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

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

Fifth Semester:-

S. N.	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
		L	T	P	CA	UE	Total		
1	Artificial Intelligence	3	1	-	30	70	100	4	PCC-CS
2	Artificial I Intelligence-Lab	-	-	2	25	25	50	1	PCC-CS
3	Design & Analysis of Algorithms	3	1	-	30	70	100	4	PCC-CS
4	Design & Analysis of Algorithms –Lab	-	-	2	25	25	50	1	PCC-CS
	Software Engineering & Project Management	3	-	-	30	70	100	3	PCC-CS
5	Elective-I	3	-	-	30	70	100	3	PEC-CS
6	Effective Technical Communication	2	-	-	15	35	50	2	HSMC
7	Profesional Skills Lab I			2	25	25	50	1	ESC
8	Yoga and Meditation (Audit Course)	2	-	-	50	-	-	Audit	MC
	Total	**16**	02	**06**			**600**	**19**	

Elective-I: 1. TCP/IP 2. Design Patterns 3. Data Warehousing and Mining

[Mrs. B. P. Dharaskar]

Dr. S. V. Sonekar
chairman

[Ms. Mona Nilchandani]

Dr. M. V. Bramhe

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

Subject: **Artificial Intelligence** Subject Code: **BTECH_CSE-501T**

Load [Th+Tu]	Credits [Th+Tu]	College Assessment Marks	University Evaluation	Total Marks
[36 + 12]=48 Hrs	**3+1=4**	**30**	**70**	**100**

Aim: To understand the basic principles and concepts of Artificial Intelligence.

Prerequisite(s): Student should have basic knowledge of computers and mathematics.

Course Objectives:

1	To create appreciation and understanding the achievements of AI and the theory underlying those achievements
2	To create an understanding of the basic issues of knowledge representation

Course Outcomes:

At the end of this course students are able to:

CO1	Demonstrate knowledge of the building blocks of AI as presented in terms of intelligent agents.
CO2	Analyze and formalize the problem as a state space, graph, design heuristics and select amongst different search or game based techniques to solve them.
CO3	To create an understanding of the basic issues of knowledge representation
CO4	Formulate and solve problems with uncertain information using Bayesian approaches.
CO5	Attain the capability to represent various real life problem domains using logic based techniques and

SYLLABUS:

UNIT-I

Introduction: What is AI? History & Applications, Artificial intelligence as representation & Search, Production system, Basics of problem solving: problem representation paradigms, defining problem as a state space representation, Characteristics.

UNIT-II

Search Techniques: Uninformed Search techniques, Informed Heuristic Based Search, Generate and test, Hill-climbing, Best-First Search, Problem Reduction, and Constraint Satisfaction.

UNIT-III

Knowledge representation: Knowledge representation Issues: First order logic, Predicate Logic, Structured Knowledge Representation: Backward Chaining, Backward Chaining, Resolution,Semantic Nets, Frames, and Scripts, Ontology.

UNIT-IV

Uncertainty: Handing uncertain knowledge, rational decisions, basics of probability, axioms of probability, Baye's Rule and conditional independence, Bayesian networks, Exact and Approximate inference in Bayesian Networks, Fuzzy Logic.

Intelligent Agents: Introduction to Intelligent Agents, Rational Agent, their structure, reflex, model-based, goal-based, and utility-based agents, behavior and environment in which a particular agent operates.

UNIT-V

Learning: What is learning?, Knowledge and learning, Learning in Problem Solving, Learning from example, learning probabilistic models

Expert Systems: Fundamental blocks, Knowledge Engineering, Knowledge Acquisition, Knowledge Based Systems, Basic understanding of Natural language

Text Books:

1. E.Rich and K. Knight, Artificial Intelligence, Tata McGraw Hill, 2008.
2. S. Russell and P. Norvig, Artificial Intelligence: A Modern Approach, 3rd edition, Pearson Education, 2015.
3. Artificial intelligence and soft computing for beginners by Anandita Das Bhattachargee, Shroff Publishers
4. Artificial Intelligence – A Practical Approach : Patterson , Tata McGraw Hill, 3rd Edition

Reference Books:

1. Introduction to Artificial Intelligence – Charniak (Pearson Education)

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Artificial Intelligence LAB 501P**

Subject Code: **BTECH_CSE-**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	**1**	**25**	**25**	**50**

Aim: This lab is aimed to provide students a complete insight of the implementation of different Artificial Intelligence algorithms.

Course Objectives:

1	To create appreciation and understanding the achievements of AI and the theory underlying those achievements
2	To create an understanding of the basic issues of knowledge representation

Course Outcomes:

Expected experiments to be performed (Not limited to):

Using the Python Libraries for Artificial Intelligence

1. **AIMA-Python**
2. **PyDatalog**
3. **Simple**
4. **Easy**

Write programs based on the following:

1. Graph search algorithms
2. Adversarial search
3. Knowledge representation
4. Logical inference
5. Probability theory
6. Bayesian networks
7. Markov models
8. Constraint satisfaction
9. Machine learning
10. Reinforcement learning
11. Neural networks
12. Natural language processing

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Design and Analysis of Algorithms** Subject Code: **BTECH_CSE-502T**

Load [Th+Tu]	Credits [Th+Tu]	College Assessment Marks	University Evaluation	Total Marks
[36 + 12]=48 Hrs	**3+1=4**	**30**	**70**	**100**

Course Objectives:

1	Analyze the asymptotic performance of algorithm
2	Apply important algorithmic design paradigms and methods of analysis
3	Solve simple to moderately difficult algorithmic problems arising in applications.
4	Able to demonstrate the hardness of simple NP-complete problems

Course Outcome:

At the end of this course students are able to:

CO1	Illustrate different approaches for analysis and design of efficient algorithms and Analyze performance of various algorithms using asymptotic notations.
CO2	Determine and Apply various divide & conquer strategies and greedy approaches for solving a given computational problem
CO3	Demonstrate and Solve various realtime problems using the concepts of dynamic programming
CO4	Make use of backtracking and graph traversal techniques for solving real-world problems
CO5	Recall and Classify the NP-hard and NP-complete problems

SYLLABUS:

UNIT-I

Definition of algorithms and brief explanation about the basic properties of algorithms Recurrence relations, solutions of recurrence relations using technique of characteristic equation, master theorem ,Asymptotic notations of analysis of algorithms, worst case, average case and best case analysis of insertion sort, selection sort and bubble sort, amortized analysis, application of amortized analysis, Biotonic sorting network.

UNIT-II

Divide and conquer strategies: Binary search, quick sort, merge sort, heap sort, Stressen's matrix multiplication algorithm, min-max algorithm.

Greedy Approach: Application to job sequencing with deadlines problem, knapsack problem, optimal merge pattern, Huffman code.

UNIT-III

Dynamic Programming: Basic Strategy, Multistage graph (forward and backward approach), Longest Common Subsequence, matrix chain multiplication, Optimal Binary Search Tree, 0/1 Knapsack problems, Travelling Salesman problem, single source shortest path using Bellman-Ford algorithm, all pair shortest path using Floyd- Warshall algorithm.

UNIT-IV

Basic Traversal and Search Techniques: Breadth first search and depth first search, connected components.

Backtracking: Basic strategy, N-Queen Problem and their Analysis (4 & 8-Queen), graph coloring, Hamiltonian cycles .

UNIT-V

NP-Hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP Hard and
NP-complete, Cook's theorem, decision and optimization problems, graph based problems on NP Principle.

Text Books:-

1. "Introduction to Algorithms", Thirs Edition, Prentice Hall of India by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein
2. The Design and Analysis of Computer Algorithms", Pearson education by Alfred V. Aho, John E. Hopcraft, Jeffrey D. Ullman.
3. "Fundamentals of Computer Algorithms", Second Edition, University Press By Horowitz, Sahani, Rajsekharam
4. Fundamentals of Algorithms", Prentice Hall by Brassard, Bratley
5. "Design and Analysis of Algorithms",Pearson Education, II nd Edition, Parag Dave, Himanshu Dave

Reference Books:

1. Computer Algorithms: Introduction to Design and analysis, 3rd Edition, By Sara Baase and Gelder Pearson Education.

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SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Design and Analysis of Algorithms LAB** Subject Code: **BTECH_CSE-502P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2Hrs /Week (Practical)	1	25	25	50

Course Objectives:

1	To learn the importance of designing an algorithm in an effective way by considering space and time complexity
2	To learn graph search algorithms.
3	To study network flow and linear programming problems
4	To learn the dynamic programming design techniques.
5	To develop recursive backtracking algorithms.

Course Outcome:

At the end of this course students will be able to:

CO1	Calculate the time complexity of algorithm.
CO2	Sort the given numbers using various sorting algorithms.
CO3	Develop programs for the problems using Divide and Conquer and greedy methods.
CO4	Develop programs for the problems using Dynamic programming.
CO5	Students will be able to write programs for the problems using Backtracking.

Expected experiments to be performed (Not limited to):

1. To find Time complexity of an algorithm.
2. To find Space complexity of an algorithm.
3. To find HCF and LCM of two numbers
4. Code and analyses to find median element in an array of integers.
5. Code and analyse to find majority element in an array of integers.
6. Code and analyse to sort an array of integers using merge sort
7. Code and analyse to sort an array of integers using quick sort
8. To implement maximum and minimum problem using divide and conquer strategy
9. To implement binary search using divide and conquer strategy
10. To implement program of Heap Sort.
11. WAP of minimum spanning tree using Kruskal algorithm.
12. WAP of minimum spanning tree using Prim's algorithm.
13. WAP to implement matrix chain multiplication
14. Code to find the shortest path in graph using Dijkstra's algorithm.
15. Code to find the shortest path using Bellman-Ford algorithm.
16. To implement LCS problem using Dynamic Programming.
17. To implement matrix chain multiplication problem using dynamic programming.
18. Code and analyze to find the minimum spanning tree in a weighted, undirected graph.
19. Code and analyze to find all occurrences of a pattern P in a given string S.
20. Code and analyze to do a depth-first search (DFS) on an undirected graph. Implementing an application of DFS such as:
    (i) to find the topological sort of a directed acyclic graph.
    (ii) to find a path from source to goal in a maze.
21. Code and analyze to do a breadth-first search (BFS) on an undirected graph. Implementing an application of BFS such as
    (i) to find connected components of an undirected graph.
    (ii) to check whether a given graph is bipartite.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Software Engineering and Project Management** Subject Code: **BTECH_CSE-503T**

Load	Lecture	Tutorial	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs	**3**	**-**	**3**	**30**	**70**	**100**

Course Objectives:

1	To understand general idea of software engineering
2	To develop skills to design various software process models
3	To develop skills required for software testing and various risk strategies

Course Outcomes:
At the end of this course students are able to:

CO1	Understand software engineering methods, practices, process models and application.
CO2	Analyse various software engineering life cycle models and apply methods for design and development of software projects.
CO3	Analyze and extract requirements for product and translate these into a documented design using different modeling techniques.
CO4	Understand and apply software testing methods and types, And to understand debugging concept with various testing methods.
CO5	Identify and apply the principles, processes and main knowledge areas for Software Projec Management

SYLLABUS:

UNIT-I

Basics: Introduction to Software Engineering, Software Myths, Software Engineering-A Layered Technology. Software Process Models: The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, Agile Process Models

UNIT-II

Measures Metrics and Indicator, Metrics for process & projects: Software measurement, metrics for software quality.
System Engineering: Hierarchy, Business Process Engineering, Product Engineering, System Modeling, Requirements Engineering: Requirements Analysis, Analysis
Modeling Approaches, Data Modeling, Object-Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, Class-based Modeling, Behavioral Model

UNIT-III

Design Engineering Concepts, Design Model, Pattern-Based Software Design,
Architectural Design, Mapping data flow into software architecture, Cohesion, Coupling, User interface analysis and Design.

UNIT-IV

Debugging, Software Testing Fundamentals, Black-Box Testing, White-Box Testing, Metrics for Source Code

Risk Management: Risk strategies, Software risks, Risk identification, Risk refinement, RMMM

UNIT-V

Quality Management: Quality Concepts, Software Quality Assurance, Software Reviews, Formal Technical Review, Software Reliability, Change Management: Software Configuration Management, SCM Repository, SCM Process, Reengineering: Software reengineering, Reverse Engineering, Restructuring, Forward Engineering

Text Books:

1. Software Engineering-A Practitioner's Approach (Sixth Edition) by Roger Pressman (TMH)
2. Software Engineering (Ninth Edition)-Ian Summerville (Pearson)
3. Software Engineering for students (4th Edition)- Douglas Bell(Pearson)

Reference Books:

1. Schaum's Outline of Theory and Problems of Software Engineering by David Gustafson (TMH)
2. Software Engineering (Third Edition) by K. K. Aggarwal and Yogesh Singh (New age International Publishers)
3. Software Engineering, Theory and Practice(4th Edition)- Pfleeger, Atlee(Pearson)

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 1: TCP/IP** Subject Code: **BTECH_CSE-504.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	3	30	70	100

Aim: The aim of the course is to provide students with an overview of the field of Internet technologies.

Prerequisite(s): Data Communication, Computer Networks

Course Objectives:

1	To, Create a comprehension of fundamental TCP / IP concepts, and how they function.
2	To, Build understanding of and functionality of TCP / IP protocol set.
3	To, Understand and evaluate various TCP / IP Interface protocols.
4	To, Introduce the student to basic definition of networking and train the students for advanced computer networking courses.

Course Outcomes:

At the end of this course Student are able to:

CO1	Enumerate the layers of the TCP/IP model.
CO2	Analyze the services of TCP/IP protocol and be able to deal with its layers. Also the concepts of IP addressing
CO3	Acquire the knowledge of routing protocols
CO4	Familiarize stuednts with the basic computer network protocols, and how they can be used to help develop and execute networks.
CO5	Generate the solution for basic issues of Internet Mechanism and its security.

SYLLABUS:

Unit I:

Networking Basics, TCP/IP Model, Router, Broadband router, Internet, NAP, ISPs, RFCs and Internet Standards.

Unit II:

IP addressig, Classful and Classless Internet address, CIDR-Subnetting and Supernetting, VLSM , IP Datagram,IP protocol. ARP, RARP, BOOTP, DHCP, VRRC vs HSRP.
IP Routing & Packet Forwarding, RIP, OSPF, EIGRP, ICMP, IGMP.

Unit III:

Protocol-Independent Multicast (PIM), Optical Time-Domain Reflectometer (OTDR).
TCP header, Services, Connection establishment and termination, Interactive data flow, Bulk data flow, Flow control and Retransmission, TCP Timers, Urgent Data processing, Congestion control, Extension headers.

Unit IV:

Switching technology, MPLS fundamentals, signaling protocols, **Carrier Ethernet**, LDP, IP traffic engineering, ECMP, SBR, Routing extensions for traffic engineering, Traffic engineering limitations and future developments.

Unit V:

IP security protocol, IPv6 addresses, Packet format, Multicast, Anycast, ICMPv6, Interoperation between IPv4 and IPv6-QoS, Auto configuration, Stateless address auto configuration (SLAAC), ACL.

Text books:

- TCP/IP Network Administration, Craig Haut, 3rd Edition, Shroff Publications, 2002.
- Internetworking with TCP/IP - Principles, Protocols, and Architecture, Douglas E. Comer, 5th edition Volume-1, Prentice Hall, 2006.
- The Internet and its Protocols- A Comparative approach, Adrian Farrel, Morgan Kaufmann, 2004
- TCP/IP Illustrated - The Protocols, W. Richard Stevens, Volume-1, Pearson Education, 2003.
- TCP/IP Protocol Suite, Behrouz A. Forouzan, 3rd Edition, Tata McGraw Hill, 2006.

Reference books:

- IPv6 Theory, Protocol and Practice, 2nd Edition By, Morgan Kaufmann, 2003.
- Internetworking TCP/IP, Comer D.E and Stevens D.L, Volume 1, 4th Edition, Prentice Hall.
- CCNA Cisco Certified Network Associate Study Guide, 7th Edition by Todd Lammle.

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

Subject: **Elective 1: Design Patterns** Subject Code: **BTECH_CSE-504.2T**

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

Aim: A design pattern offers a general comprehensive framework to particular challenges in software design to speed up the production process by offering a well-tested, validated development/design model.

Prerequisite(s): Intermediate knowledge of Object Oriented programming.

Course Objectives:

1	Understand the concept of Design patterns and its importance.
2	Be capable of applying knowledge to create an architecture for given application.
3	Apply the suitable design patterns to refine the basic design for given context.
4	Get perspectives that help render own design pattern more flexible, versatile, reusable and understandable.

Course Outcomes:

At the end of this course Student are able to:

CO1	Understand common design patterns in the context of incremental/iterative development.
CO2	Exploit well-known Creational design patterns.
CO3	Distinguish between different types of structural design patterns..
CO4	Remember the appropriate design patterns, purpose and methods and use of Behavioural Design Pattern to solve object oriented design problems.
CO5	Demonstrate an understanding of Behavioural and other useful design patterns.

SYLLABUS:

Unit I:

Introduction to Design Patterns: Software design principles, Object oriented design principles, Overview of design pattern, benefits of design patterns, Description of design patterns, Catalog and organization of catalog, design patterns to solve design problems, selection of design pattern, Use of design patterns.

Unit II:

Creational Patterns: Abstract Factory, Builder, Factory Method, prototype, Singleton, Creational Patterns.

Unit III:

Structural Pattern: Adapter, Bridge, Composite, Decorator, Façade, Flyweight, Proxy, Discussion of Structural Patterns.

Unit IV:

Behavioral Patterns Part I: Chain of Responsibility, Command, Interpreter, Iterator Mediator, Memento, Observer, Discussion of Behavioral Patterns.

Unit V:

Behavioral Patterns Part III: State, Strategy, Template Method, Visitor, Discussion of Behavioral Patterns. Expectations from Design Patterns.

Other useful Design Patterns: Model View Controller, Data Access Object and Transfer Object Design Pattern.

Text books:

1. Head First Design Patterns, by Eric Freeman and Elisabeth Freeman, Oreilly Media.
2. Design Patterns Elements of Reusable Object Oriented Software, by Erich Gamma, Addison-Wesley.
3. Applying UML and Patterns: An Introduction to Object-Oriented Analysis and Design and Iterative Development, by Craig Larman, 3rd Edition, Pearson.

Reference books:

1. Pattern-Oriented Software Architecture: A System of Pattern by Frank Buschmann, Regine Meunier, Hans Rohnert, Peter Sommerlad, Michael Stal, John Wiley & Sons, 1996.
2. Design Patterns Explained: A New Perspective on Object Oriented Design by Alan Shalloway and James Trott, 2nd edition, Addison-Wesley.
3. Introduction to design Patterns in C++ with Qt by Alan Ezust, Paul Ezust, Prentice Hall, 2011.

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

Subject: **Elective 1: Data Warehousing and Mining** Subject Code: **BTECH_CSE-504.3T**

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

Aim: To understand the overall architecture of a data warehouse and methods for data gathering and data pre-processing. The different data mining models and techniques will be discussed in this course.

Prerequisite(s): Intermediate knowledge of Object Oriented programming.

Course Objectives:

1	To understand the basic concepts of Data Warehouse and Data Mining techniques.
2	Capable to create a data warehouse and to process raw data .
3	Able to apply basic classification, clustering on a set of data.
4	Able to identify frequent data items and to apply association rule on a set of data.
5	To learn recent trends of data mining such as web mining.

Course Outcomes:

At the end of this course Student are able to:

CO1	To understand the basic concepts of Data Warehouse and Data Mining techniques.
CO2	Capable to create a data warehouse and to process raw data .
CO3	Able to apply basic classification, clustering on a set of data.
CO4	Able to identify frequent data items and to apply association rule on a set of data.
CO5	To learn recent trends of data mining such as web mining.

SYLLABUS:

UNIT I

Introduction: Characteristics, Operational database systems and data warehouse (OLTP & OLAP), Multidimensional data models, Data warehouse architecture, OLAP Operations, Design and construction of data warehouses.

UNIT II

Fundamentals of data mining:Data mining functionalities, Classification of data mining systems, Data mining task primitives, Major issues and challenges in data mining, Data preprocessing- need for processing, data cleaning, integration, transformation, data reduction, data mining application areas.

UNIT III

Classification: Introduction, Decision tree, Building decision tree- tree induction algorithm, Split algorithm based on information theory, Split algorithm based on gini index, Decision tree rules, Naive based methods.

Clustering: Cluster analysis, Desired features, Types of data in cluster analysis, Computing distance. Categorizations of major clustering methods – Partitioning methods (K-means, EM), Hierarchical methods (agglomerative, divisive).

UNIT IV

Mining frequent patterns and Association Rules: Market basket analysis, Frequent item sets and association rules, Apriori algorithm, FP growth algorithm, Improving efficiency of Apriori and FP growth algorithms.

UNIT V

Web Data Mining: Introduction, Graph properties of web, Web content mining, Web structure mining, Web usage mining, Text mining, Visual web data mining, Temporal and Spatial data mining.

TEXT BOOKS:

1. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Second Edition, Elsevier, Reprinted 2008.
2. A. K. Pujari, "Data Mining Techniques", Second Edition, University press, 2013.
3. Jason Bell, "Machine Learning for Big Data: Hands-on for Developers and Technical Professionals, Wiley India Publications, 2013.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE
SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Professional Skills Lab I** Subject Code: **BTECH_CSE-505P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	**1**	**25**	**25**	**50**

Aim: The aim of this lab is to develop an ability to design and implement static and dynamic websites.

Prerequisite(s): Internet Programming ,Fundamental of Computing and Programming

Course Objectives:

1	To understand the basic concepts of Web designing
2	Design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's.
3	Have a Good grounding of Web Application Terminologies, Internet Tools, E–Commerce and other web services.

Course Outcomes:

At the end of this course Student are able to:

CO1	List various tags in HTML , DHTML and use these, apply Cascaded style sheet to create web page.
CO2	Understand and evaluate web application architecture, technologies and frameworks
CO3	Apply the knowledge of web technology in developing web applications
CO4	Develop an interactive web applications using ASP.NET.
CO5	Evaluate different solutions in field of web application development

Expected experiments to be performed (Not limited to):

- **Client Side Scripting / Coding -**
  1. HTML (HyperText Markup Language)
  2. CSS (Cascading Style Sheets)
  3. JavaScript
  4. Ajax (Asynchronous JavaScript and XML)
  5. jQuery (JavaScript Framework Library - commonly used in Ajax development)
  6. MooTools (JavaScript Framework Library - commonly used in Ajax development)
  7. Dojo Toolkit (JavaScript Framework Library - commonly used in Ajax development)

- **Server Side Scripting / Coding -**
  1. PHP (very common Server Side Scripting language - Linux / Unix based Open Source - free redistribution, usually combines with MySQL database)
  2. Zend Framework (PHP's Object Oriented Web Application Framework)
  3. ASP (Microsoft Web Server (IIS) Scripting language)
  4. ASP.NET (Microsoft's Web Application Framework - successor of ASP)
  5. ColdFusion (Adobe's Web Application Framework)
  6. Ruby on Rails (Ruby programming's Web Application Framework - free redistribution)
  7. Perl (general purpose high-level programming language and Server Side Scripting Language - free redistribution - lost its popularity to PHP)
  8. Python (general purpose high-level programming language and Server Side Scripting language - free redistribution)

- **Use of Program Libraries and Web Application Frameworks**

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF TECHNOLOGY (B.Tech.) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Effective Technical Communication** Subject Code: **BTECH_CSE-506T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	**2**	**15**	**35**	**50**

Course Objective: At the end of the semester, students will have enough confidence to face competitive examinations (IELTES/ TOEFL/CAT/ MAT/ XAT/SNAP/GMAT/GATE etc.) to pursue masters degree. They will also acquire language skills required to write their Reviews/Projects/Reports. They will be able to organize their thoughts in English and hence face job interviews more confidently.

Course Outcomes: After completing the course, students will

1. Acquire knowledge of structure of language.
2. Be able to face competitive exams and the interview process and can become employable.
3. Develop business writing skills.
4. Become familiar with technology enabled communication and can develop technical and scientific writing skills.

Unit 1. Functional Grammar:
Common errors, Transformation of Sentences- Change the Voice, Change the Narration, Simple, Compound Complex sentences, Use of Phrases, Idioms & Proverbs.

Unit II. English for Competitive Exams & Interview Techniques:
Word building, **English** words /phrases derived from otherlanguages, Prefixes and Suffixes, Synonyms/Antonyms, Technical Jargons, Verbal Analogies, Give one word for, Types & Techniques of Interview.

Unit III. Formal Correspondence
Business Letters, (Enquiry, Quotation, Order, Complaint), Job applications and ResumeWriting, e-mail etiquette, Writing Memorandum, Circulars, notices, Analytical comprehension

Unit IV. Technical & Scientific Writing:
Features of Technical Writing, Technical Report writing (Accident, Feasibility, Trouble, Progress), Writing Scientific Projects, Writing Manuals,Writing Project Proposals, Writing Research papers.

Reference Books:

1. Effective technical Communication by Barun K. Mitra, Oxford University Press,
2. *Technical Communication-Principles and Practice* by Meenakshi Raman & Sharma, Oxford UniversityPress, 2011,
3. *Functional English for Technical Students* by Dr. Pratibha Mahato and Dr. Dora Thompson, Himalaya Publishing House
4. *How to Prepare a Research Proposal*: Guidelines for Funding and Dissertations in the Social andBehavioral Sciences by Krathwohl & R David

5. *Technical Writing- Process and Product* by Sharon J. Gerson & Steven M. Gerson, 3rd edition, Pearson Education Asia, 2000
6. *Developing Communication* skills by Krishna Mohan & Meera Banerjee

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

Subject: **Audit Course:** Yoga & Meditation Subject Code: **BTECH_CSE-507T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	-	**50 (Grade)**	-	**Grade**

Aim:

The purpose of this course is to learn the specific skills and/or the techniques of the activity. By actively participating in an activity class, the student may gain health benefits such as improved body composition, increased flexibility, increased muscular endurance and increased muscular strength. Participating in activity classes leads to a healthier lifestyle.

Course Objectives:

1. Learn the rules, fundamentals, skills & strategies of yoga.
2. Teach various asanas (postures) using hatha yoga & the Iyengar method.
3. Learn breathing techniques.
4. Improve strength, flexibility and the sense of well-being.
5. Increase relaxation of body and soul.

Instructional Methodology:

This class is an activity and participation course; the specific task/exercise(s) for students to complete will be demonstrated. Students will then complete the task/exercise(s) to the best of their ability.

Curriculum:

1. Two: Basic yoga asanas, breathing techniques and relaxation exercises.
2. Continuation of learning asanas, breathing techniques, and relaxation exercises.
3. Instructions for final yoga routine will be distributed to students.
4. Continuation of learning more advanced asanas, breathing techniques, relaxation exercises and meditation.

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SEMESTER: V (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Audit Course:** Yoga & Meditation Subject Code: **BTECH_CSE-507T**

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Examination Scheme and Syllabus

Sixth Semester:-

S. N.	Subject	Teaching Scheme			Evaluation Scheme			Credits	Category
		L	T	P	CA	UE	Total		
1	Compiler Design	4	-	-	30	70	100	4	PCC-CS
2	Compiler Design -Lab	-	-	2	25	25	50	1	PCC-CS
3	Elective-II	3	-	-	30	70	100	3	PEC-CS
4	Elective-III	3	-	-	30	70	100	3	PEC-CS
5	Open Elective-I	3	-	-	30	70	100	3	OEC
6	Professional Skills Lab II	-	-	2	25	25	50	1	PCC-CS
7	Hardware Lab	-	-	2	25	25	50	1	ESC
8	Mini Project	-	-	6	50	50	100	3	PROJ-CS
9	Economics of IT Industry	2	-	-	15	35	50	2	HSMC
10	Intellectual Property Rights (AuditCourse)	2	-	-	50	-	-	Audit	PCC
	Total	**17**	**-**	**12**			**700**	**21**	

Elective-II: - 1. Machine Learning 2. Internet of Things 3. Cluster and Cloud Computing

Elective-III: - 1. Data Science 2. Distributed Operating Systems 3. Human Computer Interaction

Open Elective 1:- 1. Linux Fundamentals 2. Android Application Development 3. Blockchain Technologies

[Mrs. B. P. Dharaskar]

Dr. S. V. Sonekar
Chairman

[Ms. Nova Nulchandani]

Dr. M. V. Bramhe

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Compiler Design** Subject Code: **BTECH_CSE-601T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
48 Hrs	**4**	**30**	**70**	**100**

Aim: To understand the principles and concepts of Compiler Design

Prerequisite(s): Student should have basic knowledge of computers and mathematics.

Course Objectives:

1	Understand the phases of the Compiler and utilities of Automata.
2	Give the implementation details of Top-Down and Bottom-up Parsers and its types.
3	Describe the importance of the Semantic Phase and Symbol Table in Compiler.
4	Give the descriptions for the Synthesis Model of the Compiler w.r.t Analysis Model.
5	Understand the Architecture of the Computer and few advanced topics for a Compiler.

Course Outcomes:

At the end of this course students will be able to:

CO1	Define the Compiler along with phases and basic programs in LEX.
CO2	Develop programs for various kinds of the Parsers.
CO3	Write simple programs related to Type Checking, Parameter Passing and Overloading.
CO4	Implement the concepts of Code Optimizations and Code Generations.
CO5	Provide the Case Studies of Object-Oriented Compilers.

SYLLABUS:

UNIT-I:
Introduction: Phases of compilation and overview. Lexical Analysis (scanner): Regular languages, finite automata, regular expressions, relating regular expressions and finite automata, scanner generator (lex, flex).

UNIT-II:
Syntax Analysis (Parser): Context-free languages and grammars, push-down automata, LL(1) grammars and top-down parsing, operator grammars, LR(O), SLR(1), LR(1), LALR(1) grammars and bottom-up parsing, ambiguity and LR parsing, LALR(1) parser generator (yacc, bison)

UNIT-III:
Semantic Analysis: Attribute grammars, syntax directed definition, evaluation and flow of attribute in a syntax tree. Symbol Table: Basic structure, symbol attributes and management. Runtime environment: Procedure activation, parameter passing, value return, memory allocation,

UNIT-IV:
Intermediate Code Generation: Translation of different language features, different types of intermediate forms. Code Improvement (optimization): control-flow, data-flow dependence etc.; local optimization, global optimization, loop optimization, peep-hole optimization etc.

UNIT-V: Architecture dependent code improvement: instruction scheduling (for pipeline), loop optimization (for cache memory) etc. Register allocation and target code generation. Advanced topics: Type systems, data abstraction, compilation of Object Oriented features and non-imperative programming languages.

TEXT BOOKS:
1. Compilers: Principles, Techniques and Tools, V. Aho, R. Sethi and J. Ullman.
2. Lex&Yacc, Levine R. John, Tony Mason and Doug Brown

REFERENCES:
1. The Design and Evolution of C++, Bjarne Stroustrup.

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Compiler Design Lab** Subject Code: **BTECH_CSE-601P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	**1**	**25**	**25**	**50**

Course Objectives:

1	To learn usage of tools LEX, YAAC
2	To develop a code generator
3	To implement different code optimization schemes

Course Outcomes:

At the end of this course students will be able to:

CO1	Generate scanner and parser from formal specification.
CO2	Generate top down and bottom up parsing tables using Predictive parsing, SLR and LR Parsing techniques.
CO3	Apply the knowledge of YACC to syntax directed translations for generating intermediate code – 3 address code.
CO4	Build a code generator using different intermediate codes and optimize the target code.
CO5	Generate scanner and parser from formal specification.

Expected experiments to be performed (Not limited to):

1. Sample programs using LEX.
2. Scanner Generation using LEX.
3. Elimination of Left Recursion in a grammar.
4. Left Factoring a grammar.
5. Top down parsers.
6. Bottom up parsers.
7. Parser Generation using YACC.
8. Intermediate Code Generation.
9. Target Code Generation.
10. Code optimization

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SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 2: Machine Learning** Subject Code: **BTECH_CSE-602.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**3**	**30**	**70**	**100**

Aim: The use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy.

Prerequisite(s): Statistics, Calculus, Linear Algebra and Probability & Programming Knowledge.

Course Objectives:

1.	To enable the Students with basic knowledge on Machine Learning Techniques.
2.	To develop skills of applying Machine Learning Techniques for solving real world problems.

Course Outcomes:

At the end of this course students will be able to:

CO1.	Understand basics of Machine Learning Techniques.
CO2.	Understand different types of Regression Techniques.
CO3.	Be capable of applying classification techniques.
CO4.	Apply unsupervised machine learning techniques.
CO5.	Apply & evaluate the machine learning techniques to real world problems.

SYLLABUS:

UNIT I: Introduction to Machine Learning

Human learning & it's types, Machine learning and it's types (Supervised ,unsupervised reinforcement),well-posed learning problems, Applications of Machine learning, issues in machine learning.

Types of data: Numerical and categorical data, data issues and remediation.

UNIT II: Supervised Learning: Regression

Data pre-processing: Dimensionally reduction, feature subset selection Types of regression: Multiple linear regression, Polynomial regression model.

UNIT III: Supervised Learning: Classification

Logistic regression, K-nearest neighbour (KNN),Naive Bayes Decision trees, Support vector machine, Recommendation Systems : Content based and collaborative techniques.

UNIT IV: Unsupervised Learning: Introduction

Clustering, K-means clustering, Apriori algorithm and association rule, anomaly detection algorithm, Hierarchial clustering , K-Medoids.

UNIT V: Trends and applications in Machine learning

Ensemble learning, Bagging, randomization, Boosting, Applications of Machine learning: Image recognition, speech recognition, Prediction recommendation: email spam and malware filtering, virtual personal assistant, online fraud detection.

Textbooks:

1. Machine Learning by Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das
2. Introduction to Machine Learning by Dr. Nilesh Shelke, Dr. Narendra. V. Choudhary, Dr. Gopal Sakarkar, Das Ganu Publications, ISBN-978-93-84336-63-9
3. Machine Learning by Tom Mitchell, Mc.Graw Publications

Reference books:

1. Python Machine Learning Dr Randal S. Olson

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 2: Internet of Things** Subject Code: **BTECH_CSE-602.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**3**	**30**	**70**	**100**

Aim: This course provides a way to understand the concepts and the basics of Internet of things, IoT applications and examples overview (building automation, transportation, healthcare, industry, etc.) with a focus on wearable electronics.

Prerequisite(s): Introductory knowledge in programming, Networking.

Course Objectives:

1	To learn the concepts about Internet of things.
2	To understand and implement smart systems.
3	To understand the Network & Communication aspects.
4	Ability to understand the Security requirements in IoT.

Course Outcomes:

At the end of this course Student will be able to:

CO1	Understand the vision of IoT from a global context.
CO2	Understand M2M to IoT – A Basic Perspective
CO3	Use of Devices, Gateways and Data Management in IoT.
CO4	Understand the Internet of Things Privacy, Security and Governance
CO5	Implement basic IoT applications on embedded platform

SYLLABUS:

Unit I:

Introduction to IoT
Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs

Unit II:

M2M to IoT – A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies.

M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit III:

Network & Communication aspects
Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination

Unit IV:

Internet of Things Privacy, Security and Governance
Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security

Unit V:

Developing IoTs
Introduction to Python, Introduction to different IoT tools, Developing applications through IoT tools, Developing sensor based application through embedded system platform, Implementing IoT concepts with python

Text books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014 .

Reference books:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications, 2013.
2. Cuno Pfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1
3. Waltenegus Dargie,Christian Poellabauer, "Fundamentals ofWireless Sensor Networks: Theory and Practice".

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 2: Cloud Computing** Subject Code: **BTECH_CSE-602.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**3**	**30**	**70**	**100**

Aim: The aim of this course is to make students understand the concepts, characteristics, models and benefits of cloud computing.

Prerequisite(s): Database Management System, Data Structures, Operating Systems, Computer Networks

.Course Objectives:

1	To study fundamental concepts of cloud computing
2	To understand the implementation of Virtualization in Cloud Computing
3	To learn the application and security on cloud computing

Course Outcomes:

At the end of this course students will be able to:

CO1	Understand the different Cloud Computing environment
CO2	Analyze virtualization technology and install virtualization software
CO3	Use appropriate data storage technique on Cloud, based on Cloud application
CO4	Apply security in cloud applications
CO5	Use advance techniques in Cloud Computing

SYLLABUS:

UNIT 1:

Introduction: Importance of Cloud Computing, Characteristics, Pros and Cons of CloudComputing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage. Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud Computing Reference Model, Cloud System Architecture, Cloud Deployment Models.

UNIT 2:

Introduction to Virtualizations: Definition of Virtualization, Adopting Virtualization, Types of Virtualizations, Virtualization Architecture and Software, Virtual Clustering, Virtualization Application, Pitfalls of Virtualization. Grid, Cloud and Virtualization: Virtualization in Grid, Virtualization in Cloud, Virtualization and Cloud Security.Virtualization and Cloud Computing: Anatomy of Cloud Infrastructure, Virtual infrastructures, CPU Virtualization, Network and Storage Virtualization.

UNIT 3:

Cloud Storage: Data Management, Provisioning Cloud storage, Data Intensive Technologies for Cloud Computing. Cloud Storage from LANs to WANs: Cloud Characteristics, Distributed Data Storage.

UNIT 4:

Risks in Cloud Computing: Risk Management, Enterprise-Wide Risk Management, Types of Risks in Cloud Computing. Data Security in Cloud: Security Issues, Challenges, advantages, Disadvantages, Cloud Digital persona and Data security, Content Level Security. Cloud Security Services: Confidentiality, Integrity and Availability, Security Authorization Challenges in the Cloud, Secure Cloud Software Requirements, Secure Cloud Software Testing.

UNIT 5:

Future Tends in Cloud Computing, Mobile Cloud, Automatic Cloud Computing: Comet Cloud. Multimedia Cloud: IPTV, Energy Aware Cloud Computing, Jungle Computing, Distributed Cloud Computing Vs Edge Computing, Containers, Docker, and Kubernetes, Introduction to DevOps. IOT and Cloud Convergence: The Cloud and IoT in your Home, The IOT and cloud in your Automobile, PERSONAL: IoT in Healthcare.

Text/Reference Books

1. A.Srinivasan, J. Suresh, "Cloud Computing: A Practical Approach for Learning andImplementation", Pearson, ISBN: 978-81-317-7651-3
2. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering CloudComputing", McGraw Hill Education, ISBN-13:978-1-25-902995-0
3. Anthony T. Velte Toby J. Velte, Robert Elsenpeter, "Cloud Computing: A PracticalApproach" McGraw Hill Tim Mather, Subra K, Shahid L.,"Cloud Security and Privacy", Oreilly, ISBN-13 978-81- 8404-815-5

4. Dr. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization and more", WileyPublications, ISBN: 978-0-470-97389-9

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject: Elective 3: **Data Science** Subject Code : **BTECH_CSE-603.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**03**	**30**	**70**	**100**

Aim: To apply data science concepts and methods to solve problems in real-world contexts and to communicate these solutions effectively.

Prerequisite(s): Preliminary Linear Algebra

Course Objectives:

1	To understand the basic concepts of Data science.
2	Demonstrate an understanding of statistics and classification concepts that are vital for data science.
3	Demonstrate the implementation of Data Science experiments through Python or R Language.

Course Outcomes:

At the end of this course Student will be able to:

1	Understanding the significance of exploratory data analysis in Data Science.
2	Demonstrate the usage of Random Sampling and bias in a given dataset.
3	Analysis of various Statistical Experiments through various types popular Testing methods.
4	Design and analysis of regression techniques to estimate outcomes and detect anomalies.
5	Ability to implement classification Techniques.

SYLLABUS:

UNIT I

Exploratory Data Analysis

Elements of Structured Data, Rectangular Data, Estimates of Location, Estimates of Variability, Exploring the Data Distribution, Exploring Binary and Categorical Data, Correlation, Exploring Two or More Variables

UNIT 2

Data and Sampling Distributions

Random Sampling and Sample Bias, Selection Bias, Sampling Distribution of a Statistic, The Bootstrap, Confidence Intervals, Normal Distribution, Long-Tailed Distribution, Student's t-Distribution. Binomial Distribution, Chi-Square Distribution, F-Distribution

UNIT 3

Statistical Experiments and Significance Testing

A/B Testing, Hypothesis Tests, Resampling, Statistical Significance and p-Values, Multiple Testing, Degrees of Freedom, ANOVA, Chi-Square Test, Multi-Arm Bandit Algorithm. Power and Sample Size

UNIT 4:

Regression and Prediction

Simple Linear Regression, Multiple Linear Regression, Prediction Using Regression, Factor Variables in Regression, Interpreting the Regression Equation, Regression Diagnostics, Polynomial and Spline Regression

UNIT 5:

Classification

Naive Bayes, Discriminant Analysis, Logistic Regression, Evaluating Classification Models, Strategies for Imbalanced Data

Text books:

1. Peter Bruce, Andrew Bruce and Peter Gedeck, Practical Statistics for Data Scientists, 2nd Edition, Oreilly.
2. R Programming for Data Science – Roger D.Peng, Learn Pub Book, Learn Publishing.
3. Sanjivranjan Das, Data Science: Theories, Models, Algorithms and Analytics.
4. Cathy O'Neil and Rachel Schutt, Doing Data Science, Straight Talk.

Reference books:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, (2nd Edition), O'Reilly, 2015. ISBN-978-1-491-93936-9.
2. R for dummies – Andrie de vries and Joris Meys, A John Wiley sons, Ltd. Publication.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE
SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 3: Distributed Operating Systems** Subject Code: **BTECH-CSE-603.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**3**	**30**	**70**	**100**

Aim: A distributed operating system is a software over a collection of independent, networked, communicating and physically separate computational nodes. They handle jobs which are serviced by multiple CPUs. Each individual node holds a specific software subset of the global aggregate operating system.

Prerequisite(s): Distributed Operating systems holds concepts such as threads, processes, mutual exclusion, deadlock. It also works on Computer networking concepts such as Internet, protocols, sockets, network application programming.

Course Objectives:

1	To understand the principles and techniques behind the design of distributed systems, such as locking, concurrency, scheduling, and communication across networks.
2	To get knowledge in distributed architecture, naming, synchronization, consistency and replication, fault tolerance, security, and distributed file systems.

Course Outcomes:

At the end of this course Student will be able to:

1	Learn the principles, architectures, algorithms and programming models used in distributed systems.
2	Understand the core concepts of distributed systems.
3	Design and implement sample distributed systems, using different algorithm.
4	Understand the Distributed File System, Architecture, and Mechanism.
5	Analyze the Distributed Scheduling, Issues in Load Distributing, components of a Load Distributing Algorithm, Load Distributing Algorithms.

SYLLABUS:

Unit I:

Fundamentals: Introduction, Models and Features, Concept of Distributed Operating system, Issues in Design of a Distributed Operating System. Foundations of Distributed System: Limitations of Distributed Systems.

Unit II:

Broadcast Algorithm, Distributed Mutual Exclusion: Requirement of Mutual Exclusion Non Token Based Algorithms: Lamport's Algorithm, Ricard-Agrawala Maekawa's Algorithm.

Unit III:

Distributed Deadlock Detection: Introduction, Deadlock Handling strategies in Distributed System, Centralized and Distributed Deadlock Detection Algorithms.

Unit IV:

Distributed File system, Architecture, and Mechanism for Building Distributed File System. General Architecture of DSM systems, Algorithm for Implementing DSM, Memory coherence and Coherence Protocols.

Unit V:

Distributed Scheduling, Issues in Load Distributing, Load Distributing Algorithms, Sender-Initiated Algorithm, Receiver-Intiated algorithm, Symmetrically Initiated Algorithm, Adaptive Algorithm.

Text books:

1. Advanced Concepts in Operating Systems, Shivaratri, Tata McGraw Hill, 2001. Mukesh Singhal and Niranjan
2. Distributed Systems - Concepts and Design, Coulouris, Dollimore and Kindberg, 5th Edition, Addison-Wesley, 2012.

Reference books:

1. Distributed Operating System, Andrew S. Tanenbaum, Pearson Education, 2003.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE
SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Elective 3: Human Computer Interaction** Subject Code: **BTECH-CSE-603.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**3**	**30**	**70**	**100**

Aim:. The course focuses on human-computer interaction and interface design.

Prerequisites: Fundamental knowledge of programming.

Course Objectives:

Students should be able to:

1	Describe what interaction design is and how it relates to human computer interaction and other fields.
2	Use, adapt and extend classic design standards, guidelines, and patterns.
3	Apply core theories, models and methodologies from the field of HCI
4	Types of Mobile Application along with Designing
5	Learn the guidelines in designing user interfaces

Course Outcomes
Students would be able to:

CO1	Understand the Importance of user Interface
CO2	Design effective dialog for HCI
CO3	Develop navigation panes in windows
CO4	Understand HCI using software tools, prototypes and golden rules
CO5	Analyse and apply various evaluation techniques.

SYLLABUS:

UNIT - I

Introduction: Importance of user Interface – definition, importance of good design. Benefits of good design. A brief history of Screen design. The graphical user interface – popularity of graphics, the concept of direct manipulation, graphical system, Characteristics, Web user – Interface popularity, characteristics- Principles of user interface.

UNIT - II

Design process – Human interaction with computers, importance of human characteristics human consideration, Human interaction speeds, understanding business junctions. Screen Designing: Design goals: Screen planning and purpose, organizing screen elements, ordering of screen data and content, screen navigation and flow, Visually pleasing composition, amount of information, focus and emphasis, presentation information simply and meaningfully, information retrieval on web, statistical graphics

UNIT - III

Windows – New and Navigation schemes selection of window, selection of devices based and screen based controls. Components – text and messages, Icons and increases – Multimedia, colors, uses problems, choosing colors.

UNIT - IV

HCI in the software process, The software life cycle Usability engineering Iterative design and prototyping Design Focus: Prototyping in practice Design rationale Design rules Principles to support usability Standards Golden rules and heuristics HCI patterns.

UNIT - V Evaluation techniques, Goals of evaluation, Evaluation through expert analysis, Evaluation through user participation, Choosing an evaluation method. Universal design, Universal design principles Multi-modal interaction
Cognitive models Goal and task hierarchies Design Focus: GOMS saves money Linguistic models The challenge of display-based systems Physical and device models Cognitive architectures Ubiquitous computing and augmented realities

Text Books:

1. The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech. Units 1, 2, 3
2. Human – Computer Interaction. Alan Dix, Janet Fincay, Gre Goryd, Abowd, Russell Bealg, Pearson Education Units 4,5

Reference Books:

1. Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia.
2. Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech.
3. User Interface Design, Soren Lauesen , Pearson Education.
4. Human –Computer Interaction, D. R. Olsen, Cengage Learning.
5. Human –Computer Interaction, Smith - Atakan, Cengage Learning.

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

Subject: **Open Elective 1: Linux Fundamentals** Subject Code: **BTECH-CSE-604.1T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**3**	**30**	**70**	**100**

Aim: To provide knowledge of Linux including the directory structure, basic commands, the shell, and using the command line.

Prerequisites: Basic knowledge of networks, and computer skills.

Course Objectives:

Students should be able to:

1	Understand basic terminology of Linux.
2	Conduct basic activities such as installation, troubleshooting, and navigation.
3	Understand and write shell scripta and management of Failure recovery.

Course Outcomes
Students would be able to:

1	Understand Linux Architecture, different Linux installation and Linux commands.
2	Effectively use Linux Environment using shell, file system, scripts, filters and program development tools
3	Perform user, group management , package management through commands
4	Perform storage management and failure recovery through commands.
5	Automate tasks and write simple programs using shell scripts.

SYLLABUS:

UNIT-I

History of Linux OS, Architecture of Linux OS, Linux Dist ribution s, Installation of Linux OS

UNIT- II

Introduction to terminal, Basic commands, File system, File handling commands, process and process management commands, VI editor.

UNIT- III

Users and Group management- Creation, Updating, Deletion of user and group, Commands - password, Shadow, user add, user mod , user del, group add, group mod, group del.

UNIT-IV

Package Management - Introduction to package manager, function of package manager, Package management commands - rpm, yum. Storage management- Types of storages, creating partitions using f disk command.

UNIT-V

Logical volume management (LVM), Creating file system, mounting file system. Shell and Shell script.

Text Book

1. Unix and Shell Programming-B. M. Harwani, OXFORD University Press.

Reference Books

1. Linux Administration: A Beginner's Guide-Wale Soyinka, McGraw **Hill** Publication

2. Unix Concepts and Applications-Sumitabha Das, McGraw Hill Publication

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR

FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject: **Open Elective 1: Android Application Development** Subject Code: **BTECH-CSE-604.2T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**3**	**30**	**70**	**100**

Aim: Introduction to Android development framework and programming.

Prerequisites: 1.Oops through java 2.XML

Course Objectives:

Students should be able to:

1	Demonstrate their understanding of the fundamentals of Android operating systems.
2	Demonstrate their skills of using Android software development tools.
3	Develop software with reasonable complexity on mobile platform.
4	Deploy software to mobile devices.
5	Debug programs running on mobile devices

Course Outcomes

Students would be able to:

1	Describe the components and structure of a mobile development framework
2	Understand the specific requirements, possibilities and challenges when developing for a mobile context.
3	Apply Java programming concepts to Android application development
4	Design and develop user Interfaces for the Android platform
5	Publish an application to the Android Market

SYLLABUS:

UNIT- I:

Introduction to Android Operating System: Android OS design and Features – Android development framework, SDK features, Installing and running applications on Eclipse platform, Creating AVDs, Types of Android applications, Best practices in Android programming, Android tools Android application components – Android Manifest file, Externalizing resources like values, themes, layouts, Menus etc, Resources for different devices and languages, Runtime Configuration Changes Android Application Lifecycle – Activities, Activity lifecycle, activity states, monitoring state changes

UNIT-II:

Android User Interface: Measurements – Device and pixel density independent measuring units. Layouts – Linear, Relative, Grid and Table Layouts. User Interface (UI) Components – Editable and non-editable Text Views, Buttons, Radio and Toggle Buttons, Checkboxes, Spinners, Dialog and pickers. Event Handling – Handling clicks or changes of various UI components.

Fragments – Creating fragments, Lifecycle of fragments, Fragment states, Adding fragments to Activity, adding, removing and replacing fragments with fragment transactions, interfacing between fragments and Activities, Multi-screen Activities.

UNIT- III:

Intents and Broadcasts: Intent – Using intents to launch Activities, Explicitly starting new Activity, Implicit Intents, Passing data to Intents, Getting results from Activities, Native Actions, using Intent to dial a number or to send SMS Broadcast Receivers – Using Intent filters to service implicit Intents, Resolving Intent filters, finding and using Intents received within an Activity Notifications – Creating and Displaying notifications, Displaying Toasts

UNIT- IV:

Persistent Storage: Files – Using application specific folders and files, creating files, reading data from files, listing contents of a directory Shared Preferences – Creating shared preferences, saving and retrieving data using Shared Preference Database – Introduction to SQLite database, creating and opening a database, creating tables, inserting retrieving and deleting data, Registering Content Providers, Using content Providers (insert, delete, retrieve and update)

UNIT- V:

Advanced Topics: Alarms – Creating and using alarms. Using Internet Resources – Connecting to internet resource, using download manager Location Based Services – Finding Current Location and showing location on the Map, updating location

Text Books:

1. Professional Android 4 Application Development, Reto Meier, Wiley India, (Wrox) , 2012

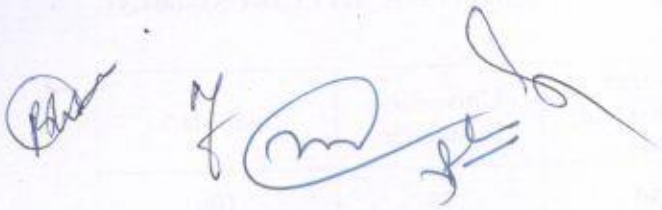
2. Android Application Development for Java Programmers, James C Sheusi, Cengage Learning, 2013

Reference Books:

Beginning Android 4 Application Development, Wei-Meng Lee, Wiley India (Wrox), 2013

Web Course:

1. https://www.nptel.ac.in/courses/106106156/



RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject: **Open Elective 1: Block-chain Technologies** Subject Code: **BTECH-CSE-604.3T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
36 Hrs.	**3**	**30**	**70**	**100**

Aim: To make students aware of Block Chain Technology and how it works. T

Prerequisites: Data Structures and algorithms and basic knowledge of Cryptography.

Course Objectives:

1	To teach the concepts of blockchain technologies.
2	To cover the technical aspects of crypto currencies, block chain technologies, and distributed consensus.
3	To familiarize potential applications for Bit coin-like crypto currencies
4	To learn, how these systems work and how to engineer secure software that interacts with the Bit coin network and other crypto currencies.

Course Outcomes:
Students would be able to:

1	Understand emerging abstract models for Block chain Technology
2	Analyse the concept of cryptocurrency and mathematical background behind it
3	Apply the tools for understanding the background of bitcoins
4	Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain
5	Understanding of latest advances and its applications in Block Chain Technology

SYLLABUS:

UNIT- I:

Introduction Basic of Blockchain Architecture – Challenges – Applications – Block chain Design Principles -The Blockchain Ecosystem - The consensus problem - Asynchronous Byzantine Agreement - AAP protocol and its analysis, Abstract Models for BLOCKCHAIN - GARAY model - RLA Model - Proof of Work (PoW) as random oracle - formal treatment of consistency, liveness and fairness - Proof of Stake (PoS) based Chains - Hybrid models (PoW + PoS)

UNIT-II:

Cryptographic Fundamentals Cryptographic basics for crypto currency - a short overview of Hashing, cryptographic algorithm – SHA 256,signature schemes, encryption schemes and elliptic curve cryptography- Introduction to Hyperledger-Hyperledger framework - Public and Private Ledgers.

UNIT- III:

Bit Coin Bit coin - Wallet - Blocks - Merkley Tree - hardness of mining - transaction verifiability - anonymity - forks - double spending - mathematical analysis of properties of Bit coin. Bitcoin blockchain, the challenges, and solutions, proof of work, Proof of stake, alternatives to Bitcoin consensus, Bitcoin scripting language and their uses.

UNIT- IV:

Ethereum Ethereum - Ethereum Virtual Machine (EVM) - Wallets for Ethereum - Solidity - Smart Contracts - some attacks on smart contracts. Ethereum and Smart Contracts- The Turing Completeness of Smart Contract Languages and verification challenges- comparing Bitcoin scripting vs. Ethereum Smart Contracts

UNIT- V:

Block Chain-Recent Trend Blockchain Implementation Challenges- Zero Knowledge proofs and protocols in Block chain - Succinct non interactive argument for Knowledge (SNARK) - pairing on Elliptic curves – Zcash - attacks on Blockchains

Text Books:

1. Melanie Swan, "Block Chain: Blueprint for a New Economy", O"Reilly, first edition 2015.
2. Daniel Drescher, "Block Chain Basics", Apress; 1stedition, 2017
3. Anshul Kaushik, "Block Chain and Crypto Currencies", Khanna Publishing House, Delhi.
4. Imran Bashir, "Mastering Block Chain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Packt Publishing, first edition – 2012.

Reference Book:

Ritesh Modi, "Solidity Programming Essentials: A Beginner"s Guide to Build Smart Contracts for Ethereum and Block Chain", Packt Publishing.

Websites:

1. https://developer.ibm.com/patterns/create-and-deploy-block chain-network-usingfabric-sdk-java/
2. https://docs.docker.com/get-started/
3. https:/console.ng.bluemix.net/docs/services/block%2520chain/index.html

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

Subject: **Professional Skills Lab II** Subject Code: **BTECH_CSE-605P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	**1**	**25**	**25**	**50**

Aim:

This lab has focus on hands-on project and assignment-based learning space where students will gain strong practical and technical skills in various programming languages and advanced tools.

Course Objectives:

The interactive experiments in this lab will give the students an opportunity for learning and better understanding of the basic concepts and constructs of computer programming as well as advanced methodology concepts

Expected experiments to be performed Based on the Electives and Open Electives opted by students (Not limited to):

Android Application Development

Or

Block Chain Technology

Or

Machine Learning

Or

Data science

Or

Human Computer Interface

Or

Linux Fundamentals

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

Subject: **Hardware Lab** Subject Code: **BTECH_CSE-606P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs/Week	**1**	**25**	**25**	**50**

Course Objectives:

To skill the students in the H/W field.

To enhance research activities in different application areas of IoT, Robotics and Embedded systems.

Expected experiments to be performed Based on the Electives and Open Electives opted by students (Not limited to):

Internet of Things
Or
Microprocessors and Micro-controllers
Or
Components of ROBOTs

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FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE
SEMESTER: VI (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject:**Mini Project** Subject Code: **BTECH_CSE-607P**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
6 Hrs/Week	**3**	**50**	**50**	**100**

Aim:

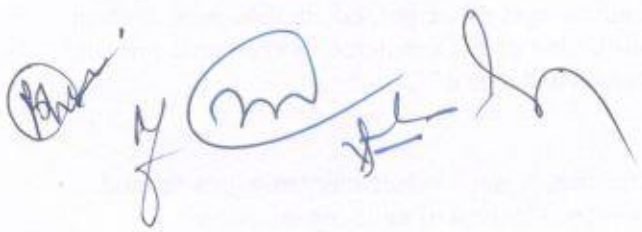
The mini project is designed to help students develop practical ability and knowledge about practical tools/techniques in order to solve real life problems related to the industry, academic institutions and computer science research. The course Mini Project is one that involves practical work for understanding and solving problems in the field of computing.

Course Objectives:

Mini-Project is intended develop investigative, research and report writing skills and will provide an opportunity to investigate a chosen topic in considerable depth so as to demonstrate the application of their programming and research skills, and to apply their knowledge to complex computing problems.

Course Outcomes:

At completion of mini-project:
Students will get knowledge of all the necessary details required for the development of a software project and its documentation using software engineering approach.



RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B. Tech..) DEGREE COURSE

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

BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject: **Economics of IT industry** Subject Code: **BTECH-CSE-608T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs /Week	**2**	**15**	**35**	**50**

Course Objective:
Objective of the course is to make learners aware about the impact of Information Communication technology (ICT) and Information Technology (IT) revolution on Indian Economy and their seamless interaction.

1. The learners will be able to distinguish between Micro and Macro economics
2. The learners will be able to relate economics concept with IT industry
3. The learners will be able to identify key trends in IT industry
4. The learners will be able to understand the key economic drivers of IT industry.

SYLLABUS:

UNIT 1:
Difference between Micro and Macroeconomics, law of demand and supply, concept and types of elasticity of demand, deflation and recession.

UNIT 2:
Role of Information and technology industry in economic growth of the country, labour intensive verses capital intensive industry, the concept of digital economy and digital age, digital divide, various phases of business cycle.

UNIT 3:
Merger and acquisition, types of merger, advantages of merger, hostile takeover, concept of top line and bottom line growth, Contribution of E-Commerce in economic growth, information technology and environment- the challenge of E - waste.

UNIT 4:
Venture and angel funding as sources of finance, organic verses inorganic growth model, 5 level capability maturity model of IT industry, Concept of agile organization

List of Reference Books:

1. Modern economic theory by K.K.Dewett,
2. Information and economic development by Yutuka Khurana, IGI Global publisher.
3. The economics of information technology by Paul Jowett, Margaret Rothwell. St Martin Press New York.
4. Industrial Economics. By, Ranjana Seth, Ane Book Pvt Ltd.

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

Subject: **Intellectual Property Rights (AuditCourse)**

Subject Code: **BTECH_CSE-609T**

Load	Credits	College Assessment Marks	University Evaluation	Total Marks
2 Hrs./Week	-	50 (Will be converted to grade)	-	-

Aim: To introduce the basics of Intellectual Property Rights, Copy Right Laws Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

Prerequisite(s): Nil

Course Objectives:

1.	To introduce fundamental aspects of Intellectual property Rights
2.	To disseminate knowledge on patents, patent regime in India and abroad and registration aspects
3.	To disseminate knowledge on copyrights and its related rights and registration aspects
4.	To disseminate knowledge on trademarks and registration aspects
5.	To disseminate knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

Course Outcomes:

At the end of this course students will be able to:

CO1.	Understand fundamental aspects of Intellectual property Rights
CO2.	Apply knowledge on patents, patent regime in India and abroad and registration aspects
CO3.	Be capable of getting copyrights and its related rights and registration aspects
CO4.	Be capable of getting trademarks and registration aspects
CO5.	Apply knowledge on Design, Geographical Indication (GI), Plant Variety and Layout Design Protection and their registration aspects

SYLLABUS:

UNIT 1:

Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967,the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

UNIT 2:

Patents - Elements of Patentability: Novelty , Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence , Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

UNIT 3:

Copyrights -Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

UNIT 4:

Trademarks - Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

UNIT 5:

Other forms of IP -

Design: Design meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection Geographical **Indication (GI):** Geographical indication meaning, and difference between GI and trademarks - Procedure for registration, effect of registration and term of protection

Plant Variety Protection: Plant variety protection meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection

Layout Design Protection Layout Design protection meaning – Procedure for registration, effect of registration and term of protection

Text books:

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.

2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.

Reference books:

1. Ahuja, V K. (2017). Law relating to Intellectual Property Rights. India, IN: Lexis Nexis.

E-resources:

1. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf

2. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub _489.pdf

Reference Journal:

1. Journal of Intellectual Property Rights (JIPR): NISCAIR

RTMNU B.TECH. SCHEME OF EXAMINATION

Scheme of Teaching & Examination of Bachelor of Technology VII Semester B.Tech. Computer Science and Engineering[CBCS]

S. N.	Course Code	Category	Subject	Hours/ Week			Credits	Maximum Marks					Min Passing Marks	
								Theory		Practical		Total	Theory	Practical
				L	T	P		Internal	University	Internal	University			
1	BTECHCSE701T	Professional Core Course	Cryptography & Network Security	3	1	-	4	30	70	-	-	100	45	-
2	BTECHCSE701P	Professional Core Course	Cryptography & Network Security	-	-	2	1	-	-	25	25	50	-	25
3	BTECHCSE702T	Professional Core Course	Program Elective-IV	3	-	-	3	30	70	-	-	100	45	-
4	BTECHCSE703T	Professional Core Course	Program Elective-V	3	-	-	3	30	70	-	-	100	45	-
5	BTECHCSE704T	Professional Core Course	Open Elective-II	3	-	-	3	30	70	-	-	100	45	-
7	BTECHCSE705T	Professional Core Course	Project	-	-	6	3	-	-	50	50	100	-	45
8	BTECHCSE706T	HSMC	Research Methodology (Audit Course)	2	-	-	Audit	-	-	-	-	-	-	-
Total				14	1	8	17	120	280	75	75	550	180	70

Elective-IV: i)Deep Learning ii)Optimization Techniques iii) GamingArchitecture

Elective-V: i)Natural Language Processing ii)Big Data Analytics iii) Mobile Computing

Open Elective-II: i)Python Programming ii) JAVA Programming iii) Basics of Database Management System

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: SEVENTH
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Cryptography and Network Security Subject Code BTECHCSE701T

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

Aim : To highlight the features of different technologies involved in Network Security.

Prerequisite(s): Mathematics, Algorithm, Networking

Course Objective:

1	To develop the student's ability to understand the concept of security goals in various applications.
2	To provide the students with some fundamental cryptographic mathematics used in various symmetric and asymmetric key cryptography.
3	To develop the student's ability to analyze the cryptographic algorithms.
4	To familiarize the student the need of security in computer networks.

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

CO 1	acquire knowledge about security goals, background of cryptographic mathematics and identification of its application
CO 2	understand, analyze and implement – the symmetric key algorithm
CO 3	acquire knowledge about the background of mathematics of asymmetric key cryptography and understand and analyze – asymmetric key encryption algorithms, digital signatures
CO 4	analyze the concept of message integrity and the algorithms for checking the integrity of data.
CO 5	to understand and analyze the existing cryptosystem used in networking

UNIT I: (08Hrs)

Introduction : Security goals, cryptographic attacks. Mathematics of cryptography: modular arithmetic, Euclidean and extended Euclidean algorithm. Traditional symmetric key ciphers; Monoalphabetic ciphers: addition and multiplication ciphers, Polyalphabetic ciphers: Vigenere's ciphers, Hill ciphers, playfair ciphers.

UNIT II: (07 Hrs)

Symmetric key cryptography: Block ciphers and its components, Stream cipher, Blowfish, DES, AES, RC4, Key distribution

UNIT III: (07 Hrs)

Asymmetric key cryptography: Euler's Phi-Function, Fermat's Little Theorem, Euler's theorem, Chinese remainder theorem. Diffie-Hellman, RSA, ECC, Entity authentication Digital signature

UNIT IV: **(07 Hrs)**

Message Integrity and authentication: Authentication requirement, MAC, HMAC. Cryptographic Hash Function: MD5, SHA, User authentication, Kerberos

UNIT V: **(07 Hrs)**

Network Security: Key Management, PGP, IPSec, SSL, Firewalls, Intrusion Detection, Password management, Virus, Virtual Private Network. Web Security

Textbooks:

- William Stallings ,"Cryptography and Network Security: Principles and Standards", Prentice Hall India, 7th Edition, 2017.
- Behrouz A. Forouzan, "Cryptography and Network Security", McGraw-Hill publication, 2nd Edition, 2010.

References:

- Richard H. Baker, Network Security, McGraw Hill International 3rd Edition,1996
- Bruce Schneier, Applied Cryptography, John Wiley New York, 2nd Edition, 1996.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY, NAGPUR
FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: SEVENTH
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Cryptography and Network Security Subject Code BTECHCSE701P

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

Aim : To highlight the features of different technologies involved in Network Security.

Prerequisite(s): Mathematics, Algorithm, Networking

Course Objective:

1	To develop the student's ability to understand the concept of security goals in various applications.
2	To provide the students with some fundamental cryptographic mathematics used in various symmetric and asymmetric key cryptography.
3	To develop the student's ability to analyze the cryptographic algorithms.
4	To familiarize the student the need of security in computer networks.

Course Outcome:

At the end of this course student are able to:

CO 1	acquire knowledge about security goals, background of cryptographic mathematics and identification of its application
CO 2	understand, analyze and implement – the symmetric key algorithm
CO 3	acquire knowledge about the background of mathematics of asymmetric key cryptography and understand and analyze – asymmetric key encryption algorithms, digital signatures
CO 4	analyze the concept of message integrity and the algorithms for checking the integrity of data.
CO 5	to understand and analyze the existing cryptosystem used in networking

Note : Minimum 10 Practicals based on given syllabus

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

Subject : Elective-IV Deep Learning Subject Code : BTECHCSE702T

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

Course Objectives:

1. To introduce basic deep learning algorithms.
2. To understand real world problem which will be solved by deep learning methods.
3. To identify deep learning techniques suitable for a real world problem.

Course Outcomes:

On successful completion of the course, students will be able to:

1. Understand basic of deep learning algorithms.
2. Represent feedforward Neural Network
3. Evaluate the performance of different deep learning models with respect to the optimization, bias variance trade-off, overfitting and underfitting.
4. Apply the convolution networks in context with real world problem solving.
5. Apply recurrent neural networks in context with real world problem solving.

UNIT I **(06 Hrs)**

Basic of Deep Learning - History of Deep Learning, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm and Convergence, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Feed forward Neural Networks.

UNIT II **(06 Hrs)**

Training of feedforward Neural Network - Representation Power of Feed forward Neural Networks, Training of feed forward neural network, Gradient Descent, Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam.

UNIT III **(06 Hrs)**

Optimization Algorithm - Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp, Adam, Activation Function and Initialization Methods: Sigmoid, Tanh, Relu, Xavier and He initialization, Regularization: Bias and variance, Overfitting, Hyperparameters tuning, L1 and L2 regualarization, Data Augmentation and early stopping, Parameter sharing and tying.

UNIT IV **(06 Hrs)**

Convolution Neural Network (CNN) - Convolutional operation, Pooling, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet. Visualizing Convolutional Neural Networks, Guided Backpropagation.

UNIT V **(06 Hrs)**

Recurrent Neural Network (RNN) - Recurrent Neural Networks, Backpropagation through Time (BPTT), Vanishing and Exploding Gradients, Long Short Term Memory (LSTM) Cells, Gated Recurrent Units (GRUs).

Text Books:

1. SandroSkansi, Introduction to Deep Learning ,Springer.
2. Charu C. ,Aggarwal. Neural Networks and Deep Learning: A Textbook. Springer. 2019.
3. Ian Goodfellow ,YoshuaBengio and Aaron Courville. Deep Learning.An MIT Press book. 2016.
4. Dr. S Lovelyn Rose, Dr. L Ashok Kumar, Dr.DKarthikaRenuka ,Deep Learning using Python,Willey Publication.

Reference Books:

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. A. Ravindran, K. M. Ragsdell , and G. V. Reklaitis, Engineering Optimization: Methods and Applications , John Wiley & Sons, Inc. , 2016.

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

Subject :	Elective IV : Optimization Technique			Subject Code :BTECHCSE702T	
Load	Credit	Total Marks	Internal Marks	University Marks	Total
03 Hrs (Theory)	03	100	30	70	100

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

Prerequisite(s): C Language

Course Objective/Learning Objective:

1	Ability to apply the theory of optimization methods and algorithms to develop and for solving various types of optimization problems.
2	Ability to go in research by applying optimization techniques in problems of Engineering and Technology

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

CO 1	Explain the theoretical workings of the graphical, simplex and analytical methods for making effective decision on variables so as to optimize the objective function.
CO 2	Identify appropriate optimization method to solve complex problems involved in various industries.
CO 3	Demonstrate the optimized material distribution schedule using transportation model to minimize total distribution cost.
CO 4	Identify appropriate equipment replacement technique to be adopted to minimize maintenance cost by eliminating equipment break-down.
CO 5	Apply the knowledge of game theory concepts to articulate real-world competitive situations to identify strategic decisions to counter the consequences.

UNIT II: **(07 Hrs)**

Introduction of operation research: LP Formulations, Graphical method for solving LP's with 2 variables, Simplex method, Duality theory in linear programming and applications, Integer linear programming, dual simplex method.

UNIT II: **(07 Hrs) Dynamic Programming :**

Basic Concepts, Bellman's optimality principles, Dynamics Programming approach in decision making problems, optimal subdivision problem.

Sequencing Models: Sequencing problem, Johnson's Algorithm for processing n jobs through 2 machines, Algorithm for processing n jobs through 3 or more machines, Processing 2 jobs through n machines.

UNIT III: **(07 Hrs)** Project Management : PERT and CPM : Project management origin and use of PERT, origin and use of CPM, Applications of

PERT and CPM, Project Network, Diagram representation, Critical path calculation by network analysis and critical path method (CPM), Determination of floats, Construction of time chart and resource labelling, Project cost curve and crashing in project management, Project Evaluation and review Technique (PERT)

UNIT IV: **(07 Hrs)** Queuing Models : Essential features of queuing systems, operating characteristics of queuing system, probability distribution in queuing systems, classification of queuing models, solution of queuing M/M/1: ∞ /FCFS,M/M/1 : N/FCFS, M/M/S : ∞/FCFS, M/M/S : N/FCFS.

UNIT V: **(07 Hrs)** Inventory Models : Introduction to the inventory problem, Deterministic Models, The classical EOQ (Economic Order Quantity) model, Inventory models with deterministic demands (no shortage & shortage allowed), Inventory models with probabilistic demand, multi item determines models

Textbooks:

- Gillet B.E. : Introduction to Operation Research, Computer Oriented Algorithmic approach – Tata McGraw Hill Publising Co. Ltd. New Delhi.
- P.K. Gupta & D.S. Hira, "Operations Research", S.Chand& Co

References:

- J.K. Sharma, "Operations Research: Theory and Applications", Mac Millan
- S.D. Sharma, "Operations Research", KedarNath Ram Nath, Meerut (UP)
- S.S. Rao "Optimization Theory and Application", Wesley Eastern

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

Subject :Elective IV Gaming Architecture Subject Code : BTECHCSE702T

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

Aim : To understand the concepts of Gaming Architecture

Prerequisite(s):

Course Objective/Learning Objective:

1	Understand the concepts of Game design and development.
2	Learn the processes, mechanics and issues in Game Design.
3	Be exposed to the Core architectures of Game Programming.
4	Know about Game programming platforms, frame works and engines. Learn to develop games.

Course Outcome:

At the end of this course Student are able to:

CO1	Discuss the concepts of Game design and development.
CO2	Design the processes, and use mechanics for game development.
CO3	Explain the Core architectures of Game Programming.
CO4	Use Game programming platforms, frame works and engines.
CO5	Create interactive Games.

UNIT I: (08)

3D GRAPHICS FOR GAME PROGRAMMING

3D Transformations, Quaternions, 3D Modeling and Rendering, Ray Tracing, Shader Models, Lighting, Color, Texturing, Camera and Projections, Culling and Clipping, Character Animation,

Physics-based Simulation, Scene Graphs..

UNIT II: (07)

GAME ENGINE DESIGN

Game engine architecture, Engine support systems, Resources and File systems, Game loop and real-time simulation, Human Interface devices, Collision and rigid body dynamics, Game profiling.

UNIT III: (07)

GAME PROGRAMMING

Application layer, Game logic, Game views, managing memory, controlling the main loop, loading and caching game data, User Interface management, Game event management.

UNIT IV: **(07)**

GAMING PLATFORMS AND FRAMEWORKS

2D and 3D Game development using Flash, DirectX, Java, Python, Game engines - Unity. DX Studio,

Development: The Development Process. Code Quality.Coding Priorities.Debugging and Module Completion.The Seven Golden Gambits.The Three Lead Balloons.

Initialization and the Main Loop: Initializing Game objects ,Game Loop, Cleanup.

UNIT V: **(07)**

Loading and Caching Game Resources: Image and Audio Formats, Compression Resource ,

Files Resource File builder, Resource Cache, 3D Graphics and 3D Engines: 3D Graphics Pipeline,3D Middleware

Game and Development: Developing 2D and 3D interactive games using DirectX or Python – Isometric and Tile Based Games, Puzzle games, Single Player games, Multi Player games.

Introduction to Augumented and Virtual Reality in game development.

Textbooks:

- Mike McShaffrfy and David Graham, “Game Coding Complete”, Fourth Edition, Cengage Learning, PTR, 2012.
- Jason Gregory, “Game Engine Architecture”, CRC Press / A K Peters, 2009.
- David H. Eberly, “3D Game Engine Design, Second Edition: A Practical Approach to Real-Time Computer Graphics” 2 nd Editions, Morgan Kaufmann, 2006.
- RadhaShankarmani , Saurabh Jain ,GaurangSinha,Game Architecture and Programming Kindle Edition

References:

- Ernest Adams and Andrew Rollings, “Fundamentals of Game Design”, 2 nd Edition Prentice Hall New Riders, 2009.
- Eric Lengyel, “Mathematics for 3D Game Programming and Computer Graphics”, 3 rd Edition, Course Technology PTR, 2011.
- Jesse Schell, The Art of Game Design: A book of lenses, 1 st Edition, CRC Press, 2008.

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SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : Natural Language Processing Subject Code BTECHCSE703T

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

Prerequisite(s):

Course Objective/Learning Objective:

1	To introduce the basic concepts and applications of Natural Language Processing (NLP)
2	To provide an understanding of the challenges in NLP and their solutions
3	To teach the different techniques and algorithms used in NLP, such as text classification, information retrieval and extraction, syntactic and semantic analysis, and deep learning models
4	To enable students to analyze text data and build NLP models
5	To equip students with the skills to evaluate and compare different NLP techniques and algorithms

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

CO1	Understand the basic concepts and applications of Natural Language Processing (NLP)
CO2	Identify the challenges in NLP and evaluate the solutions to these challenges
CO3	Analyze and preprocess text data for NLP tasks
CO4	Apply different NLP techniques and algorithms such as text classification, information retrieval and extraction, syntactic and semantic analysis, and deep learning models
CO5	Evaluate and compare different NLP techniques and algorithms using appropriate metrics

UNIT I: (08Hrs)

Introduction to NLP: Definition and scope of NLP, Historical overview and applications of NLP, Challenges in NLP and their solutions, Basic concepts in linguistics and language processing, Text preprocessing and normalization

UNIT II: (07 Hrs)

Language Models and Text Classification: Language modeling and n-gram models, Classification and categorization of text data, Text classification algorithms such as Naive Bayes, Decision Trees, and Support Vector Machines (SVM), Evaluation measures for text classification.

UNIT III: (07 Hrs)

Information Retrieval and Extraction: Information retrieval models such as vector space model and probabilistic model, Retrieval of relevant documents using query expansion, Named Entity Recognition (NER), Relation Extraction and Open Information Extraction (OIE)

UNIT IV: **(07 Hrs)**

Syntactic and Semantic Analysis: Parts of Speech (POS) tagging and parsing, Dependency Parsing, Semantic Analysis and Sentiment Analysis, Word Embeddings and Semantic Similarity

UNIT V: **(07 Hrs)**

Advanced Topics in NLP: Neural Network models for NLP tasks , Deep Learning models for NLP tasks, Natural Language Generation (NLG),

Dialogue Systems and Chatbots

Textbooks:

- Speech and Language Processing" by Daniel Jurafsky and James H. Martin
- Natural Language Processing" by Jacob Eisenstein

References:

- "Foundations of Statistical Natural Language Processing" by Christopher D. Manning and HinrichSchütze
- "Natural Language Processing with Python" by Steven Bird, Ewan Klein, and Edward Loper

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE & ENGINEERING

Subject : Elective-V Big Data Analytics Subject Code : BTECHCSE703T

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

Pre- requisites : Should have knowledge of Programming Language (Java preferably), Practice of SQL (queries and sub queries), exposure to Linux Environment.

Course Objective/Learning Objective:

1	Student should able to learn and understand the basic concept, characteristics and application of Big Data.
2	To learn Concept of Distributed system with Apache Hadoop.
3	To learn application of Hadoop to solve real world problem

Course Outcome:

At the end of this course Student are able to:

CO1	Understand Concept, characteristics, types of big data
CO2	Build and maintain reliable, scalable, distributed systems with Apache Hadoop.
CO3	Apply Hadoop ecosystem components to solve real world problems.
CO4	Apply machine learning algorithm for big data analysis.
CO5	Implement Big Data Activities using Hive

UNIT I :

Introduction to Big Data: Data, Characteristics of data and Types of digital data: Unstructured, Semi-structured and Structured, Sources of data, working with unstructured data, Evolution and Definition of big data, Characteristics and Need of big data, Challenges of big data, Data environment versus big data environment, Big Data Analysis Life Cycle.

UNIT II :

Big data analytics tools and Technologies: Overview of business intelligence, Characteristics and need of big data analytics, Classification of analytics, Challenges to big data analytics. Analytical operations: Associations rules, classifications, clustering, Mahout ML, etc.

UNIT III :

Hadoop foundation for analytics: Features, Hadoop ecosystems, Evolution of Hadoop architectures Hadoop 1.0, Hadoop 2.0, Hadoop3.0, Key aspects and Components of Hadoop 3.0. Hadoop Technology Stack: Hive, Pig, Zookeeper, Swoop, oozie, flume, etc.

Unit IV :

MapReduce and YARN framework: Introduction to MapReduce, Processing data with MapReduce, Introduction to YARN, Components YARN, Data serialization and Working with common serialization formats, Big data serialization formats

UNIT V :

NoSQL Databases: Schema-less Models, Increasing Flexibility for Data ManipulationKey Value Stores- Document Stores – Tabular Stores – Object Data Stores Hive – Sharding –-Hbase – Analyzing big data NoSQL Database Architectures.

Text Books :

• Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.

• SeemaAcharya, SubhasiniChellappan, "Big Data Analytics" Wiley 2015

• Big Data,Big Data Analytics by Michael Minelli, Michele Chambers, AmbigaDhira

● David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", Morgan Kaufmann/El sevier Publishers, 2013.

References

• Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, 2007.

• Jay Liebowitz, "Big Data and Business Analytics" Auerbach Publications, CRC press (2013)

• Tom Plunkett, Mark Hornick, "Using R to Unlock the Value of Big Data: Big Data Analytics with Oracle R Enterprise and Oracle R Connector for Hadoop", McGraw-Hill/Osborne Media (2013),

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SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Elective-V Mobile Computing Subject Code : BTECHCSE703T

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

Pre- requisites : Computer Networks.

Course Objective/Learning Objective:

1	To study Wireless Communication with Cellular system Model.
2	To study GSM system with Radio, Network Switching and Operation subsystem.
3	To learn Wireless LAN with MAC Layer.
4	To study Mobile MANET with WAP protocol.

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

CO1	To Understand the basic concepts of Wireless Communication with Cellular system.
CO2	To learn about GSM System with Cell layout, Radio, Network Switching and Operation subsystem, HLR & VLR.
CO3	To learn Wireless LAN with its Architecture and MAC Layer.
CO4	To learn Mobile IP, Dynamic Host Configuration Protocol, Mobile Ad hoc Networks.
CO5	To learn about TCP over Wireless Networks. with Wireless Application protocol.

UNIT I :

Introduction to Mobile Computing, Features of Wireless Communication, Applications of Wireless Communication, A simplified Reference Model in Mobile Computing, Cellular system Infrastructure with generic Block diagram, frequency reuse, Medium Access Control (Wireless): Motivation for a specialized MAC, Hidden and exposed terminals, near and far terminals, Wireless Network over Wired Network.

UNIT II :

Introduction to GSM system: Mobile Services, GSM Architecture, GSM operational and technical requirements. Cell layout and frequency planning, GSM radio subsystem, Network and Switching Subsystem, Operation subsystem. Echo canceller, Localization and calling, Handovers.

UNIT III :

Wireless LAN: Advantages of Wireless LAN, Applications, IEEE 802.11 standards, system Architecture, protocol architecture, physical layer, medium access control layer, MAC management, Mobile Agents, Requirement for mobile agent system, Bluetooth, Roaming.

UNIT IV :

Mobile Network Layer: Mobile IP-IP Packet delivery, Dynamic Host Configuration Protocol (DHCP), Mobile Ad hoc Networks (MANETs): Overview, Properties of a MANET, routing, DSDV, DSR, AODV& Hybrid Routing Protocol

UNIT V :

Mobile Transport Layer: Traditional TCP, Indirect TCP, Snooping TCP, Selective retransmission, Transaction oriented TCP, Wireless Application Protocol (WAP), Architecture, Wireless datagram protocol.

Text Books :

1. Mobile Communications, Jochen Schiller, Second edition, Pearson, 2006.
2. Mobile Computing for beginners, Raksha Shende, Arizona Business Alliance, 2012.
3. Handbook of Wireless Networks and Mobile Computing, Ivan Stojmenovic, Wiley, 2002.

References

1. Fundamentals of Mobile and Pervasive Computing, Adelstein, Frank, Gupta and Sandeep KS, McGraw-Hill, 2005.
2. Principles of Mobile Computing, Hansmann, Merk and Nicklous, Stober, Springer, Second Edition, 2003.
3. Mobile Communication, T. Shivakami, Annaji M. Kuthe, Scientific International Publishing House, 2022.

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SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Python Programming(Open Elective- II) Subject Code BTECHCSE704T

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

Prerequisite(s): C Language

Course Objective/Learning Objective:

1	To understand the fundamentals of Python programming language.
2	To develop problem-solving and programming skills using Python.
3	To use Python in different applications such as web development, data analysis, and artificial intelligence.

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

CO1	Develop programming skills in Python programming language.
CO2	Implement object-oriented programming concepts using Python.
CO3	Utilize Python libraries for data analysis and visualization.
CO4	Develop web applications using Flask framework.
CO5	Apply machine learning concepts using Scikit-Learn.

UNIT I: (08 Hrs)

Introduction to Python Programming: Overview of Python programming language, Variables, data types, and operators, Conditional statements and loops, Functions, and modules

UNIT II: (07 Hrs)

Object-Oriented Programming in Python: Object-oriented programming concepts, Classes, objects, and methods, Inheritance, and polymorphism

UNIT III: (07 Hrs)

Python Libraries for Data Analysis: Introduction to NumPy and Pandas, Data manipulation with NumPy and Pandas, Data visualization with Matplotlib and Seaborn.

UNIT IV: (07 Hrs)

Web Development with Flask: Introduction to Flask framework, creating web applications using Flask, Flask extensions for database integration

UNIT V: **(07 Hrs)**

Introduction to Machine Learning with Python: Introduction to Scikit-Learn, Supervised and unsupervised learning, Classification, and regression algorithms

Textbooks:

- "Python for Everybody: Exploring Data in Python 3" by Charles Severance.
- "Python Crash Course, 2nd Edition: A Hands-On, Project-Based Introduction to Programming" by Eric Matthes.

References:

- "Learning Python, 5th Edition" by Mark Lutz.
- "Python Data Science Handbook: Essential Tools for Working with Data" by Jake VanderPlas.

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SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : JAVA Programming(Open Elective - II) Subject Code BTECHCSE704T

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

Prerequisite(s): C Language

Course Objective/Learning Objective:

1	To introduce the concepts of Java programming language and its application in software development.
2	To develop a sound understanding of Java programming constructs such as variables, operators, control statements, loops, and arrays.
3	To provide students with a strong foundation in object-oriented programming concepts such as inheritance, polymorphism, encapsulation, and abstraction.
4	To enable students to create and use classes, objects, and methods in Java programs.
5	To teach students how to handle exceptions and use various input/output techniques in Java programs.

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

CO1	Understand the fundamentals of Java programming language and its application in software development.
CO2	Implement Java programming constructs such as variables, operators, control statements, loops, and arrays.
CO3	Design and implement object-oriented programs using inheritance, polymorphism, encapsulation, and abstraction concepts in Java.
CO4	Create and use classes, objects, and methods in Java programs.
CO5	Handle exceptions and use input/output techniques in Java programs.

UNIT I: (08 Hrs)

Introduction to Java Programming: Introduction to Java programming language

Java Virtual Machine (JVM), Java Development Kit (JDK), Overview of Java programming environment, Simple Java program and its execution

UNIT II: (07 Hrs)

Java Programming Constructs: Variables and data types, Operators, and expressions

Control statements: if-else, switch, for, while, do-while, Arrays: single-dimensional and multi-dimensional arrays,

Strings and string manipulation

UNIT III: (07 Hrs)

Object-Oriented Programming Concepts in Java: Classes and objects, Methods and constructors, Inheritance: single and multilevel inheritance, Polymorphism: method overloading and overriding, Encapsulation and abstraction

UNIT IV: (07 Hrs)

Handling Exceptions in Java: Exception handling: try-catch, throw, throws, Exception hierarchy in Java, Checked and unchecked exceptions, Creating custom exceptions

UNIT V: (07 Hrs)

Input/Output Techniques in Java: File handling in Java, Reading and writing data using streams, Serialization and deserialization, Networking programming in Java: sockets and URLs

Textbooks:

- Java: The Complete Reference by Herbert Schildt, McGraw Hill Education, 11th edition, 2018.Severance, C. (2016).
- "Head First Java" by Kathy Sierra and Bert Bates.

References:

- Core Java Volume I – Fundamentals by Cay S. Horstmann and Gary Cornell, Prentice Hall, 11th edition, 2018.
- Java How To Program by Paul Deitel and Harvey Deitel, Pearson Education, 11th edition, 2017.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: SEVENTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Basics of Database Management System(OPEN ELECTIVE – II) Subject Code:BTECHCSE704T

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

Aim: To understand basic concepts of Database Management System.

Prerequisite(s): NIL

Course Objective/Learning Objective:

1.	To introduce a general idea of a database management system.
2.	To develop skills to implement real life applications that involve database handling.
3.	To provide opportunities in subject areas of data handling and managing techniques

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

CO1	Understand the basics of DBMS to analyze an information problem in the form of an Entity relation diagram and design an appropriate data model for it.
CO2	Demonstrate basics of File organizations and its types
CO3	Interpret functional dependencies and various normalization forms
CO4	Perform basic transaction processing and management
CO5	Demonstrate SQL queries to perform CRUD (Create, Retrieve, Update, Delete) operations on database

UNIT I: (08 Hrs) **Introduction to DBMS** - Purpose of Database Systems,Database systems Applications, view of data,DatabaseLanguages,Database system structure,datamethods,Database Design,& ER Model : Entity,Attributes ,Relationships,Constraints,Keys,Design Process, ER Models, E-R Diagram.

UNIT II: (07 Hrs)

File organizations and its types, indexing, types of indexing, hashing, hashing techniques.

UNIT III: (07 Hrs)

Functional Dependency (FD) – data integrity rules, functional dependency, need of normalization,first normal form, second normal form, third normal form

UNIT IV: (07 Hrs)

Database Transaction Processing : transaction system concepts, desirable properties(ACID) of transactions, schedules, serializability of schedules, concurrency control, recoverability and Deadlock handling.

UNIT V: (07 Hrs)

SQL Concepts - Basics of SQL, DDL, DML, DCL, structure – creation, alteration, defining constraints, Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, Use of group by, having, order by, join and its types, Exist, Any, All

Textbooks:

- Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts 4th Ed, McGraw Hill, 2010
- RamezElmasri and Shamkant B. Navathe, Fundamentals of Database Systems (5/e), Pearson Education, 2008
- Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems (3/e), McGraw Hill

References:

- Peter Rob and Carlos Coronel, Database Systems- Design, Implementation and Management (7/e),Cengage Learning, 2007.

RTMNU B.TECH. SCHEME OF EXAMINATION

Scheme of Teaching & Examination of Bachelor of Technology VIII Semester B.Tech. Computer Science and Engineering[CBCS]

S. N.	Course Code	Category	Subject	Hours/ Week			Credits	Maximum Marks					Min Passing Marks	
								Theory		Practical		Total	Theory	Practical
				L	T	P		Internal	University	Internal	University			
1	BTECHCSE801T	Professional Core Course	Industry Project/Project**	-	-	16	8	-	-	75	75	150	-	75
2	BTECHCSE802T	Professional Core Course	Program Elective*-VI / MOOC	3	-	-	3	30	70	-	-	100	45	
3	BTECHCSE803T	Professional Core Course	Program Elective*-VII MOOC	3	-	-	3	30	70	-	-	100	45	
Total				6	-	16	14	60	140	75	75	350	90	75

** Industry Project/Project: Students are encouraged to complete this project in industry and one co guide should be assigned from institute. Rigorous monitoring and mid semester at least two progress to be monitored.

*Program Electives VI & VII can be opted from NPTEL, assigned faculty should also enroll for this course, Final examination will be conducted by RTMNU

Program Elective-VI

1. Social Networks
2. Reinforcement Learning
3. GPU Architectures and Programming

Program Elective-VII

1. Predictive Analytics - Regression and Classification
2. Blockchain and its Applications
3. Computer Vision

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SEMESTER: EIGTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Social Networks Subject Code : BTECHCSE802T

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

Aim : To understand social networks and use of tools for social network analysis.

Prerequisite(s): Discrete Mathematics

Course Objective/Learning Objective:

1	To understand highly interconnected and hence more complex social networks
2	To represent connected social networks in form of graph
3	To apply graph theory, sociology, game theory
4	To use tools and extract statistics from social networks

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

CO1	Learn social networks , its types and representation
CO2	Understand weak ties, strong and weak relationships , homophily and calculate
CO3	Analyse links
CO4	Understand Power Laws and Rich-Get-Richer Phenomena
CO5	Understand Small World Phenomenon

Week 1: Introduction
Week 2: Handling Real-world Network Datasets
Week 3: Strength of Weak Ties
Week 4: Strong and Weak Relationships (Continued) &Homophily
Week 5: Homophily Continued and +Ve / -Ve Relationships
Week 6: Link Analysis
Week 7: Cascading Behaviour in Networks
Week 8: Link Analysis (Continued)
Week 9: Power Laws and Rich-Get-Richer Phenomena
Week 10: Power law (contd..) and Epidemics
Week 11: Small World Phenomenon
Week 12: Pseudocore (How to go viral on web)

References:

- https://onlinecourses.nptel.ac.in/noc23_cs19/preview
- Networks, Crowds and Markets by David Easley and Jon Kleinberg, Cambridge University Press, 2010
- (available for free download).
- Social and Economic Networks by Matthew O. Jackson, Princeton University Press, 2010.

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SEMESTER: EIGTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : Reinforcement Learning Subject Code : BTECHCSE802T

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

Aim : The goal of the course is to introduce the basic mathematical foundations of reinforcement learning, as well as highlight some of the recent directions of research.

Prerequisite(s): Learnings & Neural Netowrks

Course Objective/Learning Objective:

1	It aims to model the trial-and-error learning process that is needed in many problem situations where explicit instructive signals are not available.
2	It has roots in operations research, behavioral psychology and AI.
3	The goal of the course is to introduce the basic mathematical foundations of reinforcement learning.
4	It highlight some of the recent directions of research

Course Outcome:

At the end of this course Student are able to:

CO1	Understand Bandit algorithm and its mathematical formulation.
CO2	Use dynamic programming for reinforcement learning
CO3	Perform function approximation and apply LSM
CO4	Fit Q, DQN & Policy Gradient for Full RL
CO5	Use combinatorial models for complex problems

Week 1 Introduction
Week 2 Bandit algorithms – UCB, PAC
Week 3 Bandit algorithms –Median Elimination, Policy Gradient
Week 4 Full RL & MDPs
Week 5 Bellman Optimality
Week 6 Dynamic Programming & TD Methods
Week 7 Eligibility Traces
Week 8 Function Approximation
Week 9 Least Squares Methods
Week 10 Fitted Q, DQN & Policy Gradient for Full RL
Week 11 Hierarchical RL
Week 12 POMDPs

References

- https://archive.nptel.ac.in/courses/106/106/106106143/
- R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 1998.

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FOUR YEAR BACHELOR OF TECHNOLOGY (B.TECH.) DEGREE COURSE
SEMESTER: EIGTH (C.B.C.S.)
BRANCH: COMPUTER SCIENCE AND ENGINEERING

Subject : GPU Architectures and Programming Subject Code : BTECHCSE802T

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

Aim : To understand GPU architecture basics in terms of functional units and then dive into the popular CUDA programming model commonly used for GPU programming.
Prerequisite(s): Programming and Data Structure, Digital Logic, Computer architecture

Course Objective/Learning Objective:

1	To introduce basics of conventional CPU architectures, their extensions for single instruction multiple data processing (SIMD)
2	To understand concept in the form of single instruction multiple thread processing (SIMT) as is done in modern GPUs.
3	To teach architecture specific details
4	To introduce different architecture-aware optimization techniques relevant to both CUDA and OpenCL

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

CO1	Understand conventional CPU architectures, their extensions for single instruction multiple data processing (SIMD)
CO2	Program in CUDA about data space & synchronization
CO3	Apply optimization on kernals, thtreadsetc
CO4	Learn basics of OpenCL
CO5	Design an application using neural networks

Week 1: Review of Traditional Computer Architecture – Basic five stage RISC Pipeline, Cache Memory, Register File, SIMD instructions
Week 2: GPU architectures - Streaming Multi Processors, Cache Hierarchy, The Graphics Pipeline
Week 3: Introduction to CUDA programming
Week 4: Multi-dimensional mapping of dataspace, Synchronization
Week 5: Warp Scheduling, Divergence
Week 6: Memory Access Coalescing
Week 7: Optimization examples : optimizing Reduction Kernels
Week 8: Optimization examples : Kernel Fusion, Thread and Block Coarsening
Week 9: OpenCL basics
Week 10: CPU GPU Program Partitioning
Week 11: Application Design : Efficient Neural Network Training/Inferencing
Week 12: Application Design : Efficient Neural Network Training/Inferencing,cont'd

References:

- https://onlinecourses.nptel.ac.in/noc23_cs61/preview

- "Computer Architecture -- A Quantitative Approach" - John L.Hennessy and David A. Patterson

"Programming Massively Parallel Processors" - David Kirk and Wen-meiHwu

- Heterogeneous Computing with OpenCL" -- Benedict Gaster,LeeHowes, David R. Kaeli

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

Subject : Predictive Analytics - Regression and Classification Subject Code : BTECHCSE803T

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

Aim : To The course will provide an overview of fundamental ideas in statistical **predictive** models.
Prerequisite(s): Probability and Statistics

Course Objective/Learning Objective:

1	The course will provide an overview of fundamental ideas in statistical predictive models
2	. The objective is to understand how statistical models handle prediction problems.
3	The stress will be on understanding the construction of the models and implementation.
4	It is a core course if students aspire to be Data Scientists.

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

CO1	To understand predictive models, LSM, Normal equations and GMT
CO2	Understand regression models and infer its statistical inference
CO3	Check model assumptions and bias variance tradeoff.
CO4	Perform regression analysis in various programming languages
CO5	Apply regression models and classification for predictive analysis

Week 1:
- Landscape of the predictive models.
- Least Squares method

Week 2:
- Normal Equations:
- Gauss Markov theorem

Week 3:
- The geometry of Regression Model and Feature Engineering
- Statistical Inference of Regression Coefficient

Week 4:
- Checking Model Assumptions
- Model Comparison with R-squared, RMSE, AIC or BIC

Week 5:
- Model Complexity and Bias-Variance tradeoff
- Feature selection and Dimension Reduction

Week 6:
- Multicollinearity and Variance Inflation Factor
- Regularization with LASSO, Ridge and Elastic Net
- Ridge Regression with Python

Week 7:

● Regression Analysis with Python
● Regression Analysis with R
● Regression Analysis with Julia

Week 8: Major Applications of Regression Models

● Capital Asset Pricing Model
● Bootstrap Regression
● Time Series Forecasting with Regression Model
● Granger Causal model.

Week 9:

● Logistic Regression
● MLE of coefficient of Logistic Regression

Week 10:

● Fit Logistic Regression with optim function in R
● Fit Logistic Regression with glm function in R
● Fit Logistic Regression with sklearn in Python
● Fit Logistic Regression in Julia

Week 11:

● Logistic Regression and Inference
● Discriminant Analysis

Week 12:

● Multinomial Logit Regression
● Generalised Linear Regression
● Poisson Regression
● Negative Binomial Regression

References:

1) https://onlinecourses.nptel.ac.in/noc23_ma46/preview
2)An Introduction to Statistical Learning by James, Witten, Hastie, and Tibshirani, Springer (https://www.statlearning.com/)
3) The Elements of Statistical Learning by Hastie, Tibshirani, and Friedman, Springer (https://hastie.su.domains/Papers/ESLII.pd)
4) Regression and Other Stories by Gelman, Hill, and Vehtari, by Cambridge University Press (https://avehtari.github.io/ROS-Examples/)

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

Subject : Block Chain and its Applications Subject Code : BTECHCSE803T

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

Aim : this subject will cover the basic design principles of Blockchain technology and its applications over different sectors. Additionally, the course also provides tutorials on setting up blockchain applications using one of the well-adopted permissionlessblockchain platforms - Ethereum, and one permissioned blockchain platform - Hyperledger.

Prerequisite(s): Computer Networks; Operating Systems; Cryptography and Network Security.
Course Objective/Learning Objective:
1 Learn its capability of providing a transparent, secured, tamper-proof solution for interconnecting different stakeholders in a trustless setup.
2 This subject will cover the basic design principles of Blockchain technology and its applications over different sectors.
3 Additionally, the course also provides tutorials on setting up blockchain applications using one of the well-adopted permissionlessblockchain platforms - Ethereum, and one permissioned blockchain platform - Hyperledger.
4 Provide its applications.

Course Outcome:
At the end of this course Student are able to:
CO1 Understand basic crypto premitives
CO2 Understand elements and evolution of blockchain
CO3 Understand consensus in permissionless and permissioned models
CO4 Hands on ethereum smart contracts and hyperledgers
CO5 Perform decentralized identity management, interoperability.

Week 1: Introduction to Blockchain Technology and its Importance
Week 2: Basic Crypto Primitives I – Cryptographic Hash
Week 3: Basic Crypto Primitives II – Digital Signature
Week 4: Evolution of the Blockchain Technology
Week 5: Elements of a Blockchain
Week 6: Blockchain Consensus I – Permissionless Models
Week 7: Blockchain Consensus II – Permissioned Models
Week 8: Smart Contract Hands On I – Ethereum Smart Contracts (Permissionless Model)
Week 9: Smart Contract Hand On II – Hyperledger Fabric (Permissioned Model)
Week 10: Decentralized Identity Management
Week 11: Blockchain Interoperability
Week 12: Blockchain Applications

References
1. Mastering Blockchain: A deep dive into distributed ledgers, consensus protocols, smart contracts, DApps, cryptocurrencies, Ethereum, and more, 3rd Edition, Imran Bashir, Packt Publishing, 2020, ISBN:

9781839213199, book website: https://www.packtpub.com/product/mastering-blockchain-third-edition/9781839213199
2. Hyperledger Tutorials - https://www.hyperledger.org/use/tutorials
3. Ethereum Development Resources - https://ethereum.org/en/developers
4. Online materials and case studies

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

Subject : Computer Vision Subject Code : BTECHCSE803T

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

Aim : The course will have a comprehensive coverage of theory and computation related to imaging geometry, and scene understanding. It will also provide exposure to clustering, classification and deep learning techniques applied in this area.

Prerequisite(s): Liner Algebra, Vector Calculus, Data Structures and Programming

Course Objective/Learning Objective:

1	To cover theory and computation related to imaging geometry, and scene understanding.
2	To learn feature extraction and matching
3	To process various parameters in images
4	To expose to clustering, classification and deep learning techniques applied in this area.

Course Outcome:

At the end of this course Student are able to:

CO1	Understand 2-D Projective Geometry, homography
CO2	Understand camera and stereo geometry
CO3	Detect and match features
CO4	Process color and range in images
CO5	Apply clustering, classification and deep learning models

Week 1: Fundamentals of Image processing
Week 2: 2-D Projective Geometry, homography, and Properties of homography
Week 3: Camera geometry
Week 4: Stereo geometry
Week 5: Stereo geometry
Week 6: Feature detection and description
Week 7: Feature matching and model fitting
Week 8: Color processing
Week 9: Range image processing
Week 10: Clustering and classification
Week 11: Dimensionality reduction and sparse representation
Week 12: Deep neural architecture and applications

Books and references

- https://archive.nptel.ac.in/courses/106/105/106105216/
- Multiple View Geometry in Computer Vision: R. Hartley and A. Zisserman, Cambridge University Press.
- Computer Vision: Algorithms & Applications, R. Szeleski, Springer.
- Computer vision: A modern approach: Forsyth and Ponce, Pearson.

Summary of Semester wise credit CSE

Sr. No.	Semester	Category							TOTAL
		BSC	ESC	HSMC	PCC	PEC	OEC	PROJ	
1	I	9.5	07	03	-	-	-	-	19.5
2	II	9.5	13	-	-	-	-	-	22.5
3	III	04	-	02	17	-	-	-	23
4	IV	03	-	-	20	-	-	01	24
5	V	-	-	02	14	03	-	-	19
6	VI	-	-	02	07	06	03	03	21
7	VII	-	-	-	05	06	03	03	17
8	VIII	-	-	-	-	06	-	08	14
	Total	**26**	**20**	**09**	**63**	**21**	**06**	**15**	**160**

Summary of Semester wise Total Marks (Theory/Practical)				
Sr. No.	**Semester**	**Theory**	**Practical**	**TOTAL**
1	I	600	150	750
2	II	600	150	750
3	III	550	150	700
4	IV	600	200	800
5	V	450	150	600
6	VI	500	150	650
7	VII	400	150	550
8	VIII	200	150	350
	Total	**3900**	**1250**	**5150**