HANDBOOK

COURSE STRUCTURE AND DETAILED SYLLABUS

B. Tech

Computer Science Engineering

Batch: 2019-23

INSTITUTE OF ENGINEERING AND TECHNOLOGY

JK LAKSHMIPAT UNIVERSITY

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Program Education Objectives

The B.Tech. Programs at IET, JKLU are designed to prepare students for continued learning and successful careers. Our alumni are expected to:

PEO1: Apply their technical knowledge, complex problem solving and research skills in professional practice.

PEO2: Continue their intellectual development through critical thinking, self- study, apprenticeship, higher education, professional development courses, as well as participation in research groups and professional networks.

PEO3: Serve as ambassadors for engineering and sustainability by exhibiting high professional standards with a deep sense of civic responsibility.

PEO4: Effectively communicate about technical and related issues. PEO5: Embrace roles of team members and leaders in their career.

Program Outcomes

The graduates of B.Tech Programs at IET, JKLU will have following competencies:

PO 1: Life-long learning: Demonstrate inquisitiveness, open mindedness, and the ability to engage in independent and life-long learning in the broadest context of technological, organizational, economic, and societal changes.

PO 2: Citizenship, Sustainability, and Professional ethics

PO 2a: Demonstrate knowledge of constitutional values of liberty, equity, justice, and fraternity with understanding of the impact of the engineering solutions in societal and environmental contexts as well as a sense of responsibility for sustainable development.

PO 2b: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, cultural, and environmental issues and the consequent responsibilities relevant to the professional engineering practice.

PO 2c: Demonstrate commitment for professional integrity and excellence and respect for ethics, responsibilities and norms as prescribed for the engineering practice.

PO 3: Engineering knowledge and Modern tool usage

PO 3a: Demonstrate clear conceptual understanding of fundamentals of engineering specialization and cognitive flexibility to appropriately 'transfer' what has been learned in a context, to different situations.

PO 3b: Apply engineering thinking, computational thinking, and the knowledge of mathematics, natural and social sciences, engineering fundamentals, information technology, engineering specialization, and engineering management to the solution of complex engineering problems.

PO 3c: Create, select, modify, and apply appropriate techniques, best practices, standards, resources, and modern engineering and IT tools including prediction and modelling to engineering and social activities with an understanding of the limitations.

PO 4: Complex problem solving, Design and Research.

PO 4a: Identify, formulate, review research literature, and analyze complex engineering problems to arrive at substantiated conclusions using critical thinking along with principles of mathematics, computing, engineering as well as natural and social sciences.

PO 4b: Use systems thinking and reflection to identify and consider underlying structures, patterns, volatility, uncertainties, complexities, ambiguities, complications, and risks to design and develop engineering solutions for complex problems to meet the specified and anticipated needs with appropriate concern for constraints, performance, sustainability, and professional ethics.

PO 4c: Use research-based knowledge and research methods including design of experiments, simulation, analysis and interpretation of data, and synthesis of the information to evaluate and improve the engineering solutions and practice.

PO 5: Individual & teamwork and Engineering management
PO 5a: Ability to work effectively as an individual and as a team member or leader in diverse and distributed teams, and in multidisciplinary settings.
PO 5b: Ability to apply engineering management principles to one's own and team's work to manage engineering projects and operations and in multidisciplinary environment.
PO 6: Communication: Ability to communicate effectively on complex engineering and technology activities, situations, problems, and solutions using verbal, textual, and pictorial elements with the colleagues, engineering community, users, clients, policy makers, and society at large with intellectual honesty, clarity, empathy, and compassion.
PO 7: Innovation and entrepreneurship:
PO 7a: Demonstrate enthusiasm and understanding to identify opportunities and translate research in engineering and other disciplines to conceive and design innovative engineering solutions for business, industry, and societal problems.
PO 7b: Demonstrate enthusiasm and understanding to conceive and plan technology based new ventures either as independent start-up businesses or within existing corporate structures.

Program Specific Outcomes

B.Tech. (Computer Science and Engineering)

The computer science and engineering graduates of JKLU will be able to:
CSEPSO1: Conceive, design, implement, and manage computational and information processing systems, agents and processes by using principles of computer science, computer engineering, software engineering, artificial intelligence, data analytics, sustainability and state of the art platforms, components and tools.
CSEPSO2: Serve in ICT areas such as software development, data science, IT infrastructure, cyber security, data administration, system administration in business, consultancy, industry, government, healthcare, etc.

JK Lakshmipat University, Jaipur								
Institute of Engineering and Technology								
Department of Computer Science Engineering								
Course Structure for the B. Tech (Batch 2019-2023)								
Semester	**Courses**							**Credits**
I	Computational Data Analysis	Design and Prototyping	Experimental Science-I	Fundamentals of Communication				**21**
	ES1101	**ES1102**	**AS1101**	**CC1101**				
	(10s 2 0)	**(6 0 0)**	**(1 0 4)**	**(2 0 1)**				
	10	**6**	**3**	**2**				
II	Calculus and Applied Mechanics	Fundamentals of Automation Engineering	Object Oriented Programming	Energy and Environmental Studies	Critical Thinking and Storytelling	Scientific Perspectives	IBM SP-I Python Programming **CS1301 (0 2 0)**	**20/21***
	ES1103	**ES1104**	**CS1101**	**ES1105**	**CC1102**	**AS1102**		
	(6s 2 0)	**(6s 2 0)**	**(1 0 4)**	**(1 0 0)**	**(2 0 0)**	(Science Week)		
	6	**6**	**3**	**1**	**2**	**2**	1	
III	Data Structures	Theoretical Foundation of Computer Science	Computational Engineering Analysis-I	Engineering Measurements and Machines	Perspectives on Contemporary Issues	Management Perspectives	IBM SP-II Data Visualisation	**22/25***
	CS1102	**CS1103**	**ES1106**	**ES1107**	**CC1103**	**IL1101**	**CS1310**	
	(3 0 2)	**(3 1 0)**	**(3 1 2)**	**(3 0 4)**	**(2 0 1)**	(Management Week)	**(2 0 2)**	
	4	**4**	**5**	**5**	**2**	**2**	**3**	
IV	Design and Analysis of Algorithms	Database Systems	Computer Architecture & Organization	Computational Engineering Analysis-II	Communication and Identity	Introduction to Design	IBM SP-III (Enterprise Programming using Java)	**21/24***
	CS1105	**CS1106**	**CS1107**	**ES1109**	**CC1104**	**IL1102**	**CS1303**	
	(3 0 2)	**(3 0 2)**	**(3 0 2)**	**(3 1 2)**	**(2 0 1)**	(Design Week)	**(2 0 2)**	
	4	**4**	**4**	**5**	**2**	**2**	**3**	
Practice School - I (PS1101) – (4 to 6 Weeks Duration) - 4 Credits								
V*	Operating Systems	Artificial Intelligence and Machine Learning	Open Elective-1	Understanding and Managing Conflict	Introduction to IoT	Automation Project	DE-1/IBM-SP-IV (Cloud Computing)	**22**
	CS1108	**CS1110**		**CC1105**	**EE1111**	**PR1101**	**CS1304**	
	(3 0 2)	**(3 0 2)**		**(2 0 0)**			**(3 0 2)**	
	4	**4**	**4**	**2**	**2**	**2**	**4**	
VI*	Computer Networks and Distributed Systems	Compiler Design/Software Engineering	DE-3/ OE-2/IBM-SP-V (Business Intelligence)	Critical Thinking for Decisions at Workplace	Emerging Tech	DE-2/IBM-SP-VI (Data Science)		**20**
	CS1111	**CS1112/CS1113**	**CS1305**	**CC1106**		**CS1313**		
	(3 0 2)	**(3 0 2)**	**(3 02)**	**(2 0 0)**		**(3 02)**		
	4	**4**	**4**	**2**	**2**	**4**		
VII*	DE-4	DE-5	DE-6	OE-3	**Minor Project**/IBM-SP-VII			**20**
					PR1103			
	4	**4**	**4**	**4**	**4**			
VIII*	**Practice School - II /Entrepreneurial Project/Research Project/Semester at a partner University**							**16**
	Total Credits							**166-172***

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B. Tech (CSE) (Batch: 2019-2023)		
Course Code	**Course Name**	**Page No**

ES1101: Computational Data Analysis

L T P: (10s 2 0) **Credits: 10**

Course Description: This course introduces computational analysis of data based on Linear Algebra Principles and Statistics. The computational analysis will include learning and utilizing Python as a programming language.

Course Outcomes

After course completion, the student will be able to

ES1101.1. Write Simple Python programs using various datatypes, control structures, decision statements, libraries, functions (M1)

ES1101.2. Develop Python programs using Objects, Classes and Files (M1, M2)

ES1101.3. Develop Programs for analyzing and interpreting Complex situations in various domains including sustainable development by combining various Linear Algebra, Statistics and Other Problem-Solving Techniques (M3)

ES1101.4. Model Complex systems as Linear simultaneous equations and analyze the same using Matrix methods (M1)

ES1101.5. Model Data as matrices and Find Eigen Values and Eigen Vectors and Apply the same for problem solving, e.g., ranking and performance analysis (M1)

ES1101.6. Summarize and Visualize different datasets (M2)

ES1101.7. Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving, e.g., Goodness of Fit (M2)

ES1101.8. Formulate and validate hypothesis with reference to different datasets (M2)

ES1101.9. Apply correlation, regression, least square method and time series analysis for modeling, analysis, interpretation and forecasting (M2)

Evaluation Scheme

Sr. No	Specifications	Weightage (in percentage)
01	Attendance	Nil
02	Assignment	15
03	Class Participation	Nil
04	Quiz	15
05	Theory Exam (Mid Term I)	Nil
06	Theory Exam (Mid Term II)	20
07	Theory Exam	Nil
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	30
13	Project -3	Nil
14	Lab Evaluation 1	10
15	Lab Evaluation 2	10
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus

Introduction to Algorithms, Hardware Overview, Python as a Tool, Installing Python and Writing a Program, Variables & Expressions, Decision Statements, How to Debug? Control Structures: Loops & Iterations, Linear Data Structure: String, List, Tuple, Data Dictionary and Set, Python Library (Pandas, Numpy, PyPlot), Functions, Classes & Objects, Working with Files

Matrix Operations, Eliminations, Matrix Inversion, Transformation, Solution of Linear, Simultaneous Equation, Eigen Values & Eigen Vectors, Linear Transformation, Linear Combination, Vector Spaces and Subspaces

Probability, Baye's Rule, Sampling, Data Processing and Pre-processing, Random Variable, Discrete & Continuous Distribution, Hypothesis Formulation, Test of Hypothesis, ANOVA, Correlation, Curve Fitting, Regression

Reference Books

1. Allen B. Downey. Think Python. Green Tea Press, Massachusetts, USA.
2. Kenneth Hoffman and Ray Kunze. Linear Algebra. PHI Learning Private Limited, 2nd Edition, 2012.
3. Gilbert Strang. Introduction to Linear Algebra. Wellesley-Cambridge Press, 4th edition, 2009.
4. Allen B. Downey. Think Stats. Green Tea Press, Massachusetts, USA.
5. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley & Sons, Inc., 3rd Edition (2004).
6. Rishard A. Johnson, Miller and Freund's probability and Statistics for Engineers, PH

Course Title and Course Code	**Design and Prototyping (ES1102)**
Hours per Week	**L T P: 6 0 0**
Credits	**6**
Students who can take	**B. Tech Semester-I (Batch: 2019-2023)**

Objective of the course:

The students will be trained to analyze an unknown situation through critical thinking and formulate it into a known problem so that solutions can be found. Once solution found, student will be able to use engineering tools to convert a conceptual product into a real product.

Course Outcomes:

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

ES1102.1. Approach design challenges from the perspective of the user and offer innovative solutions effectively.
ES1102.2. Communicate and work in team towards a common goal.
ES1102.3. Think creatively towards a fun based, desirable solution.
ES1102.4. Develop the projection views of the products with dimensions and scales.
ES1102.5. Create the schematic diagram and isometric view of the parts using AutoCAD.
ES1102.6. Fabricate prototype by combining the different parts.

Prerequisites	**Basics of Physics**

Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	30
3	Class Participation	NIL
4	Quiz	10
5	Theory Exam-I	NIL
6	Theory Exam-II	NIL
7	Theory Exam-III	NIL
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	50
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	NIL
16	Course Portfolio	NIL
Total (100)		**100**

Syllabus of Design Thinking & Prototyping

1. Empathy

Design thinking is a user-centered design process, and the empathy that comes from observing users enables design thinkers to uncover deep and meaningful needs (both overt & latent). Empathy, by definition, is the intellectual identification with or vicarious experiencing of the feelings, thoughts or attitudes of another. Three main techniques are used to gain empathy: interviewing, observation, immersion. The goal of the empathy mode is to discover gaps in between what people do and what people say they do. These gaps are the design opportunities.

a. User Experience (On ground experience)
b. Market Research
c. Benchmarking, Competitor or Comparative Study
d. Personal Experience (of the Designer)
e. Analysis
f. Revisiting the brief, make amendments (if brief is given by the client)

2. Define

The Define mode is seen as a 'narrowing' part of the process. After collecting volumes of user information, it is time to distill down to one specific user group, their need and the insight behind that need so as to unify and inspire a team. The goal of this mode is to come up with at least one actionable problem statement (often referred to as Point of View (POV)) that focuses on the insights that you uncovered from real users**.**

a. How to create a brief
b. Setting parameters

3. Ideate

Ideation is the process of idea generation. Mentally it represents a process of "going broad" in terms of concepts and outcomes. Ideation provides the fuel for building prototypes and driving innovative solutions.

a. Brain storming
b. Mood Board and Theme Development
c. Concept Sketches(doodling) and Design Proposals
d. Final Sketches and Blueprints
e. Logistics, Material and Production feasibility check

4. Prototyping or Mock-up models

Prototyping is the iterative development of artifacts – digital, physical, or experiential – intended to elicit qualitative or quantitative feedback. The act of prototyping implies "building", testing, and iterating and is, itself, both a flaring and a narrowing process. The flaring represents the proliferation of low-resolution prototypes developed as different aspects of the prototype are evaluated. The narrowing represents the refinement of the lower resolution models into increasingly complex and resolved models based on feedback, which leads to an even better understanding of the user's needs.

a. Small and quick working models
b. Scale 1:1 working prototypes.

5. Product Testing, User Testing & Iterations and Changes

The test mode is another iterative mode in which we place our low-resolution artifacts in the appropriate context of the user's life. In regard to a team's solution, we should always prototype as if we know we're right, but test as if we know we're wrong— testing is the chance to refine our solutions and make them better.

a. Testing the product on field
b. Making relevant changes

Course Title and Code: Experimental Science-I: AS1101
Hours per Week **L-T-P: 1-0-4**
Credits **3**

Course Objectives:

This course is designed to familiarize the student with the fundamental concepts of different phenomenon related with optics, electrical & electronics, modern physics, properties of water and lubricants. This course will expose the students with experimental methods of physics, chemistry and integrates theoretical knowledge and concepts to practical experience.

Course Outcomes:

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

AS1101.1. analyze ferromagnetic properties of any magnetic material and differentiate Soft and hard materials.
AS1101.2. analyze thermoelectric effect of metal junctions due to temperature differences.
AS1101.3. analyze nuclear radiation with respect to distance and thickness of absorbing media.
AS1101.4. measure electrical properties e.g., specific resistance, time constant of various electrical components.
AS1101.5. use Schroedinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials.
AS1101.6. differentiate hard and soft water by determining its hardness of different water samples.
AS1101.7. analyze conductivity of samples by different techniques such as volumetric titrations and conductometric.
AS1101.8. determine properties of the lubricant/oil samples by Pensky-Martens and Red Viscometer.

Prerequisites **Knowledge of Basic Science**

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	5
03	Class Participation	5
04	Quiz	10
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	10
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation-1 (Continuous)	20
15	Lab Evaluation-2 (Exam)	30
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus:

Electromagnetism, B-H Curve, Thermo-emf, Nuclear radiation detection, Linear air track, charging discharging of capacitors, Conversion of galvanometer into ammeter/voltmeter, Specific and high resistance determination, Concept of quantum mechanics, Schrodinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials, Water analysis for hardness, PH, Alkalinity, oxygen & chloride content, conductometric titrations, Viscosity of lubricant oil, Science of solids.

Text Books:

1. Dattu R Joshi, “Engineering Physics”, Tata McGraw Hill Education Pvt. Ltd. New Delhi, I edn. 2010.
2. Neeraj Mehta, “Applied Physics for Engineers”, PHI, I edn. 2011.
3. Jain & Jain, “Engineering chemistry”, Dhanpat Rai Publication, Delhi, 16 edn. 2014.
4. Lab Manuals

Reference Books:

1. Arther Beiser, “Concept of Modern Physics” Tata McGraw-Hill, New Delhi, 5th edn. 1997.
2. Eyvind H Wichman, “Quantum Physics” Tata McGraw Hill, Volume 4.
3. B.K. Pandey, S. Chaturvedi, “Engineering Physics”, Cengage Learning, 2012.
4. D.K. Bhattacharya, Poonam Tondon, “Engineering Physics”, Oxford University Press, 2015.
5. O.G. Palana, “Engineering Chemistry”, Tata McGraw Hill, 2009.

Course Title –Fundamentals of Communication Course Code- CC1101
Credits 2 (2-0-1)
Course Description
This course provides an introduction to the importance of effective communication, the consequences of poor communication, and the different elements of verbal and non-verbal communication. Students learn about, and enhance, the components of communication: kinesics, paralanguage (voice) and language.

Course Outcomes
The students will be able to:
CC1101.1. Identify different cultural differences and their impact on communication.
CC1101.2. Compose grammatically correct sentences and paragraphs.
CC1101.3. Deliver effective oral presentations following appropriate kinesics and paralinguistic features.
CC1101.4. Identify impact of cultural differences on communication.
CC1101.5. Apply appropriate communication skills across settings, purposes, and audiences.
Evaluation Scheme:

Sr. No	**Specifications**	**Weightage (in percentage)**
01	Attendance	Nil
02	**Assignments**	**30**
03	**Class Participation**	**10**
04	**Quiz**	**20**
05	Theory Exam I	Nil
06	**Theory Exam II**	**20**
07	**Theory Exam III**	**20**
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Topics to be Covered
1. **Nature and importance of communication**
2. **Mehrabian's Communication Theory**
3. **Ethos, Pathos, Logos: The three pillars of persuasive communication**
4. **English as a Foreign Language**
5. **Consequences of poor communication**
6. **Writing Strategy**
7. **Basic of Effective Presentation**
8. **Influence of culture on communication**
9. **Formats of Public speaking (oral narration, conversational skills)**
10. **Common Errors in English**

SUGGESTED READINGS:
(i) Raman, Meenakshi and Sangeeta Sharma, 2011. Technical Communication: Principles and Practice. Second Edition. New Delhi: Oxford University Press.
(ii) Mohan, Krishna and Meenakshi Raman. 2010. Advanced Communicative English. New Delhi: Tata McGraw Hill.

Course Title and Code	Calculus and Applied Mechanics ES1103
Hours per Week	**L-T-P: 6-2-0**
Credits	**6**
Students who can take	**B. Tech Semester-II (Compulsory)**

Course Objective:

This course introduces the basic elements of calculus and mechanics through some engineering projects. The application of multivariable calculus in civil and mechanical engineering is also highlighted. This course will equip students with essential domain knowledge of calculus and applied mechanics in solving basic engineering problems.

Course Outcomes:

ES1103.1. On successful completion of this course, the student should be able to:
ES1103.2. apply analytical techniques to determine forces in structures
ES1103.3. use commercial software (STAAD Pro.) to simulate a structure/frame and determine force in the members
ES1103.4. model physical phenomena using calculus and solve using appropriate method
ES1103.5. apply Newton's laws of motion and understand the concepts of dynamics concepts (force, momentum, work and energy)
ES1103.6. interpret the geometrical significance of differential and integral calculus
ES1103.7. solve problems of vector differentiation and integration
ES1103.8. calculate the buoyant forces of objects with various shape and carryout the stability analysis
ES1103.9. apply the concept of partial differentiation to solve optimization problems

Evaluation Scheme:

Sr. No	**Specifications**	**Marks**
1	Attendance	--
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	30
8	Report-I	--
9	Report-II	--
10	Report-III	--
11	Project-I	15
12	Project-II	15
13	Project-III	--
14	Lab Evaluation-I	--
15	Lab Evaluation-II	--
16	Course Portfolio	--
	Total (100)	**100**
Provision of retest		
1	Theory Exam-III	**30**

Syllabus:

Vectors Algebra: basics of vector algebra, resultant vector, Application of vector equilibrium on structures.

Force systems basic concepts, equilibrium of system of forces, free body diagrams, equations of equilibrium of coplanar systems, structures (trusses), analysis of structures, method of joints, method of section, friction, virtual work, work energy principle, impulse-momentum (linear, angular).

Function of several variables, functions of one and several variables, partial differentiation, maxima-minima.
Vector Differentiation: Vector functions and derivatives, Arc length and unit tangent vector, Curvature and unit normal vector, Directional derivative and gradient vectors, Tangent plane, Divergence and curl of a vector field
Integral Calculus, area under curve, arc length, double integral, change of order and triple integrals, surface and volume integrals, solids of revolution, moment of inertia, floatation, buoyancy, centroid
Vector Integration: Line integral, flux, work done, circulation, path independence, potential function and conservative fields, Surface area and surface integral, Green's theorem in the plane, Stoke's theorem, Divergence theorem.

Text Books:

1. M.D. Weir and J. Hass, Thomas, Calculus, Pearson, India, 2016.
2. R.C Hibbeler, Engineering Mechanics, Pearson India, 2010.

Reference Books:

1. Goldstein et. al., Calculus and Its Applications, Pearson, India, 2018.
2. SS Bhavikatti, Engineering Mechanics, New Age International Publishers, 2019.
3. Beer and Johnston, Vector mechanics for engineers, McGraw Hill Education, 2009.
4. S Timoshenko, Engineering Mechanics, McGraw Hill Education, 2017.
5. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, India, 2013.
6. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, New Delhi, India, 2015.

Course Name: Fundamentals of Automation Engineering (ES1104)
Credit: 6; Design Studio – 6 Hrs/week; Tutorial Hours - 2 Hrs/week

Course Description: This course aims at building key technical competencies needed by automation engineers.

Course Outcomes
On successful completion of this course, the students should be able to:
ES1104.1. propose and implement a complete solution for a simple automation problem, including power supply, actuator, sensor, sensitized with energy usage and effects on environment.
ES1104.2. evaluate the benefits and challenges of automation technologies
ES1104.3. explain the importance of adopting suitable engineering standards for automation projects
ES1104.4. use basic management practices for developing automation projects

Evaluation Scheme

Sr. No	**Specifications**	Regular student(s)
01	Attendance	Nil
02	Assignment (03)	10
03	Class Participation & Attendance	Nil
04	Quizzes	10
05	Theory Exam I	10
06	Theory Exam II	10
07	Theory Exam III	20
08	Report -I	Included with Project 1
09	Report-II	Included with Project 2
10	Report-III	Included with Project 3
11	Project -I	10
12	Project -II	10
13	Project -III	10
14	Lab Evaluation I (End Term)	10
15	Lab Evaluation II	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Evaluation scheme for retest.		
1	Theory Exam III	20
2	Lab Evaluation (End Term)	10
	Total (30)	**30**

Unit 1 Introduction to Electrical Engineering – U1

1) Analyze electrical circuits using network theorems
2) Measure electrical parameters of passive as well as active electrical components
3) Design rectifier circuit using semiconductor devices.
4) Design filters for power conditioning.
5) Design and build Printed Circuit Boards.
6) Use electrical safety practices while working on electrical projects.

Unit 2 Introduction to Automation Engineering and Control Systems – U2

1) Design and implement open-loop control system

2) Formulate mathematical models for basic mechanical, electro-mechanical and fluid systems
3) Conduct analysis of dynamic control system.
4) identify the need for feedback in control systems

Unit 3 Introduction to Digital Circuits and Embedded Systems – U3
1) Evaluate and simplify Boolean functions and design the minimized logic using logic gates.
2) Design basic combinational and sequential circuits with minimum complexity
3) Implement various logic functions using software programming with micro controller, to make optimal utilization of resources.
4) Identify the key features of embedded systems in terms of hardware and software
5) Interface sensors and design low power embedded systems projects using microcontroller

Professional Skills
Collaboration, Leadership, Team-work, Social Responsibility.

Teaching Scheme and Credits

Hrs. per Week		Credits	Duration in Weeks
In Class	Out Class	6	6
6 (L) + 2 (T)	4		

Expectations from the Students:
1. To be punctual at sessions and be interactive during discussions
2. To strictly follow safety rules while working on electrical circuits, handle the sophisticated equipment with care and neatly place the tools and equipment in safe place.
3. To dedicate 4-6 hours a week for this course (for self-study and assignments)
4. To demonstrate teamwork by contributing to the overall success of the project.
5. To seek prior concern from instructor(s) is required for absentees.
6. Academic integrity is expected from students.

Expectations from the Faculty Members:
1. To assess student progress by continuous evaluation and provide feedback to students on their performance, fortnightly.
2. To help students to update on latest automation technology used in industry and develop new project ideas.
3. To guide students to work safely and systematically for projects.

Course Feedback: Online Every Fortnight

Project Evaluation Components –

Design of circuit	Skills demonstrated	Time Mgmt.	Sophistication/ neatness in work	Presentation	
				Presentation Skills	Viva
(20%)	(20%)	(10%)	(20%)	(20%)	(10%)

Syllabus: Element of DC network and circuits, Application of network Theorems, Concept of Phasors and power factor calculations. Single phase and three phase wiring and balancing of loads. Semiconductor devices and Rectifier circuit, Transformers and power supply. Safety in handling Electrical equipment.

Introduction to control system: open and closed loops. Block diagrams, Electro-Mechanical models. Simulation for dynamic model of a control system.

Digital circuits for automation: Boolean Algebra, Karnaugh map, Logic gates, Combinational and Sequential Circuits, Displays, Sensors and Microcontrollers for automation: Working principle of sensors. Architecture of ATMega328 (concepts on ALU, memory, ports). Applications on sensors interfacing with microcontroller.

Projects: The course involves three modules which ultimately lead to common goal of developing a dynamic model for cycles developed in course Design and Prototype.

Project 1: Power supply (Specifications:)
Domain Knowledge: AC and DC current, circuit theory, semiconductor pn junction, regulators, filters.

Project 2: Dynamic system modelling for cycle
Domain Knowledge: Control Systems, Dynamic models, Simulation.

Project 3: Digital tachometer for cycle
Domain Knowledge: Digital Logic, developing software for logical functions using microcontrollers.

Text Books:

- WH Hayt, J E Kemmerly, SM Durbin, Engineering Circuit Analysis, Eight Edition, 2013, Mc. Graw Hill, ISBN 978-0-07-352957-8.
- M. Morris Mano, Digital Logic and Computer Design, 1st Edition, 2016, Pearson India Publication, ISBN: 9789332542525.
- S Palani, Control Systems Engineering, 2nd edition,2 August, Mc. Graw Hill Education, ISBN-10: 0070671931.

Reference Books:

- C. L. Wadhwa, "Basic Electrical Engineering", New Age Int. (P) Limited, Publishers, ISBN: 9788122421521.
- Dhananjay Gadre and Nehul Malhotra, Tiny AVR Microcontroller Projects for the Evil Genius, Tata Mc Graw Hill Edition, ISBN: 9780071744546.

Course Name: Object Oriented Programming **Course Code: CS1101**
L-T-P: 1-0-4 **Credits: 3**

Course Description: This course teaches object-oriented programming to those who have learnt basic programming concepts and are ready to learn in-depth programming. It focuses on object-oriented programming using JAVA. The main concepts are: Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, Interfaces, Exception Handling, and Database Connectivity. This course also covers basic concepts for software design and reuse.

Course Outcomes:
On successful completion of this course, the students should be able to:

CS1101.1. Develop Java Programs with the concepts of primitive data types, strings and arrays.
CS1101.2. Develop Java Programs using Object Oriented Programming Principles such as Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, and Interfaces.
CS1101.3. Design, develop and debug programs in Core Java using coding and documentation standards.
CS1101.4. Incorporate exception handling in Java Programs.
CS1101.5. Use JDBC API connectivity in between Java Programs and database.

Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	25
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	10
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
	Total (100)	**100**
Evaluation Scheme for Retest		
	Theory Exam-III	25
	Lab Evaluation-II	10
	Total	**35**

Basics of Java & Decision Statements - Introduction to Java**:** Features of Java, Byte Code and JVM, JDK, JRE; Data types and Operators: Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, ADT, Operator types and precedence, Statements and Flow Control: Conditional statements, looping, return, etc., Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function.
Control Structures, Methods & Constructors - Object Oriented Programming in Java: Object Life time & Garbage Collection.
Methods & Constructors - Constructor & initialization code block, Parameterized Constructor, Loops, Methods.

Array & String - Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Operation on String, Mutable & Immutable String, Collection Bases Loop for String, tokenizing a String, Creating Strings using StringBuffer.
OOP's Concept I - Class Fundamentals, Object & Object reference, Access Control, Modifiers, Methods in Java: Method Declarations, Method Signatures, Invoking Methods,
OOP's Concept II - Static vs. Instance Data Fields, Static vs. Instance Methods, Method Overloading, Encapsulation.
Inheritance, Composition, and Aggregation, Invoking Base Class Constructors, Overriding vs. Overloading, Polymorphism Overloading.
Interfaces - Inner Class & Anonymous Classes, Abstract Class, Interface**s.**
Exception Handling - Introduction to Exception handling.
JDBC Programming - The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, and Updating Database Data.
NOTE: ***Integrated Development Environments (IDEs) to be used in this Course are Eclipse or NetBeans – Both are compatible for Object Oriented Programming using Java.***

References

- Liang, Y. Daniel. Introduction to Java programming: comprehensive version. Pearson Education, 2018.
- Horstmann, Cay S., and Gary Cornell. Core Java 2: Volume I, Fundamentals. Pearson Education, 2016.
- Schildt Herbert. The Complete Reference, Java 2, Fourth Edition. TMH, 2017.

Course Title and Code Energy and Environment Studies ES1105

Hours per Week **L-T-P: 1-0-0**

Credits **1**

Students who can take **B. Tech Semester-II (Compulsory)**

Course Objective:

To enhance the understanding of conventional and non-conventional energy sources and its relationship with the ecology and environment.

Course Outcomes:

On successful completion of this course, the student should be able to:

ES1105.1. Relate renewable energy with ecology & environment

ES1105.2. Explain the climate change and threat to biodiversity

ES1105.3. Describe the various pollution sources and their impacts on Environment

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	10
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	20
8	Report-I	20
9	Report-II	20
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for retest		
1	Theory Exam III	30

Syllabus (Theory):

Unit-1: Present Energy resources in India and its sustainability, Energy Demand Scenario in India- Advantage and Disadvantage of conventional Power Plants – Conventional vs Non-conventional power generation.

Unit-2: Basics of Solar Energy, Wind energy- Environmental benefits and impacts, Biomass resources- Bioenergy, Geothermal Energy.

Unit-3: Understanding environment, global crisis, Basic Concepts Forest and Grassland ecosystems, Desert Ecosystems, Aquatic Ecosystems Introduction to Biodiversity, Biodiversity Conservation.

Unit-4: Air pollution- Sources, effects, control, air quality standards, air pollution act, air pollution measurement. Greenhouse gases – effect, Global Warming, Acid Rain, and Ozone Depletion, Water

Pollution-Sources and impacts, Noise pollution, Soil pollution, Pollution aspects of various power plants.

Reference:

- Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, New Delhi, 2e, 2011
- Ranjit Daniels & J. Krishnaswamy "Environmental Studies", Wiley India
- Davis & Cornwell "Environmental Engineering", McGraw Hill
- Gilbert M. Masters and Wendell P. ELA – Introduction to Environmental Engineering and Science
- W. Cunningham – Principles of Environmental Science, TMH
- P. Venugoplan Rao – Principles of Environmental Science and Engineering, PHI.
- Meenakshi – Environmental Science and Engineering, Prentice Hall India.
- Martin – Ethics in Engineering, TMH

Video Lectures:

- http://www.nptelvideos.in/2012/12/fundamentals-of-environmental-pollution.html
- http://www.nptelvideos.in/2012/11/energy-resources-and-technology.html
- https://nptel.ac.in/courses/122/102/122102006/
- https://nptel.ac.in/courses/127106004/

Websites (related to the course)

- http://www.cpcb.nic.in/
- http://www.rpcb.rajasthan.gov.in
- http://www.bis.org.in/
- http://www.who.int/en/
- http://www.moef.gov.in/

Course Title and Code Critical Thinking and Storytelling CC1102

Hours per Week	**L-T-P: 2-1-0**
Credits	**2**
Students who can take	**B. Tech Semester-II (Compulsory)**

Course Objective:

The modern world offers confounding opinions and choices that need to be navigated judiciously. This course explores frameworks and processes to critically examine narratives, reconstruct them, and craft well-reasoned stories that can be told using impactful communication.

Course Outcomes:

On successful completion of this course, the student should be able to:

CC1102.1. Formulate intelligent questions to investigate.
CC1102.2. Evaluate information and argument for correctness, consistency, relevance and validity.
CC1102.3. Compose well-structured and well-reasoned arguments.
CC1102.4. Articulate and evaluate the impact of narratives.
CC1102.5. Distinguish between facts, assumptions and opinion.

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	30
3	Class Participation	20
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	30 (10% weightage to MOOC course)
8	Report-I	20
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for retest		
1	Theory Exam III	30

Syllabus:

Introduction to Critical Thinking- Definitions of Critical Thinking, its applications and the methods to think critically. Paul & Elder model will be used.

Importance of questioning-The key to critical thinking is the ability to formulate intelligent questions. Students will be able to create, improve and prioritize their questions. They will be able to use different types of question by using Bloom's taxonomy to understand the root of any situation, problem or subject.

Examine data Critically-Students will be able to filter information, separate fact from opinion, identify cognitive biases and become aware of the ladder of inference. They will also be taught to conduct responsible research and basics of bibliography and citation.

Construct and reconstruct argument- Students will be taught to construct arguments with sound reasoning. They will be able to support their claims and opinions with compelling data and facts, and present well-informed arguments. Evaluate argument using logical fallacies.
Building a compelling Narrative- Stories that we create and narrate influence how we see ourselves and our association with others. The students will be able to observe, think, create and narrate their stories in an effective manner.

Text and Reference Books:

- Fisher, A. (2011). Critical thinking: An introduction. Cambridge University Press.
- Fisher, A., & Scriven, M. (1997). Critical Thinking. Its definition and evaluation.
- Dobelli, R. (2013). The art of thinking clearly: better thinking, better decisions. Hachette UK.
- Budden, L. (2007). Critical Thinking Skills: Developing Effective Analysis and Argument. Contemporary Nurse, 25(1-2), 174-175.
- Butterworth, J., & Thwaites, G. (2013). Thinking skills: Critical thinking and problem solving. Cambridge University Press.

Course Title and Code: Scientific Perspectives AS1102

Hours per Week **L-T-P: One week**

Credits **2**

Course Objective: This course aims to develop scientific temper in students and also improve their understanding of basic science fundamentals and their applications in industry and research.

Course Outcomes:

After course completion, the student will be able to:

AS1102.1. Distinguish between science, pseudo-science and other forms of knowledge.

AS1102.2. Distinguish between science, engineering, technology and mathematics and also identify the opportunities for integrating these disciplines.

AS1102.3. Use the scientific approach to identify and understand the societal problems

AS1102.4. Explain, Design and carry out Scientific studies

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	10
4	Quiz	20
5	Theory Exam-I	Nil
6	Theory Exam-II	30
7	Theory Exam-III	Nil
8	Report-I (poster)	25
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Contus.)	Nil
15	Lab Evaluation-II (exam)	15
16	Course Portfolio	Nil
	Total (100)	**100**

Evaluation Scheme for Retest		
Sr. No	**Specifications**	**Marks**
1	Theory Exam-II	30

Syllabus

The philosophical aspects of scientific activity, Introduction to the Philosophy of Science, What is a "scientific theory"? The structure of a scientific theory, the methodology used to obtain scientific knowledge, Requirements to achieve scientific results, Methodology of experiment in engineering studies, the purpose and structure of the experiment, Planning, Analysis of the results, some selected seminal scientific studies.

Reference Books:

- The Scientific Approach: Basic Principles of the Scientific Method by Carlo L. Lastrucci, Schenkman Publishing, 1963
- Trends in Bibliometrics and Scientometrics Studies by Praveen Kumar Jain, Jean-Charles Lamirel, Parveen Babbar, Athena Academic, 2017
- The Evaluation of Research by Scientometric Indicators by Peter Vinkler, Chandos Publishing
- John Stuart Mill's Philosophy of Scientific Method by John Stuart Mill; Ernest Nagel Hafner Press, 1950
- Logic, Inductive and Deductive: An Introduction to Scientific Method by Adam Leroy Jones Henry Holt, 1909
- The Path of Science by C. E. Kenneth Mees; John R. Baker John Wiley & Sons, 1946
- The Logic of Scientific Discovery by Karl R. Popper Basic Books, 1959
- Failure: Why Science Is So Successful by Stuart Firestein Oxford University Press, 2016

Course Title and Code Python Programming CS1301

Hours per Week	**L-T-P: 1-0-2**
Credits	**1**
Students who can take	**B. Tech CSE Semester II (IBM Specialization)**

Course Objective:

The aim of the course is to build up a clear understanding of the fundamentals of Python programming. The course will discuss and cover the topics necessary for the students to write and execute the programs on their own.

Course Outcomes:

On successful completion of this course, the student should be able to:

CS1301.1. Design and program the standalone Python applications.
CS1301.2. Use lists, tuples, and dictionaries in Python programs.
CS1301.3. Identify Python object types.
CS1301.4. Design structure and components of a Python program.
CS1301.5. Use Python Control and Decision-making Structures for writing programs
CS1301.6. Write long iterative programs into recursive code.
CS1301.7. Build programs that related to text analytics.
CS1301.8. Build small graphics and animation programs.
CS1301.9. Design machine learning model to perform data analysis.
CS1301.10. Build own Python packages or modules for reusability.
CS1301.11. Read and write files in Python.
CS1301.12. Use Data Handling Techniques of Python
CS1301.13. Use exception handling in Python applications for error handling, find syntax errors

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	30
3	Class Participation	Nil
4	Quiz	20
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	Nil
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	25
15	Lab Evaluation-II	25
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation policy for retest		
1	Theory Exam-III	Nil
2	Lab Evaluation-I	25
3	Lab Evaluation-II	25
	Total	**50**

Syllabus:

Fundamentals of Python: Beginnings with Python, Parts of a Program: Modules, Statements and Expressions, Whitespace, Comments, Special Python Elements: Tokens, Naming Objects, Variables, Objects and Types, Operators;

Control: The Selection Statement for Decisions: if,

Repetition: for Statement, In-Depth Control: Boolean Variables, Relational Operators, Boolean Operators, Precedence, while Statement, Nesting, Recursion;

Functions: What Is a Function? Python Functions, Flow of Control with Functions, Scope, Arguments, Parameters, and Namespaces, Default Values and Parameters, Functions as Objects;

Files and Exceptions: What Is a File?, Accessing Files: Reading Text Files, Accessing Files: Writing Text Files, Reading and Writing Text Files in a Program, File Creation and Overwriting, Handling Errors: Error Names, The try-except Construct, try-except Flow of Control, Exception;

Strings: The String Type, String Operations, Formatted Output for Strings;

Lists and Tuples: What Is a List? Iteration, Indexing and Slicing, Operators, Lists vs Strings, Split and Other Functions and Methods, Anagrams, Tuples from Lists, Python Diversion: List Comprehension;

Dictionaries and Sets: Dictionaries, Python Dictionaries, Dictionary Indexing and Assignment, Sets, Python Sets, Methods, Operators, and Functions for Python Sets, Set Methods;

Introduction to *Classes*: Object-Oriented Programming, Characteristics of OOP, Class and Instance, Object Methods, Fitting into the Python Class Model, Python and OOP, Python and Other OOP Languages, Classes, Types, and Introspection, Inheritance

Reference Books:

1. William Punch, Richard Enbody, 'The Practice of Computing Using Python'. Pearson, 2016
2. 'Python Training Module'. IBM Academic Initiative, (2019).

Course Title and Code Data Structures**:** CS1102

Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech Semester III (2019-2023) (CSE+ECE)

Course Objective: This course aims to develop understanding for Design, Analysis, and implementation of data structures and algorithms to solve computational problems using an object-oriented programming language. Topics includes introduction to algorithms and complexity analysis (time & space), Recursion, Linear Data Structures (Arrays, Queue, Stack, Linked list), Non-linear data structures (Trees, Graphs), Searching, Sorting, Indexing and Hashing.

Course Outcomes:

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

CS1102.1. Write programs for performing basic operations like insertion, deletion, searching, sorting, merging, traversal etc. on various data structures like array, queue, stack, linked list, tree, graph.

CS1102.2. Use and design appropriate data structures for solving a variety of computational problem.

CS1102.3. Develop test cases for their programs and debug the code.

CS1102.4. Analyze the algorithms in terms of asymptotic time and space complexity.

CS1102.5. Implement and compare various searching and sorting algorithms

CS1102.6. Convert a recursive algorithm to non-recursive algorithm.

Prerequisites		**Programming Language**
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	**20 (Coursera certificate 10 Marks)**
3	Class Participation	**10**
4	Quiz	**20 TCS ION LX**
5	Theory Exam-I	Nil
6	Theory Exam-II	**10**
7	Theory Exam-III	**20**
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	**10 (Hacker Rank)**
15	Lab Evaluation-II	**10 (Hacker Rank)**
16	Course Portfolio	Nil
	Total (100)	**100**

Syllabus (Theory)

Unit I: Introduction to linear Data Structures: Types of Data Structures - Linear & Non-Linear Data Structures. Linear Structures: Arrays: Types, Operations and applications (searching sequential and binary, Sorting: bubble, Insertion, Selection, Quick and Merge sorting algorithms for different characteristics of input data. Complexity analysis, Comparison of sorting algorithms in term of complexity-time and space.

Unit II: Stacks and Queues: Operations and Applications, conversion of expression from one form to other form using stack (with & without parenthesis), Evaluation of expression in infix, postfix & prefix forms using stack, Queues: Operations and Applications, Circular Queues: Operations and Applications, De-queue and Priority queue, Recursion.

Unit III: Linear linked lists: Singly, doubly and circularly connected linear linked lists insertion, deletion at/ from beginning and any point in ordered or unordered lists, Application of linked list for polynomial operations, Comparison of arrays and linked lists as data structures. Implementation of stack, and queue, Algorithms for/of insertion, deletion of stack, and queue implemented using linked list data structure.

Unit IV: Trees: Trees definition, characteristics concept of child, sibling, parent child relationship etc., binary tree: different types of binary trees based on distribution of nodes, threaded binary tree and its application, insertion, deletion and traversal of binary trees, constructing binary tree from traversal results, BST tree: Concept of BST, insertion into and deletion from BST, Height balanced tree: AVL and its operations, Application of trees for representation of sets, Splay Tree and its operation.

Unit V: Graphs: Definition, Relation between tree & graph, directed and undirected graph, representation of graphs using adjacency matrix and list, Depth first and breadth first traversal of graphs, finding connected components and minimum spanning tree- Kruskal and Prims, Dijkstra Algorithm.

Indexing and Hashing: Hashing: The symbol table, Hashing Functions, Collision Resolution Techniques.

Syllabus (Lab):

DS Lab:

1. Write a program to search an element in the array using Linear Search.
2. Write a program to merge two sorted arrays into one sorted array.
3. Write a program to search an element in the array using Iterative and recursive Binary Search.
4. Write a program to implement a program for stack that performs following operations using array.
5. PUSH (b) POP (c) PEEP (d) CHANGE (e) DISPLAY
6. Write a program to implement a program to convert infix notation to postfix notation using stack.
7. Write a program to implement QUEUE using arrays that performs following operations (a) INSERT (b) DELETE (c) DISPLAY
8. Write a program to implement Circular Queue using arrays that performs following operations. (a) INSERT (b) DELETE (c) DISPLAY
9. Write a menu driven program to implement following operations on the singly linked list.

i. Insert a node at the front of the linked list.
ii. Insert a node at the end of the linked list.
iii. Insert a node such that linked list is in ascending order. (according to info. Field)
iv. Delete a first node of the linked list.
v. Delete a node before specified position.
vi. Delete a node after specified position.

10. Write a program to implement stack using linked list.
11. Write a program to implement queue using linked list.
12. Write a program to implement following operations on the doubly linked list.

i. Insert a node at the front of the linked list.
ii. Insert a node at the end of the linked list.
iii. Delete a last node of the linked list.
iv. Delete a node before specified position.

13. Write a program to implement following operations on the circular linked list.

i. Insert a node at the end of the linked list.
ii. Insert a node before specified position.
iii. Delete a first node of the linked list.
iv. Delete a node after specified position.

14. Write a program which create binary search tree.

15. Implement recursive and non-recursive tree traversing methods in-order, pre-order and post-order traversal.
16. Write a program to implement Binary Search Tree.
17. Write a program to implement BFS in a given Graph.
18. Write a program to implement DFS in a given Graph.
19. Write a program to implement stack using linked Dijkstra's Algorithm for given graph.
20. Write a program to implement Kruskal's Algorithm for the given graph.
21. Write a program to implement Prim's Algorithm for the given graph.
22. Write a program to implement Bubble Sort, Selection sort, Insertion Sort in an array.
23. Write a program to implement Merge Sort in an array.
24. Write a program to implement Quick Sort in an array.
25. Write a program to implement Binary Search in an array.

Text Books:

T1. Sahni, Sartaj. Data structures, algorithms, and applications in Java. Universities Press, 2005.
T2. Goodrich, Michael T., Roberto Tamassia, and Michael H. Goldwasser. Data structures and algorithms in Java. John Wiley & Sons, 2014.
T3. Data Structures and Algorithms in Java -- Robert Lafore second edition Sams Publication, 2003

Reference Books:

R1. Introduction to Algorithms, by Cormen, Leiserson, Rivest, and Stein.
R2. Alfred V. Aho, Jeffrey D. Ullman, John E. Hop croft, Data Structures and Algorithms. Pearson Education, 2012

Course Title and Code: Theoretical Foundation of Computer Science: CS1103

Teaching Scheme **L-T-P: 3-1-0**

Credits **4**

Course Objective

This course is aimed to learn the concepts such as logic and proof, algebra, language and grammar, finite automata with an emphasis on applications in computer science so as to build mathematical foundation for the courses in computer science such as algorithms, compiler design, etc.

Course Outcomes:

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

CS1103.1. construct and validate simple computing models which play a crucial role in compiler design, algorithms, etc.

CS1103.2. construct conceptual models using discrete mathematics in various application areas such as linguistic, business, internet, etc.

CS1103.3. develop problem solving and critical thinking skills to solve complex computing problems

CS1103.4. use logics and proofs in order to read, comprehend and construct mathematical arguments

CS1103.5. develop mathematical models of computation and describe how they relate to formal languages

CS1103.6. relate the basic difference between deterministic and nondeterministic computing machines

CS1103.7. Interpret the language accepted by Turing machine.

Prerequisites **Nil**

Evaluation Scheme

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	10
03	Class Participation	10
04	Quiz	20
05	Theory Exam - I	15
06	Theory Exam - II	Nil
07	Theory Exam - III	25
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation-1 (Viva)	05
15	Lab Evaluation-2 (Viva)	15
16	Course portfolio	Nil
	Total	**100**
Retest		
01	Theory Exam - III	25
02	Lab Evaluation-2 (Viva)	15
	Total	**40**

Syllabus

Language of Logic: Proposition, Compound Proposition, Conjunction, Disjunction, Implication, Converse, Inverse & Contrapositive, Bi-conditional Statements, Proof Methods: Vacuous, Trivial,

Direct, Indirect by Contrapositive and Contradiction, Constructive & Non-constructive proof, Counterexample.
Sets and Functions: Sets: Definition and types, Set operations, Partition of set, Cardinality (Inclusion-Exclusion & Addition Principles), Recursive definition of set. Functions: Concept, Properties of Functions, Countable & Uncountable Sets, Composition of Functions, partial order, lattices

Relations: Boolean Matrices, Binary Relation, Adjacency Matrix of Relation, Properties of Relations, Operations on Relations, The Connectivity Relations, Transitive Closure-Warshall's Algorithm, Equivalence relations, Congruence Relations, Equivalence Class, Number of Partitions of a Finite Set, Combinatorics: counting, the Pigeonhole & Generalized Pigeonhole Principles, Generating function, Recurrence relation,

Finite Automata and Regular languages, regular expressions, DFA, NFA, non-regular languages,

Context free grammar (CFG) and Context Free Languages (CFL): Definition, Examples, Derivation, Derivation trees, Ambiguity in Grammar, Inherent ambiguity, Ambiguous to Unambiguous CFG, Push Down Automata (PDA), Equivalence of PDA and CFG, CFG to PDA and PDA to CFG, Two stack PDA, Turing machines (TM): Basic model, definition and representation

Text Books:

5. Kenneth Rosen, Discrete Mathematics and its applications, 5th edition, Tata-McGraw Hill, 2002
6. Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education

References:

1. C.L. Liu, Elements of Discrete mathematics, McGraw-Hill
2. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI
3. Martin J. C., "Introduction to Languages and Theory of Computations", TMH
4. Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI.
5. Video Lecture Series
https://www.youtube.com/playlist?list=PLHXZ9OQGMqxersk8fUxiUMSIx0DBqsKZS

Course Title and Code: Computational Engineering Analysis – I: **ES1106**

Teaching Scheme **L-T-P: 1-0-1**

Credits **5**

Course Objective

The course will cover the basic components of Ordinary Differential Equations (ODE), Complex analysis and Laplace transforms and modelling & simulation of various problems in engineering discipline. Few numerical methods will be introduced to find the numerical solutions of various problems. Various domain specific Engineering problems will be discussed, and appropriate simulation tools will be used for solving them.

Course Outcomes:

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

ES1106.1. Solve ordinary differential equations through various techniques.
ES1106.2. Determine the structural behavior of the body by determining the stresses, strains produced by the application of load.
ES1106.3. Analyze the concept of buckling and be able to solve the problems related to column and struts.
ES1106.4. Model the problems of column and struts mathematically in terms of ordinary differential equations and solve them using the appropriate method.
ES1106.5. Simulate the solutions of the above-mentioned models of columns and struts.
ES1106.6. Analyze a function of complex variables in terms of analyticity, poles and zeroes.
ES1106.7. Find Laplace and inverse Laplace transforms of given function and use Laplace transform to solve ordinary differential equations.
ES1106.8. Design and Evaluate the LC, RC & RL Networks using Foster'sand Cauer Forms
ES1106.9. Analyze stability criteria for electrical network using pole zero plot and routh-hurwitz polynomials
ES1106.10. Model and simulate electrical networks using Proteus simulator/ Virtual lab.

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
01	Attendance	NA
02	Assignment	NA
03	Class Participation	10
04	Quiz	20
05	Theory Exam I	20
06	Theory Exam II	NA
07	Theory Exam III	30
08	Report-1	NA
09	Report-2	NA
10	Report-3	NA
11	Project -1	NA
12	Project -2	NA
13	Project -3	NA
14	Lab Evaluation-1	10
15	Lab Evaluation-2	10
16	Course portfolio	NA
	Total (100)	100
Evaluation Scheme for Re-Test		
1	Theory Exam-III	30
	Total	30

Syllabus

ODE: Ordinary differential equations of first order and first degree, higher order ODEs with constant coefficients, Differential equation of second order with variable coefficients, Numerical solution of ODEs.

Applications of ODE in structural analysis : column and struts - Definitions, Classifications, Assumptions made in the Euler's Column Theory, Expressions for crippling load of different cases like both the ends are hinged or pinned, one end is fixed and other is free, both ends are fixed, one end is fixed other is hinged, Effective length of column, Slenderness ratio, Crippling stress in terms of Effective length and radius of gyration, limitations of Euler's Formula, Rankine's Formula, Eccentric loading, Johnson's Formula for Columns, both straight line and parabolic formula for columns.

Functions of Complex variables: Complex numbers, complex conjugates, functions of complex variables, real and imaginary parts of a complex function, analytic functions, C-R equations, Poles and zeros of a complex function, Taylor's theorem and Taylor's expansion.

Laplace transform: Basic Laplace transform and inverse Laplace Transforms, solution of ODEs using Laplace transform, solution of system of ODEs using Laplace transform.

Network Functions: Concept of complex frequency, transform independence, network functions of one and two port network, concepts of poles and zeros, properties of driving point and transfer functions, time response stability from pole zero plot, Routh-Hurwitz polynomials.

Network Synthesis: Positive real functions, Basic syntheses procedure, method of syntheses, driving point syntheses of one port network (R-L and R-C and R-L-C).

Transient Analysis: Modeling of Resistors, Inductors, capacitors, operating temperature, transient sources and transient output variables. Complete response of RL, RC, and RLC circuits to step, sinusoidal, exponential, ramp, impulses and the combinations of excitations. Initial value and final value theorem.

Textbook:

- Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India.
- Hibbeler, R.C., "Mechanics of Materials", 6th SI edition, Prentice Hall

References:

- Thomas' Calculus, M.D. Weir and J. Hass, Pearson.
- Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.
- Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.
- T.K. Nagsarkar, M. S. Sukhija," Basic Electrical Engineering", Oxford University press, 2nd edition, 2011.
- Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.
- Edminister Joseph A., "Electrical Circuits, Schaum's Outline Series", Tata McGraw Hill, 3rd edition, 2012.
- Hayt W.H., Kemmerly J. E., Durbin S. M., "Engineering Circuit Analysis", Tata McGraw Hill, 6th edition, 2006.
- Beer, F.P., Johnston, E.R., DeWolf, J.T., "Mechanics of Materials", 4th edition, McGraw Hill. Craig, R.R., "Mechanics of Materials", 2nd edition, John Wiley and Sons.

Course Title and Course Code	**Engineering Measurements and Machines (ES1107)**
Hours per Week	**L T P: 3 0 4**
Credits	**5**
Students who can take	**B. Tech Semester-III**

Course Objectives:

The aim of this course is to impart the knowledge of mechanical and electrical machine used in industries. Students will learn the fundamental of engineering principles governing the engineering process and its use in real-world. Students will get the knowledge of sensors, actuators, and its selection process for any industrial application.

Course Outcomes:

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

ES1107.1. Evaluate suitable electrical and non-electrical instruments for measuring physical quantities.

ES1107.2. Analyze the construction, characteristics and applications of various types of rotating machines.

ES1107.3. Analyze the working of any mechanical and electrical machine using mathematical model.

ES1107.4. Integrate the sensors for monitoring and automation of electrical and mechanical systems.

ES1107.5. Design electro-mechanical machines as per Indian standards.

Prerequisites **Basics of Physics**

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	20
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	10
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio (MOOC Course)	10
Total (100)		**100**

Evaluation scheme for Retest		**Marks**
1	Theory Exam	20
2	Lab Evaluation (Exam)	10
Total		**30**

Syllabus (Theory):

Unit-I: Measurement, Instrumentation and Calibration

Introduction, types of applications of measurement instrumentation, performance characteristics, error in measurements, calibration and standards, static and dynamic characteristics of instrument, Measuring Instruments, Digital meters, Function Generators, AC Bridges, Electronic Instruments for Measuring Basic Parameters.

Unit-II: Transducers

Classification of transducers, Selection of transducers, measurement of physical quantities, Elements of data acquisition system, Smart sensors.

Unit-III: Transformers

Construction, principle of operation, equivalent circuit, losses, testing, efficiency and voltage regulation, auto transformer, three phase connections, parallel operation of transformers, tap changing.

Unit-IV: Rotating Machines

DC Machines

Construction, EMF and torque equation, circuit model, armature reaction, methods of excitation, characteristics of generators, characteristics of motors, starting and speed control, testing and efficiency.

Induction Motors: Construction, working principle, classification and applications, equivalent circuit, Torque - slip characteristics, starting and Speed control of induction motors.

Unit-V: Mechanical Machines

Turbines: Introduction to steam turbines, Impulse and Reaction turbines, turbine power and related calculations.

Pumps: Introduction of pumps, centrifugal pumps, working of centrifugal pumps, Cavitation and its effect on pump, working of reciprocating pumps, Application of pumps in industries.

Power Transmission Systems: Mechanical drives and their performance analysis.

List of Experiments:

Measurement

1. To Determine Output characteristics of LVDT and Measure of Displacement Using LVDT.
2. Measurement of Inductance using Maxwell's bridge.
3. Measurement of earth resistance by earth tester and measurement of Insulation resistance by Megger.

Electrical Machines

1. To perform Ratio, Polarity and Load test on a single-phase transformer.
2. To perform open circuit and Short circuit test on a single-phase transformer and hence determine its equivalent circuit parameters.
3. To find the relation between open circuit voltage and field current of:

(i) Separately excited DC generator, (ii) Self excited DC shunt generator

4. Speed control of DC shunt motor: (i) By varying field current with armature voltage constant. (ii) By varying armature voltage with field current kept constant.
5. To perform No load and blocked rotor test on a three-phase Induction Motor, and hence determine its equivalent circuit parameters.

Mechanical Machines

1. To study the performance of turbines used in steam power plant
2. To study the performance of belt drive system used for power transmission.

Text Books:

1. H S Kalsi, Electronic Instrumentation, McGraw Hill Education (India) Private Limited.
2. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd.
3. B. L. Theraja, and A. K. Theraja, Text of Electrical Technology, Vol -2; S. Chand Publication.
4. J B Gupta, Theory and Performance of Electrical Machines, S.K. Kataria and Sons.
5. Ashfaq Hussain, Electrical machines, Dhanpat Rai and Co.
6. P S Bimbhra, Generalised theory of rotating machines, Khanna Publishers.
7. R K Bansal, A Textbook of Fluid mechanics and Hydraulic machines, Laxmi Publication (P) ltd.
8. S S Ratan, Theory of Machines, Tata McGraw-Hill.

Reference Books:

1. Fitzgerald and C. Kingsley Jr., Electric Machinery, McGraw-Hill Book Co.
2. Chapman, Electric Machinery Fundamentals, The McGraw-Hill Companies, Inc.

Online sources:

Electrical Measurement and Electronic Instruments
https://nptel.ac.in/courses/108/105/108105153/
Sensors and Sensor Circuit Design
https://www.coursera.org/programs/j-k-lakshmipat-university-on-coursera-kzogk/browse?index=prod_enterprise_products&productId=487N_QqXEeeqsQo32tjRBA&productType=course&query=Sensor&showMiniModal=true

Electrical Machines
https://nptel.ac.in/courses/108/102/108102146/

Motors and Motor Control Circuits
https://www.coursera.org/programs/j-k-lakshmipat-university-on-coursera-kzogk/browse?index=prod_enterprise_products&page=3&productId=-i5RF2jdEeecwwoEvbWpsg&productType=course&query=Electrical+Machines&showMiniModal=true

Turbines and Pumps
https://nptel.ac.in/courses/112/103/112103249/

Power Transmission Systems
https://www.youtube.com/watch?v=3UaFeNm_ZF8

Perspectives on Contemporary Issues
Course Code: CC1103
Credit: 2
L-T-P: 2-0-1
Course Description:
In an era of globalization, there is an increasing need for the youth to be able to empathize with others, value diverse perspectives and cultures and understand how events around the world are intertwined. Global issues revolve around social, economic and environmental factors which ultimately add to the interconnectedness of countries. In this course, students will employ key critical thinking concepts to analyze contemporary issues from multiple perspectives. They will explore the impact at micro and macro levels.
Course Outcomes:
The students will be able to:
CC1103.1. Identify different perspectives objectively.
CC1103.2. Explain interconnectedness of the issues and their impact at micro and macro levels.
CC1103.3. Recognize their own beliefs, biases, claims and assumptions.
CC1103.4. Evaluate sources, argue and defend effectively.

Evaluation Scheme:

Sr. No	Specifications	Weightage (%)
01	Assignment	20
02	Class Participation	20
03	Theory Exam II	15
04	Theory Exam III	25
05	Report	20
	Total (100)	**100**

Teaching Pedagogy:
This course will be an amalgamation of brief lectures and activity-based learning i.e. films, group discussions, debates, and case studies. The objective behind utilizing activity-based learning is for the learners to have a more hand on experience. This will encourage and ensure active participation and longer retention. The idea is for learners to feel engaged and also express their views in a conducive environment. The takeaway from this course will not only be awareness about certain issues but equipping learners with skills of decision making and reasoning in alignment with certain global contexts.
Course Content:
- **Introduction to contemporary perspective**
- **Research, analysis & evaluation of a topic from local, national and global perspectives on:**
- **Climate Change and Sustainability**

Understanding the magnitude of the issue, its impact and future challenges.
How we can meet our current needs without diminishing the quality of the environment or reducing the capacity of future generations to meet their own needs.
- **Globalization**

With increasing development throughout the world, the focus of this theme will be on the impact of globalization in India**.**
- **Nationalist Movement**

There is a sense that excesses of globalization have created an identity crisis across the world, facilitating the rise of nationalist movements. Rising nationalism is seen everywhere, from the election

of Donald Trump to Brexit, the success of far-right parties in Italian, German and Austrian elections in 2017 and 2018, nationalism appears to be on rise globally. We will look at its reasons and implication**.**

- **Technology**

Impact of unprecedented technological growth, challenges and opportunities.

- **Social justice and human rights**

An understanding of the impact of inequality and discrimination, the importance of standing up for our own rights and our responsibility to respect the rights of others

References for Reading:

1. Harari, Y. N. (2019). *21 Lessons for the 21st century*. Toronto: CELA.
2. Guha, R. (2019). *India After Gandhi: the history of the world's largest democracy*. NEW YORK: ECCO.
3. Rosling, H., Rosling, O., & Rönnlund Anna Rosling. (2019). *Factfulness: ten reasons were wrong about the world* - and why things are better than you think. London: Sceptre.
4. Kolbert, E. (2015). *The Sixth Extinction: An unnatural History.* Bloomsbury

MANAGEMENT PERSPECTIVES (IL1101)
COURSE CREDITS: 2

COURSE DESCRIPTION:
The present course is an introductory and integrative action encapsulated course designed for the engineering students to introduce them to management discipline and the core functional areas contributing to it. This course adopts the integrated problem-oriented approach via the use of cases and simulation. It implies that complex business problems, in the form of cases and simulations require students to understand different dimensions of the problem and come up with holistic solutions. The course will help students to be familiar with trending management issues and at the same time apply the knowledge gained.

COURSE OUTCOMES
After completion of this course, the students will able to:
IL1101.1. Comprehend the importance of management and its functional areas in businesses and also its interaction with technology.
IL1101.2. Highlight specific external and internal issues impacting businesses.
IL1101.3. Integrate and analyze multiple dimensions of management aspects to solve business problems.
IL1101.4. Evaluate the aspects that management might consider when evaluating technical and engineering projects such as planning and scheduling, personnel management, cost control etc. from a management perspective

ASSESSMENT MATRIX
The criteria for assess the course outcomes of this course are as follows:

S.No.	**Specification**	**Marks**
1	Attendance	**10**
2	Assignment	Nil
3	Class Participation	**10**
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	**40**
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	**40**
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total	**100**

TOPICS TO BE COVERED:
HR
1. Business organization- Current challenges
2. HR and its growing importance.
3. Overview of people management systems

4. Recent trends shaping HR.

Economics:

1. Introduction of important concepts of Micro and Macro Economics
2. Key Features of Indian Economy
3. Understanding of economic environment of business

Marketing:

1. Marketing Process
2. Elements of Marketing Mix
3. Segmentation, Targeting and Positioning

Finance and Accounts:

1. Understanding Accounting Terms
2. Overview of Financial Reports, viz., Balance Sheet, Income Statement, Cash Flow Statement
3. Interface of Balance Sheet and Income Statements
4. Types of Costs and assessing and ascertaining Costs

BOOKS FOR REFERENCE

- Aswathappa, K. (2008) - Human Resource Management Text and Cases,Tata McGraw Hill New Delhi.
- Rao VSP (2002)– Human Resource Management, Text and Cases,Excel Book, New Delhi
- Armstrong, G. and Kotler, P. (2017). Marketing: An Introduction. New Delhi: Pearson Education.
- Ramaswamy, V. S., & Namakumari, S. (2013). Marketing Management: Global Perspective, Indian Context. New Delhi: Macmillan (India) Limited.
- T. R. Jain (Latest Edition). Economics for Engineers. New Delhi: V K Publications.
- Ramachandran N & Kakani K.Ram.(2017). How to Read a Balance Sheet,2/e. New Dehi: Mc Graw Hill Publications.
- Mott Graham. (2008). Accounting for Non-Accountants: A Manual for Managers and Students. Kogan Publication.
- Goyal, V.K. & Goyal, Ruchi. (2016). Financial Accounting, 4/e, New Delhi: PHI Learning Pvt. Ltd. [ISBN. -978-81-203-4626-0]

Course Title and Code:	**Data Visualisation CS1310**
Hours per Week	**L-T-P: 2-0-2**
Credits	**3**
Students who can take	BTech. CSE Sem III (2019-2023)

Course Objective- The Data Visualisation course provides a way to summarize the findings and display it in a form that facilitates interpretation and can help in identifying patterns or trends. In this course, students will learn how to create interesting graphics and charts using Python, R & Tableau and customize them to make more effective and insightful.

Course Outcomes (Provided by IBM):

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

CS1310.1. Present the data in a form that makes sense to people.
CS1310.2. Apply various techniques for presenting data visually with R
CS1310.3. Make use of data visualization libraries in Python, viz. Matplotlib, Seaborn, and Folium.
CS1310.4. Create own data science projects using Tableau.

Evaluation Scheme		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment *****	20
03	Class Participation	Nil
04	Quiz	10
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	Nil
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	30
14	Lab Evaluation-I	20
15	Lab Evaluation-II	20
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Quiz	10
2	Lab Evaluation-II	20
	Total	**30**

Syllabus (Theory)

Introduction to Statistics, Descriptive vs Inferential statistics, Inferential Statistics,
Drawing Inferences from Data, Random Variables, Sample Statistics and Sampling Distribution, R overview and Installation, Overview and About R, Installing RStudio
Descriptive Data analysis using R, Description of basic functions used to describe data in R, Data manipulation with R, Introduction to dplyr (filter, select, arrange, mutate, summarize), Introduction to data.table, Introduction to reshape package, Introduction to tidyr package, Introduction to Lubridate package, Data visualization with R, Working with Base R Graphics (Scatter Plot, Bar Plot, and Histogram), Working with ggplot, Data visualization in Watson Studio, Adding data to data refinery Visualization of Data on Watson Studio.

Introduction to Python, Python and Anaconda Installation, Introduction to Jupyter Notebook, Python scripting basics, Numpy and Pandas, Numpy overview - Creating and Accessing Numpy Arrays, Introduction to pandas, Pandas read and write csv, Descriptive statistics using pandas, Pandas working with text data and date time columns, Pandas Indexing and selecting data, Pandas- groupby, Merge/Join datasets

Introduction to Data Visualization Tools in Python, Introduction to Matplotlib, read a CSV and Generate a line plot with matplotlib, Basic plots using matplotlib, Area plot, Bar Chart, Histogram, Specialized Visualization Tools using Matplotlib, Pie Charts, Box Plot, Scatter Plots, Bubble Plots, Advanced Visualization Tools using Matplotlib, Waffle Chart, Word Clouds, Introduction to Seaborn, Seaborn functionalities and usage.

Reference Books:

- Collins, Robert. Data Visualization: Introduction to Data Visualization with Python, R and Tableau. CreateSpace Independent Publishing Platform, 2018.
- Wickham, Hadley, and Garrett Grolemund. R For Data Science: Import, Tidy, Transform, Visualize and Model Data. Beijing: O'Reilly, 2017.

Course Title and Code: Design and Analysis of Algorithms: CS1105	
Hours per Week	**L-T-P: 3-0-4**
Credits	**4 (CSE)**

Course Objective:

This course introduces an understanding of the design and analysis of algorithms. The course aims to develop a familiarity with important algorithms and data structures and an ability to analyze the asymptotic performance of algorithms. It will equip the students to apply important algorithmic design paradigms and methods of analysis to develop efficient algorithms in common engineering design situations.

Course Outcome:

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

CS1105.1. Analyze the complexity of different algorithms using asymptotic analysis.

CS1105.2. Analyze and select an appropriate data structure for a computing problem.

CS1105.3. Differentiate between different algorithm designs technique: Divide and Conquer Technique, Greedy, Backtracking, and Dynamic Programming. Also, recognize when an algorithmic design situation calls for using these.

CS1105.4. Develop algorithm and programs using Divide and Conquer technique to solve various computing problems, e.g., Sorting, Strassen's matrix multiplication, and Closest pair.

CS1105.5. Develop energy-efficient algorithms and programs using Greedy approach to solve various computing problems, e.g., Minimum Spanning Trees, Shortest Path, Knapsack, Job scheduling, Graph coloring etc.

CS1105.6. Develop algorithms and programs using Backtracking technique to solve various computing problems, e.g., N queen, Hamiltonian Cycle detection, Travelling salesman, and Network flow.

CS1105.7. Develop algorithms and programs using Dynamic Programming technique to solve various computing problems, e.g., Knapsack, Shortest path, Coinage, Matrix Chain Multiplication, Longest common subsequence.

CS1105.8. Apply Query optimization algorithms using Greedy and Dynamic programming approaches.

CS1105.9. Apply various search-based problem-solving methods e.g., Uninformed search (BFS, DFS, DFS with iterative deepening), Heuristics, and Informed search (hill-climbing, generic best-first, A*).

CS1105.10. Evaluate and apply appropriate energy efficient algorithmic design technique for solving complex computing problem.

CS1105.11. Explain the ways to analyze randomized algorithms (expected running time, probability of error).

CS1105.12. Differentiate between P, NP, NP-Complete, and NP-Hard problems.

Prerequisites: Nil

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	10
04	Quiz	20
05	Theory Exam– 1	Nil
06	Theory Exam – 2	10
07	Theory Exam–3	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation-1	15

15	Lab Evaluation-2	15
16	Course portfolio	Nil
	Total (100)	100

Retest Evaluation Scheme		
1	Theory Exam–3	20
2	Lab Evaluation-2	15
	Total (35)	**35**

Syllabus (Theory):

UNIT I: Introduction: Algorithms, Analyzing algorithms, Complexity of algorithms, Growth of functions, Performance measurements, Types of approaches.

UNIT II: Selection sort, Bubble sort, Insertion Sort, Shell sort, Quick sort, Merge sort, Heap sort, sorting in linear time: Radix sort, Counting Sort, Comparison of sorting algorithms, Divide and Conquer with examples such as Sorting, Matrix Multiplication, Convex hull and Searching

UNIT III: Greedy methods with examples such as Optimal Reliability Allocation, Knapsack, Minimum Spanning trees – Prim's and Kruskal's algorithms, Single-source shortest paths - Dijkstra's and Bellman-Ford algorithms.

UNIT IV: Dynamic programming with examples such as Knapsack, all pair shortest paths – Warshal's and Floyd's algorithms, Resource allocation problem, Backtracking, Branch and Bound with examples such as Travelling Salesman Problem.

UNIT V: Selected Topics: String Matching, Huffman Coding, Theory of NP-completeness, Approximation algorithms and Randomized algorithms.

Text Book(s)

1. Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest, "Introduction to Algorithms", Prentice Hall of India. 2002

Reference Book(s)

1. RCT Lee, SS Tseng, RC Chang and YT Tsai. Introduction to the Design and Analysis of Algorithms. Mc Graw Hill, 2005.
2. E. Horowitz & S Sahni. Fundamentals of Computer Algorithms. 1984
3. Berman, Paul. Algorithms. Cengage Learning. 2002
4. Aho, Hopcraft, Ullman, The Design and Analysis of Computer Algorithms. Pearson Education, 2008.

Syllabus (Practical):

1. SEARCHING AND SORTING BASED PROBLEMS

I. Implement an algorithm to find an element in a matrix in which each row and each column is sorted.
II. Implement an efficient algorithm to find a majority element in an array. A majority element is one whose number of occurrences is more than half the size of the array.
III. Given an array [a1 to an] and we must construct another array [b1 to bn] where bi = a1*a2*...*an/ai. You are allowed to use only constant space and the time complexity is O(n). No divisions are allowed
IV. Implement the following sorting algorithms: Insertion, Selection, Bubble, Count, Shell, Radix

2. DIVIDE AND CONQUER

I. Write a program to implement the merge sort using recursive and non-recursive procedures.
II. To implement finding greatest common divisor between two positive integers.
III. To implement Matrix Multiplication and analyze its time complexity.
IV. To implement Quick sort on the given list of elements by considering pivot as the median of the 3 values first, middle and last value.

3. GREEDY AND DYNAMIC PROGRAMMING

I. To implement Longest Common Subsequence problem and analyze its time complexity.
II. To implement minimum spanning tree using Kruskal's and Prim's algorithms.
III. To implement Dijkstra's algorithm and analyze its time complexity.
IV. To implement Job sequencing problem using greedy approach
V. To find whether a set of integers can be divided into two subsets such that the sum of elements in each set is equal using dynamic programming.
VI. To implement 0/1 knapsack using dynamic programming.

4. BACKTRACKING AND BRANCH-BOUND TECHNIQUES

I. To implement graph coloring problem using backtracking
II. To implement DFS graph search algorithm
III. To implement Travelling Salesman problem using backtracking.

5. STRING MATCHING

I. To implement naïve String-Matching algorithm.
II. To implement Rabin Karp algorithm using.
III. To implement Knuth Morris Pratt algorithm and analyze its time complexity.

6. PROBLEM SOLVING BY SEARCH

I. To implement uninformed and informed search techniques for problem solving
II. To solve 8 puzzle problem
III. To solve n-queen problem

NPTEL Swayam Course:

1. https://nptel.ac.in/courses/106/106/106106127/
2. https://nptel.ac.in/courses/106/102/106102064/
3. http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html

Course Title and Code: Database Systems; CS1106	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	Sem IV (2019-2023)

Course Objective: This course introduces the fundamental concepts of database systems and modelling of real-world problems using ER-model /UML and to convert ER model into relational model. This course helps students to work with Database management system to develop and manage database. This course helps students to implement SQL and to normalize a given database. It also includes transaction management and methods
of concurrency control.

Course Outcome:

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

CS1106.1. Outline database system components and their functions

CS1106.2. Model the real-world systems from the given requirements specification using Entity Relationship Diagrams/Unified Modelling Language

CS1106.3. Convert the ER model into a relational logical schema using various mapping algorithms

CS1106.4. Apply SQL commands to define, query and manipulate a relational database

CS1106.5. Apply SQL coding standards to embed SQL in an application program

CS1106.6. Write relational algebra expressions and optimize the same for given query

CS1106.7. Convert relational algebra expressions into SQL commands and vice versa

CS1106.8. Normalize a given database up to Boyce Codd Normal Form (BCNF) based on identified keys and functional dependencies

CS1106.9. Determine the transaction atomicity, consistency, isolation, and durability for a given transaction-processing system.

CS1106.10. Determine the deadlock in transaction-processing system. Apply the method of deadlock avoidance and deadlock detection and recovery

CS1106.11. Apply various concurrency control protocol like two phase locking, timestamping and the method of log base recovery in case of failure

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	15
03	Class Participation	Nil
04	Quiz	15
05	Theory Exam-I	NIL
06	Theory Exam-II	NIL
07	Theory Exam-III	30
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	20
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation I (Continuous)	10
15	Lab Evaluation II	10
16	Course portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-III	30
2	Lab Evaluation II	10
	Total	**40**

Syllabus (Theory)

UNIT I: Basic Concepts: data, database, database systems, database management systems, instance, schema, Database Applications, Purpose and Advantages of Database Management System (over file systems); Dynamic web applications, Database design standards, Web design standards;

View of Data (Data Abstraction, Data Models), Database Languages (DML, DDL), Relational Databases (Tables, DML, DDL), Data Storage and Querying (Components, Storage Manager, Query Processor), Database Architecture, Database User and Administrators

UNIT II: Design Phases, Design Alternatives (Major Pitfalls), Entity Relational Model (Entity Sets, Relationship Sets, Attributes), Constraints (Mapping Cardinalities, Keys, Participation Constraints), Entity Relationship Diagram, Weak Entity Set, Extended E-R features (Generalization, Specialization and Aggregation), E-R Notations, Examples of ERD

U**NIT III:** Features of Good Relational Design, Atomic Domain and First Normal Form, Decomposition Using Functional Dependency (Key and Functional Dependency, BCNF, 2NF, 3NF), Functional Decomposition Theory (Closure Set of Functional Dependency with Armstrong Rules, Canonical Cover and Loseless Decomposition), Dependency Preservation, Comparison of 3NF and BCNF, Decomposition Using Multi-Valued Dependencies (Multi-Valued Dependency and 4 NF);

UNIT IV: Structure of Relational Databases (Basic Structure, Database Schema, Types of Keys), Fundamental Relational Algebra Operations (Select, Project, Union, Set Difference, Cartesian Product and Rename Operator), Additional Relational Algebra Operators (Set Intersection, Natural Join, Division Operator, Assignment Operator), Examples

UNIT V: (Transaction State, Basic Definitions, ACID Property), Implementation of Atomicity and Durability (Shadow Paging Concept), Concurrent Execution (Reasons of Concurrent Execution, Serial and Concurrent Schedule), Serializability (Conflict and View Serializability), Recoverability of Schedules (Recoverable Schedule and Cascade- less Schedule), Lock-based Protocol (Types of Lock and Deadlock Concept), Two-Phase Locking Protocol, Deadlock Handling (Deadlock Prevention Techniques like Wait-Die, Wound-Wait), Recovery of Deadlock (Selection of victim, Rollback, and Starvation), Insert and Delete Operations (Delete, Insertion, Phantom Phenomenon), Transaction Failure, Storage Structure and Transaction Log and Log-Based Recovery (Deferred Database Modification, Immediate Database Modification, Checkpoints).

Syllabus (Practical)

Introduction to SQL, Advantages of using SQL, SQL concepts and tools, The generic SQL Sentence Construct, Create Table, Insertion of Data into tables, Viewing data in the tables, Delete Operations, Update Operations, Modifying the structure of tables, Renaming Tables, Destroying Tables, Examining Objects created by a User, Arithmetic Operators, Logical Operators, Range Searching, Pattern Matching, Column Alias, Aggregate Functions, Scalar Functions, Date Conversion Functions, Data Constraints, Defining integrity constraints in the alter table command, Dropping integrity constraints in the alter table command, Default Value Concept, Grouping Data from tables, Manipulating dates in SQL, Subqueries, Joins, Union, Intersect and Minus Clause, Index, View, Sequence

Reference Books:

- Silberschatz, Abraham, Henry F. Korth, and Shashank Sudarshan. *Database system concepts*. Vol. 4. New York: McGraw-Hill, 1997.
- Date, Christopher John. *An introduction to database systems*. Pearson Education India, 2006.
- Singh, Shio Kumar. *Database systems: Concepts, design and applications*. Pearson Education India, 2011.
- Elmasri, Ramez, and Shamkant Navathe. *Fundamentals of database systems*. Addison-Wesley Publishing Company, 2010.
- Coronel, Carlos, and Steven Morris. *Database systems: design, implementation, & management*. Cengage Learning, 2016.

Course Title and Code: Computer Architecture and Organization: CS1107	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech. CSE IV

Course Objectives: To study the basic organization and architecture of digital computers (CPU, memory, I/O, software). Discussions will include digital logic and microprogramming. Learners would be able to program to optimize cache hit and estimate cost of different hardware for the number systems. Such knowledge leads to better understanding and utilization of digital computers, and can be used in the design and application of computer systems or as foundation for more advanced computer-related studies.

Course Outcome:

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

CS1107.1. Draw the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

CS1107.2. Summarize and compare different computer systems.

CS1107.3. Categorize different types of computers based on Instruction set Architecture.

CS1107.4. Develop assembly language programs for multiplication, division, and I/O interface using 8086.

CS1107.5. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.

CS1107.6. Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.

CS1107.7. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

CS1107.8. Analyze the performance of pipeline and cache-based systems.

CS1107.9. Design algorithms to optimize hit-rate in cache memory.

CS1107.10. Program and estimate the execution time of arithmetic functions using different number systems.

Prerequisites		**Basics of Computer Networks**
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	**10**
3	Class Participation	Nil
4	Quiz	**20**
5	Theory Exam-I	Nil
6	Theory Exam-II	**20**
7	Theory Exam-III	**30**
8	Report-I	Nil

9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	**20**
16	Course Portfolio	Nil
	Total (100)	**100**
Re-Test Evaluation		
	Theory Exam-III	**30**
	Total:	**30**

Course Syllabi (Theory):

Unit I: BASIC STRUCTURE OF COMPUTERS: Functional units, Basic operational concepts, Bus structures, Performance and metrics, Number Systems, Instructions and instruction sequencing, Hardware-Software Interface, x86 Architecture, Instruction set architecture, Addressing modes, RISC, CISC. ALU design, Fixed point and floating-point operations.

Unit II: BASIC PROCESSING UNIT: Fundamental concepts, Execution of a complete instruction, Multiple bus organization, Hardwired control, Micro programmed control, Nano programming.

Unit III: PIPELINING: Basic concepts, Data hazards, Instruction hazards, Influence on instruction sets, Data path and control considerations, Performance considerations, Exception handling.

Unit IV: MEMORY SYSTEM: Basic concepts, Memory Hierarchy, Semiconductor RAM, ROM, Speed, Size and cost, Cache memories, Improving cache performance, Virtual memory, Memory management requirements, Associative memories, Secondary storage devices.

Unit V: I/O ORGANIZATION: Accessing I/O devices, Programmed Input/Output, Interrupts, Direct Memory Access, Buses, Interface circuits, Standard I/O Interfaces (PCI, SCSI, USB), I/O devices and processors.

Text Books:

- Mano, M. Morris. "Computer system architecture, 1993." Prentice Hall 3: 299.
- Stallings, William. Computer organization and architecture: designing for performance. Pearson Education India, 2003.

Reference Books:

- Patterson, David A., and John L. Hennessy. Computer Organization and Design MIPS Edition: The Hardware/Software Interface. Newnes, 2013.
- Hayes, John P. Computer architecture and organization. McGraw-Hill, Inc., 2002.
- Heuring, Vincent P., Harry Frederick Jordan, and Miles Murdocca. Computer systems design and architecture. Addison-Wesley, 1997.

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
ES1109	Computational Engineering Analysis – II	3	1	2	0	5

Course Objectives: The course will develop ability to use Partial Differential Equations (PDE), Fourier transforms and Z-transform for a variety of Engineering applications from fluid dynamics, heat conduction and circuit design. It also aims to develop skills for using common simulation Platforms i.e., Virtual lab /Python/ MATLAB. Few numerical methods will also be introduced to find the numerical solutions of various problems.

Course Outcomes:

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

ES1109.1. Classify various types of partial differential equations and solve them through various analytical and numerical methods.

ES1109.2. Formulate and analyze differential equations especially Navier stokes and energy equations and use numerical methods for solving the same.

ES1109.3. Use Numerical method for solving partial differential equations using finite difference method.

ES1109.4. Find Fourier and inverse Fourier transforms of given function and use Fourier transform to solve partial differential equations.

ES1109.5. Find Z-transform and inverse Z-transforms of given functions and use them to analyze control systems.

ES1109.6. Design and analyse various types of filters and attenuators to minimize power losses and improve signal quality.

ES1109.7. Solve problems involving vertex and edge connectivity, planarity and crossing numbers.

Evaluation Scheme:		
Sr. No	**Specifications**	**Marks**
1	Attendance	-
2	Assignment	10
3	Class Participation	10
4	Quiz	15
5	Theory Exam-I	15
6	Theory Exam-II	-
7	Theory Exam-III	30
8	Report-I	-
9	Report-II	-
10	Report-III	-
11	Project-I	-
12	Project-II	-
13	Project-III	-
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	-
	Total (100)	**100**

Evaluation policy for retest	
Theory Exam-III	30
Total	30

Course Syllabi (Theory):

PDE: Partial Differential Equations of First Order, Variable separable technique for solving PDE. Heat equation, wave equation, Laplace equation

Boundary value problems: Solution of boundary value problems using separation of variables technique. Numerical solution of PDE.

Application of PDE: Momentum and Energy Transport:

The governing equations of fluid dynamics- models of the flow, continuity equation, momentum equation, Energy equation, boundary conditions. Poisouli's flow, Couette flow, steady and unsteady conduction.

Fourier Transforms: Fourier transform and inverse Fourier transform, properties of Fourier transform, Applications in solving Partial differential equations.

Filter Circuits: Types of passive filters, design low-pass, High-pass, Band-pass, Band-reject filters as constant k type, design low-pass, High-pass, Band-pass, Band-reject filters as RC type, Advantages of active filters over passive filters.

Graph Theory: Introduction, Linear graph of a network, Tie-set and cut-set schedule, incidence matrix, cut-set, and tie-set. Graph theory application to a practical radial system.

Z-transform: Introduction, standard z- transform, properties of z – transform, initial and final value theorems, inverse z-transform, applications in control systems.

Textbook:

1. Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India.
2. White F. M., "Fluid Mechanics" Tata McGraw-Hill, New Delhi.
3. Incropera F P "Principles of Heat and Mass Transfer", John Wiley & Sons.
4. Hayt W.H., Kemmerly J. E., Durbin S. M., "Engineering Circuit Analysis", Tata McGraw Hill, 6th edition, 2006.

Reference Books –

1. Thomas' Calculus, M.D. Weir and J. Hass, Pearson.
2. Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.
3. Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.
4. Fox and McDonald, "Introduction to fluid dynamics", John Wiley & Sons.
5. Cengel Y. "Heat and Mass Transfer" Tata McGraw-Hill, New Delhi.
6. J. D. Anderson Jr. "Computational Fluid Dynamics" McGraw-Hill International Edition.
7. Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.
8. Edminister Joseph A., "Electrical Circuits, Schaum's Outline Series", Tata McGraw Hill, 3rd edition, 2012.

Course Title and Code: Communication and Identity: CC1104

Course Description:

This course enables students to explore their personal and professional identities, to create their distinctive presence. It intends to help them gain an understanding of the basic purpose, benefits, and responsibilities of self-presence, and to begin the process of defining their values, strengths, and goals, which helps them enhancing their employability skills through exposing themselves through various activities.

Course Outcomes

CC1104.1. Analyse their personal identities, both private and social
CC1104.2. Identify their different values, strengths and areas of professional interest
CC1104.3. Articulate their personal statement and use it to craft an influential pitch
CC1104.4. Express themselves through various communication formats on different platforms

Prerequisites		**N/A**
Hours per Week		**L-T-P: 2-1-0**
Credits		**2**
Sr. No	**Specifications**	**Weightage**
01	Attendance	**NIL**
02	Assignment	**30**
03	Class Participation	**30**
04	Viva	**20**
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	**20**
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Module	**Topics/ Session no.**	**Topics to be Covered**
Identifying Self	Factor that shape our identity	The 3 Types of Diversity That Shape Our Identities. Three things: demographic diversity (our gender, race, sexual orientation, and so on), experiential diversity (our affinities, hobbies, and abilities), and cognitive diversity (how we approach problems and think about things).
	Internal confidence or "principle-centred living"	Living a principle-centred life is the key to excelling in all other areas of our living. A principle is based on the fundamental idea that there is learned behavior that governs human effectiveness.

	Personal Statement	Use of story map to create a personal statement.
Persuasive Communication	Steps to build a Personal Brand	Personal branding: meaning, importance and how to create and use it; the three Cs' of personal branding and
	Online presence	Creating an online presence for professional and personal branding through social media. (LinkedIn, Facebook etc.)
	Elevator Pitch, Cover Letter	Elevator Pitch: Meaning and use of an elevator pitch in interview and workplace; techniques to craft and improve their pitch Purpose of a cover letter, types of the cover letter, the structure of a cover letter and tips on the cover letter, to craft their cover letter to be used for placements
	Presence in Group Discussion and Personal Interviews	Practice different types of group discussions, dos and don'ts of group discussions and use of techniques to perform well in GDs
Assessments		

1. Self- identity

1. *When Your Job Is Your Identity, Professional Failure Hurts More*
   Timothy O'Brien
   Pub Date: Jun 18, 2019
   Source: Harvard Business School Publishing - HBD
   Product #: H050HO-PDF-ENG
   Discipline: General Management
   Length: 1106 words

2. *The 3 Types of Diversity That Shape Our Identities*
   Celia de Anca; Salvador Aragón
   Pub Date: May 24, 2018
   Source: Harvard Business School Publishing – HBD
   Product #: H04BSY-PDF-ENG
   Discipline: Human Resource Management
   Length: 1004 words

3. *Coaching Makena Lane*
   Ethan S. Bernstein; Om Lala
   Pub Date: Oct 1, 2017
   Source: HBS
   Product #: 418031-PDF-ENG
   Discipline: Organizational Behavior
   Length: 24 p

4. *The Talent Curse*
Jennifer Petriglieri; Gianpiero Petriglieri
Pub Date: May 1, 2017
Source: Harvard Business School Publishing - HBD
Product #: R1703E-PDF-ENG
Discipline: General Management
Length: 8 p

2. Personal Statement

1 *From Purpose to Impact*
Nick Craig; Scott A. Snook
Pub Date: May 1, 2014
Source: Harvard Business School Publishing - HBD
Product #: R1405H-PDF-ENG
Discipline: General Management
Length: 9 p

3. Internal confidence or "principle centered living"

1 *Cultivating Everyday Courage*
James R. Detert
Pub Date: Nov 1, 2018
Harvard Business School Publishing - HBD
Product #: R1806K-PDF-ENG
Discipline: General Management
Length: 9 p

4. Steps to build Personal Brand

1 *A Strategic Marketing Plan to Successfully Deliver Your Professional Brand*
Kimberly A Whitler
Pub Date: Oct 20, 2015
Source: University of Virginia Darden School Foundation
Product #: UV7572-PDF-ENG
Discipline: Marketing
Length: 7 p

2 *Sadiq Gillani's Airline Career Takes Off: Strategy in Action*
Jeffrey Pfeffer
Pub Date: Nov 30, 2018
Source: Stanford University
Product #: OB95-PDF-ENG
Discipline: Organizational Behavior
Length: 17 p

3 *How Women Can Develop - and Promote - Their Personal Brand*
Dorie Clark
Pub Date: Mar 2, 2018
Source: Harvard Business School Publishing - HBD
Product #: H046PA-PDF-ENG

Discipline: Human Resource Management
Length: 1419 words

5. Online presence

1 *What's Your Personal Social Media Strategy?*
Soumitra Dutta
Pub Date: Nov 1, 2010
Source: Harvard Business School Publishing - HBD
Product #: R1011L-PDF-ENG
Discipline: Organizational Behavior
Length: 6 p

6. Resume, Elevator Pitch, Cover Letter

1 *The Art of the Elevator Pitch*
Carmine Gallo
Pub Date: Oct 3, 2018
Source: Harvard Business School Publishing - HBD
Product #: H04KFL-PDF-ENG
Discipline: General Management
Length: 992 words

2 *Writing Your Résumé When Your Job Title Doesn't Reflect Your Responsibilities*
Jane Heifetz
Pub Date: May 16, 2017
Source: Harvard Business School Publishing - HBD
Product #: H03NAN-PDF-ENG
Discipline: Human Resource Management
Length: 1243 words

3 *Improve Your Résumé by Turning Bullet Points into Stories*
Jane Heifetz
Pub Date: May 4, 2016
Source: Harvard Business School Publishing - HBD
Product #: H02UR4-PDF-ENG
Discipline: Human Resource Management
Length: 1481 words

7. Presence in Personal Interviews

1. *15 Rules for Negotiating a Job Offer*
Deepak Malhotra
Pub Date: Apr 1, 2014
Source: Harvard Business School Publishing - HBD
Product #: R1404K-PDF-ENG
Discipline: General Management
Length: 5 p

2. *How to Show You're Passionate in a Job Interview*
Sabina Nawaz
Pub Date: Apr 24, 2019

Source: Harvard Busines School Publishing - HBD
Product #: H04WSV-PDF-ENG
Discipline: Human Resource Management
Length: 724 words
How to Highlight Your Talents in a Job Interview Without Showing Off
Tomas Chamorro-Premuzic PhD.
Pub Date: Dec 28, 2017
Source: Harvard Business School Publishing - HBD
Product #: H0436N-PDF-ENG
Discipline: Human Resource Management
Length: 1139 words

Course Title and Code: Introduction to Design IL1102	
Hours per Week	30
Credits	2
Students who can take	2nd Year B. Tech

Course Objective: The students are going to explore the world of hand-crafted toys and animation during this week. Thus, taking an idea forward from an intangible thought to a material-based product or communicating it visually. The toys we explore will be designed in relevance to the audience group that the students choose.

Course Outcome:

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

IL1102.1. Identify the user and build its persona.
IL1102.2. Sketch their ideas on paper to visualize and assess viability.
IL1102.3. Create a plan for process and management to materialize the desired idea.
IL1102.4. Test the material for possibilities and capabilities.
IL1102.5. Develop skills of joinery, material manipulation and various hand tools.
IL1102.6. Develop technical and narrative skills useful for both film and animation.
IL1102.7. Develop troubleshooting and problem-solving skills.

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	Nil
5	Theory Exam I	Nil
6	Theory Exam II	Nil
7	Theory Exam III	Nil
8	Report-1	Nil
9	Report-2	Nil
10	Report-3	Nil
11	Project -1	35
12	Project -2	35
13	Project -3	Nil
14	Lab Evaluation1	Nil
15	Lab Evaluation2	Nil

16	Course portfolio	Nil
	Total (100)	**100**

Course Contents:

1. Introduction to Design Process for making Toys.
2. Material properties – Cardboard, Epoxy Putty, Wire, Thread
3. Material joinery
4. Use of tools – Plier, Paper Cutter, Basic Stationery
5. Developing creative thinking.
6. Basic drawing and visualisation skills including 2D to 3D - Form exploration.
7. Principles of animation.
8. Technical aspects of animation and film making (Frame rate, persistence of vision).
9. Building a Narrative – Start, Middle and End of a story.
10. Mediums of animation.

Suggested Reading Materials:

1. https://en.wikipedia.org/wiki/Toy
2. https://en.wikipedia.org/wiki/Category:Traditional_toys (Hover over the categories to see the thumbnail)
3. https://fashion.mithilaconnect.com/6-popular-traditional-toys-in-india/
4. Simple wooden toymaking by Mathias, available at MP Ranjan LRC Call number: 745.592
5. https://www.etsy.com/market/toys_handmade
6. https://www.dutchcrafters.com/Amish-Toys-Games-Hobbies/cat/98
7. https://www.walmart.com/cp/toys/4171 (Toys that we are not interested in)
8. https://www.target.com/c/toys/-/N-5xtb0 (Toys that we are not interested in)
9. https://in.pinterest.com/pin/12807180177802375/
10. https://www.youtube.com/watch?v=_ppedXZHhE0 (Stop Motion Basics)
11. https://www.youtube.com/watch?v=p5SygzMSLhM (Stop Motion in Movies)
12. https://www.youtube.com/watch?v=GcryIdriSe4 (12 principles of animation)

Course Name: Enterprise Programming using JAVA **Course Code: CS1303**
L-T-P: 2-0-2 **Credits: 3**

Course Objective: The course focus on Java application programming interfaces (APIs), focusing on the APIs most commonly used in real-world Java applications such as Collections, Input/Output (I/O), and Threads. The main concepts are: overview of exception handling and Multithreading, JDBC API, web applications using Servlet, JSP, Aspect Oriented Programming using Spring Framework. This course also covers basic concepts for software design and reuse.

Course Outcome:
On successful completion of this course, the students should be able to:
CS1303.1. Design, develop and debug software applications in Core Java taking into account coding and documentation standards.
CS1303.2. Apply concepts like multithreading, interfaces, generics in Java program design and implementation.
CS1303.3. Use JDBC API for database-independent connectivity between the Java programs and MySQL database.
CS1303.4. Develop server-side solution using Servlet and JSP technologies.
CS1303.5. Design, develop, and debug web applications using Aspect Oriented Programming using Spring Framework.

Evaluation Scheme:

Prerequisites		OOP
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	
2	Assignment	20
3	Class Participation	
4	Quiz	20
5	Theory Exam-I	
6	Theory Exam-II	
7	Theory Exam-III	
8	Report-I	
9	Report-II	
10	Report-III	
11	Project-I	
12	Project-II	30
13	Project-III	
14	Lab Evaluation-I	15
15	Lab Evaluation-II	15
16	Course Portfolio	
	Total (100)	100
Evaluation Scheme for Retest		
	Quiz	10
	Lab Evaluation-II	30
	Total	40

Enterprise Programming Using Java

Unit 1 – Object Oriented Programming Concepts-Java, JRE, JVM & JDK, Operators, Methods, Keywords, Control Structures, Method Overloading & Overriding, Input using Command Line

Arguments & Scanner, Constructors, finalize (), Garbage Collection, Strings, Access Modifiers, Inner Classes, Cloning Objects, Abstract Classes, Interfaces, Packages, UTIL Package, Collections and Generics, File I/O using java.io package

Unit 2 - Exception Handling: The Idea behind Exception, Exceptions & Errors, Types of Exceptions, Control Flow in Exceptions, Multi-Threaded Programming, Thread Life-Cycle, Thread Priorities, Synchronizing Threads, Inter Communication of Threads, Multithreading in JAVA.

Unit 3 – JDBC Programming - The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, Updating Database Data, Error Checking and the SQLException Class, The SQLWarning Class, The Statement Interface, PreparedStatement, CallableStatement The ResultSet Interface, Updatable Result Sets, JDBC Types, Executing SQL Queries, ResultSetMetaData, Executing SQL Updates, Transaction Management. Servlet API & Overview - Servlet Model: Overview of Servlet, Servlet Life Cycle, HTTP Methods Structure & Deployment descriptor ServletContext & ServletConfig interface, Attributes in Servlet, Request Dispatcher interface The Filter API: Filter, FilterChain, Filter Config Cookies and Session Management: Understanding state and session, Understanding Session Timeout and Session Tracking, URL Rewriting

Unit 4 – Java Server Pages (JSP) - JSP Overview: The Problem with Servlets, Life Cycle of JSP Page, JSP Processing, JSP Application Design with MVC, Setting Up the JSP Environment, JSP Directives, JSP Action, JSP Implicit Objects JSP Form Processing, JSP Session and Cookies Handling, JSP Session Tracking JSP Database Access, JSP Standard Tag Libraries, JSP Custom Tag, JSP Expression Language, JSP Exception Handling, JSP XML Processing.

Unit 5 – Java Web Frameworks: Spring MVC Overview of Spring, Spring Architecture, bean life cycle, XML Configuration on Spring, Aspect Oriented Programming - Spring, Managing Database, Managing Transaction.

NOTE: ***Integrated Development Environments (IDEs) to be used in this Course are Eclipse or NetBeans – Both are compatible for Enterprise Programming using Java.***

References

- Liang, Y. Daniel. Introduction to Java programming: comprehensive version. Pearson Education, 2018.
- Zambon, Giulio. Beginning JSP, JSF and Tomcat: Java web development. Apress, 2012.

Course Title and Code – Understanding and Managing Conflict CC1105
Hours per Week **L-T-P: 2-0-0**
Credits **2**

Course Description

In today's increasingly complex and fragmented world, it is important to be able to resolve conflicts and build healthy relationships. Interpersonal and Group Dynamics is a course designed to prepare students to identify conflicts, manage emotions, analyze the situation and characters, and practice different frameworks to deal with conflicts.

Course Outcomes

The students will be able to:

CC1105.1. Define a group and explain the stages of group development
CC1105.2. Describe conflict and explain types and causes of conflict
CC1105.3. Use inquiry and advocacy to engage with groups
CC1105.4. Give and receive feedback effectively
CC1105.5. Identify sources of conflict and manage them using difference conflict handling styles

Evaluation Scheme:

Sr. No	Specifications	Marks
1.	Attendance	Nil
2.	Assignment	30
3.	Class Participation	20
4.	Quiz	20
5.	Theory Exam-I	Nil
6.	Theory Exam-II	Nil
7.	Theory Exam-III	30
8.	Report-I	Nil
9.	Report-II	Nil
10.	Report-III	Nil
11.	Project-I	Nil
12.	Project-II	Nil
13.	Project-III	Nil
14.	Lab Evaluation-I	Nil
15.	Lab Evaluation-II	Nil
16.	Course Portfolio	Nil
	Total (100)	100

Course Content

- Introduction to the stages of group development
- Introduction to Personality, Perception and Learning as source of differences in individual and groups
- Nature, Types and sources of Conflict
- Conflict Resolution Strategies
- Emotional Intelligence
- Empathy and Feedback
- Inquiry & Advocacy – Concept of silence (Masking, Avoiding, Withdrawing) and violence (Controlling, Labeling, Attacking)

References for Reading:

- Fisher, R., & Ury, W. (2011). Getting to yes: Negotiating agreement without giving in. Toronto, ON: Penguin Random House.
- Harper, G. (2004). The joy of conflict resolution: Transforming victims, villains and heroes in the workplace and at home. Gabriola Island, BC: New Society Publishers.
- Miles, E. W. (2013). Developing strategies for asking questions in negotiation. Negotiation Journal, 29(4): 383–412. doi: 10.1111/nejo.12034.

Course Title and Code: Operating System CS1108

Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Sem V

Course Objectives:

The main aim of this course is to develop an understanding of the fundamental concepts and techniques of operating systems.

Course Outcomes:

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

CS1108.1. Use basic LINUX commands: file/directory handling, standard I/O, redirection, pipes and filters.

CS1108.2. Analyze the structure of OS and its interface with hardware.

CS1108.3. Differentiate between different types of operating systems – Multiprogramming systems, Time-sharing systems, Parallel systems, Real-Time systems, Distributed systems and Mobiles systems. Compare Windows, Android and LINUX OS with respect to their key features and functionality.

CS1108.4. Differentiate between various states of process and their representation using process control block (PCB). Analyze data structures used by an OS to manage the processes.

CS1108.5. Implement and Assess the performance of different types of scheduling algorithms.

CS1108.6. Examine process synchronization and Inter process communication- Race condition, semaphores, monitors, inter process communication through message passing.

CS1108.7. Categorize the conditions that cause deadlock in resource allocation. Implement deadlock handling strategies.

CS1108.8. Analyze paging, segmentation, and segmentation with paging for VM support in memory management. Implement different page replacement algorithms.

CS1108.9. Analyze and implement various disk-scheduling algorithms.

Prerequisites: Computer Organization & Architecture

Evaluation Scheme:

Sr. No	Specifications	Marks
01	Attendance	NIL
02	Assignment	NIL
03	Class Participation	NIL
04	Quiz	20
05	Theory Exam-I	NIL
06	Theory Exam-II	NIL
07	Theory Exam-III	30
08	Report-I	NIL
09	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	20
15	Lab Evaluation-II	30
16	Course Portfolio	NIL
	Total (100)	100

Evaluation Scheme for Retest		
1	Theory Exam-III	30
	Total	**30**

Syllabus (Theory)

UNIT-1: **Introduction to OS:** Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, services, system calls, characteristics of OS, Structure of an OS-Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on LINUX and WINDOWS Operating System.

UNIT-2: Process: Concept of process, Process states, Process State transitions, Process Control Block (PCB), Context switching, **Thread:** Definition, Benefits of threads, Types of threads, multithreading. **Process scheduling**: Foundation and Scheduling objectives, Types of Schedulers. **Scheduling criteria:** CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time**. Scheduling algorithms:** Pre-emptive and Non-pre-emptive, FCFS, SJF, Priority, R-R scheduling, Multilevel queue scheduling. **Inter process communication:** Critical section, Race condition, semaphores, monitors, message passing, Classical IPC Problems: Readers-Writer Problem, Dinning Philosopher Problem etc. **Deadlock:** Shared resources, resource allocation and scheduling, resource graph models, deadlock prevention, deadlock avoidance, deadlock detection, deadlock recovery algorithms.

UNIT-3: Memory Management: Memory management schemes, Contiguous/Non-contiguous memory allocation, storage management, paging, page table structure, segmentation, segmentation with paging, virtual memory, demand paging, page fault, Page replacement algorithms.

UNIT-4: File management: file concept, types and structures, attributes of a file, operations performed on file, File organization and access method, file allocation methods, directory structure, file directories, directory implementation.

UNIT-5: I/O Hardware: I/O devices, I/O hardware, device driver, Kernel I/O sub-system, Interrupt. **Disk scheduling:** Disk Structure, FCFS, SSTF, SCAN, LOOK, C-SCAN, C-LOOK.

Contents (Lab)

- Linux Operating System, components of Linux system.
- Basic LINUX commands and its Use.
- Execution of various file/directory handling commands.
- Commands related to standard I/O, Redirection, Pipes and Filters.
- Process Management Commands in Linux.
- Implementation of CPU Scheduling Algorithms.
- Implement Semaphores.
- Implement of Banker's Algorithm for Deadlock Avoidance.
- Implement the page replacement algorithms.
- Implement disk scheduling algorithms.

Reference/Text Books:

- Silberschatz, Peter B. Galvin and G. Gagne, Operating System Concepts, Wiley, 2012.
- W. Stallings. Operating Systems: Internals and design Principles, Pearson Education, 2014.
- M. G. Venkateshmurthy. Introduction to Unix & Shell Programming, Pearson Education, 2009.
- Andrew S. Tanenbaum and Herbert Bos. Modern Operating Systems, Pearson Education, 2014.
- Thomas Anderson and Michael Dahlin. Operating Systems: Principles and Practice, Recursive Books, 2014.
- Richard Blum, Christine Bresnahan. Linux Command Line and Shell Scripting Bible, Wiley, 2015.
- Daniel P. Bovet, Marco Cesati. Understanding the Linux Kernel, O'Reilly media 3rd Edition, 2005.
- https://nptel.ac.in/courses/106/106/106106144/
- https://nptel.ac.in/courses/106/105/106105214/

Course Title and Code: Artificial Intelligence and Machine Learning; CS1110
Hours per Week L-T-P: 3-0-2
Credits 4
Students who can take B.TECH. CSE Sem V (2018-2022)

Course Objective:

This course introduces the fundamental concepts of artificial intelligence (AI) along with state-of-the machine learning (ML) algorithms. The course will cover the development of AI models to solve new as well as classical critical problems, and ML models to understand the real dataset to predict the future outcome. This course helps the students to pursue project related to AI and ML with real-world problems.

Course Outcomes:

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

CS1110.1. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.
CS1110.2. Implement intelligent agents for making computers solve critical problems the way human beings do.
CS1110.3. Analyze the usage of Game theory and role of heuristics for building Intelligent Agents.
CS1110.4. Apply AI techniques in applications which involve perception, reasoning and learning.
CS1110.5. Acquire the knowledge of real-world knowledge representation.
CS1110.6. Identify machine learning techniques suitable for a given problem.
CS1110.7. Interpret fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.
CS1110.8. Use the standards and energy efficient ML algorithms.
CS1110.9. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.
CS1110.10. Utilize state-of-the art algorithms of Machine Learning for building applications related to SDG goals

Prerequisites Programming, Linear Algebra, Statistics

Evaluation Scheme

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	20
03	Class Participation	10
04	Quiz	Nil
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-I	10
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	15
12	Project-II	15
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-III	30
	Total	**30**

Syllabus:

UNIT–I: Introduction to Artificial Intelligence, History and Philosophy of AI, Intelligent Agents, Solving Problems by Searching, uninformed search, Informed Search and A*, Heuristics, Adversarial Search, Graph Pruning, Alpha-Beta Pruning, Min-Max Algorithm, Constraint Satisfaction Problems,

UNIT–II: First-Order Logic, Inference in First-Order Logic, Classical Planning, Planning and Acting in the Real World, Need of Representing and Reasoning Knowledge (Predicate, Prepositional and Fuzzy Logic)

UNIT–III: Introduction to Machine Learning, Supervised and Unsupervised Learning, Simple and Multiple Linear Regression, Decision Tree Regression, Fitting dataset and evaluating their performance set, Evaluation of selected features, Model evaluation metrics

UNIT–IV: K-Nearest Neighbor, Decision tree Classification Train/test split, Confusion matrix for evaluation, Class probabilities and class predictions, ROC Curve, Model evaluation metrics. Clustering; K-Means, Introduction to artificial neural network, kinds of neural network, perceptron algorithm

UNIT–V: Applications of Artificial Intelligence and Machine Learning; Usage of AI and ML Techniques for achieving sustainable practices, NIST and IEEE standards for AI and ML libraries, tools and techniques

Reference Books

- Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Third Edition, Pearson Education, 2010.
- Ethem Alpaydin, Introduction to Machine Learning, Second Edition, 2016

Course Title and Code:	**Cloud Computing, CS1304**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech Sem V (IBM Cloud Computing)

Course Objective- This course will prepare students to develop, build, deploy, and test applications using a cloud platform to build Software as a Service (SaaS) solutions. This will provide cloud application development skills, such as NoSQL, Cloud Apps with AI and DevOps framework.

Course Outcome:

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

CS1304.1. Use public cloud, private cloud and hybrid cloud.
CS1304.2. Build and deploy application on the clouds offered by main providers
CS1304.3. Build cognitive solutions, leveraging AI and data science in cloud solutions.
CS1304.4. Design and build agile cloud solutions, using the cloud Garage methodology
CS1304.5. Develop & test microservices and use DevOps framework

Prerequisites		Basic IT Literacy Skills
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment (Assessment based on MOOC)	10
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III (Certification Exam by IBM)	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	15
12	Project-II	15
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30
2	Lab Evaluation	10

Syllabus (Theory):

CLOUD COMPUTING LANDSCAPE: Cloud impact in our lives, Cloud enterprise adoption, Cloud services.

CLOUD INDUSTRY ADOPTION: Drivers for Digital Transformation, Cloud Impact in Banking, Cloud Impact in Education.

API PLATFORM REVOLUTION: Cloud Culture of Change, API Platforms Landscape, APIs driving the Cloud platform revolution.

DATA IN THE CLOUD: Where and how will data be used? Why use NoSQL? Attributes of NoSQL databases.

CLOUD AND AI: AI Industry Adoption, AI Evolution, Empowered Cloud Apps with AI.

CLOUD FOR MULTI-CHANNEL: The Need for a Multi-channel platform, Multi-channel platform characteristics, Rapid and Intelligent.
CLOUD SECURITY: Cloud Security landscape, Security concerns in microservices, OAuth protocol.
DEVOPS FRAMEWORK: What is DevOps? DevOps Agile Culture, DevOps Lifecycle.

LAB

- Create an IBM Cloud Account

ACME AIRLINE CLOUD ADOPTION

- Prepare your Environment
- Creating an APP
- Developing an App
- Acme Business Case- Preparing the APP

MAINTENANCE CREW CLOUD APP

- Digital App Builder Data Sets
- Cloud Management
- Return to the Digital App Builder
- Preview Dataset in Action

ADD AI TO MAINTENANCE CREW APP

- Create Cloud Cognitive Services
- Connect Services to your App
- Train and Implement Cognitive Services

ADD MULTI-CHANNEL SUPPORT

- Android Studio
- Enabling Android in Digital App Builder
- Preview your APP in Android Device

SECURE THE MAINTENANCE CREW APP

- Login Security
- Mobile Phone Authorization
- Test new security functionality

EXPLORE TOOLCHAINS

- Enable Toolchains
- Create and Explore the Garage Method
- Finalize the Creation of Toolchain
- Agile Planning
- Continuous Integration and Delivery
- Manage IBM Cloud Apps
- Manage App Using New Relic & PagerDuty
- Slack and PagerDuty Integration
- Learn from Users

DEVELOP & TEST MICROSERVICES

- Create Microservices Toolchain
- Configure Tool Integrations
- View Build & Deployment Activity
- Manager Access
- Configure Pager Duty
- Submit an Issue
- Modify Code Identify an Error
- Fix the Problem and Deploy

- Explore the DevOps Insights
- Improve Deployment Management
- Improve Visibility
- Delete Tools and Artifacts

Suggested Reading Materials:

1. IBM Skill Academy.
2. Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 2014.
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; 2015.
4. Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 2016.

Recommended MOOC:

https://www.coursera.org/learn/introduction-to-cloud?utm_source=link&utm_medium=page_share&utm_content=xdp&utm_campaign=nav_button

This course introduces you to the core concepts of cloud computing. You gain the foundational knowledge required for understanding cloud computing from a business perspective as also for becoming a cloud practitioner. You understand the definition and essential characteristics of cloud computing, its history, the business case for cloud computing, and emerging technology use cases enabled by cloud. We introduce you to some of the prominent service providers of our times (e.g. AWS, Google, IBM, Microsoft, etc.) the services they offer, and look at some case studies of cloud computing across industry verticals.

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1111	Introduction to IoT	1	0	2	0	2

Course Objectives:

The course aims to develop understanding of Internet of Things concepts and working on IoT development boards to interface sensors and actuators. The course will enable the students to upload data from sensors on a web server and to use this data for analytical purposes or to actuate some transducers.

Course Outcomes:

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

EE1111.1. Interface the Analog and Digital sensors to Node-MCU
EE1111.2. Develop Embedded C programs to read sensor data and upload to public cloud platform.
EE1111.3. Use Python-based IDE (integrated development environments) for the Raspberry Pi
EE1111.4. Interface Raspberry Pi with I/O devices.
EE1111.5. Visualize sensor data uploaded on public cloud.
EE1111.6. Apply standard protocol(s) for implementation of IoT Systems.
EE1111.7. Analyze and Improve existing systems with innovative IoT based approaches.

Prerequisites **Basic Programming**

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
1	Attendance	NA
2	Assignment	NA
3	Class Participation	NA
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	NA
7	Theory Exam-III	20
8	Report-I (Case Study on Raspberry Pi, IoT)	20
9	Report-II	NA
10	Report-III	NA
11	Project-I	NA
12	Project-II	NA
13	Project-III	NA
14	Lab Evaluation-I (Continuous)	30
15	Lab Evaluation-II	NA
16	Course Portfolio (MOOC certificate)	10
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	20
2	Lab Evaluation-II	0
	Total (40)	20

Course Syllabi (Theory):

UNIT 1: Introduction to IoT Fundamentals: Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking.

UNIT 2**:** Sensors and Actuators: Sensors and Transducers, Sensor Classes, Sensor Types, Actuator Basics, Actuator Types,

UNIT 3**:** Basics of IoT Networking & Protocol: IoT Components, Inter-dependencies, SoA, Wireless Networks, Protocol Classification, MQTT, Secure MQTT, CoAP, XMPP, AMQP (Advanced Message Queuing Protocol)

UNIT 4**:** Connectivity Technologies: IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, Zwave.

UNIT 5**:** Introduction to NodeMCU and Server: Basic Concepts of Arduino Platform, Examples of Arduino Programming, Interfacing different sensors with NodeMCU. Introduction to Blynk App, Uploading and downloading data from server using Blynk App. Introduction to ThingSpeak Server, Uploading and downloading data from ThingSpeak server.

UNIT-6 Raspberry Pi: Basic functionality of the Raspberry Pi B+ board, Setup and Configuring Raspberry Pi, programming on the Raspberry Pi using Python, Python functions to access the Raspberry Pins, how Raspberry Pi interact with online services through the use of public APIs and SDKs, case studies.

Course code	Course Title	Teaching Scheme	
		NA	Credits
PR1101	Automation Project		2

Course Objectives: This course aims to develop skills for designing, implementing and testing solutions for automation and IoT problems.

Course Outcomes:

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

PR1101.1. Design and implement a complete project in IoT/Automation using microcontroller/SOC interfaced with sensors or any other automation hardware/tools.

PR1101.2. Apply anyone/more standard data communication/IoT protocol(s).

PR1101.3. Use cloud servers for data streaming/logging and analytic techniques.

PR1101.4. Implement algorithms/signal processing using the data at edge/cloud.

PR1101.5. Deploy techniques to conserve bandwidth/energy/other resources and achieve cost economy for project.

Assessment Scheme:

	Evaluation Component	Marks
	Attendance	Nil
	Assignment	Nil
	Class Participation	Nil
	Quiz	Nil
	Theory Exam-I	Nil
	Theory Exam-II	Nil
	Theory Exam-III	Nil
	Report I (Synopsis)	30
	Report II (Midterm Progress Presentation and Viva)	30
	Report III	Nil
	Project I (with Report)	Nil
	Project II	Nil
	Project III (With Report)	40
	Lab Evaluation I	Nil
	Lab Evaluation II	Nil
	Course Portfolio	Nil
	Total (100)	**100**
aluation scheme for retest.		
	Project III (with Report)	**40**
	Total (100)	**40**

Course code		Course Title	Teaching Scheme			
			L	T	P	Credits
PS1101		Practice School – I				4
Evaluation Scheme						
S. No.	Evaluation Component		Marks (100) (Weightage %)			
1	External Supervisor	Day to Day task Record	30			
		Report Content and Presentation	20			
2	Faculty Supervisor	Reporting Activity Fortnightly	20			
		Presentation, Viv, Report	30			

Syllabus:

This course is for 6 weeks at the end of 4th semester during summer term of 4 year full time B. Tech. and 5 year Integrated Dual degree (B.Tech + M.Tech, B.Tech + MBA) programs in all the engineering disciplines. The objective of this Programme is to provide the students an understanding of working of corporate world in various functions associated with an Industry/Organization. During this Programme, they will observe and learn various real-world applications of their curricula and develop an understanding of vast engineering operations and its various facets such as inventory, productivity, management, information systems, human resource development, data analysis etc. The general nature of PS-1 assignments is of study and orientation.

Course Title: - Computer Networks and Distributed Systems (CS1111)

Course Objectives: This course aims to provide an understanding of the fundamental concepts of computer networking, layers of protocols and network technologies. It also includes the concept of Distributed System and associated algorithms to deal with Distributed system.

Course Outcomes:

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

CS1111.1. Categorize the various type of Networks on the basis of geographical distance, topology and implementation.

CS1111.2. Compare the function and services provided by different layers of OSI and TCP/IP network architectures.

CS1111.3. Do network programming using sockets in C.

CS1111.4. Find out the errors in the transmitted segments through error detection techniques like Checksum, Cyclic Redundancy check etc.

CS1111.5. Use various network monitoring commands like netstat, traceroute, ipconfig etc.

CS1111.6. Analyze the underlying architectures and protocols of networking applications like File Transfers, Mail Transfers etc.

CS1111.7. Apply the concepts of IP addressing, subnet masking and routing algorithms.

CS1111.8. Apply and compare the sliding window – Transmission Control Protocols like Go-Back N, Stop-N-Wait and Selective Repeat using the criteria of segment loss, acknowledgement loss etc.

CS1111.9. Analyze distributed systems and understand classification of agreement protocol.

CS1111.10. Apply the concept of logical clocks and global clocks in distributed systems.

Evaluation Scheme

Prerequisites		**Nil**
Hours per Week		**L-T-P: 3-0-2**
Credits		**4**
Sr. No	**Specifications**	**Marks**
01	Attendance	0
02	Assignment	10
03	Class Participation	0
04	Quiz (2)	15
05	Theory Exam-1	0
06	Theory Exam-II	15
07	Theory Exam-III	30
08	Report-1	0
09	Report-2	0
10	Report-3	0
11	Project -1	15
12	Project -2	0
13	Project -3	Nil
14	Lab Evaluation1	15
15	Lab Evaluation2(Final)	0
16	Course portfolio	00
	Total (100)	**100**

Evaluation Scheme for Retest	**Theory Exam-III (30 marks)**

Syllabus (Theory)

Introduction Concepts: Goals and Applications of Networks, Network structure and architecture, The OSI reference model, services, Network Topology Design - Delay Analysis, Back Bone Design, Local Access Network Design, Physical Layer Transmission Media, Switching methods.

Medium Access sub layer: Medium Access sub layer - Channel Allocations, LAN protocols - ALOHA protocols - Overview of IEEE standards. Data Link Layer - Elementary Data Link Protocols, Sliding Window protocols, Error Handling.

Network Layer: Network Layer - Point - to Pont Networks, routing, Congestion control Internetworking -TCP / IP, IP packet, IP address, IPv6.Transport Layer: Transport Layer - Design issues, connection management,

Session Layer- Design issues, remote procedure call. Presentation Layer-Design issues, Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals etc. Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection. Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem

IEEE 802 Standards for Networks, RFC Standards, Energy Efficient routing algorithms, Energy efficient distributed systems.

Text Book(s)

1. Forouzan, B. & Fegan, S. C. (2011). Data communication and Networking (4th ed.). New Delhi: McGraw HIll.
2. Tanenbaum, A. S. & Wetherall, D. J. (2014). Computer networks (5thed.). New Delhi: Pearson.
3. Stallings, W. (2014). Data and Computer Communications (9thed.). New Delhi: Pearson
4. Pradeep K. Sinha. Distributed Operating Systems. Concepts and Design.
5. Schaum's Outline of Theory and Problems of Computer Networking, McGraw Hill Education (India) Pvt. Ltd.

Course Title and Code: Compiler Design CS1112		
Hours per Week		**L-T-P: 3-0-2**
Credits		**4**
Students who can take		**B.Tech. Odd Sem (VII)**
Course Objective- This course aims to familiarize the students with the design of a compiler including its phases and components, develop a compiler.		
Course Outcome: On successful completion of this course, the students should be able to: CS1112.1. Specify and analyze the lexical, syntactic and semantic structures of programming language features CS1112.2. Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation CS1112.3. Write scanners, parsers, and semantic analyzers without the aid of automatic generators CS1112.4. Utilize the compiler design concept to write efficient programs CS1112.5. Design the structures and support required for compiling advanced language features.		
Prerequisites		**Nil**
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignments	10
03	Class Participation	Nil
04	Quiz (4)	10
05	Theory Exam	Nil
06	Theory Exam (midterm-II)	20
07	Theory Exam (Final)	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project-1	Nil
12	Project-2	Nil
13	Project-3	Nil
14	Lab Evaluation1	20
15	Lab Evaluation2(Final)	20
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus (Theory):

UNIT I: Introduction, Lexical analysis: Language processor, compiler, structure of a compiler, applications of Compiler technology, interpreter, cousins of a compiler, introduction to one pass & multipass compilers, Bootstrapping, Review of finite automata, Lexical analyzer, input buffering, Recognition of tokens, Lex: A lexical analyzer generator, Error handling

UNIT II: Syntax analysis: Review of context-free grammars (CFGs), Ambiguity of grammars, Taxonomy for parsing techniques, Top-down parsing techniques: non- predictive or backtracking, recursive descent and non-recursive (LL) predictive parsing, bottom up (Shift reduce) parsing techniques: operator precedence parsing, LR (SLR, CLR and LALR) parsers, parsing with ambiguous grammar

UNIT III: Syntax directed definition and Intermediate Code Generation: Syntax- Directed definitions (SDDs): Evaluation order for SDDs; Applications of Syntax- directed translation; Syntax-directed translation schemes**,** Intermediate code generation**:** Variants of syntax trees; Three-address code; Types and declarations; Translation of expressions; Type checking; Control flow; Back patching; Switch statements; Intermediate code for procedures.

UNIT IV: Run time environments: Storage organization, Stack allocation of space, Access to non-local data on the stack, symbol table organization, Data structures used in symbol tables

UNIT V: Code generation: Basic blocks and Flow graphs, DAG (Directed Acyclic Graph) representation of basic block, Optimization of basic blocks, Issues in design of code generator, The Target language; Addresses in the target code, A simple code generator, Code generation from a DAG

Syllabus (Practical):

1 Program to implement a Deterministic Finite Automata.

2 Program for a lexical analyzer to recognize a few patterns in PASCAL and C.

3 Program to generate a lexical analyser using LEX.

4 Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.

6 Program to recognize the grammar (anb n|>=10)

7 Program to recognize a valid arithmetic expression that uses operator +, -, * and /.

8 8 Program to develop a recursive descent parser.

9 Program to find FIRST of NON-TERMINALS of the given grammar

10 Program to find out FOLLOW of NONTERMINALS of given productions.

11 Program for generating for various intermediate code forms:

● Three address code ●Quadruple

12 Program to generate the intermediate code in the form of Polish Notation.

13 Program to implement code optimization techniques to optimize given intermediate code (Three Address Code) form.

14 Program to Simulate Heap storage allocation strategy.

Textbook(s):

1. K. Muneeswaran, Compiler Design, Oxford University Press, 2012

Reference Book(s):

1. Compilers- Principles, Techniques and Tools, Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman – 2nd Edition, Addison-Wesley, 2007.

2. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.

3. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.

Web Resources:

http://nptel.ac.in/courses/106108052/1

Course Title and Code: Software Engineering**:** CS1113		
Hours per Week	**L-T-P: 3-0-2**	
Credits	**4**	
Students who can take	B.Tech Sem VI	
Course Objective: In this course, students will gain a broad understanding of the discipline of software engineering and apply theories, models, and techniques to solve real-world problems.		
Course Outcome: On successful completion of this course, the students will be able to: CS1113.1. Use software development lifecycle models for project development. CS1113.2. Explain the advantages of agile software development over traditional software engineering methods. CS1113.3. Apply agile development method namely Extreme Programming (XP), Adaptive software development (ASD), Scrum and Crystal for software development. CS1113.4. Design solutions in various application domains using software engineering approaches that integrate ethical and economic concerns. CS1113.5. Elicit and Evaluate functional and non-functional requirements for a software system. CS1113.6. Design, represent and document software requirements specification according to IEEE standards. CS1113.7. Apply UML modelling for software design. CS1113.8. Apply coding standards and guidelines. CS1113.9. Prepare code checklist and perform code inspections, code reviews and walkthrough. CS1113.10. Develop and implement various manual and automated testing procedures. CS1113.11. Estimate the cost of software project. CS1113.12. Evaluate software in terms of software quality and quality assurance according to ISO standards. CS1113.13. Execute activities for software project such as re-engineering, reverse engineering and software configuration.		
Prerequisites: : C, C++ or Java programming		
Sr. No	**Specifications**	**Marks**
01	Attendance	NIL
02	Assignment	10
03	Class Participation	10
04	Quiz	20
05	Theory Exam-I	NIL
06	Theory Exam-II	NIL
07	Theory Exam-III	30
08	Report	10
09	Report-II	NIL
10	Report-III	NIL
11	Project	20
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	NIL
16	Course Portfolio (MOOC certification)	NIL
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	30
2	Quiz	20
	Total	**50**

Syllabus (Theory)

UNIT I: Basics, Software Engineering, Software Components, Software Characteristics, Software Crisis, Software Engineering Processes, Software Development Life Cycle (SDLC) Models: Waterfall Model, Iterative waterfall model, Incremental Process Model, Evolutionary Development Models, Specialized Process Model, V-Model, An Agile view of process, Agile process models namely Extreme Programming (XP), Adaptive software development (ASD), Scrum and Crystal.

UNIT II: Requirement Engineering Process: Elicitation, Analysis, Documentation, Review and Management of User Needs, Feasibility Study, Information Modeling, Data Flow Diagrams, Entity Relationship Diagrams, Decision Tables, SRS Document, IEEE Standards for SRS.

UNIT III: Basic Concept of Software Design, Architectural Design, Low Level Design, Modularization, Design Structure Charts, Pseudo Codes, Flow Charts, Coupling and Cohesion Measures, Design methods and Strategies: Function Oriented Design, Object Oriented Design, Top-Down and Bottom-Up Design.

UNIT IV: Coding and Software Testing: Coding standards, programming style, code inspection, code review and walkthrough; Testing Objectives, Unit Testing, Integration Testing, Acceptance Testing, Regression Testing, Testing for Functionality and Testing for Performance, Top-down and Bottom-up, Testing Strategies, Test Drivers and Test Stubs, Structural Testing (White Box Testing), Functional Testing (Black Box Testing), Test Data Suit Preparation, Alpha and Beta Testing of Products.

UNIT V: Software Measures, Metrics and Models: Various Size Oriented Measures, Hallstead's Software Science, Function Point (FP) Based Measures, Cyclomatic Complexity Measures, Control Flow Graphs, Software metrics classification, Cost estimation models, Estimation of Various Parameters such as Cost, Efforts, Schedule/Duration, Constructive Cost Models (COCOMO); Software quality and quality assurance, ISO standards; Software Re-engineering, Reverse engineering and Software Configuration.

Course Syllabus (Practical):

Experiments are to practice software engineering techniques. Use any open-source CASE tool. You can choose any other CASE tool, as per choice.

Design Approach: Object Oriented

These designing can be done on any automation system e.g., library management system, billing system, payroll system, bus reservation system, students result management system.

- Do a feasibility study
- Document all the requirements as specified by customer in Software Requirement Specification. IEEE Standards for SRS
- Software Design: DFD/Design structure chart/activity diagram/sequence diagrams/ interaction diagram/class diagram/state chart diagram etc. for project. IEEE standards for Software design description (SDD).
- Code and test the project

Reference/Text Books:

- Pressman, Roger S. *Software engineering- A practitioner's approach*. McGraw Hill Education, 2014.
- Sommerville, Ian. *Software engineering*. Pearson education, 2015.
- Jawdekar, Waman S. Software Engineering: Principles and Practice. McGraw Hill Education 2004.
- Martin, Robert C. *Agile software development, principles, patterns, and practices*. Pearson, 2013.

Course Title and Code: Critical Thinking for Decisions at Workplace CC1106

Course Objective: In today's world, the idea of right and wrong is being challenged by businesses, use of technology, economic conditions, and norms of societies. The relevance of a well-reasoned decision is crucial. This course intends to make students take better decisions keeping in mind purpose, context, and ethics.

Course Outcomes

The students will be able to:

CC1106.1. Apply techniques of Critical Thinking to analyse organisational problems through positive inquiry

CC1106.2. Describe and analyse appropriate problem-solving and ethical decision-making processes

CC1106.3. Choose the most effective and logical decision among multiple alternatives

CC1106.4. Evaluate solutions and anticipate likely risks based on purpose, context and ethics

Pre-requisites		**N/A**
Hours per Week		**L-T-P: 2-1-0**
Credits		**2**
Sr. No	**Specifications**	**Weightage**
01	Attendance	Nil
02	Assignment	**20**
03	Class Participation	**20**
04	Quiz	Nil
05	Theory Exam-1	Nil
06	Theory Exam-2	Nil
07	End term Viva	**30**
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Presentation	**30**
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Evaluation scheme for re-test

Sr. No	**Specifications**	**Weightage**
01	Theory Exam-3	**30**
	Total (30)	**30**

SYLLABUS

	Topic	**Sub-topics**
1	Decision Making: Definition and Type	• Organisational decision-making • Concept of thinking triangle

		• Importance of decision-making at work place
2	Barriers to Sound Reasoning	• Identifying barriers to Critical Thinking • Biases, prejudices, facts, opinions, assumptions. • Overcoming the obstacles
3	Steps of Decision Making	• Factors impacting decision-making • Concept of enquiry circle • Understanding arguments in business parlance
4	Ethics and Decisions	• Theories of ethics (Teleological, Deontological, Virtue Ethics, Conduct Ethics, Rights based, Utilitarianism, Hedonism, Egoism) • Concept of Moral reasoning • Role of ethics and values in Decision Making
5	Importance of purpose and context	• Role of Stakeholders in decision making.
6	Problem analysis best practices	• Root cause analysis • Identifying questions at the heart of a problem • Thinking checklist
7	Decision Implementation Techniques	• Developing intellectual virtues • Paul Elder's model (Intellectual humility, courage, empathy, integrity and confidence.
8	Comparing alternative solutions	• Ladder of Inference • Meta-thinking • Perspectives

Suggested Readings

1. Jonah Lehrer, 2009: **How we Decide.** Houghton Mifflin Harcourt, Boston, New York
2. Chip Heath and Dan Heath, 2013. **Decisive: How to Make Better Choices in Life and Work.** Crown Business, ISBN 0307956393
3. John S. Hammond, Howard Raiffa, Ralph L. Keeney, 2002. **Smart Choices: A Practical Guide to Making Better Decisions.** Crown Business, ISBN 0767908864
4. Ramesh K. Arora, **Ethics, Integrity and Values in Public Service.** New Age International Publishers, New Delhi.
5. Bradley H. Dowden, 1993. **Logical Reasoning.** Wadsworth Publishing Company, Belmont, California, ISBN 0534176887

Course Title and Code: Business Intelligence (IBM Course) CS1305		
Hours per Week	**L-T-P: 3-0-2**	
Credits	**4**	
Students who can take	B.TECH. CSE (IBM BDA) Sem VI (2018-2022)	

Course Objective-

This course will prepare students to understand report building techniques using relational data models. They will also learn how to enhance, customize, and manage professional reports and will then further be explained about Active reports content and functionality.

Course Outcomes (Provided by IBM):

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

CS1305.1. Understand the importance of analytics and how it transforming the world today
CS1305.2. Understand how analytics provided a solution to industries using real case studies
CS1305.3. Explain what analytics is, the various types of analytics, and how to apply it
CS1305.4. Understand how a business analysis software works, and its architecture
CS1305.5. Describe a reporting application, its interface, and the different report types
CS1305.6. Create different types of advanced reports
CS1305.7. Understand Active Reports and how to create them

Prerequisites		Basics of Cloud, Statistics
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	Nil
03	Class Participation	Nil
04	Quiz	25
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III (Case Study)	25
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	20
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-III	30
	Total	**30**

Syllabus

Business Analytics Overview: Analytics overview, Analytics trends: Past, present & future, Towards a predictive enterprise, Analytics: Industry domains, Case studies and solutions, Business Intelligence and Analytics 101, IBM Cognos Analytics for Consumers, Business analysis solutions

IBM Cognos Analytics: Author Reports Fundamentals – Introduction, create list reports, focus reports using filters, Create crosstab reports, Present data graphically, Focus reports using prompts, extend reports using calculations, Use additional report building techniques, Customize reports with conditional formatting, Drill-through definitions, Enhance report layout

IBM Cognos Analytics: Author Reports Advanced – Introduction, Create query models, Create reports based on query relationships, Create advanced dynamic reports, Design effective prompts, Create

additional advanced reports, Examine the report specification, Distribute reports through bursting, Enhance user interaction with HTML,

IBM Cognos Analytics: Author Active Reports –Introduction to IBM Cognos Active Reports, Use Active Report connections, Active Report charts, visualizations, and decks

Reference Books:

- Cindi Howson. Successful Business Intelligence, Second Edition: Unlock the Value of BI & Big Data. McGraw-Hill Education, 2013.
- Dan Volitich, Gerard Ruppert. IBM Cognos Business Intelligence 10: The Official Guide. McGraw- Hill Education, 2013.

Suggested MOOC:

- IBM Data Science Professional Certificate, Coursera, https://www.coursera.org/professional-certificates/ibm-data-science

Course Title and Code:	Data Science (IBM Course) CS1313
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.TECH. CSE (IBM BDA) Sem VI (2018-2022)

Course Objective-

The course provides students data science fundamental knowledge with the latest job-ready tools and skills, including open-source tools and libraries, Python, databases, SQL, data visualization, data analysis, statistical analysis, predictive modeling, and machine learning algorithms. The Students will learn data science through hands-on practice in the IBM Cloud using real data science tools and real-world data sets.

Course Outcomes (Provided by IBM):

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

CS1313.1. Understand the evolution and relevance of data science in the world today.
CS1313.2. Explore end-to-end data science industry use cases using the data analytics lifecycle.
CS1313.3. Understand the scientific method for science projects, and the data science team key roles
CS1313.4. Acquire technical expertise using popular open-source data science frameworks including Jupyter notebooks and Python.
CS1313.5. Gain a competitive edge using low-code cloud- based platform for data science - IBM Watson Studio
CS1313.6. Data engineering and data modeling practices using machine learning
CS1313.7. Explore data science industry case studies: transportation, automotive, human resources, aerospace, banking and healthcare
CS1313.8. Experience teamwork agile industry practices using design thinking

Prerequisites		Statistics, Programming
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	Nil
04	Quiz	15
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III (Certification Exam by IBM)	25
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	20
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	15
15	Lab Evaluation-II	15
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Theory Exam-III	25
2	Lab Evaluation-II	15
	Total	**45**

Syllabus

UNIT I: Data Science Landscape - Data Science Overview, Data Science Domains, Data Science Roles; Data Science Methodology - Data Analytics in Practice, Data Analytics Methodologies, Data Science Method; Data Science on the Cloud - Integrated environment for Data Science projects, Cloud-based Data Science Lifecycle, Data Science capabilities on the cloud

UNIT II: Explore and Prepare Data - Business understanding, Explore data, Prepare data, Understanding data; Represent and Transform Data - Statistics and representation techniques, Data transformation, Represent and transform unstructured data, Data transformation tools; Data Visualization and Presentation - Decision-centered Visualization, Fundamentals of Visualizations, Common Graphs, Common Tools
UNIT III: Data Modelling - Overview of modeling techniques, Machine learning techniques, Accuracy, precision and recall, Model Deployment; Machine Learning Algorithms - About Machine Learning, From Regression to Neural Nets, Decision Tree Classifier, Machine Learning Framework

LAB

Accessing IBM Cloud	• Create an IBM Cloud Account • Navigate the Catalog
Exploring and Preparing Auto Data	• Access IBM Cloud • Provision Watson Studio Service • Import automobile data
Validating Automotive Data	• Data Refinery • Sort and filter data • Review Frequency and statistics
Data Refinery Visualization	• Visualize preliminary data wrangling results • Run summary statistics on the results
Visualizing Automotive Data	• Create new project in Watson Studio • Create Jupyter Notebook environment • Import dataset into Pandas data frame • Visualize data using Brunel
Predict Heart Failure	• Load patient data into Object Storage • Create Apache Spark machine learning • Train and evaluate a model • Persist a model in a Watson ML repository
Apply ML Models to Attrition	• Create a new Watson Studio project • Import data set from local drive • Perform data cleansing and transformation • Apply various machine learning models • Conclude which model gives best prediction

Reference Books:

- Dr. Alfio Gliozzo, Chris Ackerson, Rajib Bhattacharya, Addison Goering, Albert Jumba, Seung Yeon Kim, Laksh Krishnamurthy, Thanh Lam, Angelo Littera, Iain McIntosh, Srini Murthy, Marcel Ribas. *Building Cognitive Applications with IBM Watson Services*, IBM Redbooks publication 2017
- Data Science Certification Course Material, IBM AP Skills Academy, IBM, 2021.

Suggested MOOC:

- IBM Data Science Professional Certificate, Coursera, https://www.coursera.org/professional-certificates/ibm-data-science

Course Title and Code: Building RPA Applications CS1121	
Hours per Week	**L-T-P: 2-0-0**
Credits	**2**

Students who can take	B.Tech.(CSE/EEE/ME – VI) Even Sem

Course Objective:

- The course aim is to develop understanding about Robotic Process Automation for automating business processes using software robots with cost efficient digital delivery.

Course Outcome:

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

CS1121.1. Use and understand the various functionalities and features of UiPath Studio and Orchestrator.
CS1121.2. Design, implement, and use RPA activities.
CS1121.3. Develop basic robots using UiPath Community Edition.
CS1121.4. Explore various data extraction techniques.
CS1121.5. Deploy, monitor and control robots with UiPath Orchestrator.
CS1121.6. Identify processes which can be automated.
CS1121.7. Apply best practices in RPA projects.

Prerequisites: To understand and complete the course successfully the student must have basic programming skills.

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignments	Nil
03	Class Participation	10
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	Nil
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project-1	30
12	Project-2	Nil
13	Project-3	Nil
14	Lab Evaluation-1	20
15	Lab Evaluation-2	Nil
16	Course portfolio	20
	Total (100)	**100**

Evaluation Scheme for Retest		
1	Quiz	20
2	Lab Evaluation-1	20
	Total	**40**

Syllabus (Theory):

Unit I: Programming Basic & Recap: Programming concept basic; **Introduction to RPA:** scopes and techniques of automation, RPA components and various RPA platforms, Introduction to UiPath as RPA platform, Applications and Benefits of RPA, Introduction to UiPath Studio, UiPath robot, types of robots, and UiPath Orchestrator. Setup, configuration, Brief on Studio interface and components.

Unit II: **RPA Projects:** Types of Projects in RPA: Sequence, Flowcharts, and State machines; Variables, Arguments, Data Types and Control flow: flow chart activities and sequences activities. **Data Manipulation:** Text and Data Manipulation**,** Data tables, clipboard management, file operation, importing from and exporting to CSV/Excel file and data table.

Unit III: **Control of Controls:** Attach window activity, Finding the control, Waiting for a control, Act on Control- mouse and keyboard activity. Handling event driven controls as working with UiExplorer handling events. Recording and Advanced UI Interaction: Definition, what can be recorded, Components, Automatic & Manual Recording Activities, Basic, Desktop & Web Recording, OCR, types of OCR and Screen Scrapping Using OCR. **Selectors:** Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors. RPA Challenge.
Unit IV: **Application with Plugins and Extensions:** Java plugins, Citrix automation, Mail plugins, PDF plugins, Web integration, excel and word plugins. Extensions- Java, chrome, firefox, and Silverlight. Image and Text automation; **Excel Data Tables, PDF, Word:** Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Word automation. **Email Automation:** Incoming Email automation, Sending Email automation.
Unit V: **Debugging and Exception Handling:** Common exceptions and ways to tackle them, Strategies for solving issues, Catching errors. **Introduction to Orchestrator:** Tenants, Authentication, Robots, Environments, Asset. **Capstone Project.**

Syllabus (Practical):

1. Setup, configuration, and introduction of components of UiPath Studio.
2. Execution of prebuilt examples of sequence, flow chart and state machines projects.

Create a sequence/Flow chart activity defining various types of variable as:

3. Generic Value Variables, Text Variables, Boolean Variables, Number Variables,
4. Array Variables, Date and Time Variables, Data Table Variables

Managing Arguments:

5. Create two activities, one activity defined with arguments and second activity which manages the argument to receive value from first activity.
6. Create an activity to manage importing active namespaces.

Create a project to Manage the control Flow:

7. The Assign Activity, The Delay Activity, The Do While Activity, The If Activity
8. The Switch Activity, The While Activity, The For-Each Activity, The Break Activity.

The Recording toolbar Activity:

9. Exercises using basic, web, and Desktop recoding.
10. Automate manual recording projects on Left-click on buttons, check boxes, drop-down lists, GUI elements, and Text typing

Data Scrapping:

11. Bot to extract structured data from your browser, application or document to a database, .csv file or even Excel spreadsheet.
12. Image and Text Automation
13. Excel Data Tables & PDF
14. Email Automation
15. Deployment of plugins and extensions.
16. Deploying and maintaining the BOT.

Text Books:

T1 Tripathi, Alok Mani. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool–UiPath. Packt Publishing Ltd, 2018.
T2. Murdoch, Richard. "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant." Middletown, DE. Omakustanne (2018).

Reference Books:

R1. Abhinav Sabharwal, “Introduction To RPA”, Independently Published Kindle Edition on Amazon Asia-Pacific Holdings Private Limited, 201 8
R2. Gerardus Blokdyk, “Rpa Robotic Process Automation”, 5Starcook, Second Edition, 2018

R3. Kelly Wibbenmeyer, “The Simple Implementation Guide to Robotic Process Automation (Rpa): How to Best Implement Rpa in an Organization” Paperback, iUniverse, 2018
R4. Willcocks, Leslie P., Mary Lacity, and Andrew Craig. "The IT function and robotic process automation." (2015).

Course Title and Code: Minor Project PR1103

Prerequisites	**Nil**
Hours per Week	**L-T-P:**
Credits	**04**
Students who can take	**B. Tech Semester VII**

Course Objective:

In Minor Project, Students are expected to work towards the goals and milestones set in Minor Project. The student will submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. At the end there would be a demonstration of the solution and possible future work on the same problem. The student will have to present the progress of the work through seminars and progress reports. (in continue contact with Faculty Supervisor Assigned)

Operation Procedure

- Student has to devote full semester for Minor Project.
- Student has to report to the Supervisor regularly.
- Seminars s evaluation has to be carried out in the presence of at least two-member Committee comprising.
- Experts in the relevant area constituted by the Supervisor.
- Final Seminar Report to be submitted has to be in formal hard bound cover bearing of the Institute emblem.

Assessment Scheme:

Sr. No	Specifications	Marks
01	Attendance	NIL
02	Assignment	NIL
03	Class Participation	NIL
04	Quiz	NIL
05	Theory Exam (Mid Term)	NIL
06	Theory Exam	NIL
07	Theory Exam (Final)	NIL
08	Report-1 (Synopsis) (Panel)	15
09	Report-2	NIL
10	Report-3	NIL
11	Project -1 (Mid Term) (Panel)	20
12	Project -2 (Day to Day work) (Demo, Presentation, Viva, Report)	25
13	Project -3 (End Term) (Panel) (Demo, Presentation, Viva, Report)	40
14	Lab Evaluation – I	NIL
15	Lab Evaluation – II	NIL
16	Course portfolio	NIL
	Total (100)	**100**

PS1102/ PR2107/ PR1105/ PR1104

Practice School-II/ Industrial Project-II/ Entrepreneurial Project/ Research Project

Course Syllabi:

This course is for five four and half months (summer and one semester) in VII or VIII Semester. The objective of this programme is to provide the students, an opportunity to work on live projects of corporate world in various fields. During this programme, they will work on real world applications of their curricula through organizational function of their choice. The students are expected to be involved directly in problem solving efforts of specific interest to the host organization. The learning of PS-I will help them in completing PS-II successfully. PS-II duration of internship is 4 - 4.5 months. PS -II Winter internship Dec to May.

Course Code	**Course Title**	**Teaching Scheme**	
		Total Duration	**Credits**
PS1102/ PR2107/ PR1105/ PR1104	**Practice School-II/ Industrial Project-II/ Entrepreneurial Project/ Research Project**	**4 months**	**16**

Evaluation Scheme:			
Expert Evaluation	**Evaluation Component**	**Mid-Term**	**Final Term**
Industry Expert	Day to Day Task Record	20	40
	Report Content & Presentation	10	30
JKLU faculty	Reporting Activity Fortnightly	8	18
	Presentation, Viva, Report	20	50
	PS-2 Coordinator Feedback	2	2
	Total	**60**	140

ANNEXURE

Program Education Objectives

The B.Tech. Programs at IET, JKLU are designed to prepare students for continued learning and successful careers. Our alumni are expected to:

PEO1: Apply their technical knowledge, complex problem solving and research skills in professional practice.

PEO2: Continue their intellectual development through critical thinking, self- study, apprenticeship, higher education, professional development courses, as well as participation in research groups and professional networks.

PEO3: Serve as ambassadors for engineering and sustainability by exhibiting high professional standards with a deep sense of civic responsibility.

PEO4: Effectively communicate about technical and related issues.

PEO5: Embrace roles of team members and leaders in their career.

Program Outcomes

The graduates of B.Tech Programs at IET, JKLU will have following competencies:

PO 1: *Life-long learning:* Demonstrate inquisitiveness, open mindedness, and the ability to engage in independent and life-long learning in the broadest context of technological, organizational, economic, and societal changes.

PO 2: Citizenship, Sustainability, and Professional ethics

PO 2a: Demonstrate knowledge of constitutional values of liberty, equity, justice, and fraternity with understanding of the impact of the engineering solutions in societal and environmental contexts as well as a sense of responsibility for sustainable development.

PO 2b: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, cultural, and environmental issues and the consequent responsibilities relevant to the professional engineering practice.

PO 2c: Demonstrate commitment for professional integrity and excellence and respect for ethics, responsibilities and norms as prescribed for the engineering practice.

PO 3: Engineering knowledge and Modern tool usage

PO 3a: Demonstrate clear conceptual understanding of fundamentals of engineering specialization and cognitive flexibility to appropriately 'transfer' what has been learned in a context, to different situations.

PO 3b: Apply engineering thinking, computational thinking, and the knowledge of mathematics, natural and social sciences, engineering fundamentals, information technology, engineering specialization, and engineering management to the solution of complex engineering problems.

PO 3c: Create, select, modify, and apply appropriate techniques, best practices, standards, resources, and modern engineering and IT tools including prediction and modelling to engineering and social activities with an understanding of the limitations.

PO 4: Complex problem solving, Design and Research

PO 4a: Identify, formulate, review research literature, and analyze complex engineering problems to arrive at substantiated conclusions using critical thinking along with principles of mathematics, computing, engineering as well as natural and social sciences.

PO 4b: Use systems thinking and reflection to identify and consider underlying structures, patterns, volatility, uncertainties, complexities, ambiguities, complications, and risks to design and develop engineering solutions for complex problems to meet the specified and anticipated needs with appropriate concern for constraints, performance, sustainability, and professional ethics.

PO 4c: Use research-based knowledge and research methods including design of experiments, simulation, analysis and interpretation of data, and synthesis of the information to evaluate and improve the engineering solutions and practice.

PO 5: Individual & teamwork and Engineering management

PO 5a: Ability to work effectively as an individual and as a team member or leader in diverse and distributed teams, and in multidisciplinary settings.

PO 5b: Ability to apply engineering management principles to one's own and team's work to manage engineering projects and operations and in multidisciplinary environment.

PO 6: Communication: Ability to communicate effectively on complex engineering and technology activities, situations, problems, and solutions using verbal, textual, and pictorial elements with the colleagues, engineering community, users, clients, policy makers, and society at large with intellectual honesty, clarity, empathy, and compassion.

PO 7: Innovation and entrepreneurship:

PO 7a: Demonstrate enthusiasm and understanding to identify opportunities and translate research in engineering and other disciplines to conceive and design innovative engineering solutions for business, industry, and societal problems.

PO 7b: Demonstrate enthusiasm and understanding to conceive and plan technology based new ventures either as independent start-up businesses or within existing corporate structures.

Program Specific Outcomes

B.Tech. (Computer Science and Engineering)

The computer science and engineering graduates of JKLU will be able to:

CSEPSO1: Conceive, design, implement, and manage computational and information processing systems, agents and processes by using principles of computer science, computer engineering, software engineering, artificial intelligence, data analytics, sustainability and state of the art platforms, components and tools.

CSEPSO2: Serve in ICT areas such as software development, data science, IT infrastructure, cyber security, data administration, system administration in business, consultancy, industry, government, healthcare, etc.

Institute of Engineering and Technology								
Department of Computer Science Engineering								
Course Structure for the B. Tech (Batch 2019-2023)								
Semester	**Courses**							**Credits**
I	Computational Data Analysis	Design and Prototyping	Experimental Science-I	Fundamentals of Communication				**21**
	ES1101	**ES1102**	**AS1101**	**CC1101**				
	(10s 2 0)	**(6s 2 0)**	**(1 0 4)**	**(2 0 1)**				
	10	**6**	**3**	**2**				
II	Calculus and Applied Mechanics	Fundamentals of Automation Engineering	Object Oriented Programming/ Python Programming	Energy and Environmental Studies	Critical Thinking and Storytelling	Scientific Perspectives		**20**
	ES1103	**ES1104**	**CS1101 / CS1301**	**ES1105**	**CC1102**	**AS1102**		
	(6s 2 0)	**(6s 2 0)**	**(1 0 4)/ (0 2 0)**	**(1 0 0)**	**(2 0 1)**	(Science Week)		
	6	**6**	**3**	**1**	**2**	**2**		
III	Data Structures	**Computational Engineering Analysis-I**	**Engineering Measurements and Machines**	Theoretical Foundation of Computer Science	**Perspectives on Contemporary Issues**	**Management Perspectives**	Data Visualisation (IBM)	**22/25***
	CS1102	**ES1106**	**ES1107**	**CS1103**	**CC1103**	**IL1101**	**CS1310**	
	(3 0 2)	**(3 1 2)**	**(3 0 4)**	**(3 1 0)**	**(2 0 1)**	(Management Week)	**(2 0 2)**	
	4	**5**	**5**	**4**	**2**	**2**	**3**	
IV*	Design and Analysis of Algorithms	**Computational Engineering Analysis-II**	Database Systems	Computer Architecture & Organization	**Communication and Identity**	**Introduction to Design**	IBM-SP-III	**21/24***
	CS1105	**ES1109**	**CS1106**	**CS1107**	**CC1104**	**IL1102**		
	(3 0 2)	**(3 1 2)**	**(3 0 2)**	**(3 0 2)**	**(2 0 1)**	(Design Week)	**(2 0 2)**	
	4	**5**	**4**	**4**	**2**	**2**	**3**	
Practice School - I (PS1101) – (4 to 6 Weeks Duration) - 4 Credits								
V*	Operating Systems	Artificial Intelligence and Machine Learning	Open Elective-1	**Understanding and Managing Conflict**	**Introduction to IoT**	DE-1/IBM-SP-IV	**Automation Projects**	**22**
	CS1108	**CS1110**		**CC1105**	**EE1111**		**PR1101**	
	(3 0 2)	**(3 0 2)**		**(2 0 0)**		**(3 0 2)**		
	4	**4**	**4**	**2**	**2**	**4**	**2**	
VI*	Computer Networks and Distributed Systems	Compiler Design/Software Engineering	DE-3/ OE-2/IBM-SP-V/ Minor Project	**Critical Thinking for Decisions at Workplace**	**Emerging Tech Week**	DE-2/IBM-SP-VI		**20**
	CS1111	**CS1112/CS1113**		**CC1106**				
	(3 0 2)	**(3 0 2)**		**(2 0 0)**				
	4	**4**	**4**	**2**	**2**	**4**		
VII*	DE-4	DE-5	DE-6	OE-3	**Minor Project**/IBM-SP-VII			**20**
					PR1103			
	4	**4**	**4**	**4**	**4**			
VIII*	**Practice School - II /Entrepreneurial Project/Research Project/Semester at a partner University**							**16**
	Total Credits							**166-172***

INDEX

Course Code: ES1101

Course Name: Computational Data Analysis

Course Outcomes: After course completion, the student will be able to

ES1101.1. Write Simple Python programs using various datatypes, control structures, decision statements, libraries, functions (M1)
ES1101.2. Develop Python programs using Objects, Classes and Files (M1, M2)
ES1101.3. Develop Programs for analyzing and interpreting Complex situations in various domains including sustainable development by combining various Linear Algebra, Statistics and Other Problem-Solving Techniques (M3)
ES1101.4. Model Complex systems as Linear simultaneous equations and analyze the same using Matrix methods (M1)
ES1101.5. Model Data as matrices and Find Eigen Values and Eigen Vectors and Apply the same for problem solving, e.g., ranking and performance analysis (M1)
ES1101.6. Summarize and Visualize different datasets (M2)
ES1101.7. Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving, e.g., Goodness of Fit (M2)
ES1101.8. Formulate and validate hypothesis with reference to different datasets (M2)
ES1101.9. Apply correlation, regression, least square method and time series analysis for modeling, analysis, interpretation, and forecasting (M2)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO -1	PSO-2
ES1101.1																	
ES1101.2											1						
ES1101.3					1	1					1			1			
ES1101.4			1		1	1				1	1						
ES1101.5			1		1	1				1	1			1			
ES1101.6					1	1		1			1		2				
ES1101.7		1	1		1	1		1			1		1	1			
ES1101.8		1	1		2	1		2			1		1	1			
ES1101.9		1	1		2	1		2		1	1		1	1			

Course Code: ES1102

Course Name: Design and Prototyping

Course Outcomes: After course completion, the student will be able to

ES1102.1. Approach design challenges from the perspective of the user and offer innovative solutions effectively.
ES1102.2. Communicate and work in team towards a common goal.
ES1102.3. Think creatively towards a fun based, desirable solution.
ES1102.4. Develop the projection views of the products with dimensions and scales.
ES1102.5. Create the schematic diagram and isometric view of the parts using AutoCAD.
ES1102.6. Fabricate prototype by combining the different parts.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
ES1102.1	2	1	1	1										2			
ES1102.2											1	1	1				
ES1102.3	2				2	1	1	1						2			
ES1102.4					1	1	1										
ES1102.5	1				2	1	1										
ES1102.6	2				2	1	1				1	1	1				

Course Code: AS1101

Course Name: Experimental Science-I

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

AS1101.1. analyze ferromagnetic properties of any magnetic material and differentiate Soft and hard materials.
AS1101.2. analyze thermoelectric effect of metal junctions due to temperature differences.
AS1101.3. analyze nuclear radiation with respect to distance and thickness of absorbing media.
AS1101.4. measure electrical properties e.g., specific resistance, time constant of various electrical components.
AS1101.5. use Schroedinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials.
AS1101.6. differentiate hard and soft water by determining its hardness of different water samples.
AS1101.7. analyze conductivity of samples by different techniques such as volumetric titrations and conductometric.
AS1101.8. determine properties of the lubricant/oil samples by Pensky-Martens and Red Viscometer.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
AS1101.1	1				1									1			
AS1101.2	1																
AS1101.3	1										1						
AS1101.4	1				1						1						
AS1101.5	1																
AS1101.6	1		1		1	1	1				1		1		1		
AS1101.7	1		1				1				1		1				
AS1101.8	1																

Course Code: CC1101

Course Name: Fundamentals of Communication

Course Outcomes: After course completion, the student will be able to:

CC1101.1. Identify different cultural differences and their impact on communication.
CC1101.2. Compose grammatically correct sentences and paragraphs.
CC1101.3. Deliver effective oral presentations following appropriate kinesics and paralinguistic features.
CC1101.4. Identify impact of cultural differences on communication.
CC1101.5. Apply appropriate communication skills across settings, purposes, and audiences.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CC1101.1									1		1		1				
CC1101.2																	
CC1101.3	1										1						
CC1101.4																	
CC1101.5	1										1		1				

Course Code: ES1103

Course Name: Calculus and Applied Mechanics

Course Outcomes: After course completion, the student will be able to

ES1103.1. apply analytical techniques to determine forces in structures

ES1103.2. use commercial software (STAAD Pro.) to simulate a structure/frame and determine force in the members

ES1103.3. model physical phenomena using calculus and solve using appropriate method

ES1103.4. apply Newton's laws of motion and understand the concepts of dynamics concepts (force, momentum, work and energy)

ES1103.5. interpret the geometrical significance of differential and integral calculus

ES1103.6. solve problems of vector differentiation and integration

ES1103.7. calculate the buoyant forces of objects with various shape and carryout the stability analysis

ES1103.8. apply the concept of partial differentiation to solve optimization problems

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1103.1						2					1		2				
ES1103.2						2	2				1						
ES1103.3	1				1	2	2		1		2		1				
ES1103.4	2				1	2	2				1						
ES1103.5	1				1	2	2										
ES1103.6						1	1										
ES1103.7						1	1		1		1		2				
ES1103.8						2	1				1		1				

Course Code: ES1104

Course Name: Fundamentals of Automation Engineering

Course Outcomes: On successful completion of this course, the students should be able to:

ES1104.1 Analyze electrical circuits using network theorems,
ES1104.2 Measure electrical parameters of passive as well as active electrical components,
ES1104.3 Design rectifier circuit using semiconductor devices,
ES1104.4 Design filters for power conditioning,
ES1104.5 Design and test a linear power supply for given specifications
Es1104.6 Design and build Printed Circuit Boards,
ES1104.7 Use electrical safety practices while working on electrical projects,
Es1104.8 Formulate mathematical models for basic electro-mechanical systems,
ES1104.9 Design and simulate a basic analog open-loop control system,
ES1104.10 Evaluate and simplify Boolean functions and design the minimized logic using logic gates.
ES1104.11 Design basic combinational and sequential circuits with minimum complexity,
ES1104.12 Implement combinational circuit using simulation tools.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
ES1104.1.					2			1									
ES1104.2.						2								1			
ES1104.3.					1			1									
ES1104.4.					2							1		1			
ES1104.5.					1							1		1			
ES1104.6.							1		1			1		1			
ES1104.7.	2						2						1		2		
ES1104.8.	2				2			2						2	2		
ES1104.9.					1							1		1			
ES1104.10.																	
ES1104.11.	2				2							1			2		
ES1104.12.						2			2			1	1	1			

Course Code: CS1101

Course Name: Object Oriented Programming

Course Outcomes: On successful completion of this course, the students should be able to:

CS1101.1. Develop Java Programs with the concepts of primitive data types, strings and arrays.

CS1101.2. Develop Java Programs using Object Oriented Programming Principles such as Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, and Interfaces.

CS1101.3. Design, develop and debug programs in Core Java using coding and documentation standards.

CS1101.4. Incorporate exception handling in Java Programs.

CS1101.5. Use JDBC API connectivity in between Java Programs and database.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1101.1					1	1	1							1			
CS1101.2																	
CS1101.3					1	1					1	1		1			
CS1101.4																	
CS1101.5											1	1					

Course Code: ES1105

Course Name: Energy and Environment Studies

Course Outcomes: On successful completion of this course, the student should be able to:

ES1105.1. Relate renewable energy with ecology & environment

ES1105.2. Explain the climate change and threat to biodiversity

ES1105.3. Describe the various pollution sources and their impacts on Environment

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
ES1105.1	1					1											
ES1105.2		1									1						
ES1105.3	1				1												

Course Code: CC1102

Course Name: Critical Thinking & Storytelling

Course Outcomes: On successful completion of this course, the student should be able to:

CC1102.1. Formulate intelligent questions to investigate.

CC1102.2. Evaluate information and argument for correctness, consistency, relevance, and validity.

CC1102.3. Compose well-structured and well-reasoned arguments.

CC1102.4. Articulate and evaluate the impact of narratives.

CC1102.5. Distinguish between facts, assumptions and opinion.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CC1102.1			1					1									
CC1102.2			1			1							1				
CC1102.3											1						
CC1102.4													1				
CC1102.5													1				

Course Code: AS1102

Course Name: Scientific Perspectives

Course Outcomes: After course completion, the student will be able to

AS1102.1. Distinguish between science, pseudo-science and other forms of knowledge.

AS1102.2. Distinguish between science, engineering, technology and mathematics and also identify the opportunities for integrating these disciplines.

AS1102.3. Use the scientific approach to identify and understand the societal problems

AS1102.4. Explain, Design and carry out Scientific studies

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
AS1102.1	1												1				
AS1102.2					1	1											
AS1102.3		1			1												
AS1102.4	1												1				

Course Code: CS1102

Course Name: Data Structures

Course Outcomes: On successful completion of this course, the students should be able to:

CS1102.1. Write programs for performing basic operations like insertion, deletion, searching, sorting, merging, traversal etc. on various data structures like array, queue, stack, linked list, tree, graph.

CS1102.2. Use and design appropriate data structures for solving a variety of computational problem.

CS1102.3. Develop test cases for their programs and debug the code.

CS1102.4. Analyze the algorithms in terms of asymptotic time and space complexity.

CS1102.5. Implement and compare various searching and sorting algorithms

CS1102.6. Convert a recursive algorithm to non-recursive algorithm.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1102.1	1		1		1	1						1					2
CS1102.2			1		1	1										2	2
CS1102.3	2			1	1	1				1			1				2
CS1102.4		1			1		1					2				2	2
CS1102.5	1				1		1									2	2
CS1102.6	1			1	1						1		1			2	2

Course Code: CS1103

Course Name: Theoretical Foundation of Computer Science

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

CS1103.1. construct and validate simple computing models which play a crucial role in compiler design, algorithms, etc.

CS1103.2. construct conceptual models using discrete mathematics in various application areas such as linguistic, business, internet, etc.

CS1103.3. develop problem solving and critical thinking skills to solve complex computing problems

CS1103.4. use logics and proofs in order to read, comprehend and construct mathematical arguments

CS1103.5. develop mathematical models of computation and describe how they relate to formal languages

CS1103.6. relate the basic difference between deterministic and nondeterministic computing machines

CS1103.7. Interpret the language accepted by Turing machine.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1103.1					1		1	1		1						2	1
CS1103.2					1			1	1					1		2	1
CS1103.3					1	1	1	1	1					1		2	1
CS1103.4					1	1		1					1			1	1
CS1103.5					1	1		1					1	1		1	1
CS1103.6					1			1					1			1	1
CS1103.7					1			1		1			1			1	1

Course Code: IL1101

Course Name: Management Perspectives

Course Outcomes: After course completion, the student will be able to

IL1101.1. Comprehend the importance of management and its functional areas in businesses and also its interaction with technology.

IL1101.2. Highlight specific external and internal issues impacting businesses.

IL1101.3. Integrate and analyze multiple dimensions of management aspects to solve business problems.

IL1101.4. Evaluate the aspects that management might consider when evaluating technical and engineering projects such as planning and scheduling, personnel management, cost control etc. from a management perspective

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
IL1101.1	1				1												
IL1101.2	1	1											1				
IL1101.3	2		1		1						1		1				
IL1101.4	1			1							2	1					

Course Code: ES1106

Course Name: Computational Engineering Analysis – I

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

ES1106.1. Solve ordinary differential equations through various techniques.
ES1106.2. Determine the structural behavior of the body by determining the stresses, strains produced by the application of load.
ES1106.3. Analyze the concept of buckling and be able to solve the problems related to column and struts.
ES1106.4. Model the problems of column and struts mathematically in terms of ordinary differential equations and solve them using the appropriate method.
ES1106.5. Simulate the solutions of the above-mentioned models of columns and struts.
ES1106.6. Analyze a function of complex variables in terms of analyticity, poles and zeroes.
ES1106.7. Find Laplace and inverse Laplace transforms of given function and use Laplace transform to solve ordinary differential equations.
ES1106.8. Design and Evaluate the LC, RC & RL Networks using Foster'sand Cauer Forms
ES1106.9. Analyze stability criteria for electrical network using pole zero plot and routh-hurwitz polynomials
ES1106.10. Model and simulate electrical networks using Proteus simulator/ Virtual lab.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
ES1106.1					2	2	2	1	1		1	1					
ES1106.2					2			2									
ES1106.3					1			1							1		
ES1106.4		1			1	2	2	1	1	1	2	1					
ES1106.5							2	1		1							
ES1106.6					2												
ES1106.7					2	2	1	1	1		1	2					
ES1106.8					2	2		2			1	1		1			
ES1106.9					2	2		1			1	1					
ES1106.10	1						1		1								

Course Code: ES1107

Course Name: Engineering Measurements and Machines

Course Outcomes: On successful completion of this course, the students be able to:

ES1107.1. Evaluate suitable electrical and non-electrical instruments for measuring physical quantities.

ES1107.2. Analyze the construction, characteristics and applications of various types of rotating machines.

ES1107.3. Analyze the working of any mechanical and electrical machine using mathematical model.

ES1107.4. Integrate the sensors for monitoring and automation of electrical and mechanical systems.

ES1107.5. Design electro-mechanical machines as per Indian standards.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
ES1107.1	2				2	1	1				1	1	1	1			
ES1107.2		1			1	1	1	1									
ES1107.3					1	2	1	1	1		1						
ES1107.4	1	1	1		1	1	1	1	1		1		1				
ES1107.5	1		1	1	1	1	1	1	1		1	1					

Course Code: CC1103

Course Name: Perspectives on Contemporary Issues

Course Outcomes: After course completion, the student will be able to

CC1103.1. Identify different perspectives objectively.

CC1103.2. Explain interconnectedness of the issues and their impact at micro and macro levels.

CC1103.3. Recognize their own beliefs, biases, claims and assumptions.

CC1103.4. Evaluate sources, argue and defend effectively.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CC1103.1	1		1					1			1	1					
CC1103.2						1					1	1	1				
CC1103.3											1	1	1				
CC1103.4	1		1									1	1				

Course Code: CS1105

Course Name: Design and Analysis of Algorithms

Course Outcomes: On successful completion of this course, the students should be able to:

CS1105.1. Analyze the complexity of different algorithms using asymptotic analysis.

CS1105.2. Analyze and select an appropriate data structure for a computing problem.

CS1105.3. Differentiate between different algorithm designs technique: Divide and Conquer Technique, Greedy, Backtracking, and Dynamic Programming. Also, recognize when an algorithmic design situation calls for using these.

CS1105.4. Develop algorithm and programs using Divide and Conquer technique to solve various computing problems, e.g., Sorting, Strassen's matrix multiplication, and Closest pair.

CS1105.5. Develop energy-efficient algorithms and programs using Greedy approach to solve various computing problems, e.g., Minimum Spanning Trees, Shortest Path, Knapsack, Job scheduling, Graph coloring etc.

CS1105.6. Develop algorithms and programs using Backtracking technique to solve various computing problems, e.g., N queen, Hamiltonian Cycle detection, Travelling salesman, and Network flow.

CS1105.7. Develop algorithms and programs using Dynamic Programming technique to solve various computing problems, e.g., Knapsack, Shortest path, Coinage, Matrix Chain Multiplication, Longest common subsequence.

CS1105.8. Apply Query optimization algorithms using Greedy and Dynamic programming approaches.

CS1105.9. Apply various search-based problem-solving methods e.g., Uninformed search (BFS, DFS, DFS with iterative deepening), Heuristics, and Informed search (hill-climbing, generic best-first, A*).

CS1105.10. Evaluate and apply appropriate energy efficient algorithmic design technique for solving complex computing problem.

CS1105.11. Explain the ways to analyze randomized algorithms (expected running time, probability of error).

CS1105.12. Differentiate between P, NP, NP-Complete, and NP-Hard problems.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1105.1	2		1		2											2	2
CS1105.2	2		1		2				1							2	2
CS1105.3	2		1		2				1							2	2
CS1105.4	2		1		1				1							2	2
CS1105.5	1		1		1				1							2	2
CS1105.6	1															2	2
CS1105.7	1		1		1				2							2	2
CS1105.8	1							1						1			2
CS1105.9	1				1			1	1					1	1	2	2
CS1105.10								1						1		2	2
CS1105.11	1		1		1			1						1			1
CS1105.12	1		1		1			1						1			1

Course Code: CS1106

Course Name: Database Systems

Course Outcomes: On successful completion of this course, the students should be able to:

CS1106.1. Outline database system components and their functions

CS1106.2. Model the real-world systems from the given requirements specification using Entity Relationship Diagrams/Unified Modelling Language

CS1106.3. Convert the ER model into a relational logical schema using various mapping algorithms

CS1106.4. Apply SQL commands to define, query and manipulate a relational database

CS1106.5. Apply SQL coding standards to embed SQL in an application program

CS1106.6. Write relational algebra expressions and optimize the same for given query

CS1106.7. Convert relational algebra expressions into SQL commands and vice versa

CS1106.8. Normalize a given database up to Boyce Codd Normal Form (BCNF) based on identified keys and functional dependencies

CS1106.9. Determine the transaction atomicity, consistency, isolation, and durability for a given transaction-processing system.

CS1106.10. Determine the deadlock in transaction-processing system. Apply the method of deadlock avoidance and deadlock detection and recovery

CS1106.11. Apply various concurrency control protocol like two phase locking, timestamping and the method of log base recovery in case of failure

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1106.1	1				1	1	1				1	1	1			1	1
CS1106.2	1	1			1	2	2		1		1					1	2
CS1106.3	1	1			1	2	2		1		1					1	2
CS1106.4	1				1	1	1									1	
CS1106.5	1					1		1	1		1					2	1
CS1106.6	1	1			1			1	1				1			1	1
CS1106.7	1							1								1	1
CS1106.8	1	1			1	2	2	1	1		1					2	2
CS1106.9	1		1				1	1	1				1			1	1
CS1106.10	1		1				1	1	1				1			1	1
CS1106.11	1				1								1			1	1

Course Code: CS1107

Course Name: Computer Architecture and Organization

Course Outcomes: On successful completion of this course, the students should be able to:

CS1107.1. Draw the functional block diagram of single bus architecture of a computer and describe the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.

CS1107.2. Summarize and compare different computer systems.

CS1107.3. Categorize different types of computers based on Instruction set Architecture.

CS1107.4. Develop assembly language programs for multiplication, division, and I/O interface using 8086.

CS1107.5. Given a CPU organization and instruction, design a memory module and analyze its operation by interfacing with the CPU.

CS1107.6. Write a flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.

CS1107.7. Given a CPU organization, assess its performance, and apply design techniques to enhance performance using pipelining, parallelism and RISC methodology.

CS1107.8. Analyze the performance of pipeline and cache-based systems.

CS1107.9. Design algorithms to optimize hit-rate in cache memory.

CS1107.10. Program and estimate the execution time of arithmetic functions using different number systems.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1107.1		1		1				1				1				2	
CS1107.2	1		1			1								1			2
CS1107.3		1					1				1						
CS1107.4			1		1				1	1			1			2	2
CS1107.5	1							1				1		1		2	
CS1107.6		1		2			2				1					2	2
CS1107.7	1		1		1				1			1					2
CS1107.8	1	2				2				2				1		2	2
CS1107.9	1		1		1			1				1				2	
CS1107.10	1	2				2			2				1				2

Course Code: ES1109

Course Name: Computational Engineering Analysis – II

Course Outcomes: After course completion, the student will be able to

ES1109.1. Classify various types of partial differential equations and solve them through various analytical and numerical methods.
ES1109.2. Formulate and analyze differential equations especially Navier stokes and energy equations and use numerical methods for solving the same.
ES1109.3. Use Numerical method for solving partial differential equations using finite difference method.
ES1109.4. Find Fourier and inverse Fourier transforms of given function and use Fourier transform to solve partial differential equations.
ES1109.5. Find Z-transform and inverse Z-transforms of given functions and use them to analyze control systems.
ES1109.6. Design and analyse various types of filters and attenuators to minimize power losses and improve signal quality.
ES1109.7. Solve problems involving vertex and edge connectivity, planarity and crossing numbers.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
ES1109.1	1				1	1		1			1						
ES1109.2	2		2		2	2	1	2			1		1	2			
ES1109.3						1	2										
ES1109.4					2	2		1			1						
ES1109.5	1		1		2	2		1			1			1			
ES1109.6		1				1	2			2				1			
ES1109.7						1	2	2						1			

Course Code: CC1104

Course Name: Communication and Identity

Course Outcomes: After course completion, the student will be able to

CC1104.1. Analyse their personal identities, both private and social

CC1104.2. Identify their different values, strengths and areas of professional interest

CC1104.3. Articulate their personal statement and use it to craft an influential pitch

CC1104.4. Express themselves through various communication formats on different platforms

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CC1104.1													1	1			
CC1104.2	1		2	1										2			
CC1104.3													1				
CC1104.4													2				

Course Code: IL1102

Course Name: Introduction to Design

Course Outcomes: After course completion, the student will be able to

IL1102.1. Identify the user and build persona of the
IL1102.2. Sketch their ideas on paper to visualize and assess viability.
IL1102.3. Create a plan for process and management to materialize the desired idea.
IL1102.4. Test the material for possibilities and capabilities.
IL1102.5. Develop skills of joinery, material manipulation and various hand tools.
IL1102.6. Develop technical and narrative skills useful for both film and animation.
IL1102.7. Develop troubleshooting and problem-solving skills.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
IL1102.1	1								1	1			1	1			
IL1102.2	2						1						2				
IL1102.3	1						1	1						2			
IL1102.4	1						1	1									
IL1102.5							1	1									
IL1102.6	2						1						1				
IL1102.7	1		1			1	1										

Course Code: CC1105

Course Name: Understanding and Managing Conflict

Course Outcomes: After course completion, the student will be able to

CC1105.1. Define a group and explain the stages of group development
CC1105.2. Describe conflict and explain types and causes of conflict
CC1105.3. Use inquiry and advocacy to engage with groups
CC1105.4. Give and receive feedback effectively
CC1105.5. Identify sources of conflict and manage them using difference conflict handling styles

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CC1105.1	1										2		1				
CC1105.2	1							1									
CC1105.3	1		1						1		2	1	1				
CC1105.4	1										1		1				
CC1105.5	1										1	1	1				

Course Code: CS1108

Course Name: Operating System

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

CS1108.1. Use basic LINUX commands: file/directory handling, standard I/O, redirection, pipes, and filters.

CS1108.2. Analyze the structure of OS and its interface with hardware.

CS1108.3. Differentiate between different types of operating systems – Multiprogramming systems, Time-sharing systems, Parallel systems, Real-Time systems, Distributed systems and Mobiles systems. Compare Windows, Android and LINUX OS with respect to their key features and functionality.

CS1108.4. Differentiate between various states of process and their representation using process control block (PCB). Analyze data structures used by an OS to manage the processes.

CS1108.5. Implement and Assess the performance of different types of scheduling algorithms.

CS1108.6. Examine process synchronization and Inter process communication- Race condition, semaphores, monitors, inter process communication through message passing.

CS1108.7. Categorize the conditions that cause deadlock in resource allocation. Implement deadlock handling strategies.

CS1108.8. Analyze paging, segmentation, and segmentation with paging for VM support in memory management. Implement different page replacement algorithms.

CS1108.9. Analyze and implement various disk-scheduling algorithms.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1108.1	1				1	1	1									1	1
CS1108.2	1				1	1										1	3
CS1108.3	1				1	1										1	
CS1108.4	1				1	1										1	
CS1108.5	1				1	1	1				1	1				3	3
CS1108.6	2				2	1		1	1		1	1	2			3	3
CS1108.7	2				2	1		1	1		1	1				3	3
CS1108.8	2				2	1	1	1	1		1	1	1		1	3	3
CS1108.9	2				2	1	1	3	3		1	1	2		3	3	3

Course Code: CS1110

Course Name: Artificial Intelligence and Machine Learning

Course Outcomes: On successful completion of this course, the students should be able to:

CS1110.1. Explain the role of agents and how it is related to environment and the way of evaluating it and how agents can act by establishing goals.

CS1110.2. Implement intelligent agents for making computers solve critical problems the way human beings do.

CS1110.3. Analyze the usage of Game theory and role of heuristics for building Intelligent Agents.

CS1110.4. Apply AI techniques in applications which involve perception, reasoning and learning.

CS1110.5. Acquire the knowledge of real-world knowledge representation.

CS1110.6. Identify machine learning techniques suitable for a given problem.

CS1110.7. Interpret fundamental issues and challenges of machine learning: data, model selection, model complexity, etc.

CS1110.8. Use the standards and energy efficient ML algorithms.

CS1110.9. Appreciate the underlying mathematical relationships within and across Machine Learning algorithms and the paradigms of supervised and un-supervised learning.

CS1110.10. Utilize state-of-the art algorithms of Machine Learning for building applications related to SDG goals

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1110.1	1			1												1	1
CS1110.2			1			2		2				1				2	3
CS1110.3						1					1	2		1	1	1	1
CS1110.4	2	1		1			1		2		2	2		3		3	3
CS1110.5			1		3			1					2			3	
CS1110.6	2	1		1		3			2	1	2		1		3		3
CS1110.7			1		2		3					1		2	2		3
CS1110.8	2		1					3	3		3	1		3		3	2
CS1110.9		1		1		2		2	1		2	2	3		3	3	2
CS1110.10			2	1	1		2		2	2		2		2	2	3	2

Course Code: EE1111

Course Name: Introduction to IoT

Course Outcomes: On successful completion of this course, the students should be able to:

EE1111.1. Interface the Analog and Digital sensors to Node-MCU
EE1111.2. Develop Embedded C programs to read sensor data and upload to public cloud platform.
EE1111.3. Use Python-based IDE (integrated development environments) for the Raspberry Pi
EE1111.4. Interface Raspberry Pi with I/O devices.
EE1111.5. Visualize sensor data uploaded on public cloud.
EE1111.6. Apply standard protocol(s) for implementation of IoT Systems.
EE1111.7. Analyze and Improve existing systems with innovative IoT based approaches.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
EE1111.1								1		1	1						
EE1111.2							1	1	1		1						
EE1111.3								1		1							
EE1111.4								1	1	1	1		1	1			
EE1111.5							1	1		1	1			1			
EE1111.6									1	1			1	1			
EE1111.7									1	1	1						

Course Code: PR1101

Course Name: Automation Project

Course Outcomes: On successful completion of this course, the students should be able to:

PR1101.1. Design and implement a complete project in IoT/Automation using microcontroller/SOC interfaced with sensors or any other automation hardware/tools.

PR1101.2. Apply anyone/more standard data communication/IoT protocol(s).

PR1101.3. Use cloud servers for data streaming/logging and analytic techniques.

PR1101.4. Implement algorithms/signal processing using the data at edge/cloud.

PR1101.5. Deploy techniques to conserve bandwidth/energy/other resources and achieve cost economy for project.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
PR1101.1	2				2					2		2		3			
PR1101.2						2											
PR1101.3							2										
PR1101.4	2								2								
PR1101.5					2		2										

Course Code: CS1111

Course Name: Computer Networks and Distributed Systems

Course Outcomes: On successful completion of this course, the students should be able to:

CS1111.1. Categorize the various type of Networks on the basis of geographical distance, topology and implementation.

CS1111.2. Compare the function and services provided by different layers of OSI and TCP/IP network architectures.

CS1111.3. Do network programming using sockets in C.

CS1111.4. Find out the errors in the transmitted segments through error detection techniques like Checksum, Cyclic Redundancy check etc.

CS1111.5. Use various network monitoring commands like netstat, traceroute, ipconfig etc.

CS1111.6. Analyze the underlying architectures and protocols of networking applications like File Transfers, Mail Transfers etc.

CS1111.7. Apply the concepts of IP addressing, subnet masking and routing algorithms.

CS1111.8. Apply and compare the sliding window – Transmission Control Protocols like Go-Back N, Stop-N-Wait and Selective Repeat using the criteria of segment loss, acknowledgement loss etc.

CS1111.9. Analyze distributed systems and understand classification of agreement protocol.

CS1111.10. Apply the concept of logical clocks and global clocks in distributed systems.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1111.1	1			1	1	2		1	1	2	1		1	2		2	2
CS1111.2				1									2	1			
CS1111.3				1	2			1			3	2	1	1	3	2	3
CS1111.4						1			1	1							2
CS1111.5					1		2						1		2	2	3
CS1111.6						1	2				1	2	1			2	3
CS1111.7	1						1		2			2	1		1	3	2
CS1111.8							1	2		1		2		1		2	2
CS1111.9	1					1	2			2		1			1	2	2
CS1111.10	1			1	1					2		1			1	2	1

Course Code: CS1112

Course Name: Compiler Design

Course Outcomes: On successful completion of this course, the students should be able to:

CS1112.1. Specify and analyze the lexical, syntactic and semantic structures of programming language features

CS1112.2. Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation

CS1112.3. Write scanners, parsers, and semantic analyzers without the aid of automatic generators

CS1112.4. Utilize the compiler design concept to write efficient programs

CS1112.5. Design the structures and support required for compiling advanced language features.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1112.1	1				2	1	2									2	2
CS1112.2	1				1		1									2	2
CS1112.3	1				1		1						1			2	2
CS1112.4	1				2	1	2				1		1			3	3
CS1112.5	1				2	1	2	1	1		1	1	1			3	3

Course Code: CS1113

Course Name: Software Engineering

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

CS1113.1. Use software development lifecycle models for project development.
CS1113.2. Explain the advantages of agile software development over traditional software engineering methods.
CS1113.3. Apply agile development method namely Extreme Programming (XP), Adaptive software development (ASD), Scrum and Crystal for software development.
CS1113.4. Design solutions in various application domains using software engineering approaches that integrate ethical and economic concerns.
CS1113.5. Elicit and Evaluate functional and non-functional requirements for a software system.
CS1113.6. Design, represent and document software requirements specification according to IEEE standards.
CS1113.7. Apply UML modelling for software design.
CS1113.8. Apply coding standards and guidelines.
CS1113.9. Prepare code checklist and perform code inspections, code reviews and walkthrough.
CS1113.10. Develop and implement various manual and automated testing procedures.
CS1113.11. Estimate the cost of software project.
CS1113.12. Evaluate software in terms of software quality and quality assurance according to ISO standards.
CS1113.13. Execute activities for software project such as re-engineering, reverse engineering and software configuration.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1113.1	2				1	1										1	1
CS1113.2	1				1	1										1	1
CS1113.3	1				1	1										1	2
CS1113.4	1				1	1										1	1
CS1113.5	1				1	1										2	1
CS1113.6	1	1	1	1	1	1	2									2	2
CS1113.7	1				1	1					1	2	2			2	2
CS1113.8	1	1	1	1	1	1					1	2		1		2	2
CS1113.9	1				1	1					1	2	2	1		2	2
CS1113.10	1	1	1	1	1	1			2		1	2		1		2	2
CS1113.11	1	1	1	1	1	1			2					1		2	2
CS1113.12	1	1	1	1	1	1	2		2		2	2		2	2	3	3
CS1113.13	1	1	1	1	1	1	2		2		2	2		2	2	3	3

Course Code: CC1106

Course Name: Critical Thinking for Decisions at Workplace

Course Outcomes: After course completion, the student will be able to

CC1106.1. Apply techniques of Critical Thinking to analyse organisational problems through positive inquiry

CC1106.2. Describe and analyse appropriate problem-solving and ethical decision-making processes

CC1106.3. Choose the most effective and logical decision among multiple alternatives

CC1106.4. Evaluate solutions and anticipate likely risks based on purpose, context and ethics

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CC1106.1	1										2		2				
CC1106.2	2					1		2					1				
CC1106.3									1		1	2	1				
CC1106.4							1	2				2					