R.T. M. Nagpur University, Nagpur
FOUR YEAR B.E. COURSE

B.E. SCHEME OF EXAMINATION wef: 2021-22

Scheme of Teaching & Examination of Bachelor of Engineering III Semester B.E. (Computer Science and Engineering)

Sr. No.	Course Code	Category	Course Name	Hours/ Week			Credits	Maximum Marks				
								Theory		Practical		Total
				L	T	P		Internal	University	Internal	University	
1	BECSE301T	Basic Sciences courses	Applied Mathematics – III	3	1	-	4.00	30	70	-	-	100
2	BECSE302T	Professional core courses	Object Oriented Programming with Java	3	1	-	4.00	30	70	-	-	100
3	BECSE303T	Professional core courses	Operating System	3	-	-	3.00	30	70	-	-	100
4	BECSE304T	Professional core courses	Computer Architecture & Digital System	3	1	-	4.00	30	70	-	-	100
5	BECSE305T	Professional core courses	Ethics in IT	3	-	-	3.00	30	70			100
6	BECSE306T	Humanities Social and Management Courses	Universal Human Values	2	-	-	2.00	15	35	-	-	50
7	BECSE307T	Mandatory Course	Environment Science (Audit)	2	-	-	0.00	-	-	-	-	-
8	BECSE302P	Professional core courses	Object Oriented Programming with Java Lab	-	-	2	1.00	-	-	25	25	50
9	BECSE303P	Professional core courses	Operating System Lab	-	-	2	1.00	-	-	25	25	50
10	BECSE308P	Professional core courses	Computer Workshop-I Lab	-	-	2	1.00	-	-	25	25	50
Total				**19**	**3**	**6**	**23.00**	**165**	**385**	**75**	**75**	**700**

Dr. S. V. Sonekar
Chairman.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: 3rd (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Applied Mathematics - III*** Subject Code : **BECSE301T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
03 Hrs. (Theory) 01 Hr. (Tutorial)	04	30	70	100

Aim: To provide the necessary mathematical skills required to solve problems of practical interest and to expose students to a range of problems and teach appropriate methods to solve them.

Prerequisite(s): Basic Mathematics and Calculus

Course Objectives:

1	A primary objective is to provide a bridge for the student from lower-division mathematics courses to upper-division mathematics
2	Explain the importance of mathematics and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results.
3	Propose new mathematical and statistical questions and suggest possible software packages and/or computer programming to find solutions to these questions.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand numerical methods, matrices for the solution of linear and nonlinear equations, and the solution of differential equations, among other mathematical processes and activities.
CO2	Analyze real world scenarios to recognize when matrices and probability are appropriate, formulate problems about the scenarios, creatively model these scenarios (using technology, if appropriate) in order to solve the problems using multiple approaches.
CO3	Organize, manage and present data in a clear and concise manner.
CO4	Develop an ability to identify, formulate, and/or solve real world problems.
CO5	Understand the impact of scientific and engineering solutions in a global and societal context.
CO6	Create the groundwork for post-graduate courses, specialized study, and research in computational mathematics.

Unit I: Numerical Methods **[8 Hours]**

Solution of algebraic and transcendental equations: Newton–Raphson method, Method of false position and their convergence, Solution of simultaneous linear equations using Gauss-Seidal method and Crout's method (LU decomposition).

Numerical solution of ordinary differential equations: Taylor's series method, Euler's modified method, Runge-Kutta fourth order method, Milne's predictor- corrector method.

Unit II: Matrices **[7 Hours]**

Linear dependence of vectors, Eigen values and Eigen vectors, Reduction to diagonal form, Singular value decomposition, Sylvester's theorem (Statement only), Largest Eigen value and its corresponding Eigen vector by iteration method.

Unit III: Mathematical Expectation and Probability Distributions **[8 Hours]**

Discrete Random Variable: Review of discrete random variable, Probability function and Distribution function, Mathematical expectation, Variance and Standard deviation, Moments, Moment generating function.

Probability Distributions: Binomial distribution, Poisson distribution, Normal distribution, Exponential distribution.

Unit IV: Statistical Techniques **[6 Hours]**

Statistics: Introduction to correlation and regression, Multiple correlation and its properties, Multiple regression analysis, Regression equation of three variables.

Measures of central tendency and dispersion: Mean, Median, Quartile, Decile, Percentile, Mode, Mean deviation, Standard deviation.

Skewness: Test and uses of skewness and types of distributions, Measure of skewness, Karl Pearson's coefficient of skewness, Measure of skewness based on moments.

Unit V: Stochastic Process and Sampling Techniques **[7 Hours]**

Stochastic Process: Introduction of stochastic process, Classification of random process, Stationary and non-stationary random process, Stochastic matrix.

Markov Chain: Classification of states, Classification of chains, Random walk and Gambler ruin.

Sampling: Population (Universe), Sampling types and distribution, Sampling of mean and variance, Testing a hypothesis, Null and Alternative Hypothesis, One-tail and two-tails tests (Only introduction), t test and F test (Only introduction), Chi-square test.

Text/ Reference Books:

1. Advanced Engineering Mathematics (Wiley), Erwin Kreyzig.
2. Higher Engineering Mathematics (Khanna Publishers), B. S. Grewal.
3. Advanced Engineering Mathematics (S. Chand), H. K. Dass.
4. Probability and Statistics (Schaum's Outline Series), Murray Spiegel, John Schiller, R. A. Srinivasan.
5. Advanced Mathematics for Engineers, Chandrika Prasad.
6. Probability, Statistics and Randam Processes (TMH), T. Veerarajan.

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: 3rd (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Object Oriented Programming with Java*** Subject Code : **BECSE302T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
03 Hrs. (Theory) 01 Hr. (Tutorial)	04	30	70	100

Aim:

This course explains the fundamental ideas behind the object-oriented approach to programming. Knowledge of java helps to create the latest innovations in programming. Like the successful computerlanguages that came before, java is the blend of the best elements of its rich heritage combined with the innovative concepts required by its unique environment. This course involves OOP's concepts, java basics concepts, inheritance, polymorphism, interfaces, inner classes, packages, Exception handling, multithreading and objects Oriented Methodology basic concepts.

Prerequisite(s): Knowledge of structure programming language and Application development

Course Objectives:

1	Gain knowledge about basic Java language syntax and semantics to write Java programs and use concepts such as variables, conditional and iterative execution methods etc.
2	Be able to use the Java SDK environment to create, debug and run simple Java programs.
3	To analyze the object-oriented paradigm using java programming language
4	To implement small/medium scale java programs to resolve small business problems.

Course Outcomes:

At the end of this course student are able to:

CO1	Identify classes, objects, members of a class and relationships among them for a specific problem
CO2	Understand and demonstrate the concepts of garbage collection, polymorphism, inheritance etc.

CO3	Do numeric (algebraic) and string-based computation.
CO4	Understand and implement modularity as well as basic error handling techniques
CO5	Develop, design and implement small multithreaded programs using Java language
CO6	Apply appropriate problem-solving strategies for the implementation of small /medium scale java applications

Unit I: **[8 Hrs]**

Object Oriented Programming features: objects and classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Characteristics of Java, Java Source File Structure – Compilation. Fundamental Programming Structures in Java, Introduction of JVM, Object class, Constructors, Access specifiers, static members, Data Types.

Unit II: **[7 Hrs]**

Operators, Control Flow, Wrapper classes, Command line arguments, static modifier, this keyword, Garbage collection, Java Arrays, Declaration and initialization of an array, One Dimensional Array, Two-Dimensional Array, Vector. String Handling: String, StringBuffer and StringBuilder class, String constructors, Data conversion using valueOf(), toString() methods, Methods for String Comparison, Searching string and modifying string

Unit III: **[7 Hrs]**

Inheritance: Types of inheritance, Abstract class, Method Overriding, super keyword, final modifier Packages: Package Fundamental, importing packages, Concept of interface, Exception Handling: Fundamental Exception type: Checked, Unchecked Exceptions, throw and throws keywords, creating user defined exceptions, Built-in Exceptions.

Unit IV: **[7 Hrs]**

Threads and Multithreading: Fundamentals, Thread Life Cycle, Ways of creating threads, Creating multiple threads, isAlive (), join (), sleep(), Thread Synchronization, Thread priorities, Interthread communication, Methods for suspending, resuming and stopping threads

Unit V: **[7 Hrs]**

Collection Framework: Introduction, Difference between Array and Collection, List interface and its classes, Set interface and its classes, Map interface and its classes.

Text Books:

- The Complete Reference (8th Edition) by Herbelt Schildt, Tata McGraw-Hill publications
- Head First Java,2nd Edition by Kathy Sierra, Bert Bates, O'Reilly Media
- Programming in Java(Fifth edition) by E Balguruswami, McGraw Hill Education

Reference Books:

- Sun Certified Java Programmer for Java 6 by Kathy Sierra.
- The JavaTM Programming Language (3rd Edition) by Arnold, Holmes, Gosling, Goteti
- Core Java for Beginners by Rashmi Kanta Das(III Edition) Vikas Publication
- Java A Beginner's Guide, Fifth Edition, Tata McGra

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: THIRD (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : *Operating System* **Subject Code : BECSE303T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs (Theory)	3	30	70	100

Aim: To understand operating system concepts used in designing operating system.

Prerequisite(s): Basic knowledge of microprocessors, data structures and any programming language.

Course Objectives:

1	To make the computer system convenient to use in an efficient manner.
2	To provide users a convenient interface to use the computer system.
3	Course Description Covers the classical internal algorithms and structures of operating systems, including CPU scheduling, memory management, device management and deadlock
4	To keep track of who is using which resource, to provide efficient and fair sharing of resources among users and programs.

Course Outcomes:

At the end of this course Student are able to:

CO1	Explain the basic concepts of Operating System.
CO2	Understand the process management policies and scheduling algorithms.
CO3	Design the various memory management techniques.
CO4	Analyze process synchronization techniques.
CO5	Understand file system concepts.
CO6	Evaluate deadlock detection & prevention mechanism.

Unit I: **[09 Hrs]**

Introduction: Evolution of OS, Types of OS, Basic h/w support necessary for modern operating systems, services provided by OS, system programs and system calls, OS structure: Layered, Monolithic, Microkernel, Disk space management and space allocation strategies, disk arm scheduling algorithms.

Unit II: **[06 Hrs]**

Process Scheduling: Process concept, Process control Block, Types of scheduler, context switch, threads, multithreading model, goals of scheduling and different scheduling algorithms, examples from WINDOWS 2000 & LINUX.

Unit III: **[06 Hrs]**

Memory Management: Contiguous allocation, Relocation, Paging, Segmentation, Segmentation with paging, demand paging, page faults and instruction restart, page replacement algorithms, working sets, Locality, Thrashing, Garbage Collection.

Unit IV: **[06 Hrs]**

Process Cooperation and Synchronization: Concurrency conditions, Critical section problem, software and hardware solution, semaphores, conditional critical regions and monitors, classical inter process communication problems.

Unit V: **[09 Hrs]**

File Systems: File concept, Access methods, directory structures, Recovery, Log-structured File System. **Deadlocks & Protection:** Deadlock characteristics, Prevention, Avoidance, Detection and recovery, Goals of Protection, access matrix, implementation, Security problem.

Text books:

1. Operating System Concepts (8th Edition) by Silberschatz, Peter B. Galvin and Greg Gagne, WileyIndian Edition (2010).
2. Modern Operating Systems (Third Edition) by Andrew S Tanenbaum, Prentice Hall India (2008).
3. Operating Systems – A.Godbole: TMH Pubilcations
4. Operating Systems by D.M. Dhamdhere, Tata McGraw Hill 2nd edition.

Reference books:

1. Operating Systems (5th Ed) – Internals and Design Principles by William Stallings, Prentice Hall India, 2000
2. Operating System: Concepts and Design by Milan Milenkovik , McGraw Hill Higher Education
3. Operating Systems, 3rd Edition by Gary Nutt, Pearson Education
4. Operating System, 3rd Edition by P.Balakrishna Prasad ,SciTech Publications

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: III (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Computer Architecture & Digital System*** Subject Code : **BECSE304T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs. (Theory) 1 Hr. (Tutorial)	4	30	70	100

Aim: To understand the basic principles and the working of Computer and Digital Systems.

Prerequisite(s): Knowledge of semiconductors, transistors and concepts of physics related to digital system.

Course Objectives:

1	Discuss the basic concepts of digital system that are applicable in the designing of computer architecture
2	Explain concepts of basic processing unit of computer such as ALU, CU, MU, I/O Units and Arithmetic Operation used in computer.
3	Explain various technologies used in memory system and motivate students to design memory modules.
4	Discuss the different types of interrupts and interrupt handling mechanism.

Course Outcomes:

At the end of this course student are able:

CO1	Understand the basic concept of digital system & apply for problem solving.
CO2	Describe the Computer Architecture & addressing modes.
CO3	Understand various instruction formats.
CO4	Perform the arithmetic operations.
CO5	Design & evaluate various memory management system.
CO6	Illustrate I/O mapped & memory mapped operations.

Unit I: Motivation for Digital Systems: **[8 Hrs]**

Logic and Boolean algebra, Logic Gates & Truth Tables, Demorgan's law, Minimization of combinational circuits using Karnaugh maps. Multiplexers, Demultiplexer, Encoders, Decoders.

Unit II: Basic Structure of Computers: **[08 Hrs]**

Functional units, Von Neumann Architecture, Basic operational concepts, Bus structures Addressing modes, Subroutines: parameter passing, Instruction formats: Three- address Instructions, Two-address instructions, One- address instructions, Zero-address instructions.

Unit III: Basic Processing Unit: **[06 Hrs]**

Bus architecture, Execution of a complete instruction, sequencing of control signals, Hardwired control, Micro-programmed Control, microinstruction format.

Unit IV: Arithmetic: **[6 Hrs]**

Number representations and their operations, Addition and Subtraction with signed-magnitude, Design of Fast Adders, Array multiplier, Signed multiplication: Booth's Algorithm, Bit-pair recoding, Integer Division, Floating-point Arithmetic operations, guard bits and rounding.

Unit V: The Memory System: **[8 Hrs]**

Various technologies used in memory design, higher order memory design, Memory hierarchy, Main memory, Auxiliary memory, Cache memory, cache optimization techniques ,Memory interleaving, Virtual memory, Address Space and Memory Space, Associative memory, Page table, Page Replacement.

Input/output Organization: I/O mapped I/O and memory mapped I/O, Interrupts and Interrupts handling mechanisms, vectored interrupts, Synchronous vs. Asynchronous data transfer, Direct Memory Access.

Text books:

1. V.C.Hamacher,Z.G.Vranesic and S.G.Zaky, Computer Organisation, McGraw Hill,5thed,2002.
2. Computer Organization, Design and Architecture (IV Ed), Sajjan G. Shiva, CRCPress
3. Computer Architecture & Organization III Ed-J.P.Hayes.
4. Fundamental of Digital Electronics: A. Anand Kumar

Reference books:

1. M. Mano,"Computer System and Architecture", PHI, 1993
2. W. Stallings, "Computer Organization & Architecture", PHI, 2001.
3. Digital circuit & design: A.P.Godse

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: III (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Ethics in IT*** Subject Code : **BECSE305T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
3 Hrs. (Theory)	3	30	70	100

Aim: To understand the ethical behavior of individuals, organizations towards IT Profession

Prerequisite(s): None

Course Objectives:

1	Ability to understand and meet ethical standards and legal responsibilities.
2	Create an awareness on professionals Ethics and Human Values.
3	Discuss the Privacy and Anonymity issues, Defamation and Hate Speech
4	Gain the knowledge of Copyrights, Patents and Trade Secret Laws.
5	Create and understand the awareness on Whistle-blowing

Course Outcomes:

At the end of this course Student are able:

CO1	Acquire knowledge about ethical values & principals.
CO2	Understand key issues of privacy protection policies.
CO3	Understand and apply Intellectual Property Rights and related law in reality.
CO4	Understand the core values that shape the ethical behavior of an engineer / IT Professional.
CO5	Identify the multiple ethical interests at stake in a real-world situation.
CO6	Develop cognitive skills in solving social problems.

Unit I: **[09 Hrs]**

An overview of Ethics: Ethics in IT, Ethics for IT professionals and IT users, IT professionals, Ethical behavior, IT professional malpractices, IT users. Educating Employees, contractors and part-time Workers **Computer and Internet Crime:**Types of Exploits, Reducing Vulnerabilities, Establishing a Security Policy, Prevention, Detection, Response.

Unit II: **[07 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, Workplace Monitoring, Advanced surveillance Technology, Freedom of Expression: Key issues, Controlling Access to Information on the Internet, Defamation and Hate Speech.

Unit III: **[07 Hrs]**

Intellectual Property: Copyrights, Patents, Trade Secret Laws, Key Intellectual Property Issues, Plagiarism, Reverse Engineering, Open Source Code, Software Development, Strategies to Engineer Quality Software, Capability Maturity Model Integration for Software, Development of Safety-Critical Systems.

Unit IV: **[06 Hrs]**

Ethics of IT Organization: Need for Nontraditional Workers, Contingent Workers H-IB Workers, Whistle-blowing, Protection for Whistle-Blowers, Dealing with Whistle-Blowing Situation.

Unit V: **[07 Hrs]**

The Impact of Information Technology on the Quality of Life: The impact of IT on the standard of Living and productivity, The impact of IT on Health care costs, Electronic Health Records, Use of Mobile and Wireless Technology, Telemedicine.

Text books:

1. George Reynolds, "Ethics in information Technology" Cengage Learning

Reference books:

1. Deborah G.Johnson,"Computer Ethics",3/e Pearson Education.
2. Sara Baase, "A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet," PHI Publications.
3. Richard A.Spinello, "Case study in Information Technology Ethics", second Edition PHI Publications.
4. Duncan Lanford "Internet Ethics".
5. D. Micah Hester and Paul J. Ford "Computer and Ethics in the Cyber age".
6. Prof.A.R.Aryasri, Dharanikota Suyodhana "Professional Ethics and Morals" Maruthi Publications.
7. A.Alavudeen, R.KalilRahman and M.Jayakumaran "Professional Ethics and Human Values" - LaxmiPublications.

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: 3rd (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Universal Human Values*** Subject Code : **BECSE306T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
02 Hrs (Theory)	02	15	35	50

Aim: To inculcate sensitivity among students towards themselves and their surrounding including family, society and nature.

Prerequisite(s): None

Course Objectives:

1	Development of a holistic perspective based on self-exploration, about themselves (human being), family, society and nature/existence.
2	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence.
3	Strengthening of self-reflection.
4	Development of commitment and courage to act.

Course Outcomes:

At the end of this course Student are able to:

CO1	Become more aware of themselves, and their surroundings (family, society, nature)
CO2	Become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
CO3	They would have better critical ability.
CO4	Become sensitive to their commitment towards what they have understand (human values, human relationship and human society).

Unit 1 **[06 Hrs]**

Value education, definition, need for value education. The content and the process of value education, basic guidelines for value education, self-exploration as a means of value education, happiness and prosperity as part of value education.

Unit 2 **[06 Hrs]**

Harmony of self with body, coexistence of self and body, understanding the needs of self and the needs of body, understanding the activities in the self and the activities in the body.

Unit 3 **[06 Hrs]**

Values in relationship, the five dimensions of human endeavour, the holistic perception of harmony in existence.

Unit 4 **[06 Hrs]**

Basics for ethical human conduct, defects in ethical human conduct, human rights violations and social disparities, value based life.

Text Books:

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

Reference Books

1. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. Indian Ethos and Modern Management: Amalgam of the best of the ideas from the East and the West, B.L. Bajpai, New Royal Book Bo., Lucknow, 2004
4. Human society in ethics and politics, Bertrand Russel, Routledge Publications, 2009

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: 3rd (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Environmental Science*** Subject Code : **BECSE307T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
02 Hrs (Theory)	NIL	NIL	NIL	NIL

Course Outcomes:

At the end of this course student are able to:

CO1	Identify different types of air pollutions as well as explain their causes, detrimental effects on environment and effective control measures.
CO2	Recognize various sources of water pollutants and interpret their causes and design its effective control measure
CO3	Illustrate various types of pollutants and waste management
CO4	Analyze various social issues related to environment and challenges in implementation of environmental laws.

Unit I: **[06 Hrs]**

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: **[06 Hrs]**

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: **[06 Hrs]**

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: **[06 Hrs]**

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

1.Field Trip & Report Writing

2.Case-study & Report Writing

Books suggested:

1.Benny Joseph, Environmental Studies, Mc Graw Hill Education (India) Private Limited

2.B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut

3.P Aarne Vesilind, 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

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: 3rd (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Object Oriented Programming with Java*** Subject Code : **BECSE302P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
02 Hrs (Practical)	01	25	25	50

Note:

1. Practical's are based on Object Oriented Programming with java syllabus (subject code: **BECSE302T**)
2. There should be at the most two practical's per unit
3. Minimum ten practical's have to be performed
4. IDE (e.g. eclipse, netbeans)
5. Include at least one content beyond syllabus practical
6. Do not include study experiments

Text Books:

1. The Complete Reference (8th Edition) by Herbelt Schildt, Tata McGrawHill Publications
2. Head First Java,2nd Edition by Kathy Sierra, Bert Bates, O'Reilly Media
3. Programming in Java(Fifth edition) by E Balguruswami, McGraw Hill Education

Reference Books:

1. Sun Certified Java Programmer for Java 6 by Kathy Sierra.
2. The JavaTM Programming Langauge(3rd Edition) by Arnold, Holmes, Gosling, Goteti
3. Core Java for Beginners by Rashmi Kanta Das(III Edition) Vikas Publication
4. Java A Beginner"s Guide, Fifth Edition, Tata McGRAW-HILL.

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: 3rd (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Operating System*** Subject Code : **BECSE303P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
02 Hrs (Practical)	01	25	25	50

Note:

1.Practical's are based on Operating system syllabus

2. There should be at the most two practical's per unit

3. Minimum ten practical's have to be performed

4. Include at least one content beyond syllabus practical

Text books:

1. Operating System Concepts (8th Edition) by Silberschatz, Peter B. Galvin and Greg Gagne, WileyIndian Edition (2010).
2. Modern Operating Systems (Third Edition) by Andrew S Tanenbaum, Prentice Hall India (2008).
3. Operating Systems – A.Godbole: TMH Pubilcations
4. Operating Systems by D.M. Dhamdhere, Tata McGraw Hill 2nd edition.

Reference books:

1. Operating Systems (5th Ed) – Internals and Design Principles by William Stallings, Prentice Hall India, 2000
2. Operating System: Concepts and Design by Milan Milenkovik , McGraw Hill Higher Education
3. Operating Systems, 3rd Edition by Gary Nutt, Pearson Education

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: THIRD (C.B.S.C)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : ***Computer Workshop-I*** Subject Code : **BECSE308P**

Load	Credit	College Assessment Marks	University Evaluation	Total Marks
2 Hrs. (Practical)	01	25	25	50

Note: - Practical list must have at least 10 practical's.

Unit I: **[Min 2 Practicals]**

Basic concepts of HTML: HTML, Web Pages, World Wide Web, Tags in HTML, HTML As a Markup Language, HTML as a Page Formatting Tool, Structure of an HTML Page, Commands Written In Notepad, the <H>TAG, the basic tags, the <P>TAG, The Text attributes: The <marquee> tag, Example of Text Styles, the images, the list tag: Ordered List, Unordered List, Nested List The links: Links between Two Pages, Links in the Same Page, Images as Links, Attributes of Links, the basic web page, other formatting tags: sounds and videos, comments, the <XMP> tag, special characters.

Unit II: **[Min 2 Practicals]**

The Tables: The Table, The Rows, The Columns, Cellspacing, Cellpadding, Alignment of the Text Present inside the Cells, Alignment of Table, Border Attributes in the Table, Merging Of Rows and Columns, Colspan, Rowspan, Table within a Table, Empty Cells inside the Table, Links in the Table.

Unit III: **[Min 2 Practicals]**

The Forms: The<input> Tag, The <textarea></textarea> Tag, The Dropdown List, The Normal List, HTML 5: New Markup Elements of HTML5, Basic Tags, Images, List and Links, Tables and Forms. Cascading Style Sheet(CSS): Definition and Usage, Syntax, Selectors, Borders, Margin, padding, Box Model, outline, link, table, Rounded Corners, Border Images, Backgrounds.

Unit IV: **[Min 2 Practical]**

Java Script: Variables, Array, Comments, Operators, Conditional Statements, Looping Statements.

Unit V: **[Min 2 Practicals]**

The Frames: Frames with Column Arrangement, Column Size for Frames, Row Size for Frames, Frame Spacing, Margin Width and Height in Frames.
Applets: Basics of applets – Types of Applet- Life cycle of an Applet – AWT: Event Handling Delegation event Model.

Text Books:

1. HTML Programming, Freeman and Robson, Oreilly publications.
2. E. Balaguruswamy, "Programming in java", Fourth Edition, Tata McGraw Hill, 2010.

Dr. S. V. Sonekar
Chairman CSE

RTMNU B.E. SCHEME OF EXAMINATION 2021-22

Scheme of Teaching & Examination of Bachelor of Engineering IV Semester B.E. (Computer Science and Engineering)

Sr. No.	Course Code	Category	Course Name	Hours/ Week			Credits	Maximum Marks				
								Theory		Practical		Total
				L	T	P		Internal	University	Internal	University	
1	BECSE401T	Basic sciences	Discrete Mathematics and Graph Theory	3	0	0	3.00	30	70	-	-	100
2	BECSE402T	Professional core courses	Data Structure and Program Design	3	1	0	4.00	30	70	-	-	100
3	BECSE402P	Professional core courses	Data Structure and Program Design Lab	0	0	2	1.00	-	-	25	25	50
4	BECSE403T	Professional core courses	Database Managements Systems	3	0	0	3.00	30	70	-	-	100
5	BECSE403P	Professional core courses	Database Managements Systems Lab	0	0	2	1.00	-	-	25	25	50
6	BECSE404T	Professional core courses	Computer Networks	3	0	0	3.00	30	70			100
7	BECSE405T	Professional core courses	Theory of Computation	3	1	0	4.00	30	70	-	-	100
8	BECSE406T	Professional core courses	System Programming	3	0	0	3.00	30	70			100
9	BECSE407P	Professional core courses	Computer Workshop-II (Python)	0	0	2	1.00	-	-	25	25	50
10	BECSE408	Project-CS	Internship	0	0	2	1.00	-	-	50	-	50
Total				**18**	**2**	**8**	**24.00**	180	420	**125**	75	800

Dr. S. V. Sonekar
Chairman

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE
SEMESTER: FOURTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Discrete Mathematics and Graph Theory Subject Code : BECSE401T

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory)	03	100	30	70	100

Aim: To develop background in modern computer science, in particular logic, relations, combinatorics and graph theory so that students can better understand the algorithms.

Pre Requisites:

1. Basic concepts of logic, matrices and combinatorics.
2. Higher secondary school mathematics through trigonometry.

Course Objectives:

1. A primary objective is to provide a bridge for the student from lower-division mathematics courses to upper-division mathematics.
2. Obtain skills and logical perspectives in introductory (core) courses that prepare them for subsequent courses.
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 world problems.

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 constraint satisfaction.
2. Gain an introduction into how mathematical models for engineering are designed, analyzed and implemented in industry and organizations.
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 plausible ones.
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 multiple approaches.

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

6. Apply their knowledge in life-long learning.

Unit 1: Set Theory, Relations and Functions **(08 Hrs)**

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

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 2: Fuzzy Set and Fuzzy Logic **(07 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 3: Group Theory and Ring Theory **(07 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 simple examples).

Unit 4: Graph Theory **(07 Hrs)**

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.

Unit 5: Combinatorics **(07 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), Bart Kosko.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE
SEMESTER: FOURTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Data Structure and Program Design Subject Code : BECSE402T

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory) 01 Hr (Tutorial)	04	100	30	70	100

Aim : To understand the implementation of various data structures and algorithms.

Prerequisite(s): C Language

Course Objective/Learning Objective:

1	To introduce the fundamental concept of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms.
2	To implement data structure Algorithms by using C/C++ Language.
3	To select an appropriate data structure to solve real world problem and compare alternative implementations of data structures with respect to performance.
4	To acquire knowledge on Searching and Sorting techniques.

Course Outcome:
At the end of this course Student are able to:

CO1	Analyze the complexity of algorithms and sorting techniques.
CO2	Apply the concept of stack and queues to solve real world problem.
CO3	Describe and implement linked list operation.
CO4	Demonstrate different methods for traversing trees.
CO5	Utilize the concepts of graphs to build solution. Design and implement searching techniques and hashing function

UNIT I: **(08 Hrs)**

Introduction to algorithm: General concepts of data structures, Types of Data Structure with its properties and Operations, Time and space analysis of algorithms, Big oh, theta, and omega notations, Average, best and worst case analysis.

Sorting and Searching Techniques: Selection sort, insertion sort, heap sort, shell sort, linear and binary search.

UNIT II: **(07 Hrs)**

Stack & Queue: Representation of Stack & queue using array, Application of stacks, Conversion from infix to postfix and prefix expressions, Evaluation of postfix expression using stacks, Linear Queues, Circular Queues, and Priority Queues.

UNIT III: **(07 Hrs)**

Linked List: Representation of ordered list using array and its operation, Linked Lists, Singly linked list, Implementation of linked list using static and dynamic memory allocation, operations on linked list, polynomial representations using linked list, circular linked list, doubly linked list.

UNIT IV: **(07 Hrs)**

Trees: General and binary trees, Representations and traversals of trees, Threaded Binary Trees, Binary search trees, the concept of balancing, AVL Trees, B-Trees, B+ Trees.

UNIT V: **(07 Hrs)**

Graphs: Representation of Graph, Matrix Representation of Graph, List Representation of Graph, Directed Graphs(Digraphs), Breadth first search and Depth first search, spanning trees.

Hashing: Hash tables, hash functions, hashing techniques, Collision resolution techniques, overflow handling.

Textbooks:

- Classical Data Structure, D. Samanta, Prentice Hall of India.
- Data Structures using C, Aaron M. Tanenbaum, Pearson Education.
- Data Structure with C, Seymour Lipschutz, Tata Mcgraw Hill.

References:

- Ellis Horowitz, Sartaj Sahni & Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press.
- An Introduction to Data Structures and Applications, Jean-Paul Tremblay, Paul G. Sorenson, P. G. Sorenson, Tata McGraw Hill Publication.
- Data Structures using C and C++, Y. Langsam, Pearson Education.
- Algorithms in a Nutshell, George H & Garry, O'reilly Publication.
- Data Structure and Algorithms using Python, Rance D. Necaise, John Wiley Publication.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: FOURTH (C.B.C.S)

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Data Structure and Program Design Subject Code : BECSE402P

Load	Credit	Total Marks	Internal Marks	University Marks	Total
02 Hrs (Practical)	01	50	25	25	50

- Ten Practicals based on syllabus. Course coordinator should make sure that all units will be covered in their list. No study experiment should be included in the list.

Textbooks:

- Classical Data Structure, D. Samanta, Prentice Hall of India.
- Data Structure with C, Seymour Lipschutz, Tata Mcgraw Hill.
- Data Structures using C, Aaron M. Tanenbaum, Pearson Education.

References:

- An Introduction to Data Structures and Applications, Jean-Paul Tremblay, Paul G. Sorenson, P. G. Sorenson, Tata McGraw Hill Publication.
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RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: FOURTH (C.B.C.S)

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: Database Management Systems **Subject Code:** BECSE403T

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory)	03	100	30	70	100

Aim: To understand and implement the concepts of databases in order to gain the proficiency at application level.

Prerequisite(s): Basic concept of file processing and fundamentals of operating systems.

Course Objective/Learning Objective:

1	To understand general idea of database management systems.
2	To develop skills to design databases using data modeling and design techniques.
3	To develop skills to implement real life applications which involve database handling.
4	Demonstrate an understanding of career opportunities in subject areas of designing, storage techniques, data handling and managing techniques

Course Outcome:

At the end of this course Student are able to:

CO1	**Understand** basic database concepts and data modeling techniques used in database design.
CO2	**Study** the concept of functional dependency and **Perform** the calculus with **Design** database by using different normalization technique.
CO3	**Study** query processing and **Perform** optimization on query processing.
CO4	**Understand** the concept of transaction processing and different recovery technique used in RDBMS.
CO5	**Study** and **Implement** advanced databases which are used real time system.

UNIT I: **(07 Hrs)**

Introduction to database systems: Approaches to building a database, Three-schema architecture of a database, Challenges in building a DBMS, DBMS Architecture-Various components of a DBMS, Types of data models.

UNIT II: **(08 Hrs)**

Relational Data Model: Concept of relations, Schema-instance distinction, Keys, referential integrity and foreign keys, Relational algebra operators, Tuple relation calculus, Domain relational

calculus. **Physical and logical hierarchy:** Concept of index, B-trees, hash index, function index, bitmap index. Concepts of Functional dependency, Normalization (1NF,2NF,3NF,BCNF, etc).

UNIT III: **(07 Hrs)**

Query Processing and Optimization: Query Processing and Optimization process, measures of query cost estimation in query optimization, pipelining and Materialization, Structure of query evaluation plans.

UNIT IV: **(07 Hrs)**

Transactions: Transaction concepts, properties of transactions, Serializability of transactions, Testing for serializability, System recovery, Two-Phase Commit protocol, Recovery and Atomicity, Log based recovery, concurrent executions of transactions, Locking mechanism, solution to concurrency related problems, deadlock, two-phase locking protocol, Isolation.

UNIT V: **(07 Hrs)**

Recovery System and advanced databases: Failure classification, recovery and atomicity, log based recovery, checkpoints, buffer management, advanced recovery techniques, Web databases, Distributed databases, Data warehousing, Data mining, Data Security, NOSQL databases.

Textbooks:

- Database System Concepts by Avi Silberschatz, Henry F. Korth, S. Sudarshan, Tata McGraw Hill, Fifth Edition.
- Fundamentals of Database Systems – Elmasiri and Navathe, Addison Wesley, 2000.
- An introduction to Database Systems, C J Date, A. Kannan, S. Swamynathan –Eight Edition.

Reference books:

- Database Management Systems - by Raghu Ramakrishnan and Johannes Gehrke, Tata McGraw Hill Publication, Third Edition.
- Introduction to Database Management Systems by Kahate, Pearson Education.

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FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: FOURTH (C.B.C.S)

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Database Management Systems Subject Code : BECSE403P

Load	Credit	Total Marks	Internal Marks	University Marks	Total
02 Hrs (Practical)	01	50	25	25	50

- Ten Practicals based on syllabus. Course coordinator should make sure that all units will be covered in their list. No study experiment should be included in the list.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: FOURTH (C.B.C.S.)

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject: Computer Networks **Subject Code:** BECSE404T

Load	Credits	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory)	03	100	30	70	100

Aim: To understand networking concepts and various protocols used in Computer Network.

Prerequisite(s): Basics of data communication, networking concepts and computer architecture.

Course Objectives:

1	To study the basic taxonomy and terminology of the computer networking and enumerate the layers of OSI model and TCP/IP model.
2	To study the fundamentals and basics of Physical layer, and will apply them in real time applications.
3	To study data link layer concepts, design issues, and protocols.
4	To Gain core knowledge of Network layer routing protocols and IP addressing.
5	To study process-to-process communication and Congestion control mechanism.
6	To study about domain name, Application layer and network management.

Course Outcomes:

At the end of this course Student are able to:

CO1	Describe the functions of each layer in OSI model along with basic networking concepts.
CO2	Explain physical layer functionality and its working along with transmission media with real time applications.
CO3	Describe the functions of data link layer and explain the protocols used in data link layer.
CO4	Classify the routing protocols and analyze how to map IP addresses. Identify the issues related to transport layer, congestion control
CO5	Describe Quality of Service, DNS, Application layer protocols & Network security issues.

Unit I: **(07 Hrs)**

Introduction to Data Communication:

Data Communication Components, Data Representation, data flow (Simplex, Half-Duplex and Full-Duplex mode), Network Criteria, Type of connection, physical topology, Categories of Network (LAN, MAN, WAN,PAN), study of OSI reference model.

Unit II: **(07 Hrs)**

Physical Layer and Media:

Analog and digital Data, Analog and digital signals, TRANSMISSION MODES: Serial and Parallel transmission, Asynchronous and Synchronous Transmission. COMMUNICATION MEDIA: guided media and unguided.

Unit III: **(07 Hrs)**

Data Link Layer:

Types of errors, framing (character and bit stuffing), Protocols: for noiseless channels (Simplex, Stop and wait), for noisy channels (Stop and wait ARQ, Go back-N ARQ, Selective repeat ARQ), Point-to-Point (PPP), Multiple Access Protocol: Pure ALOHA, Slotted ALOHA, CSMA, CSMA/CD, CSMA/CA.

Unit IV: **(07 Hrs)**

Network Layer:

IPv4 Addresses, IP addressing Methods with sub-netting and super-netting, **Routing Protocols**: Distance Vector, Link State, Path Vector.

Transport Layer:

Duties of transport layer, Process-to-process delivery, Congestion control: Data Traffic, Congestion control Category (Open loop, closed loop),

Unit V: **(08 Hrs)**

Quality of Service: Introduction to QoS, Techniques to improve QoS: Leaky bucket algorithm, Token bucket algorithm. **Application Layer:** Domain Name System, Functions of Network management system, Voice over IP, Firewall

Text Books:

- B. A. Forouzan – "Data Communications and Networking (3rd Ed.) " – TMH
- A. S. Tanenbaum – "Computer Networks (4th Ed.)" – Pearson Education/PHI
- W. Stallings – "Data and Computer Communications (8th Ed.)" – PHI/ Pearson Education

Reference Books:

- Kurose and Rose – "Computer Networking -A top down approach featuring the internet" – Pearson Education
- Introduction to Data Communications and Networking by Wayne Tomasi-Pearson Edition
- Comer – "Internetworking with TCP/IP, vol. 1, 2, 3(4th Ed.)" – Pearson Education/PHI

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: FOURTH (C.B.C.S)

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Theory of Computation **Subject Code:** BECSE405T

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory) 01 Hr (Tutorial)	04	100	30	70	100

Aim: The main motivation behind developing Theory of Computation was to develop methods to describe and analyze the dynamic behavior of discrete systems.

Prerequisite(s): Basics of Discrete Mathematics

Course Objective/Learning Objective:

1	To discuss the Chomsky classification of formal language with discussion on grammar and automata for regular, context-free, context sensitive and unrestricted language.
2	Understand the basic properties of Turing machines and computing with Turing machines.
3	To discuss the notion of decidability.
4	To compute Ackerman function and analyze recursively and non-recursively enumerable language

Course Outcome:

At the end of this course Student are able to:

CO1	Design finite automata and its minimization along with Moore and Mealy machines.
CO2	pply regular expression and create grammar for the same.
CO3	al with context free grammar and various normal forms of CFGs.
CO4	eate Push Down Automata for the given CFG and inter-conversion of the same.
CO5	eate Turning Machine for the grammar and Deal with Recursive and Recursively Enumerable Languages.

UNIT I: **(08 Hrs)**

Finite Automata (FA): Basic Terminology and Definitions, Chomsky hierarchy, Deterministic Finite Automata , language of a DFA. Nondeterministic Finite Automata, Equivalence of Deterministic and Non-deterministic Finite Automata, Applications of Finite Automata, Finite Automata with Epsilon Transitions, Eliminating Epsilon transitions, Minimization of Deterministic Finite Automata, Finite automata with output (Moore and Mealy machines) and Inter conversion.

UNIT II: **(07 Hrs)**

Regular Grammars (RG): Definition, regular grammars and FA, Conversion. Proving languages to be non-regular, Pumping lemma, applications, Closure properties of regular languages.

Regular Expressions (RE): Introduction, Identities of Regular Expressions, Finite Automata and Regular Expressions, Converting from DFA's to Regular Expressions, Converting Regular Expressions to Automata, applications of Regular Expressions.

UNIT III: **(07 Hrs)**

Context Free Grammar (CFG): Definition, Parse Tress, Derivation Trees, Rightmost and Leftmost derivations of Strings and Conversions. Ambiguity in CFGs, Minimization of CFGs, Normal forms for CFG, Pumping Lemma for CFLs.

Unit –IV: **(07 Hrs)**

Push down Automata (PDA): Definition, Model, Non-determinism, acceptance by two methods and their equivalence, conversion of PDA to CFG, CFG to PDAs, closure and decision properties of CFLs.

UNIT V: **(07 Hrs)**

Turing Machines (TM) : Formal definition and behavior, Languages of a TM, TM as acceptor, TM as transducers, Variations of TM, Linear Bounded Automata, TM as computer of function. Properties of recursive and recursively enumerable languages, Recursively enumerable set, Undesirability, Decidability and solvability, Post correspondence Problem, Primitive recursive functions, Ackerman function

Textbooks:

- John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory Languages and Computation, 3rd edition, Pearson Education.
- Michael Sipser, Introduction to the Theory of Computation, 3rd edition, Cengage Learning.
- Peter Linz,An Introduction to Formal Languages and Automata, 5th Edition, Malloy, Inc.

- Vivek Kulkarni, Theory of Computation, Oxford University Press, ISBN-13: 978-0-19-808458-7.
- Theory of Computation - O.G. Kakde ,University Science Press

Reference books:

- K. L. P Mishra, N. Chandrashekaran , Theory of Computer Science-Automata Languages and Computation, 2nd edition, Prentice Hall of India, India.
- John C Martin, Introduction to languages and the Theory of Computation, TMH
- Daniel I.A. Cohen, John Wiley, Introduction to Computer Theory.
- P.K. Srimani, Nasir S, A Text book on Automata Theory, Cambridge University Press.
- Kamala Krithivasan, Rama R, Introduction to Formal languages Automata Theory and Computation Pearson.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: FOURTH (C.B.C.S.)

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : System Programming Subject Code: BECSE406T

Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs. (Theory)	03	100	30	70	100

Aim: To understand about system programs and device drivers.

Prerequisite(s): Data Structures, Theoretical computer science, Operating system, Computer Architecture

Course Objective/Learning Objective:

1	To acquire knowledge about various system software programs
2	To understand the design of Assembler
3	To understand concept and design of microprocessor and various types of loaders
4	To understand the working of Compiler, Interpreter and various types of device drivers.

Course Outcome: -

After learning the course, the students should be able to:

CO1	Identify the relevance of different system programs.
CO2	Describe the various data structures and passes of assembler design.
CO3	Identify the need for different features and designing of macros
CO4	Distinguish different loaders and linkers and their contribution in developing efficient user applications.
CO5	Grab the concepts of phases of compiler, LEX and YACC

Unit I: **(08 Hrs)**

Introduction to Systems Programming

Introduction of Components of System Software: - Assemblers, Loaders, Macros, Compilers, and Formal Systems. Operating System, computer language, Machine Architecture IBM 360/370, Instruction Formats, Data Formats, System Software Development, Recent Trends in Software Development, Levels of System Software, computer languages: Machine language, assembly language.

Unit II: Assembler **(07 Hrs)**

Elements of Assembly language programming, Data base for assembler design, Types of Assemblers, design of two-pass assembler and single pass assembler.

Unit III: Macro and Macro Processors **(07 Hrs)**

Introduction, Macro Definition and Call, Macro Expansion, Functions of a Macro Processor, Basic Tasks of a Macro Processor, Features of macro, Design Issues of Macro Processor, design of macro processor

Unit IV: Linker and Loader **(07 Hrs)**

Introduction, Task of Loader, Relocation and Linking concepts, Compile-and-Go Loaders, General Loader Schemes, Absolute Loaders, Relocating Loaders, design of direct linking loader. Linker's v/s Loaders

Unit V: Compiler, Interpreters, Debuggers & Device Driver **(07 Hrs)**

Compilers: Basic compilers function, Phases of compilers, Lexical Analysis- Role of Finite State Automata in Lexical Analysis, Design of Lexical analyzer, data structures used,Syntax Analysis- Role of Context Free Grammar in Syntax analysis Study of LEX & YACC. Benefits of Interpretation, Overview of Interpretation, The Java Language Environment, Java Virtual Machine, Types of Errors, Debugging Procedures, Comparative study between device drivers for UNIX & Windows

Text Books: -

Sr. No.	Title	Author	Publication
1	System Programming	J. J. Donovan	Tata McGraw-Hill Education
2	System Programming	D M Dhamdhere	McGraw Hill Publication
3	System Software	Santanu Chattopadhyay	Prentice - Hall India,2007
4	UNIX programming Tools LEX and YACC	Levine, Mason and Brown	O'Reilly

Reference Books: -

Sr. No.	Title	Author	Publication
1	System Software – An Introduction to Systems Programming	Leland L. Beck	Pearson Education Asia, 2000
2	Principles of Compiler Design	Aho and Ullman	Pearson Education
3	System Programming and Compiler Construction	R.K. Maurya & A. Godbole	Kindle Edition
4	System Programming	Srimanta Pal	OXFORD Publication

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: FOURTH (C.B.C.S)

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: Computer Workshop-II-Lab **Subject Code:** BECSE407P

Load	Credits	Total Marks	Internal Marks	University Marks	Total
02 Hrs (Practical)	01	50	25	25	50

Aim: To implement the concepts of python programming

Prerequisite(s): C programming and basics of object oriented programming

Course Objectives:

1	To implement various concepts of python programming
2	To gain hands on experience on organizing python codes using object oriented programming concepts

Course Outcomes:

At the end of this course Student are able to:

CO1	Declare python operators, numeric data types and string operations
CO2	Implement tuple, conditional blocks and loops in python
CO3	Apply functions, modules, and packages using python
CO4	Handle exceptions, sorting algorithms and various data structures
CO5	Implement various file operations using python and Implement concepts of object oriented programming and python database connectivity

UNIT I:

Origin of Python, Python versions, Features of Python, Installation and Working with Python, Identifiers, Keywords, Understanding Python variables , Python basic Operator ,Declaring and using Numeric data types: int, float, complex Using string data type and string operations

UNIT II:

Defining list and list slicing ,Use of Tuple, frozenset, map, dictionary, Non data type, Math functions, Conditional blocks using if, else and else if, Simple for loops in python, for loop using ranges, string, list and dictionaries ,Use of while loops in python, Loop manipulation using pass, continue, break and else.

UNIT III:

Organizing python codes using functions, Organizing python projects into modules ,Importing own module as well as external modules Understanding ,Packages Powerful Lamda function in python ,Programming using functions, modules and external packages,

UNIT IV:

Handling Exceptions, try catch block, Finally Block, Possible combination of try catch and finally block, Regular expression, Search Algorithms, Sorting Algorithms, Link List, Stack, Queues, Dequeues Hash Tables.

UNIT V:

Reading config files in python,Writing log files in python, Understanding read functions, read(), readline() and readlines(),Understanding write functions, write() and writelines, Manipulating file pointer using seek Programming using file operations

Classes and Object-Oriented Programming, Abstract Data Types and Classes, Inheritance, Encapsulation and Information Hiding, Graphical User interface, Networking in Python, Python database connectivity,

Books Recommended:

Text Books:

- 'Head-First Python' (2nd Edition) by Paul Barry, O'Reilly Publications

Reference Books:

- John V Guttag. "Introduction to Computation and Programming Using Python", Prentice Hall of India
- R. Nageswara Rao, "Core Python Programming", Dreamtech
- Wesley J. Chun. "Core Python Programming - Second Edition", Prentice Hall

Note:

1. There should be at the most two practicals per unit.
2. Minimum ten practical's have to be performed based on above syllabus.
3. Do not include study experiment.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF ENGINEERING (B.E.) DEGREE COURSE

SEMESTER: FOURTH (C.B.C.S)

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Internship Subject Code : BECSE408

Load	Credit	Total Marks	Internal Marks	University Marks	Total
02 Hrs (Practical)	01	50	50	-	50

- Student should have to undergo minimum internship of two to four weeks. After completion of the internship report of the same should be submitted to the department. Minimum one month internship is desirable

Dr. S. V. Sonekar
Chairman