Reverse Engineering, Open Source Code, Competitive Intelligence, Cyber squatting, Software Development, Strategies to Engineer Quality Software, The Importance of Software Quality, Software Development Process, Capability Maturity Model Integration for Software, Key Issues in Software Development, Development of Safety-Critical Systems, Quality Management Standards. Nontraditional Workers, Contingent Workers H-IB Workers. The Impact of Information Technology on the Quality of Life, standard of Living, Health care, Electronic Health Records, Use of Mobile and Wireless Technology, Telemedicine.

Text Book:

1.De George Richard T., "The Ethics of Information Technology and Business ", John Wiley and Sons Ltd, 2002.

2.Anderson James G, "Ethics and Information Technology ", Cengage Learning, 2002.

3. Ethics in Information Technology, 4/e by Reynolds George, Cengage Publisher

Reference Books:

1.Keith W Miller, MariarosariaTaddeo, "The Ethics of Information Technologies", Routledge, 2016.

2. Robert A. Schultz , "Contemporary Issues in Ethics and Information Technology", Second Edition, Woodbury University, 2006.

3. S Hongladarom , "Information Technology Ethics - Cultural Perspectives ",IGI Global, 2006.

4. Fabris Adriano, "Ethics of Information and Communication Technologies ", Tata McGraw Hill Publication, 2016.

Total Credits: 03	Subject Code: BECT403T
Teaching Scheme	Examination Scheme
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment : 30 Marks
Practical: 0 Hours/Week	University Assesment:70 Marks

Course Objectives:
1. To make students to understand elements of JAVA programming language.
2. To make students to understand concepts of object-oriented programming.
3. To make students to write programs in Java to solve variety of problems.

Course Outcomes:
After completing the course, students will be able to
1.Explain various data types, operators, control flow statements, iterative statements and apply it to develop a Java program.
2.Describe concepts of objects, classes, interface and apply it to develop an object-oriented Java program.
3.Describe scope rules, storage classes, intricacies of constructors and apply it to develop a Java program.
4.Describe polymorphism, inheritance, method overloading, function overloading and apply it to develop a Java program.
5.Describe exception handling, input-output streams and apply it to develop Java program.

Unit I (6 Hrs)
Data types and Operators: Primitive Data types, Variables, Naming Conventions, Literals, types of literals, Arrays, (multi-dimensional arrays, array of object references), Enumerated Data types, Non-Primitive Data types, defining a class, variable and method in Java, Method Signature, method calls, Various operators in java, Operator Precedence, Implicit Type Conversions, Type casting Strict typing, Type conversion
Control Flow statements: if, if-else, if-else-if, switch case, for loops, while and do-while loops, continue Statement, labeled continue statement, The break Statement, labeled break statement etc. programming examples based on above topics

Unit II (8 Hrs)
Object Oriented Concepts: Classes and Objects, defining a class, Defining instance variables and methods, creating objects out of a class, Method calls via object references, Abstraction, Interfaces and Abstract classes, Abstract and non-abstract methods, Inheritance, extends and implements keywords, Super class and Sub class, this keyword, super keyword, Concrete classes

Unit III
(8Hrs)Var-Args, Reference variables, local variables, instance variables, Memory allocations to Variables, toString() method, static variables and methods, static imports, static initialization blocks; instance initialization blocks, static concept in inheritance

Constructors: Properties of Constructors, Default and Parameterized Constructors, Rules for constructor implementation, this call; super call for constructors, Constructors for Abstract classes and interfaces

Unit IV   **(7 Hrs)**
Polymorphism: concepts of polymorphism, Compile-time polymorphism, Overloading of methods, run-time polymorphism, overriding of methods, Method Overriding rules and method overloading rules, the Object class and its methods, Encapsulation, Protection of data, access modifiers. Packages, need, package declaration, resolutions of name clashes using packages

Unit V   **(7 Hrs)**
Exceptions: Need for exceptions, Exceptions hierarchy, Types of Exceptions, try, catch, finally, throw, throws, Rules for coding Exceptions, Declaring Exceptions, Defining and Throwing Exceptions, Errors and Runtime Exceptions.
Input-Output: Introduction to Stream, Byte Stream, Character stream, Readers and Writers, File Class, File Input Stream, File Output Stream, Input Stream Reader, Output Stream Writer, FileReader, FileWriter, Buffered Reader

Text Books :
1. E.Balaguruswamy : Programming with Java A Primer, McGraw Hill Publications
2. Herbert Schild : The Complete Reference, Java 2 ,Tata McGraw Hill Publications

Reference Books:
1. Daniel Liang : Introduction to Java Programming (Comprehensive Version), Pearson Education Publication.
2. Sachin Malhotra , Saurabh Chaudhary : Programming in Java, Oxford University Press.
3.Horstmann and Cornell, : Core Java Volume-I Fundamentals, Pearson Education Publication.

Total Credits: 01	Subject Code: BECT403P
Teaching Scheme: Lectures: 0 Hours/Week Tutorials: 0 Hours/Week Practical: 2 Hours/Week	Examination Scheme: College Assessment: 25 Marks University Assesment:25 Marks

Minimum ten experiments should be conducted based on the theory syllabus.

Faculty of Science and Technology
R.T.M Nagpur University, Nagpur

Syllabus for B.Tech. Fourth Semester CT

Data Structures and Program Design (TH)

Total Credits: 03	Subject Code: BTCT404T
Teaching Scheme :	Examination Scheme :
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 0 Hours/Week	College Assessment : 30 Marks
Practical: 0 Hours/Week	University Assesment:70 Marks

Course Objectives:

1. To make students to understand essential fundamentals of various data structures.

2. To make students to understand characteristics of algorithms, time complexity and space complexity analysis.

3. To make students to understand program design methodologies and application of various data structures in program design.

Course Outcomes:
After completing the course, students will be able to
1. Define and describe data structures , types of data structures, analysis of an algorithm and carry out time and space complexity of various sorting, searching, hashing techniques.
2. Describe representation of Stack and Queue and implementation of various operation on Stacks and Queues.
3. Explain Linked list and implementation of various operations on different types of linked list.
4. Describe Tree as a nonlinear data structure, Tree Traversals, types of Tree.
5. Explain graphs as data structure, representation of graphs, graph traversal algorithms, applications of graph and analysis of these algorithms.

Unit I (9 Hrs)
Fundamentals of Data Structures, Classification of Data Structures, Algorithm analysis, average and worst case analysis, asymptotic notation.

Searching and Sorting techniques : Searching Algorithms, Analysis of sequential and Binary Search, Hashing techniques, collision handling

Sorting Algorithms: Bubble Sort, Selection Sort, Insertion Sort, Merge Sort , Quick Sort

Unit II (7 Hrs)

Stacks & Queues: Fundamentals, Evaluation of expressions, Polish expressions their compilation, Application of stacks, Multiple stacks, Queue, Circular Queue and priority queues**.**

Unit III (8 Hrs)

Linked Lists: Basics of Linked List, Singly Linked List,Polynomial addition, Doubly linked list, Circular linked list , Implantation of Stacks and Queues using Linked list

Unit IV (6 Hrs)

Trees: Tree Terminology, Types of trees, Binary tree representations, Binary tree traversals, Binary search trees. AVL Tree, Threaded Binary Tree.

Unit V (6 Hrs)

Graphs: The Graph Abstract Data Type, Definition & terminology, An Adjacency Matrix, An Adjacency List, multi list, Breadth First Search Analysis, Depth First Search Analysis, Dijkstra's Shortest path algorithm, Minimum cost spanning trees Prim's Algorithm.

Text Books:

1.Horowitz and Sahani : Fundamentals of Data Structures

2.George H & Garry : Algorithms in a Nutshell, O'reilly Publication

3.Rance D. Necaise : Data Structures and Algorithms Using Python, Wiley Student Edition,2016.

4.John Hubbard : Data Structures with Java, McGraw Hill Publications.

Reference Books:

1. Tanenbaum : Data Structures using C , Pearson Education

Faculty of Science and Technology
R.T.M Nagpur University, Nagpur

Syllabus for B.Tech. Fourth Semester CT

Data Structures and Program Design (P)

Total Credits: 01	**Subject Code: BTCT404P**
Teaching Scheme:	Examination Scheme:
Lectures: 0 Hours/Week	College Assessment: 25 Marks
Tutorials: 0 Hours/Week	University Assesment:25 Marks
Practical: 2 Hours/Week	

Minimum ten experiments should be conducted based on the theory syllabus either in C or Python.

Total Credits: 04	Subject Code: BECT405T
Teaching Scheme :	Examination Scheme :
Lectures: 3 Hours/Week	Duration of University Exam : 03 Hrs.
Tutorials: 1 Hours/Week	College Assessment : 30 Marks
Practical: 0 Hours/Week	University Assesment:70 Marks

Course Objectives:
1. To make students to understand the basic concepts of the organization and management of local area networks (LANs), and their topology.
2. To introduce fundamental concepts of designing a computer communication network and operations of ODI and TCP/IP model.
3. To make students understand issues involved in design, implementation and maintenance of a typical computer network (LAN) and provide quantitative arguments in evaluating different designs.

Course Outcomes:
After completing the course, students will be able to
1. Define and illustrate the fundamentals of networks, different network models and various data transmission methods.
2. Explain different techniques for error detection and correction during data transmission and apply various protocols.
3. Summarize the inter-network layer with its protocols and apply various protocols in routing and congestion control.
4. Recall and demonstrate the working of Transport layer protocols such as TCP and UDP.
5. Recall and demonstrate application layer protocols such as HTTP, FTP, SMTP etc.

Unit I (9 Hrs)
Introduction to Networks Components and categories ,Types of connections ,Topologies, Protocols and standards ,ISO / OSI model and TCP/IP model, Transmission media ,Coaxial cable , Fiber optics , Line coding ,Modems . RS232 interfacing sequences.

Unit II (11 Hrs)
Data Link Layer : Error – Detection and correction, Parity, LRC, CRC, Hamming code, Flow Control and error control, Stop and wait, Go back-N, ARQ – Selective repeat ARQ –Sliding window, HDLC, LAN – Ethernet IEEE 802.3, IEEE 802.4 , IEEE 802.5.
Medium Access Sub layer : Channel allocation in LAN's and MAN's Network: Protocols-persistent and Non Persistent CSMA, CSMA with collision detection, binary countdown, Limited Contention protocol.

Unit III (10 Hrs)
Network Layer : Internetworks – Packet switching and datagram approach, IP addressing methods, Subnetting, Routing, Distance vector routing , Link state routing , Routers, Congestion control.

Unit IV (10Hrs)
Transport Layer : Duties of transport layer, Multiplexing and Demultiplexing, Sockets, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), Quality of Services (QOS) – Integrated services.

UnitV (8 Hrs)Application Layer : DNS, SMTP, SNMP, FTP, HTTP & WWW; Security: Cryptography, user authentication, security protocols in internet, Firewalls.

Text Books :
1. B. A. Forouzan : Data Communications and Networking , 3rd Edition , Tata McGraw Hill Publications
2. A. S. Tanenbaum : Computer Networks , 4th Edition, Pearson Education/PHI Publications
3. W. Stallings : Data and Computer Communications , 5th Edition, Pearson Education/PHI Publications

Reference Books:
1. Kurose and Rose : Computer networking -A top down approach featuring the internet, Pearson Education
2. Leon, Garica, Widjaja : Communication Networks , Tata McGraw Hill Publications

Total Credits: 04	Subject Code: BECT406T
Teaching Scheme : Lectures: 3 Hours/Week Tutorials: 1 Hours/Week Practical: 0 Hours/Week	Examination Scheme : Duration of University Exam : 03 Hrs. College Assessment : 30 Marks University Assesment:70 Marks

Course Objectives:
1. To make students to understand structure of an operating systems and various types of operating systems.
2. To make students to understand various resources of an operating systems and its management.
3.To enable students to evaluate different operating systems depending on their structure and resource management techniques.

Course Outcomes:
After completing the course, students will be able to
1.Describe different types of operating systems, structure of an operating systems, basic concepts of process, process scheduling and multithreading.
2. Describe various process scheduling algorithms, performance analysis, selection of suitable algorithm. To explain concepts of inter-process synchronization, inter-process communication and develop suitable solution.
3. Describe deadlocks, deadlock prevention, detection, resolution techniques and explain need and mechanism of protection.
4. Describe primary memory management issues, primary memory allocation methods, page replacement policies and performance analysis of various allocation methods, page replacement algorithms.
5. Explain secondary memory management issues, secondary memory allocation methods and input-output systems

Unit I   (9 Hrs)
Introduction: Definition, Functions of Operating Systems, Types of OS, Structural overview, System calls, Process Concept, Process States, Process Scheduling, Operations on Processes, Types of scheduler, Context switch, Threads Overview, Multithreading Models, Threading issues.

Unit II   (11 Hrs)
CPU Scheduling: Concepts, Scheduling Criteria, Scheduling Algorithms.
Process Synchronization: The Critical-Section Problem, software and hardware solution, Semaphores, Classical inter-process communication problems.

Unit III   (10 Hrs)
nd Characterization, Deadlocks Prevention, Avoidance, Detection, Recovery from Deadlock.
Protection: Goals of Protection, access matrix, implementation of access matrix, Security problem

Unit IV   **(10 Hrs)**

Memory Management: Background, Swapping, Contiguous Memory Allocation Schemes, Paging, Segmentation, Segmentation with paging, demand paging, page Faults and instruction restart, page replacement algorithms, working sets, Locality of references.

Virtual Memory Management: Demand Paging scheme, Page Replacement Policies, Allocation of Frames, Thrashing.

Unit V   **(8 Hrs)**

File System: Directory Structure, File-System Mounting, File Sharing & Protection. File-System Structure, File-System Implementation. Directory Implementation, Disk space management and space allocation strategies File Recovery, disk arm scheduling strategies.

Input/Output Systems: Overview, I/O Hardware, Application I/O Interface, and Kernel I/O Subsystem.

Text Books:
1.Silberchatz and Galvin : Operating System concepts, Addison Wesley Publication.
2.MilanMilenkovik : Operating System concepts and design, McGraw-Hill Publication.

Reference Books:
1.Tanenbaum : Modern Operating Systems , 2nd edition Pearson Education.
2. D M Dhamdhere : System Programming and Operating Systems, McGraw-Hill Publication.

Faculty of Science andTechnology
R.T.M Nagpur University,Nagpur
Syllabus for B. E. Fourth Semester CT
Computer Workshop-II (P)

Total Credits: 01	Subject Code: BECT407P
Teaching Scheme: Lectures: 0 Hours/Week Tutorials: 0 Hours/Week Practical: 2 Hours/Week	Examination Scheme: College Assessment: 25 Marks University Assesment:25 Marks

Minimum ten experiments should be conducted based on following topics

- Basic Linux commands.
- Vi editor.
- Shell scripting

Course Code	BECT408			
Category	Mandatory Courses			
Course Title	Environmental Science			
Scheme & credits	L	T	P	Credits
	2	0	0	0

* The subject would be taught by Faculty Members of Chemistry only

Course Outcomes

On successful completion of the course, the students:

1. Identify different types of air pollution's as well as explain their causes, detrimental effects on environment and effective control measures.

2. Recognize various sources of water pollutants and interpret their causes and design its effective control measure

3. Illustrate various types of pollutants and waste management.

4. Analyze various social issues related to environment and challenges in implementation of environmental laws.

Syllabus

Unit-I
Air pollution and its control techniques: (6 lectures)

Contaminant behaviour in the environment, Air pollution due to SOx, NOx, photochemical smog, Indoor air pollution

Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle.

Factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs).

Techniques to control Air pollution, ambient air quality and continuous air quality monitoring, Control measures at source, Kyoto Protocol, Carbon Credits.

Unit-II
Water pollution and its control techniques: (6 lectures)

Major sources of water pollution: Eutrophication, acid mine drains, pesticides and fertilizers, dyeing and tanning, marine pollution, microplastics

Techniques to control water pollution: Conventional waste water treatment-types of sewage, sewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal and its utility.

Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, and agro based industries such as rice mills

Unit-III
Other Environmental Pollution& Waste Management: (6 lectures)

Soil pollution: Soil around us, Soil water characteristics, soil pollution.

Causes, effects &control : noise pollution, nuclear & radiation hazards, marine pollution (Oil spills & Ocean Acidification)

Solid waste management: Composting, vermiculture, landfills, hazardous waste treatment,

bioremediation technologies, conventional techniques (land farming, constructed wetlands), and phytoremediation.

Degradation of xenobiotics in environment: Petroleum hydrocarbons, pesticides, heavy metals
Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

Unit-IV
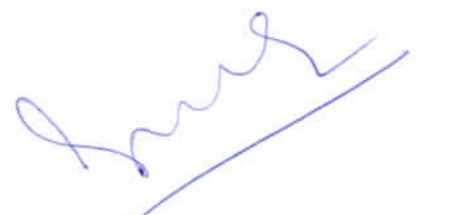### Social Issues and the Environmental Laws   (6 lectures)

Concept of Sustainable development, Water conservation, rain water harvesting, watershed
Management, Resettlement and rehabilitation of people; its problems and concerns.
Environmental Laws (brief idea only)
Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act
Issues involved in enforcement of environmental legislation.
Different government initiatives (brief idea only)- National ambient air quality standard 2009, Swachh Bharat Abhiyan, National afforestation program and Act- 2016, National River conservation plan and National Ganga River basin authority, Formation of National Green Tribunal

Activity
Field Trip & Report Writing
Case-study & Report Writing

Books suggested:
1) Benny Joseph, Environmental Studies, McGraw Hill Education (India) Private Limited
2) B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3) P AarneVesilind, J. Jeffrey Peirce and Ruth F. Weiner, Environmental Pollution and Control, Butterworth-Heinemann
4) D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd.
5) Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer-Verlag Berlin Heidelberg
6) Indian Environmental Law: Key Concepts and Principles edited by Shibani Ghosh, Publisher, Orient BlackSwan, 2019. ISBN, 9352875796.
7) P. Thangavel&Sridevi, Environemental Sustainability: Role of Green technologies, Springer publications

Dr. S. V. Sonekar
chairman