B.Tech CSE **Year- III** **Semester-VI**

School of Engineering & Applied Technology

Department of Computer Science & Engineering

B. Tech CSE Course Structure (R-21)

B.Tech CSE **Year- III** **Semester-VI**

S. No	Course Code	Course Name	L – T – P	Credits
1.	21PC601	Design and Analysis of Algorithms	3 – 0 – 0	3
2.	21PC602	Formal Languages And Automata Theory	3 – 0 – 0	3
3.	21PC502	Big Data Analytics	3 – 0 – 0	3
4.	21PE602	Internet of Things	3 – 0 – 0	3
		Skill oriented Courses		
5.	21HS601	Soft Skills-1	1 – 0 – 2	2
6.	21PC609	Web Application Development	0 – 0 – 2	1
		Mandatory Non Credit Course		
7.	21MC601	Intellectual Property Rights & Patents	2 – 0 – 0	0
		Laboratories		
8.	21PC601P	Design and Analysis of Algorithms Lab	0 – 0 – 3	1.5
9.	21PC502P	Big Data Analytics Lab	0 – 0 – 3	1.5
10.	21PE602P	Internet of Things Lab	0 – 0 – 3	1.5
11.	21EEC601	Community Service Project	0 – 0 – 2	1
Total Credits				**20.5**

L – Lecture **T – Tutorial** **P – Practical**

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DESIGN AND ANALYSIS OF ALGORITHMS(21PC601)

UNIT 1:

Applications of Graph Search: Review of BFS/DFS, checking if an undirected graph is 2-edge connected. Checking if a directed graph is strongly connected.

Greedy algorithms: Introduction to the greedy paradigm, Examples of activity selection, deadline scheduling, fractional knapsack, Kruskal's algorithm for minimum spanning trees, Huffman coding.

UNIT 2:

Divide and Conquer: Explain why the divide and conquer paradigm is useful. Illustrate the paradigm through integer multiplication, writing recurrence relations and solving them. Further examples from geometry – domination number of a set of points, identifying maximal points, closest pair of points. Linear time algorithm for finding the median, Randomized divide and conquer algorithms: randomized quicksort and selection.

UNIT 3:

Dynamic Programming and shortest paths: Computing Fibonacci numbers and why divide-and- conquer is not a good idea. Idea of storing function calls, tables. Notion of sub problems and optimal substructure. Illustration through subset sum, (integer) knapsack, longest increasing subsequence, longest common subsequence, matrix chain multiplication. Dijkstra's algorithm for single-source shortest paths, Bellman-Ford for SSSP with negative weights, Floyd Warshall for APSP.

UNIT 4:

Network flows: The maximum s-t flow problem in capacitated networks. Ford Fulkerson algorithm or maximum flow. Max-flow min- cut theorem and integrality of maximum flow for integral capacities. Applications of max flow to maximum bipartite matching, max disjoint paths.

UNIT 5:

Intractability: Models of computation, Turing machines, RAM model. Brief discussion on other models of computation e.g. PRAM model, Memory Hierarchy etc. Notion of polynomial time computation. Polynomial time reductions. Yes and No instances of decision problems. Decision vs optimization. NP as a class of problems with Yes certificates which can be efficiently checked. NP-hardness and Cook- Levin theorem (just the statement). NP-completeness. Examples of Reductions.

Suggested Texts:

1. Algorithm Design, 1 st Edition, Jon Kleinberg and Éva Tardos, Pearson.
2. Algorithms, Sanjoy Dasgupta, Christos Papadimitriou, Umesh Vazirani
3. Introduction to Algorithms, 4 th Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
4. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.

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T2: FORMAL LANGUAGES AND AUTOMATA THEORY(21PC602)

UNIT I Finite Automata

Why Study Automata Theory? The Central Concepts of Automata Theory, Automation, Finite Automation, Transition Systems, Acceptance of a String by a Finite Automaton, DFA, Design of DFAs, NFA, Design of NFA, Equivalence of DFA and NFA, Conversion of NFA into DFA, Finite Automata with E-Transition, Minimization of Finite Automata, Mealy and Moore Machines, Applications and Limitation of Finite Automata.

UNIT II Regular Expressions

Regular Expressions, Regular Sets, Identity Rules, Equivalence of two Regular Expressions, Manipulations of Regular Expressions, Finite Automata, and Regular Expressions, Inter Conversion, Equivalence between Finite Automata and Regular Expressions, Pumping Lemma, Closers Properties, Applications of Regular Expressions, Finite Automata and Regular Grammars, Regular Expressions and Regular Grammars.

UNIT III Context Free Grammars

Formal Languages, Grammars, Classification of Grammars, Chomsky Hierarchy Theorem, Context- Free Grammar, Leftmost and Rightmost Derivations, Parse Trees, Ambiguous Grammars, Simplification of Context Free Grammars-Elimination of Useless Symbols, E-Productions and Unit Productions, Normal Forms for Context Free Grammars-Chomsky Normal Form and Greibach Normal Form, Pumping Lemma, Closure Properties, Applications of Context Free Grammars.

UNIT IV Pushdown Automata

Pushdown Automata, Definition, Model, Graphical Notation, Instantaneous Description Language Acceptance of pushdown Automata, Design of Pushdown Automata, Deterministic and Non – Deterministic Pushdown Automata, Equivalence of Pushdown Automata and Context Free Grammars Conversion, Two Stack Pushdown Automata, Application of Pushdown Automata.

UNIT V Turing Machine

Turing Machine, Definition, Model, Representation of Turing Machines-Instantaneous Descriptions, Transition Tables and Transition Diagrams, Language of a Turing Machine, Design of Turing Machines, Techniques for Turing Machine Construction, Types of Turing Machines, Church's Thesis, Universal Turing Machine, Restricted Turing Machine. Decidable and Undecidable Problems: NP, NP-Hard and NP-Complete Problems.

Textbooks:

1. Introduction to Automata Theory, Languages and Computation, J.E.Hopcroft, R.Motwani and J.D.Ullman, 3rd Edition, Pearson, 2008.
2. Theory of Computer Science-Automata, Languages and Computation, K.L.P.Mishra and N.Chandrasekaran, 3rd Edition, PHI, 2007.

Reference Books:

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1. Formal Language and Automata Theory, K.V.N.Sunitha and N.Kalyani, Pearson, 2015.
2. Introduction to Automata Theory, Formal Languages and Computation, ShyamalenduKandar, Pearson, 2013.
3. Theory of Computation, V.Kulkarni, Oxford University Press, 2013.
4. Theory of Automata, Languages and Computation, Rajendra Kumar, McGraw Hill, 2014.

Online Learning Resources:

https://nptel.ac.in/courses/106106049/

https://nptel.ac.in/courses/106104028

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T3: BIG DATA ANALYTICS (21PC502)

UNIT I

Getting an Overview of Big Data: Introduction to Big Data, Structuring Big Data, Elements of Big Data, Big Data Analytics. Exploring the use of Big Data in Business Context Use of Big Data in Social Networking, Use of Big Data Preventing Fraudulent Activities, Use of Big Data in Retail Industry

UNIT II

Introducing Technologies for Handling Big Data Distributed and Parallel Computing for Big Data, Introducing Hadoop, Cloud Computing and Big Data, In-memory Computing Technology for Big Data. Understanding Hadoop Ecosystem Hadoop Ecosystem, Hadoop Distributed File System, Map Reduce, Hadoop YARN, Introducing HBase, Combining HBase and HDFS, Hive, Pig and Pig Latin, Sqoop, ZooKeeper, Flume, Oozie.

UNIT III

Understanding Map Reduce Fundamentals and H Base The Map Reduce Framework, Techniques to Optimize Map Reduce Jobs, Uses of Map Reduce, Role of H Base in Big Data Processing. Processing Your Data with Map Reduce Recollecting he Concept of Map Reduce Framework, Developing Simple Map Reduce Application, Points to Consider while Designing Map Reduce.

UNIT IV

Customizing Map Reduce Execution and Implementing Map Reduce Program Controllong Map Reduce Execution with Input Format, Reading Data with Custom Record Reader, Organizing Output Data with Output Formats, Customizing Data with Record Writer, Customizing the Map Reduce Execution in Terms of YARN, Implementing a Map Reduce Program for Sorting Text Data. Testing and Debugging Map Reduce Application Debugging Hadoop Map Reduce Locally, Performing Unit Testing for Map Reduce Applications.

UNIT V

Exploring Hive: Introducing Hive, Hive Service, Built-In Functions in Hive, Hive DDl, Data Manipulation in Hive, Data Retrieval Queries, Using JOINS in Hive. NoSQL Data Management Introduction to NoSQL, Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models, Sharding

Textbooks:

1. Big Data Black Book, DT Editorial services, Dreamtech Press

Reference Books:

1. Data Science for Business by F. Provost and T. Fawcett, O'Reilly Media.
2. Hadoop: The Definitive Guide by Tom White, O'Reilly Media.
3. Big Data and Business Analytics by Jay Liebowitz, Auerbach Publications, CRC Press.

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T4: INTERNET OF THINGS (21PE602)

Course Objectives:

1. Understand the basics of Internet of Things and protocols.
2. Discuss the requirement of IoT technology
3. Introduce some of the application areas where IoT can be applied.
4. Understand the vision of IoT from a global perspective, understand its applications,
5. determine its market perspective using gateways, devices and data management

UNIT I : Introduction to IoT

Definition and Characteristics of IoT, physical design of IoT, IoT protocols, IoT communication models, IoT Communication APIs, Communication protocols, Embedded Systems, IoT Levels and Templates

UNIT II Prototyping IoT Objects using Microprocessor/Microcontroller

Working principles of sensors and actuators, setting up the board – Programming for IoT, Reading from Sensors, Communication: communication through Bluetooth, Wi-Fi.

UNIT III IoT Architecture and Protocols

Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, Protocols- 6LowPAN, RPL, CoAP, MQTT, IoT frameworks- Thing Speak.

UNIT IV Device Discovery and Cloud Services for IoT

Device discovery capabilities- Registering a device, Deregister a device, Introduction to Cloud Storage models and communication APIs Web-Server, Web server for IoT.

UNIT V UAV IoT

Introduction toUnmanned Aerial Vehicles/Drones, Drone Types, Applications: Defense, Civil, Environmental Monitoring; UAV elements and sensors- Arms, motors, Electronic Speed Controller(ESC), GPS, IMU, Ultra sonic sensors; UAV Software –Arudpilot, Mission Planner, Internet of Drones(IoD)- Case study FlytBase.

Suggested Textbooks & Reference Books:

1. Vijay Madisetti and ArshdeepBahga, " Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
2. Handbook of unmanned aerial vehicles, K Valavanis; George J Vachtsevanos, New York,Springer, Boston, Massachusetts : Credo Reference, 2014. 2016.
3. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, " From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
4. ArshdeepBahga, Vijay Madisetti - Internet of Things: A Hands-On Approach, Universities Press, 2014.
5. The Internet of Things, Enabling technologies and use cases – Pethuru Raj, Anupama C.Raman, CRC Press

6. Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1st Edition, Apress Publications, 2013
7. Cuno Pfister, Getting Started with the Internet of Things, O‟Reilly Media, 2011, ISBN: 978- 1-4493- 9357-1
8. DGCA RPAS Guidance Manual, Revision 3 – 2020
9. Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs, John Baichtal

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Soft Skills –I (21HS601)

Module 1: **20Hrs**

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression– articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups -Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches-convincing-negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

Module2: **20Hrs**

Emotional Intelligence & Stress Management

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation– Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations. Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates.

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra BarunK.) Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)

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2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha Kapoor Publisher: I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Educationof India

Online Learning Resources:

1. https://www.youtube.com/watch?v=DUlsNJtg2L8&list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://www.youtube.com/watch?v=xBaLgJZ0t6A&list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://www.youtube.com/watch?v=-Y-R9hDl7lU
4. https://www.youtube.com/watch?v=gkLsn4ddmTs
5. https://www.youtube.com/watch?v=2bf9K2rRWwo
6. https://www.youtube.com/watch?v=FchfE3c2jzc

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WEB APPLICATION DEVELOPMENT (21PC609)

Introduction

Basics of HTML/CSS, Javascript Basics, node.js, Angular.js, mongoDB

Project Phase1: Creating a User Story app (Server side)

Start your first project
Setting up
Your first Hello World
Create a database
Your first Schema: Creating User Schema
Password hashing
Create a custom method
Your first API: Signup API
Get all users API
Login API
Create a custom middleware
Test the middleware
Your second Schema: Creating Story Schema
Post method in Home API
Decoded user's information

Phase2: Creating a User Story app (Frontend)

Setup the front-end files
First Angular Service (part 1): Creating Auth Factory
First Angular Service (part 2): Creating AuthToken Factory
First Angular Service (part 3): Creating AuthInterceptor Factory
First Angular Controller: Creating Main Controller for Login and Logout
Routing System
Login Html
Signup Frontend
Testing Login and Logout
Fix signup bugs
Creating Story service and controller (part 1)
Creating Story service and controller (part 2)
Adding real-time capability
Getting All Stories
Creating a new directive: reverse.js
Deploy our app to heroku

Resources:

1. https://www.udemy.com/course/realtime-meanstack/
2. https://www.w3schools.com/nodejs/
3. https://www.w3schools.com/angular/
4. https://www.mongodb.com/
5. https://www.w3schools.com/mongodb/

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INTELLECTUAL PROPERTY RIGHTS AND PATENTS(21MC601)

(Mandatory Non-Credit Course)

Course Objectives:

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws, Cyber 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

UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law- Semiconductor Chip Protection Act.

UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

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Suggested Textbooks & References:

1. Deborah E.Bouchoux: "Intellectual Property". Cengage learning, New Delhi
2. Kompal Bansal &Parishit Bansal "Fundamentals of IPR for Engineers", BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western's Special Topics Collections
4. Prabhuddha Ganguli: 'Intellectual Property Rights" Tata Mc-Graw – Hill, New Delhi
5. Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.
6. R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.
7. M. Ashok Kumar and Mohd. Iqbal Ali: "Intellectual Property Right" Serials Pub.

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COMMUNITY SERVICE PROJECT(21EEC601)

……Experiential learning through community engagement

Objective

Community Service Project shall be an integral part of the curriculum, as an alternative to the two months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships.

The specific objectives are:

1. To sensitize the students to the living conditions of the people who are around them,
2. To help students to realize the stark realities of the society.
3. To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
4. To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
5. To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
6. To help students to initiate developmental activities in the community in coordination with public and government authorities.
7. To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Timeline for the Community Service Project Activity

Duration: 8 weeks

I. Preliminary Survey (One Week)

- A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
- A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
- The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

II. Community Awareness Campaigns (Two Weeks)

- Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

III. 3. Community Immersion Programme (Four Weeks)

- Along with the Community Awareness Programmes, the student batch will work along with any one of the below listed governmental agencies and do service in tandem with them. This community involvement programme will involve the students in exposing

themselves to the experiential learning about the community and its dynamics while serving the people. Programmes could be in consonance with the Govt. Departments.

IV. Community Exit Report (One Week)

- During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

Throughout the Community Service Project, a daily log-book need to be maintained by the student's batch, which shall be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.