HAND BOOK

of

CURRICULUM STRUCTURE AND SYLLABUS

Bachelor of Technology in Computer Science and Engineering (Programme Code: 3102)

Batch: 2019-23

Institute of Engineering and Technology

Vision

To be one of India's most innovative higher education institutions.

Mission

To realise its vision, the University will:

Practice teaching that inculcates critical thinking and problem solving,

Pursue research that leads to innovation and enhancement of real-life applications,

Offer experience that leads to all round development, and

Develop a culture that is strongly rooted in interdisciplinarity and learning by building, not just doing.

Values

Caring for people.

Integrity including intellectual honesty, openness, fairness, and trust.

Commitment to excellence.

IQAC Documentation

Document Name: Handbook of Curriculum Structure and Syllabus, Bachelor of Technology in Computer Science and Engineering (Programme Code: 3102) - Batch 2019-2023

Document Creation Date: Jan 24, 2022

Document Description: This document supplements the document titled Curriculum Structure: BTech, MTech and BCA Programs and is prepared by the Institute of Engineering and Technology (IET), JKLU to serve as an information baseline for further planning and delivery of courses w.r.t Bachelor of Technology in Computer Science and Engineering (B.Tech CSE), Batch 2019-23.

It includes Program Education Objectives, Programme Outcomes, Programme Specific Outcomes, Desired minimum level of competence for POs and PSOs, Curriculum Structure, collation of Semester wise Course Description, and Course Articulation Matrix (CAM) of each course (including electives and additional courses, if any, opted by students) prepared by respective faculty members. The document also includes Programme Articulation Matrix (PAM).

This document is in compliance with BoS (upto 13th meeting) and approvals of the Academic Council (upto 20th meeting).

Document Creation Team:

Dr Sonal Jain

Dr Amit Sinhal

Santosh Verma

Umesh Tripathi

Quality Checked by:

Dr Devika Kataria

Dr Umesh Gupta

JK LAKSHMIPAT UNIVERSITY IQAC JAIPUR

Approved by:

DIRECTOR-IQAC
JK LAKSHMIPAT UNIVERSITY
JAIPUR

Vice Chancellor
JK Lakshmipat University
Jaipur-302026

CONTENTS

Program Education Objectives

The B.Tech and M.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 the roles of team members and leaders in their careers.

Program Outcomes

"*Competence is a demonstrated ability to apply knowledge, skills and attributes for achieving desirable results."* The graduates of B.Tech. and M.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 & team work 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 Outcome

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.

Desired minimum level of competence for POs and PSOs

PO/PSO	Competence Level
PO 1	Competent
PO 2a	Novice
PO 2b	Novice/Advanced Beginner
PO 2c	Novice
PO 3a	Competent
PO 3b	Advanced Beginner
PO 3c	Advanced Beginner
PO 4a	Advanced Beginner
PO 4b	Advanced Beginner
PO 4c	Novice
PO 5a	Advanced Beginner
PO 5b	Advanced Beginner
PO 6	Advanced Beginner
PO 7a	Advanced Beginner
PO 7b	Novice
CSEPSO 1	Competent
CSEPSO 2	Competent

Following process has been adopted to create Course Articulation Matrix (CAM) and Program Articulation Matrix (PAM).

- Course Outcome of each Course is mapped to Program Outcome (PO) / Program Specific Outcome (PSO) using three Levels viz., Low Correlation (1), Moderate Correlation (2) and Substantial Correlation (3).
- Average of these Levels of each Course Outcome w.r.t each specific PO/PSO is calculated and it indicates expectations laid in a course to attain different PO/PSO. In order to avoid over commitment of a course w.r.t its contribution to POs/PSOs, the following validation check is applied on the sum of PO/PSO wise averages in each course.

$$\sum (\text{Average}) <= \text{Min}(\text{Credits} * \text{Year}, 15)$$

  In above equation, Credits are the credits assigned to the course, Year indicates the level of the students from 1st to 4th year. In case this sum exceeds the upper limit, CO-PO mappings are revised. This check ensures that early or low credit courses are not over burdened with very high expectations.
- For creation of Program Articulation Matrix, sum of these averages of different courses w.r.t each PO/PSO is calculated and interpreted as per following Table.

Competence Level *	B.Tech
Novice	<8
Advanced Beginner	8 - 16
Competent	>=16

Novice* (N): Knows objective facts, features, and rules for determining actions w.r.t this PO/PSO without being context-sensitive. The student has studied the basic concepts.
Advanced beginner* (AB): Recognizes common situations w.r.t this PO/PSO that help in recalling which rules should be exercised, starts to recognize and handle situations not covered by given facts, features and rules. The student has problem-solving and repeated practice experience for common situations w.r.t. this PO/PSO.
Competent* (C): Performs most standard actions w.r.t. PO/PSO without conscious application of rules after considering the whole situation. Handles new situations through the appropriate application of rules, can design systems, and may lead. Has demonstrated this PO/PSO through repeated engagements in advanced problem-solving, projects, extensive practice in common and exception situations, and participated in professional networks.

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology
Curriculum Structure
Bachelor of Technology in Computer Science and Engineering (Batch 2019-2023)

Sem	Courses							Credits
I	Computational Data Analysis ES1101 (10s 2 0) 10	Design and Prototyping ES1102 (6s 0 0) 6	Experimental Science-I AS1101 (1 0 4) 3	Fundamentals of Communication CC1101 (2 0 1) 2				**21**
II	Calculus and Applied Mechanics ES1103 (6s 2 0) 6	Fundamentals of Automation Engineering ES1104 (6s 2 0) 6	Object Oriented Programming CS1101 (1 0 4) 3	Energy and Environmental Studies ES1105 (1 0 0) 1	Scientific Perspectives AS1102 (2 0 0) 2	*IBM SP-I Python Programming* CS1301 (1 0 2) 1	Critical Thinking and Storytelling CC1102 (2 0 1) 2	**20/21***
III	Data Structures CS1102 (3 0 2) 4	Theoretical Foundation of Computer Science CS1103 (3 1 0) 4	Computational Engineering Analysis-I ES1106 (3 1 2) 5	Engineering Measurements and Machines ES1107 (3 0 4) 5	Management Perspectives IL1101 (2 0 0) 2	*IBM SP-II Data Visualisation* CS1310 (2 0 2) 3	Perspectives on Contemporary Issues CC1103 (2 0 1) 2	**22/25***
IV	Design and Analysis of Algorithms CS1105 (3 0 2) 4	Database Systems CS1106 (3 0 2) 4	Computer Architecture and Organization CS1107 (3 0 2) 4	Computational Engineering Analysis-II ES1109 (3 1 2) 5	Introduction to Design IL1102 2	*IBM SP-III Enterprise Programming using Java* CS1303 (2 0 2) 3	Communication and Identity CC1104 (2 0 1) 2	**21/24***
Practice School-I (PS1101) – (4 to 6 Weeks Duration) - 4 Credits								
V	Operating Systems CS1108 (3 0 2) 4	Artificial Intelligence and Machine Learning CS1110 (3 0 2) 4	Introduction to IoT EE1111 (1 0 2) 2	Automation Project PR1101 2	Understanding and Managing Conflict CC1105 (2 0 0) 2	DE-I*/*IBM-SP-IV (Cloud Computing-CS1304)* (3 0 2) 4	OE-I* 4	**22**
VI	Computer Networks and Distributed Systems CS1111 (3 0 2) 4	Compiler Design-CS1112/Software Engineering-CS1113 (3 0 2) 4	Emerging Tech Week 2	Critical Thinking for Decisions at Workplace CC1106 (2 0 0) 2	DE-II*/*IBM-SP-V (Big Data Engineering - CS1312)* (3 0 2) 4	DE-III*/OE-II*/*IBM-SP-VI (Business Intelligence - CS1305)* (3 0 2) 4		**20**
VII	Minor Project-PR1103/*IBM-SP-VII (AI with IBM Watson-CS1314)* (3 0 2) 4	DE-IV* 4	DE-V* 4	DE-VI* 4	OE-III* 4			**20**
VIII	Practice School-II /Entrepreneurial Project/Research Project/Semester at a partner University PS1102/PR1105/PR1104/ 16							**16**
	Total Credits							**166-173***

- Minimum required credit – 160
- A student can choose to drop DE/OE and still complete the minimum credit requirement of 160 for completion of B.Tech.
- Credits can vary for specific (*) courses.

List of Electives	
Sem V	
DE-I	**OE-I**
Mobile Application Development- CS1205	Urban and Regional Planning- CE1215
Cryptography- CS1214	Introduction to User-Experience- IL1204
	Idea to Business Model- ED1102
	Energy Management System
	Design and Manufacturing
	Speech Processing
	Numerical Methods- AS1204
	Numerical and Scientific Computing- AS2202
Sem VI	
Emerging Tech week	
Robotic Process Automation Lab-CS1125	
Geographical Information Systems Lab-CE1114	**OE-II**
DE-II	Electric Vehicle Technology-EE1220
Cloud Computing Architecture-CS1217	Green Energy- IL1202
Deep Learning-CS1218	Mechatronics-ME1207
Software Engineering-CS1113 (Flexi core)	Disaster Management- CE1206
Compiler Design-CS1112 (Flexi core)	Modern Physics
DE-III	Introduction to Nano Technology
Full Stack Web Development with REACT-CS1212	Introduction to Quantum Computing
Cyber Security-EE1219	Engineering Optimisation
	Integral Transforms
Sem VII	
DE-IV, V, VI (Tentative)	**OE-III (Tentative)**
Advanced Data Structures and Algorithms-CS1213	Geographical Information System- CE1214
Blockchain Technology and Applications-CS1203	Operations Research- AS1201
Natural Language Processing- CS2203	Fintech in Retail Banking and Insurance-FA1151
Cross-Platform App Development- CS1215	Industrial Safety
Machine Vision- EE1217	Advanced Statistics- AS1202

NOTE:

1. For every credit, in each course, every student is expected to put in a total work of 35-36 hours including the class time. The specified teaching scheme is applicable if the course is taught as full semester course. However, sometimes, a few courses may actually be completed in a shorter duration by increasing the weekly contact hours.
2. Students have the option for earning additional Minor certification in Cyber-Physical Systems (through electives/minor project, 16 Credits) or a Concentration in Data Science, Artificial Intelligence, Embedded Systems and IoT, Software Engineering and Robotic Process Automation, Cloud Computing, Big Data Analytics, Information Security, or Mobile Computing (through electives, 12 credits).
3. Learning outcomes focus on higher order thinking and practical skills. Rote learning is completely de-emphasized and assessment scheme includes several components like assignments, labs, projects, reports etc. The exams are designed to assess problem solving ability through questions focusing on analysis, synthesis, and evaluation.
4. Emerging Tech Week in the VI semester is a slot in which the actual course is decided flexibly. The course has to be in an emerging technology area. Students have the option to replace the course on Emerging Tech Week by a Department elective or Open elective.
5. Relevant engineering standards and sustainability issues are incorporated in all engineering courses.
6. Student can optionally take upto four Independent Study courses with 2 credits each to complete their credit requirement.
7. Students can optionally undergo additional summer internship of 2 credits each after first year and third year to complete their credit requirement.
8. A student may sometimes be allowed to take a few additional courses for earning extra credits, fulfilling credit deficiency or completion of academically equivalent core course requirements in special cases, e.g., lateral entry/transfer cases, semester exchange at partner universities, medical cases, student detention, backlog, etc.

Additional Courses offered for the B. Tech students (2019-23)

Bachelor of Technology in Computer Science and Engineering

Sem	Code	Course Name	Credits
III	CS1411	Object Oriented Programming in JAVA (MOOC)	2
IV	CS1402	Data Analytics using Python (MOOC)	4
IV	CS1414	Introduction to Programming (MOOC)	2

- These courses are offered to enable students for earning extra credits, fulfilling credit deficiency or completion of academically equivalent core course requirements in special cases, e.g., lateral entry/transfer cases, semester exchange at partner universities, medical cases, student detention, backlog, etc.

INDEX OF COURSE DESCRIPTIONS

ES1101: Computational Data Analysis

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

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

Course Objective:

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

Syllabus of Engineering Drawing,

Introduction to Engineering Drawing, Orthographic Projections

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales. Angle of projection.

Projection of line.

Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes. Determination of true lengths and true inclinations by rotating line method and traces.

Projections of plane

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Projections of regular solid.

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

Sections of Regular Solids

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

Development of surface

Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

Isometric Projections

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Syllabus of AutoCAD Lab

1. Introduction to Autocad software basic Sketch tool.
2. Advance sketch tool.
3. Editing tool.
4. Dimensioning.
5. Hatching, Layers, and block.
6. 3D Design in AutoCAD.

Syllabus of Workshop Practice

Carpentry, Welding, foundry, sheet metal work, fitting, 3D printing.

Text books.

1. K.C John, "Textbook of Machine Drawing", Phi Learning Pvt. Ltd. New Delhi, 2010
2. N.D Bhatt, "Elementary Engineering Drawing", Charotar Publishing House.
3. Vishnu P. Singh, "AUTOCAD 2019", ASIAN (2018).
4. Choudhury H S K, "Elements of Workshop Technology Vol-1", MPP pvt. Ltd.
5. SK Hajra Choudhury, Nirjhar Roy, Elements of Workshop Technology, Vol-II: Machine Tools, 15th Edition, Media Promotors & Publishers Pvt Ltd.

Reference books:

1. P.S Gill, "Engineering Drawing", S.K. Kataria & Sons.
2. Rajendra Singh, "Introduction to Basic Manufacturing Process & Workshop Technology", New Age International.
3. W.A.J. Chapman, "Workshop Technology Part 1, May 6th 2016" by Routledge.

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 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, 5thedn. 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 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 Title –Fundamentals of Communication Course Code- CC1101
Credits 2 (2-0-1)
Course Objective
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 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 Title and Code	Calculus and Applied Mechanics ES1103
Hours per Week	**L-T-P: 6s-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:

On successful completion of this course, the student should 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

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

Course Objective: 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. 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 mechanical, electro-mechanical and fluid systems.
ES1104.9. Design and simulate 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.

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 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				
ES1104.8	2				2			2						2			
ES1104.9					1							1		1			
ES1104.10																	
ES1104.11	2				2							1					
ES1104.12						2			2			1	1	1			

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

Course Objective: 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 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 Title and Code Energy and Environmental 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 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 Title and Code Critical Thinking and Storytelling CC1102

Hours per Week	**L-T-P: 2-0-1**
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 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 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 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 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 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
CS1301.1	1																
CS1301.2											1						
CS1301.3							1										
CS1301.4																	
CS1301.5										1							
CS1301.6																	
CS1301.7							1									1	
CS1301.8			1														
CS1301.9						1											
CS1301.10			1														
CS1301.11																	
CS1301.12									1								
CS1301.13													1				

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 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 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 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 Title and Code: Computational Engineering Analysis – I: ES1106

Teaching Scheme **L-T-P: 3-1-2**

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 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 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

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					

Perspectives on Contemporary Issues
Course Code: CC1103
Credit: 2
L-T-P: 2-0-1
Course Objective:
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:

Evaluation Scheme		
Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	20
3	Class Participation	20
4	Quiz	NIL
5	Theory Exam-I	NIL
6	Theory Exam-II	15
7	Theory Exam-III	25
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**

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

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				

MANAGEMENT PERSPECTIVES (IL1101)
COURSE CREDITS: 2

COURSE OBJECTIVE:
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 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	0.5				0.2												
IL1101.2	0.5	1											0.5				
IL1101.3	1		0.2		0.2						1		0.5				
IL1101.4	1			0.2							1	2					

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 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
CS1310.1					1	1	1							1			
CS1310.2					1	1	1										
CS1310.3					1	1	1										
CS1310.4					1	1	1	1						1	1	1	1

Course Name: Object Oriented Programming in JAVA
Course Code: CS1411
Credits: 2
Course Objective: 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 Outcome:
On successful completion of this course, the students should be able to:

CS1411.1. Name and apply some common object-oriented design patterns and give examples of their use.
CS1411.2. Write programs in Core JAVA.
CS1411.3. Design, develop and debug software applications taking into account coding and documentation standards.
CS1411.4. Apply concepts like interfaces and abstract classes in Java program design and implementation.
CS1411.5. Design and create web based and other applications using practices of object-oriented concepts.

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

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 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
CS1411.1					1	1	1							1			
CS1411.2																	
CS1411.3					1	1					1	1		1			
CS1411.4																	
CS1411.5											1	1					

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

- Implement an algorithm to find an element in a matrix in which each row and each column is sorted.
- 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.
- 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
- Implement the following sorting algorithms: Insertion, Selection, Bubble, Count, Shell, Radix

2. DIVIDE AND CONQUER

- Write a program to implement the merge sort using recursive and non-recursive procedures.
- To implement finding greatest common divisor between two positive integers.
- To implement Matrix Multiplication and analyze its time complexity.
- 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

- To implement Longest Common Subsequence problem and analyze its time complexity.
- To implement minimum spanning tree using Kruskal's and Prim's algorithms.

- To implement Dijkstra's algorithm and analyze its time complexity.
- To implement Job sequencing problem using greedy approach
- 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.
- To implement 0/1 knapsack using dynamic programming.

4. BACKTRACKING AND BRANCH-BOUND TECHNIQUES

- To implement graph coloring problem using backtracking
- To implement DFS graph search algorithm
- To implement Travelling Salesman problem using backtracking.

5. STRING MATCHING

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

6. PROBLEM SOLVING BY SEARCH

- To implement uninformed and informed search techniques for problem solving
- To solve 8 puzzle problem
- 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-sttures-and-algorithms.html

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 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 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 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 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			1	
CS1107.5	1							1				1		1			2
CS1107.6		1		2			1				1				1	1	
CS1107.7	1		1		1				1			1					
CS1107.8		2				2								1		1	2
CS1107.9			1		1			1				1				2	
CS1107.10	1								1				1		1		2

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 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 Title and Code: Communication and Identity: CC1104

Course Objective:

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: 2-0-1**
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 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 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 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 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 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
CS1303.1					1	1	1							1			
CS1303.2					1	1	1										
CS1303.3					1	1								1			
CS1303.4					2	2	2	1						1	1	1	1
CS1303.5											1	1				1	

Course Title and Code: Data Analytics using Python: CS1402	
Hours per Week	**Curated MOOC (approx. 6 hrs. per week)**
Credits	**4**
Students who can take	**B.Tech**
Course Objective: This course includes examples of analytics in a wide variety of industries, discussion of various statistical techniques and implementation of techniques using python.	

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

CS1402.1 Write Simple Python programs using various datatypes, control structures, decision statements, libraries, functions

CS1402.2 Summarize and Visualize different datasets using python

CS1402.3 Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving

CS1402.4 Formulate and validate hypothesis with reference to different datasets

CS1402.5 Apply correlation, regression, least square method, cluster analysis for interpretation and forecasting

CS1402.6 Develop Programs for analyzing and interpreting Complex situations in various domains including sustainable development by combining various, Statistical techniques

Prerequisites: Mathematics of Grade 12

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	40
3	Class Participation	Nil
4	Quiz	Nil
5	Theory Exam I	Nil
6	Theory Exam	10
7	Theory Exam (End Term)	30
8	Report-1	Nil
9	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation1	10
15	Lab Evaluation2	10
16	Course portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30
2	Lab Evaluation	10

Course Contents:

Introduction to data analytics and Python fundamentals, Introduction to probability, Sampling and sampling distributions, Hypothesis testing, Two sample testing and introduction to ANOVA, Two way ANOVA and linear regression, Linear regression and multiple regression, Concepts of MLE and Logistic regression, ROC and Regression Analysis Model Building, Test and introduction to cluster analysis, Clustering analysis, Classification and Regression Trees (CART)

Suggested Reading Materials:

- McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
- Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.
- Ken Black, sixth Editing. Business Statistics for Contemporary Decision Making. “John Wiley & Sons, Inc”.
- Anderson Sweeney Williams (2011). Statistics for Business and Economics. “Cengage Learning”.
- Douglas C. Montgomery, George C. Runger (2002). Applied Statistics & Probability for Engineering. “John Wiley & Sons, Inc”
- Jay L. Devore (2011). Probability and Statistics for Engineering and the Sciences. “Cengage Learning”.
- David W. Hosmer, Stanley Lemeshow (2000). Applied logistic regression (Wiley Series in probability and statistics). “Wiley-Interscience Publication”.
- Jiawei Han and Micheline Kamber (2006). Data Mining: Concepts and Techniques. “
- Leonard Kaufman, Peter J. Rousseeuw (1990). Finding Groups in Data: An Introduction to Cluster Analysis. “John Wiley & Sons, Inc”.

This course would be delivered on SWAYAM from 27th January, 2020 to 17th April, 2020 by Prof. A Ramesh, IIT Roorkee.

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
CS1402.1	1																
CS1402.2											1						
CS1402.3							1										
CS1402.4																	
CS1402.5										1							
CS1402.6																	

Course Title and Code: Introduction to Python Programming CS1414	
Hours per Week	**Curated MOOC**
Credits	**2**
Students who can take	**IV Sem**

Course Objective: This course introduces programming and the Python language. Students are introduced to core programming concepts like conditionals, loops, variables, and functions. It also provides hands-on coding exercises using commonly used data structures, writing custom functions, and reading & writing to files.

Course Outcome:

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

CS1414.1. Explain core aspects of programming and features of the Python language

CS1414.2. Apply core programming concepts like conditionals, loops, variables, and functions

CS1414.3. Use different tools for writing and running Python code

CS1414.4. Design and write fully functional Python programs using commonly used data structures, custom functions, and reading & writing to files.

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	20
3	Class Participation	Nil
4	Quiz	10
5	Theory Exam I	Nil
6	Theory Exam	Nil
7	Theory Exam (End Term)	20
8	Report-1	Nil
9	Report-2	Nil
10	Report-3	Nil
11	Project -1	20
12	Project -2	20
13	Project -3	Nil
14	Lab Evaluation1	Nil
15	Lab Evaluation2	10
16	Course portfolio	Nil
	Total (100)	**100**

Evaluation Scheme for Retest

Sr. No	Specifications	Marks
1	Lab Evaluation2	10
2	Theory Exam (End Term)	20

Course Contents:

Module 1: Course Introduction, Introduction to Programming and The Python Language, Variables, Conditionals, Jupyter Notebook, and IDLE

Module 2: Introduction to Lists, Loops, and Functions

Module 3: More with Lists, Strings, Tuples, Sets, and PyCharm

Module 4: Dictionaries and Files

Suggested Reading Materials:

- https://www.coursera.org/learn/python-programming-intro

This course is part of the **Introduction to Programming with Python through Coursera**. Student may refer course notes, videos & ppts.

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
CS1414.1	1																
CS1414.2											1						
CS1414.3							1										
CS1414.4																	

Course Title and Code Operating Systems**:** CS1108	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech-CSE, 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

Sr. No	Specifications	Marks
01	Attendance	NIL
02	Assignment	NIL
03	Class Participation	10
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 (Continuous)	20
15	Lab Evaluation-II (Test-2 Nos)	10+10
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, difference between process and thread, multithreading, multithreading models, 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 Articulation Matrix: (Mapping of COs with POs)

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	1
CS1108.3	1				1	1										1	
CS1108.4	1				1	1										1	
CS1108.5	1				1	1	1									1	1
CS1108.6	2				2	2		2	2				2			2	2
CS1108.7	2				2	2		2	2							2	2
CS1108.8	2				2	2	2	2	2				1		1	2	2
CS1108.9	2				2	2	2	3	3				2		3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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 (2019-2023)

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 and ML models to solve new as well as classical and real-world and critical problems. This course builds upon the Computational Data Analysis, and Database Management Systems and lays the foundation for the course on Advanced 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

Prerequisites	Programming, Linear Algebra, Statistics

Evaluation Scheme

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	20
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	20
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	20
12	Project-II	20
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	Quiz	20
2	Theory Exam-III	20

	Total	40

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

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

Course Articulation Matrix: (Mapping of COs with POs)

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

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Understanding and Managing Conflict|CC1105**
Hours per Week	**L-T-P: 2-0-0**
Credits	**2**
Students who can take	B.Tech - Sem V

Course Objective-

In today's increasingly complex and fragmented world, it is important to be able to resolve conflicts and build healthy relationships. Understanding and Managing Conflict 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 Outcome:

On successful completion of this course, the students should 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.

Prerequisites		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	30
03	Class Participation	20
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	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30

Syllabus (Theory):

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

References for Reading:

1. Fisher, R., & Ury, W. (2011). Getting to yes: Negotiating agreement without giving in. Toronto, ON: Penguin Random House.

2. 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.
3. Miles, E. W. (2013). Developing strategies for asking questions in negotiation. Negotiation Journal, 29(4): 383–412. doi: 10.1111/nejo.12034.

MOOC Reference Course:

(Certificate is not mandatory, this course is used for reference)

a. Course Title: Conflict Management Specialization
b. Offered by: University of California, Irvine
c. Duration and Course Load: 4 months, 1-2 hours/week
d. Platform: Coursera

Course Articulation Matrix: (Mapping of COs with POs)

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				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Introduction to IoT; EE1111**
Hours per Week	**L-T-P: 1-0-2**
Credits	**2**
Students who can take	B.Tech Sem V All Branches

Course Objective- The course aims to develop understanding of Internet of Things concepts and also develop skills for 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 Outcome:

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 interfacing of I/O devices with Raspberry Pi.
EE1111.4. Implement communication protocols for interfacing sensors to microcontrollers.
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
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	10
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 (Continuous)	35
15	Lab Evaluation-II	Nil
16	Course Portfolio (MOOC certificate)	Nil
	Total (100)	**100**

Retest

1	Theory Exam-III	30
2	Lab Evaluation-II	0
	Total (30)	**30**

Syllabus (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. Introductio to Blynk App, Uploading and downloading data from server using Blynk App. Intoduction 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.

Reference Books:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Rajkamal, Internet of Things, Architecture and Design Principles, Mc. Graw Hill Education (India) Pvt Ltd.
4. IoT fundamentals: networking technologies, protocols, and use cases for the internet of things: Hanes, David | Salgueiro, Gonzalo | Grossetete, Patrick | Barton, Robert Henry, Jerome, Pearson, 2018, ISBN: 9789386873743.
5. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT by David Etter.

Video lectures:

1. Introduction to internet of things By Prof. Sudip Misra, IIT Kharagpur
   https://swayam.gov.in/nd1_noc20_cs66/preview

MOOC course

The Arduino Platform and C Programming
https://www.coursera.org/learn/arduino-platform?specialization=iot

Course Articulation Matrix: (Mapping of COs with POs)

CO		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						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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 CSE (IBM)

Course Objective- This course will prepare students to provide an overview of an exciting field of Cloud Computing and introduce tools require building, deploying, running and managing applications on a cloud platform. This course will also enable students to develop the cloud application development skills, such as Node.js, REST architecture, JSON, Cloud Foundry and DevOps services and will help them to solve complex real-world problems.

Course Outcome:

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

CS1304.1. Understand the vision of Cloud Computing from a global context.

CS1304.2. Understand various computing options on IBM Cloud by market perspective of Cloud Computing

CS1304.3. Analyze architecture and implementation of APIs with services of IBM Cloud in Cloud Computing.

CS1304.4. Integrate the Node.js application with Watson services over IBM Cloud.

CS1304.5. Build and create state of the art architecture in Kubernetes cluster.

Evaluation Scheme		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	Nil
04	Quiz (Best 4)	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	20
12	Project-II	20
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Quiz	20
2	Project-II	20

Syllabus (Theory):

UNIT-I Introduction to Cloud Computing and IBM Cloud

Definition with Real Time Examples, Introduction to cloud computing and its characteristics, Benefits of cloud, Models of Cloud, IBM Cloud resources, Cloud Foundry concepts.

UNIT-II DevOps and REST APIs with data services on IBM Cloud

What is DevOps? Capabilities of IBM Cloud Continuous Delivery, Architecture of REST, IBM Watson services, Databases types and capabilities, APIs interaction with Cloudant database.

UNIT-III Developing Cloud Application with Node.js

Introduction to JavaScript, Node.js modules, Synchronous and Asynchronous callback, Introduction to Express framework, Route handling, Middleware functions.

UNIT-IV Application with IBM Cloud services

Understand business problems and goals, functional and non-functional requirements, IBM Cloud App ID, IBM Cloud monitoring services, Introduction to Async patterns in ECMAScript, Callbacks and Promises.

UNIT-V React and Introduction to Kubernetes

Introduction to React & its components, React deployment with IBM Cloud, Container orchestration (Kubernetes), Kubernetes building blocks: Pods, Deployment and Service, Building a Kubernetes cluster by using IBM Cloud, Deployment of an application to Kubernetes.

LAB

1. Configuring IBM Cloud account and create an application using Cloud Foundry Service on IBM Cloud.
2. Mention all commands use in IBM cli to push an application from local system to IBM cloud environment.
3. Configuring secure a web-application with single sign-on (APP ID) on IBM cloud.
4. Configuring Cloudant and managing the datasets on IBM Cloud.
5. Configuring Visual Recognition Service with IBM Watson.
6. Configuring IAM (identity access management) service on IBM cloud.
7. Configuring a server to fetch files from local file system using Nodejs.
8. Implementation of containerization using Docker.
9. Implementation of container orchestration using Kubernetes.
10. Creating a Nodejs application using Express Framework.

Text Material & Resources: IBM AP Skills Academy

Reference Books:

- Anubhav Hanjura, "Cloud Application Development", Packt Publishing Ltd, 2014.
- Gautam Shroff, "Enterprise Cloud Computing Technology Architecture Applications", Cambridge University Press; 2014.
- Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach" McGraw-Hill Osborne Media; 2015.
- Dimitris N. Chorafas, "Cloud Computing Strategies" CRC Press; 2016.

Recommended MooC:

Introduction to Cloud Computing (Offered By IBM)
https://www.coursera.org/learn/introduction-to-cloud?utm_source=link&utm_medium=page_share&utm_content=xdp&utm_campaign=nav_button

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
CS1304.1	1													1			
CS1304.2														1	2		
CS1304.3					1	1	2									2	
CS1304.4					2	2	3									2	
CS1304.5					2	2	3									2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**PR1101 Automation Project**
Credits	2
Students who can take	B.Tech. (All programs)

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

Course Outcome:

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 standard IoT protocol(s),

PR1101.3 use cloud servers for data streaming and analysis,

PR1101.4 implement algorithms using the data at edge/cloud,

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

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	Nil
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	Nil
8	Report I (Synopsis)	30
9	Report II (Midterm Progress Presentation and Viva)	30
10	Report III	Nil
11	Project I (with Report)	40
121	Project II	Nil
13	Project III (With Report)	Nil
14	Lab Evaluation I	Nil
15	Lab Evaluation II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation scheme for retest.		
	Project III (with Report)	**40**
	Total (100)	**40**

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 Title and Code: Practice School – I (PS-I), PS1101	
Total Duration	45 Days
Credits	**04**
Students who can take	B.Tech Semester-V

Course Objective:
The purpose of Practice School-I is to give an opportunity to re-understand their theoretical knowledge in the context of real-life situations.

After course completion, the student will be able to:

PS1101.1 Identify skills and capabilities that interconnect effectively with the needs of industry.
PS1101.2 Demonstrate problem solving skills in the context of some real-life situation.
PS1101.3 Reflect and evaluate on future employment opportunities.

Evaluation Scheme:

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignments	Nil
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam-1	Nil
06	Theory Exam-2	Nil
07	Theory Exam-3	Nil
08	Report-1(Reporting Activity Fortnightly by faculty supervisor)	10
09	Report-2 (By faculty supervisor)	20
10	Report-3	Nil
11	Project-1 (Day to day task record by External supervisor)	10
12	Project-2	Nil
13	Project-3 (Presentation & Viva)	20
14	Lab Evaluation-1	Nil
15	Lab Evaluation-2	Nil
16	Course portfolio (Traits and Competencies)	40
	Total (100)	**100**

Course Articulation Matrix: (Mapping of COs with POs)

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
PS1101.1	1		2	1	2		2				2						
PS1101.2	1			1	3	2	2	2					1				
PS1101.3	1		2	2			1	1			3	2	1	1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Idea to Business Model; ED1102**
Hours per Week	**L-T-P: 3-0-0**
Credits	**4**
Students who can take	B.Tech Sem V

Course Objective- To encourage students to nurture their entrepreneurial traits and think creatively to develop innovative ideas/products for commercial exploitation.

Course Outcome:

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

ED1102.1. Identify problem worth solving through design thinking.
ED1102.2. Identify customer segment and niche for specific markets.
ED1102.3. Craft Value Preposition Canvas.
ED1102.4. Create business model using Lean Canvas Template
ED1102.5. Build 'A' team for new start-ups.
ED1102.6. Design and validate solution demo and MVP.
ED1102.7. Analyse cost, revenue, key channels and pricing model for the venture.
ED1102.8. Craft positioning statement of a new venture.
ED1102.9. Classify the different sources of funding.

Prerequisites		Basic IT Literacy Skills
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	Nil
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III (End Term)	40
08	Report-I	20
09	Report-II	20
10	Report-III	Nil
11	Project-I	20
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**

Retest

1	Theory Exam	40
2	Project-I	20

Syllabus:

- **Overview of Entrepreneur and Entrepreneurship**
- **Self-Discovery**
- **Opportunity Discovery**
- **Identify Customer**
- **Value Preposition Canvas**
- **Business Model**
- **Validation**
- **Money (Revenue, Costs, Pricing and Financing)**
- **Team Building**
- **Marketing and Sales**
- **Sources of Fund**
- **Support (Institutional and Government policies)**

- **Project**

Text Book And Additional Reading Materials

LearnWISE™ (It is a leading digital learning platform provided by Wadhwani Foundation)

Additional Reading Material

1. Robert D Hisrich, Michael P Peters, Dean A Shepherd (2017). **Entrepreneurship/10e.**. New Delhi; Tata McGraw-Hill.
2. Poornima M Charantimath (2012). **Entrepreneurship Development Small Business Enterprises**. New Delhi: Pearson.
3. Rajeev Roy (2011). **Entrepreneurship**. New Delhi: Oxford
4. Arya Kumar (2015). *Entrepreneurship: Creating and Leading an Entrepreneurial Organisation.* New Delhi: Pearson.
5. Vasant Desai (2016). *Dynamics of Entrepreneurial Development and Management*. Himalaya Publishing House.

Note: Latest edition of the readings will be used

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES (IET)														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
ED1102.1					1	2		1	1	1				2	1		
ED1102.2					1			1							1		
ED1102.3					2									2			
ED1102.4			2		1									2	2		
ED1102.5											2	1	1				
ED1102.6								1					1	2	2		
ED1102.7					2					1							
ED1102.8																	
ED1102.9					2												

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Urban and Regional Planning CE1215**
Hours per Week	**L-T-P: 3-1-0**
Credits	**4**
Students who can take	B. Tech (V Sem) OE

Course Objective- To introduce the issues, concept and frameworks for urban and regional development and planning.

Course Outcome:

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

CE1215.1 Demonstrate a broad concept in urban and regional planning, including deep understanding of underlying principles and concepts.

CE1215.2 Address land-use and built-environment problems in a range of social, economic and environmental contexts.

CE1215.3 Analyze the various components of water supply, sanitation, transportation and waste management.

CE1215.4 Analyze the various types of plans and their execution.

CE1215.5 Plan and design various types of social infrastructure projects.

Prerequisites		None
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	10
04	Quiz	10
05	Theory Exam-I	Nil
06	Theory Exam-II	20
07	Theory Exam-III	30
08	Report-I	10
09	Report-II	10
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**

Retest

Evaluation scheme for retest	
Theory Exam III	30
Total	**30**

Syllabus (Theory):

Introduction to Planning: Defining planning as a discipline, multidisciplinary nature, role of a planner, fields of planning, Urban, regional, environmental, transport and infrastructure, Concepts of garden City, City beautiful, linear city, Various definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning; Arguments for and against planning. Economics and social planning as bases of physical planning. Planning Process. Levels of planning in India.

Types of Plans: Definition of development plan; Types of development plans: Master plan, City development plan, Structure plan, District plan, Action area plan, Subject plan, Comprehensive planning, Zonal plans, special area development plan e.g. SEZ (special economic zones), SIR (special investment regions).

Water Supply System: Water supply systems and networks, water sources, quality and quantity requirements, collection and water requirement for various land uses; Factors affecting water demand; Storage facilities; Distribution Systems; rainwater harvesting system.

Sanitation, Sewer system and SWM: Sanitation and Sewer System, types of sewers: General considerations, Sewage Disposal and treatment, Low-cost appropriate technologies for sanitation, Elements of Solid Waste Management, Best practices for solid waste management.

Transport System Types and characteristics of transport systems; Principles of transport infrastructure planning and, pedestrian and cyclist infrastructure; parking facilities; principles of traffic management, urban mass transport systems

Regional planning: definition, need and importance, function, objective, concept of region, types of regions, types and contents of regional planning for block, district, state, national, NCR, resource region, agro–climatic region, topographic region and sectoral planning, major regional problems and their solutions.

Text books:

1. Hutchinson, B.G., Principles of Urban Transport Systems Planning, Scripta, McGraw-Hill, New York, 1974.
2. Claire, Hand Book of Urban Planning, Van Nostrand Book Company, 1974.
3. Gallian, B. Arthur and Simon Eisner, The Urban Pattern - City Planning and Design, Affiliated Press Pvt. Ltd., New Delhi, 1985.
4. RobertsM., An Introduction to Town Planning Techniques, Hutchinson, London, 1980.
5. Hiraskar, G. K., Fundamentals of Town Planning, Dhanpat Rai Publications,1992
6. Grigg, Neil, Infrastructure Engineering and Management, Wiley, (1988).
7. Kopardekar & Diwan (1994), 'Urban and Regional Planning-Principles, Practice and Law' S.H.
8. Kopardekar, Talegaon – dabhade.
9. Kulshrestha S.K. (Ed. 2006), 'Dictionary of Urban and Regional Planning', Kalpaz Publications, Delhi.

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
CE1215.1	2	2	1										1				
CE1215.2	2	1	1									1					
CE1215.3	1				1			1	2		1						
CE1215.4	1	1	2		2	2		2	1		1	2		1	1		
CE1215.5	1	1	2		1	2		2	2		2	2	2	1	2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Numerical and Scientific Computing (AS2202)	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Semester-V (Batch:2019-2023) **Open Elective** and M.Tech Semester-I (Batch: 2021-2023) **Elective**

Course Objective:
This course aims to introduce advanced numerical methods to model engineering systems and to solve them using appropriate computational techniques. Laboratory sessions involve the applications of numerical analysis to statics, dynamics, fluid dynamics, heat transfer, electrical circuits, and vibratory systems.

Course Outcomes: After course completion, the student will be able to:
AS2202.1. Demonstrate understanding of common numerical methods, their development and applications to obtain approximate solutions for complex mathematical problems including intractable ones.
AS2202.2: Formulating and solving scientific and engineering problems using numerical methods.
AS2202.3: Analyse and evaluate the accuracy of common numerical methods.
AS2202.4: Write efficient, well-documented Python code and present numerical results in an informative way.

Prerequisites		Basic Numerical methods, Python Programming
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	5
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	25
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	20
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest Evaluation Scheme

1	Theory Exam (End Term)	30
	Total (30)	**30**

SYLLABUS

Modeling, Computers, and Error Analysis: Mathematical Modeling and solution using Programming and Software, Computer Arithmetic and Errors: *Approximations and Round-Off Errors, Truncation Errors and the Taylor Series*

Transcendental and polynomial equations: Solution of non-linear Equations: *Bracketing Methods, Open Methods, Roots of Polynomials*

Linear Algebraic Equations: LU Decomposition and Matrix Inversion, Iterative methods for solving system of linear equations, finding Eigen values and Eigen vectors

Interpolation and approximation: Interpolation for equally and unequally spaced points, Lagrangian Polynomial

Numerical Differentiation and Integration: Numerical Differentiation and Integration, Newton-Cotes Integration Formulae.
Ordinary Differential Equations: Difference equation, Single step methods, Stiffness and Multistep Methods, Predictor-corrector method
Partial Differential Equations: Finite Difference: *Elliptic and Parabolic Equations*, Mesh analysis
Text Books:
1. JV Lambers, ACS Mooney, VA Montiforte, **Explorations in Numerical Analysis: Python Edition**, WSPC (January18, 2021).
2. Q Kong, T Siauw, A Bayen, **Python Programming and Numerical Methods: A Guide for Engineers and Scientists**, Academic Press; 1st edition (December 16, 2020)

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
AS2202.1	1				2	2		2									
AS2202.2								2									
AS2202.3										2							
AS2202.4	1						2						1	1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	Introduction to User-Experience**;** IL1204
Hours per Week	**2-2-0:**
Credits	4
Students who can take	B.Tech Sem III/V (All Branches)
Course Objective- The course takes a student through the complete User-Experience (UX) life-cycle including problem-identification, problem-framing, design exploration and design-evaluation.	
Course Outcome: On successful completion of this course, a student should be able to: CS1204.1. Appreciate UX holistically with respect to different types of user-needs. CS1204.2. Conduct User-Studies. CS1204.3. Synthesize a Problem-Statement. CS1204.4. Conduct Creative Design-Exploration. CS1204.5. Conduct Systematic Design Evaluation.	
Prerequisites	None

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 (Certification Exam by IBM)	Nil
08	Report-I	20
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	50
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**

Retest

1	Project-I	50

Syllabus (Theory):

UNIT-I Introduction to User-Experience

UXLife Cycle, Layers of User-Experience, Maslow's Hierarchy of Needs.

UNIT-II User-Studies

Ethnography-based Methods, Data-Synthesis, Problem Framing

UNIT-III Design

Design-Exploration, Prototyping

UNIT-IV Evaluation

Planning and Conducting UX-Evaluation, Analyzing Data, Recommending Design Directives.

Studio

- Contextual User-Studies.
- Data Analysis.
- Problem-Synthesis.
- Design-Exploration
- Design-Evaluation.

Text Material & Resources:

Reference Books:

- Buxton, B. (2010). *Sketching user experiences: getting the design right and the right design*. Morgan kaufmann.
- Beyer, H., & Holtzblatt, K. (1999). Contextual design. *interactions*, *6*(1), 32-42.
- Mayhew, D. J. (1999, May). The usability engineering lifecycle. In *CHI'99 Extended Abstracts on Human Factors in Computing Systems* (pp. 147-148).
- Cooper, A., Reimann, R., Cronin, D., & Noessel, C. (2014). *About face: the essentials of interaction design*. John Wiley & Sons.

Recommended MooC:

- NPTEL Course: Interaction Design: Dr. A. Srivastava, IIT Guwahati. Available at https://nptel.ac.in/courses/107/103/107103083/ (accessed 03-sep-2021)

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
IL1204.1	1	0	0	0	0	0	0	0	1	0	0	0	3	1	0	0	0
IL1204.2	3	0	1	0	0	1	0	0	3	0	2	0	0	1	0	0	2
IL1204.3	3	0	1	0	0	1	0	0	3	0	2	0	0	1	0	1	2
IL1204.4	3	0	0	0	0	1	0	0	3	0	2	0	0	1	0	2	0
IL1204.5	3	0	0	0	0	1	0	0	3	0	2	0	0	1	0	0	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: Mobile Application Development: CS1205	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Sem-V (CSE)

Course Objectives: This Course is designed to offer learners an introduction to Android platform and related applications in the business world. The Course will cover ethical contents and security related issues in app deployment at Google Play Store. All techniques will be illustrated using different app design with real-time and static databases. The Course lays the foundation for cross-platform app development course.

Course Outcome:

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

CS1205.1. Develop high-level plans for script solutions for mobile and evaluate the post-production outcome;
CS1205.2. Design scripts to meet given interface and media control requirements;
CS1205.3. Use variables, properties and other code elements appropriately to implement the code design;
CS1205.4. Devise, carry out and evaluate functional test strategies of mobile design;
CS1205.5. Implement and evaluate techniques for the installation of mobile applications and delivery via various channels;
CS1205.6. Explain the principles of technologies which support media production and delivery on a variety of platforms;
CS1205.7. Create event listeners for responding to events;
CS1205.8. Administer permissions and Android manifests;
CS1205.9. Integrate Android XML resources with Java code;
CS1205.10. Create a Google Play Store account and preparing apps for the Play Store.

Prerequisites		**Java Programming**
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	30
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	30
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
Re-Test Evaluation		
	Theory Exam-III	30
	Total:	30

Syllabus (Theory)

Module I – Mobile Application Overview

Introduction to Mobile Computing, Introduction to Android Development Environment, Mobile Software Engineering, Design of application (view level).

Module II – Framework and User Interface Development

Frameworks and Tools, Generic UI Development, Android User (privileges), VUIs and Mobile Apps Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodial UIs, Android Intents and Services, Characteristics of Mobile Applications

Successful Mobile Development.

Module III – Storing Retrieving Data with Real-time Database

Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider, Communications Via Network and the Web, State Machine, Correct Communications Model, Android Networking and Web.

Module IV – Notifications, Alarming and Location

Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics and Multimedia, Mobile Agents and Peer-to-Peer Architecture, Android Multimedia, Mobility and Location Based Services.

Text Books and References:

1. Android Cookbook, 2nd Edition by Ian F. Darwin Publisher: O'Reilly Media, Inc. Release Date: May 2017
2. Sam's Teach yourself Android Application Development. by Lauren Darcey and Shane Conder: 2012
3. Professional Android 4 Application Development by Reto Meier, 2012
4. Android Programming for Beginners by John Horton, 31 Dec 2015
5. https://developer.android.com/

Course Articulation Matrix: (Mapping of COs with POs)

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
CS1205.1	1									2					2		
CS1205.2			1					1					1	1		1	
CS1205.3					2	1			1		1					1	
CS1205.4							2	1				2		1	1		3
CS1205.5						3						2			1		
CS1205.6				2	2				1		1					2	
CS1205.7		1			3			1		1				1		2	
CS1205.8			1		1		1					1					3
CS1205.9	1						2		1					2		2	2
CS1205.10		1		1	2	1		1			1		2	2	2		

Course Title and Code: CS1214: Cryptography	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech. Sem V

Course Objective-

In this course student will understand cryptographic algorithms and their applications. Throughout the course, students will be exposed to many exciting open problems in the field and work on programming projects. This course will help students to explore security aspects of various future courses like, Network Security, Mobile Application Developments and Cloud Computing.

Course Outcome:

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

CS1214.1. Explain the concept of Cryptography

CS1214.2. Realize the complexities of Cryptographic Attacks

CS1214.3. Apply the Public-Key Cryptography

CS1214.4. Learn Symmetric-Key Algorithm

CS1214.5. Use the techniques of Digital Signatures in their projects

CS1214.6. Demonstrate the Secure Protocols

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

Retest

1	Lab Evaluation-II	10
2	Theory Exam-III	20

Syllabus

1. Overview of cryptography. What is a cipher?

2. Basic symmetric-key encryption, Stream ciphers, one time pad, Block ciphers, AES and DES. Pseudo Random Permutations (PRP); Pseudo Random Functions (PRF); Chosen plaintext attacks (CPA);

3. Message integrity: CBC-MAC and PMAC, Collision resistant hashing, Merkle-Damgard and Davies-Meyer. MACs from collision resistance, SHA and HMAC, Active attacks

4. Public key cryptography: Arithmetic modulo primes, Vanilla key exchange (Diffie-Hellman), Public key encryption, ElGamal encryption, RSA and Rabin functions, Trapdoor permutations

5. Digital signatures: Signature using RSA, Hash based signatures, certificates, certificate transparency, certificate revocation.

6. Protocols: Identification protocols, Password protocols, salts; one-time passwords, challenge response authentication, Zero knowledge proof

7. Cryptography in the age of quantum computers, Grover's algorithm and Shor's algorithm

Text Books:

1. Introduction to Modern Cryptography, Katz and Lindell, 3rd Edition.
2. Free book of Cryptography, Dan Boneh and Victor Soup.

Reference Courses:

1. Cryptography I, at Coursera by Dan Boneh. https://www.coursera.org/learn/crypto
2. Cryptography, at IITB by M. Prabhakaran https://www.cse.iitb.ac.in/~mp/teach/crypto/

Course Articulation Matrix: (Mapping of COs with POs)

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
CS1214.1					1		1	1		1						2	1
CS1214.2					1			1	1					1		2	1
CS1214.3					1	1	1	1	1					1		2	1
CS1214.4					1	1		1					1			1	1
CS1214.5					1	1		1					1	1		1	1
CS1214.6					1			1		1			1			1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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

Credits: 4 , L-T-P : 3-0-2

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 Outcome:

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

CS1111.1. Categorize the various type of Networks on the basis of geographical distance, topology and implementation.
CS1111.2. Implement socket programming to develop networking programs in C.
CS1111.3. Apply the concepts of IP addressing, subnet masking and routing algorithms to design efficient computer networks
CS1111.4. Build and deploy applications that use transport protocols like UDP, TCP
CS1111.5. Analyze distributed systems and classification of agreement protocol.

Prerequisites: (optional)

Evaluation Scheme

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	10
07	Theory Exam-III	20
08	Report	NIL
09	Report-II	NIL
10	Report-III	NIL
11	Project	10
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	15
16	Course Portfolio	NIL
17	Presentation	5
18	Viva	5
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	20
2	Lab Evaluation-II	15
	Total	**35**

Syllabus (Theory)

Introduction, history and development of computer networks, network topologies. Layering and protocols.

Physical Layer: Different types of transmission media, errors in transmission: attenuation, noise. Repeaters. Encoding (NRZ, NRZI, Manchester, 4B/5B, etc.).

MAC Layer: Aloha, CSMA, CSMA/CD, CSMA/CA protocols. Examples: Ethernet, including Gigabit Ethernet and WiFi (802.11).

Data Link Layer: Error detection (Parity, CRC), Sliding Window, Stop and Wait protocols.

Network layer: Internet Protocol, IPv6, ARP, DHCP, ICMP, Routing algorithms: Distance vector, Link state, Metrics, Inter-domain routing. Subnetting, Classless addressing, Network Address Translation.
Transport layer: UDP, TCP. Connection establishment and termination, sliding window revisited, flow and congestion control, timers, retransmission, TCP extensions, etc.
Network Programming: Socket Programming.
Application Layer: File Transfer, DNS, DHCP, 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.

References

1. LL Peterson, BS Davie, Computer Networks: A Systems Approach, 5th Ed., Morgan-Kauffman, 2011. Available at:
https://cseweb.ucsd.edu/classes/wi19/cse124-a/courseoverview/compnetworks.pdf

Additional Resources:

1. Andrew Tanenbaum. 2010. *Computer Networks* (5th ed.). Prentice Hall Professional Technical Reference.
2. Behrouz A. Forouzan. 2007. *Data Communications and Networking* (4 ed.). McGraw-Hill, Inc., New York, NY, USA.
3. James F. Kurose and Keith Ross. 2002. *Computer Networking: A Top-Down Approach Featuring the Internet* (2nd ed.). Addison-Wesley Longman Publishing Co., Inc., Boston, MA, USA

Course Articulation Matrix: (Mapping of COs with Pos):

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		1				1	1	1	
CS1111.2					1		1	1	1	1	1						1
CS1111.3				1		1	2	1	1	1	1	1					1
CS1111.4	1					2	1	1	1	2	2	1					1
CS1111.5	1					1	1	2	1	1	1	2		1		1	

Course Title and Code:	Big Data Engineering; CS1312
Hours per Week	L-T-P: 3-0-2
Credits	4
Students who can take	B.Tech CSE Sem VI (IBM Course)

Course Objective- The main goal of this course is to help students learn, understand, and practice modern big data technologies for scaling up data science techniques focusing on industry applications. This course builds upon the foundations laid on Computer Architecture and organisation, Database Management Systems, and Computer Network and Distributed Systems.

Course Outcomes (Provided by IBM):

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

CS1312.1. Identify the characteristics of datasets and compare the trivial data and big data for various applications.

CS1312.2. Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.

CS1312.3. Integrate Data Science libraries in Python with big data technologies.

CS1312.4. Use different SciKit package ML Algorithms.

CS1312.5. Implement different IBM Watson Services like Notebook or Spark Services.

Prerequisites	Linux, SQL

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	15
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	Nil
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	10
	Total (100)	**100**

Evaluation Scheme for Retest

01	Theory Exam-III	30
	Total	**30**

Syllabus (Theory) (Provided by IBM):

UNIT 1: Introduction to Big Data and Hadoop: What is Big data, 4Vs of Big Data, types of Big Data, ustry sectors that are using Big Data and it's Use Cases; Hadoop overview: Hadoop Introduction, p architecture, HDFS Introduction, HDFS architecture, MapReduce v 1.0 and YARN differences and rchitecture

UNIT 2: Introduction to HDP: What is HDP, HDP Components, Big data and Spark, Resilient Distributed Datasets, Spark's Scala and Python shells, Programming with Spark, Spark SQL; Hive, Hive architecture, SQL for Hadoop, Hive and HBase, Pig, Characteristics of the Pig language, Sqoop, Sqoop commands

UNIT 3: Hadoop Security, Data Science and Data Governance: How is security provided in Hadoop. Data Governance, The need for data governance, Data Science - using the Scientific Method; AI >> Machine Learning >> Deep Learning, The Work of the Data Scientist, The art of Data Science in 5 steps

UNIT 4: Data Science Libraries: Getting started with Jupyter Notebook, How notebooks help data scientists; Essential packages: NumPy, SciPy, Pandas, Scikit-learn, Data visualizations: matplotlib, Data and notebooks in Jupyter

UNIT 5: BigSQL and IBM Watson Introduction: Big SQL integrates with RDBMS, Big SQL architecture, the relationship between Big SQL and Db2, Creating a Big SQL table; Introduction to IBM Watson Studio, Analyzing data with Watson Studio Reference

List of Experiments:

1. Familiarization with Hadoop Cluster.
2. Run Cloudera Compiled machine version
3. Run each and every basic commands on hadoop/hdfs
4. Interact with Hadoop localhost System with memory Management.
5. Run Word count Program on Mapreduce.
6. Use Sqoop to manage the structured datasets.
7. Run Hive Commands to create Dynamic and Static partition.
8. Run different type of operations on datasets by using Data Science Library in python.
9. Program to Visualize the dataset by using different graphs.
10. Run Spark and Scala Service of IBM Watson.
11. Use IBM Watson for Data Visualization.

Text Material & Resources: IBM AP Skills Academy

Reference Books:

1. Benjamin Bengfort and Jenny Kim. *Data Analytics with Hadoop: An Introduction for Data Scientists*. O'Reilly Media, 2016.
2. Jake VanderPlas. *Python Data Science Handbook: Essential Tools for Working with Data*. O'Reilly Media, 2016.
3. James D. Miller. *Learning IBM Watson Analytics*. Packt Publishing Limited, 2016.

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
CS1312.1	1													1			
CS1312.2														1	2		
CS1312.3					1	1	2									2	
CS1312.4					2	2	3									2	
CS1312.5					2	2	3									2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

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 strategies of Critical Thinking to examine organisational problems through positive inquiry

CC1106.2 Describe and examine suitable problem-solving and ethical decision-making processes

CC1106.3 Choose the simplest and logical decision among multiple alternatives

CC1106.4 Evaluate solutions and count on possible risks based on purpose, context and ethics

Pre-requisites		**N/A**
Hours per Week		**L-T-P: 2-0-0**
Credits		**2**
Sr. No	**Specifications**	**Weightage**
01	Attendance	Nil
02	Assignment	**20**
03	Class Participation	**10**
04	Quiz	Nil
05	Theory Exam-1	Nil
06	Theory Exam-2	Nil
07	Theory Exam-3	**30**
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
17	Presentation	**20**
18	Viva	**20**
	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 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					

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	25
12	Project-II	Nil
13	Project-III (Case Study)	Nil
14	Lab Evaluation-I	20
15	Lab Evaluation-II	Nil
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 Articulation Matrix: (Mapping of COs with POs)

CO		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
CS1305.1	1													1			
CS1305.2														1	2		
CS1305.3					1	1	2									2	
CS1305.4					2	2	3									2	
CS1305.5					2	2	3									2	
CS1305.6					2	2	3									2	
CS1305.7					2	2	3									2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Robotic Process Automation Lab, CS1125**
Hours per Week	**L-T-P: 0-0-4**
Credits	**2**
Students who can take	

Course Objective- The course aim is to develop understanding about Intelligent Automation through 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:

CS1125.1 Use and understand the various functionalities and features of UiPath Studio and Orchestrator.

CS1125.2 Design, implement, and use RPA activities.

CS1125.3 Develop basic robots using UiPath Community Edition.

CS1125.4 Explore various data extraction techniques.

CS1125.5 Identify processes which can be automated.

CS1125.6 Apply best practices in RPA projects.

Prerequisites		Basic Programming Skills
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	Nil
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I(Implementation)	15
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Test)	20
15	Lab Evaluation-II	Nil
16	Course Portfolio	10
17	Presentation	5
18	Viva	10
	Total (100)	**100**

Retest

1	Quiz	20
2	Lab Evaluation-I (Test)	20

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. 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. Introduction to Recorder, 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. **UiPath Advanced Automation concepts and techniques:** Image, Text and introduction of Citrix Automation; **Excel Data Tables & PDF:** Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors. **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 **Capstone Project.**

LAB

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 Material & Resources:

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 Articulation Matrix: (Mapping of COs with POs)

CO		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
CS1125.1	1																1
CS1125.2						1										1	1
CS1125.3	1				1											1	1
CS1125.4																2	
CS1125.5					1					1				1		2	2
CS1125.6						1	1									2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code: **Geographical Information Systems Lab (GIS): CE1114**	
Hours per Week	**L-T-P: 1 0 2**
Credits	**2**
Students who can take	B. Tech Sem VI sem (B Tech CSE, EEE and ME)
Course Objective: This course aims to develop understanding of various methods of remote sensing, satellite images data acquisition, data format, data analyze and data output. It also explains the major applications of GIS i.e. climate change, natural resources management and water resources management.	
Course Outcomes: **On completion of the course, the student should be able to:** CE1114.1 Asses the various sources for remote sensing data. CE1114.2 Analyze the data from various type of images. CE1114.3 Analyze the data acquisition and data output through GIS. CE1114.4 Incorporate GIS in resources management and climate changes.	

Prerequisites		
Teaching Scheme (Hours per Week)		L-T-P: 1 0 2
Credits		2
Sr. No.	**Evaluation Component**	Marks
1	Attendance	5
2	Assignment	Nil
3	Class Participation	10
4	Quiz (2)	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	10
12	Project-II	15
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	20
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	10
	Total (100)	
	Evaluation scheme for retest	
	Quiz	10
	Lab Evaluation-II	20

Syllabus (Theory)

1. Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves and resolution, Satellite Image - Characteristics and formats, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Supervised Classification
2. Basic concepts of geographic data, GIS and its components, Data acquisition, Raster and Vector formats, topology and Data models, Spatial modelling, Data output
3. Application of GIS: Climate change, Natural resources management, Forest management, Water Resources management, Drought Management

Syllabus (Practical)

2. Creating and Exploring a Basic Map
3. Classifying and Creating Vector Data
3. Laying Out of the Maps
4. Classifying and Creating Raster Data
5. Terrain Analysis
6. Raster to Vector Conversion
7. Hydrologic Analysis

Text /Reference Books:

1. Bhatta B., "Remote sensing and GIS", Oxford University Press, 2011.
2. Satish G., "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson, 2011.
3. Joseph George, "Fundamentals of Remote Sensing", University Press, 2011.
4. Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. GPS Theory and Practice. Springer, 1994. ISBN: 9780387824772.

https://nptel.ac.in/courses/105/108/105108077/

Course Articulation Matrix: (Mapping of COs with POs) (CSE)

CO		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
CE1114.1					1	1	2	2	1	2	1	2				1	1
CE1114.2					2	1	2	2	2	1				1	1	1	
CE1114.3	2	1	2		2	1	3	1	1	2				2	2	2	1
CE1114.4	2		2		2	2	2				2	2		1	2		2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	Cloud Computing Architecture; CS1217
Hours per Week	L-T-P: 3-0-2
Credits	4
Students who can take	B.Tech. CSE Sem VI (2019-2023)

Course Objective:

The course presents a top-down view of cloud computing, from applications and administration to programming and infrastructure. The main focus is on deployment of solution elements, including infrastructure components such as networks, systems and applications services in the cloud infrastructure. This course builds upon the Operating System, Computer Networks, Database, Computer Architecture.

Course Outcomes:

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

CS1217.1. Apply fundamental concepts in cloud infrastructures to understand the trade-offs in power, efficiency and cost

CS1217.2. Build and deploy cloud applications that are resilient, elastic and cost-efficient

CS1217.3. Analyse the trade-offs between deploying applications in the cloud and over the local infrastructure.

CS1217.4. Deploy applications over commercial cloud computing infrastructures, i.e., Google Cloud

CS1217.5. Analyse the performance, scalability, and availability of the underlying cloud technologies and software

Prerequisites	Operating System, Computer Networks, Database, Computer Architecture

Evaluation Scheme

Sr. No	Specifications	Marks
01	Attendance	Nil
02	Assignment	20
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	20
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	15
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	15
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	10
	Total (100)	**100**
Evaluation Scheme for Retest		
1	Lab Evaluation-I	15
2	Theory Exam-III	20
	Total	**35**

Syllabus:

Cloud Computing Overview: Definition and evolution of Cloud Computing, Enabling Technologies, Service and Deployment Models, Popular Cloud Stacks and Use Cases, Benefits, Risks, and Challenges of Cloud Computing, Economic Models and SLAs, Topics in Cloud Security Cloud Infrastructure: Historical Perspective of Data Centres, Datacentre Components: IT Equipment and Facilities, Design Considerations: Requirements, Power, Efficiency, & Redundancy, Power Calculations, PUE and Challenges in Cloud Data Centres, Cloud Management and Cloud Software Deployment Considerations

Google Cloud Platform Fundamentals: Google App Engine, Google Compute Engine, Google Kubernetes Engine, Google Cloud Storage, Google Cloud SQL, and BigQuery, Google Cloud Resource Manager hierarchy and Google Cloud Identity and Access Management, infrastructure design, and virtual networking configuration with Virtual Private Cloud (VPC), Projects, Networks, Subnetworks, IP addresses, Routes, and Firewall rules

Google Cloud Infrastructure: Compute Engine, Core Services, customer-supplied encryption keys, security and access management, quotas and billing, and resource monitoring, Scaling and Automation, securely interconnecting networks, load balancing, auto-scaling, infrastructure automation and managed services, Design and Process, define and balance business and technical requirements to design Google Cloud deployments, Kubernetes Engine, Creating and managing software containers and an introduction to the architecture of Kubernetes.

Cloud Computing Standards- Introduction- Objectives, Best Practices and Standards, Practical Issues- Interoperability- Portability- Integration- Security

Reference Books

1. Thomas Erl, Ricardo Puttini, Zaigham Mahmood. *Cloud Computing: Concepts, Technology & Architecture*. Pearson, 2013.
2. Michael J. Kavis. *Architecting the Cloud: Design Decisions for Cloud Computing Service Models*. Wiley, 2014.
3. Online Cloud Computing Specialization, Coursera, https://www.coursera.org/specializations/cloud-computing

Course Articulation Matrix: (Mapping of COs with POs)

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
CS1217.1		1		1			1			1						1	
CS1217.2	1					2		1	1		2			2			2
CS1217.3				1		1	2	2	3	1		2	1			3	
CS1217.4					1	1		1		3	3					2	3
CS1217.5						2		2		2	2	1	2			2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Name: Deep Learning **L-T-P: 3-0-2**
Course Code: CS1218 **Credits: 4**

Course Objective: This course covers the most successful form of artificial intelligence, deep learning. We will be covering linear regression, logistic regression, deep neural networks, convolutional and recurrent neural networks. The course will also focus on optimization techniques like gradient descent and its variants. Programming will be an important component of the course. We will be using Python as our primary language. For implementation of algorithms, we will be using Tensorflow and Keras. The course will be equally inclined towards theory and programming.

Course Outcome:

On completion of this course, the students will have the ability to:
CS1218.1 Prioritize the collection and usefulness of data for a particular deep learning task
CS1218.2 Apply theory and implementation learned in the course to real world problems on computer vision and natural language processing
CS1218.3 Judge whether a particular problem can be solved using deep learning or not
CS1218.4 Critically analyze which architecture to use for a specific problem
CS1218.5 Design and implement deep learning algorithms using Tensorflow and Keras framework

Sr. No.	**Evaluation Component**	
1	Attendance	NIL
2	Assignment	10
3	Class Participation	NIL
4	Quiz	10
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	15
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation- Continuous	10
15	Lab Evaluation- Exam	15
16	Course Portfolio	NIL
17	Presentation	5
18	Viva	5
	Total (100)	**100**
Evaluation Scheme for Retest		
	Theory Exam-III	20
	Lab Evaluation-II	15
	Total	**35**

Course Topics:

Topics	**Lecture Hours**
UNIT – I Introduction	4

Linear and logistic regression. Cost function for logistic regression.	
UNIT – II Deep Neural Networks Generalization of logistic regression to deep neural networks. Cost functions. Optimization algorithms: Gradient descent, Stochastic gradient descent, Momentum, RMSprop, Adam.	9
UNIT – III Regularization Techniques Underfitting and overfitting of neural networks: bias and variance. L1, L2 and dropout regularization techniques, hyperparameter tuning.	6
UNIT – IV Deep Learning for Computer Vision Basics of CNN: convolutions and pooling. Detailed understanding of Alexnet, ResNet, VGG-16, VGG-19 and inception architectures. Their implementations. Object recognition and face recognition.	12
UNIT – V Deep Learning for Natural Language Processing Basics of RNN, LSTM, GRU, Bidirectional RNN, deep RNNs. Representations of words as vectors. One hot encoding and word embeddings. Learning word embeddings using word2vec, GloVe. Transformers.	9

References:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press. Online available at http://www.deeplearningbook.org/

Additional Resources:

1. Stanford CS230: Deep Learning
2. Coursera specialization on Deep Learning
3. Coursera Specialization on Natural Language Processing
4. Speech and Language Processing (3rd ed. draft)
5. Transactions of the Association for Computational Linguistics
6. CS224n: Natural Language Processing with Deep Learning

CO	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
CS1218. 1	1						1	1		1				1	1	1	
CS1218. 2					1		1	1	1	1	1						2
CS1218. 3				1		1	2	1	1	1	1	1				3	
CS1218. 4	1					2	1	1	1	2	2	1				2	3
CS1218. 5	1					1	1	2	1	1	1	2		1		2	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. Design solutions in various application domains using software engineering approaches that integrate ethical and economic concerns.

CS1113.3. Elicit and evaluate functional and non-functional requirements for a software system.

CS1113.4. Design, represent and document software requirements specifications according to IEEE standards.

CS1113.5. Apply UML modeling for software design.

CS1113.6. Apply coding standards and guidelines.

CS1113.7. Prepare code checklist and perform code inspections, code reviews and walkthrough.

CS1113.8. Develop and implement various manual and automated testing procedures.

CS1113.9. Estimate the cost of the software project.

CS1113.10. Evaluate software in terms of software quality and quality assurance according to ISO standards.

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	**20**
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	NIL
17	Presentation	**10**
18	Viva	NIL
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	20
2	Quiz	20
	Total	**40**

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 the 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 designs 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 the 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:

- R. S. Pressman, "Software Engineering – A practitioner's approach", Eighth Edition, McGraw Hill International editions, 2019.
- Ian Somerville, "Software Engineering", Tenth Edition, Pearson Education, 2017.
- Rajib Mall, "Fundamentals of Software Engineering", Fifth Edition, Prentice-Hall of India Pvt. Ltd., 2018.

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										2	1
CS1113.4	1	1	1	1	1	1	2									2	2
CS1113.5	1				1	1					1	2	2			2	2
CS1113.6	1	1	1	1	1	1					1	2		1		2	2
CS1113.7	1				1	1					1	2	2	1		2	2
CS1113.8	1	1	1	1	1	1			2		1	2		1		2	2
CS1113.9	1	1	1	1	1	1			2					1		2	2
CS1113.10	1	1	1	1	1	1	2		2		2	2		2	2	3	3

Course Title and Code: CS1112: Compiler Design	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	**B.Tech. Sem (VI)**
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**
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	10
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	10
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	**100**

Retest

1	Theory Exam-III	30
	Total	30

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

Text Book(s)

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

Reference Book(s)

- Compilers- Principles, Techniques and Tools, Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman – 2nd Edition, Addison-Wesley, 2007.
- Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.
- 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 Outcomes	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
CS1112.1	1			1		1			1		1	1		1			1
CS1112.2		1	1		1		1			1			1		1	1	1
CS1112.3		1		1				1	1	1	1	1	2		1	1	2
CS1112.4	1		1				1		1	1			1	1	1	1	1
CS1112.5	1	1		1		1	1		1	1		1	2	1	2	1	2

Course Title and Code: Full Stack Web Development with REACT (CS1212)	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech. CSE VI

Course Objective: This course will equip the students with understanding and skills for MERN stack web development using MongoDB database, NodeJS, Express and React library.

Course Outcome:

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

CS1212.1 Develop high-level plans for script solutions for web to evaluate the post-production outcome.
CS1212.2 Implement front end web design in ReactJs.
CS1212.3 Design scripts to meet given interface and media control requirements.
CS1212.4 Devise, carry out and evaluate functional test strategies of web design.
CS1212.5 Implement and evaluate techniques for the installation of cross platform mobile applications and delivery via various channels.
CS1212.6 Implement NoSQL databases using MongoDB, work within a Node.js environment and Express framework.
CS1212.7 Communicate to the client side through a RESTful API and web services.

Prerequisites: HTML, CSS, JavaScript, Programming Language

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-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	30
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	30
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	100

Retest

1	Lab Evaluation-II	30
	Total	30

Course Contents:

JavaScript application development and the React library, React Router and Single Page Applications, Reactstrap, React Native UI Elements and Redux.

React Native Alerts, Animations, Gestures, and Persist Redux Store, Accessing Native Capabilities of Devices: The Expo SDK

Front-end Web UI Frameworks Overview: Bootstrap, Bootstrap CSS Components, Bootstrap JavaScript Components

Web Tools - Bootstrap JavaScript, CSS preprocessors, Less and Sass, automation using NPM scripts, and task runners like Grunt and Gulp.

Introduction to Server-side Development - Node, Node modules and the Node HTTP server, Express framework and set up a REST API using Express.

Data storage with MongoDB, the popular NoSQL database, Express generator, interaction with MongoDB from a Node application, REST API server with Express, Mongo and Mongoose, Mongoose population, secure communication using HTTPS.

Text Books:

Fullstack React Native: Create beautiful mobile apps with JavaScript and React Native

React Native in Action: Developing iOS and Android Apps with JavaScript

Practical React Native: Build Two Full Projects and One Full Game using React Native

Reference Online Course:
https://www.coursera.org/specializations/full-stack-react?action=enroll

Course Outcomes	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
CS1212.1			1		1		1	1	1		1		1	1		2	2
CS1212.2	1		2	1	1			2						1	2	2	2
CS1212.3	1			1			1	1		1	1			1		2	2
CS1212.4	1		1		1					1						2	3
CS1212.5						1		1		1						3	3
CS1212.6	1	1					1		1		1		1	1		3	3
CS1212.7		1	1			1	1		1		1		1	1	2	3	3

Course Title and Code: Cyber Security EE1219	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.C.A. IV semester, B. Tech VI semester

Course Objectives- This course introduces the NIST Cybersecurity framework and sensitizes the students on security risks, malware and social engineering attacks. It builds skills for ensuring good cyber hygiene, monitoring and reporting cyber-attacks for an online computer.

Course Outcome:

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

EE1219.1. Recommend the implementation tier for the NIST framework for a specific organization.

EE1219.2 Detect malicious attempts in a network using network sniffers

EE 1219.3 Analyze network and application attacks using SIEM.

EE1219.4 Appreciate the significance of cyber forensics and carry stages of forensic investigation by taking memory backups, data recovery, analyzing registry, traffic logs etc.

EE1219.5 Apply SQL injection, Cross-site script hacking, and other ethical hacking on virtual boxes and understand how hackers work.

EE1219.6 Use automation tools for threat intelligence perception.

Prerequisites: Nil

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	**05**
3	Class Participation	Nil
4	Quiz	**15**
5	Theory Exam-I	Nil
6	Theory Exam-II	**10**
7	Theory Exam-III	**30**
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I (Scenario on Network Security)	**10**
12	Project-II (Scenario on Forensic)	**10**
13	Project-III (Scenario on Ethical Hacking)	**10**
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	**Nil**
16	Course Portfolio	Nil
17	Presentation	**Nil**
18	Viva	**10**
	Total (100)	**100**

Retest

1	Theory Exam III	**30**
	Scenario (any one)	**10**
	Total	**40**

Course Contents:

Module 1: Introduction to NIST framework, Organization functions, CyberSeek, Types of Cyber Attacks, Vulnerabilities, Risks and Exploits, Overview of zero trust.

Network and Application Security- Intrusion Detection systems (IDS), Intrusion Prevention systems (IPS), Security Information and Event Management (SIEM) log analysis- using Splunk, Snort, Demilitarized zones (DMZ), Honeypots in network. Monitoring cyberattacks using SIEM for DOS, SQLi, XXS, XXE, LFi, Command Injection, identifying False Positive and False Negatives in

SIEM logs. **Authentication Protocols** -Lightweight Directory Access Protocol, Kerberos, New Technology LAN manager (NTLM), Active Directory Domain Service (AD DS).
Module 2- Forensic - Introduction, Benefits and Challenges of Digital Forensic, Methodology, setting up Forensic workstation, NIST catalog for searching forensic tools and techniques, Computer, Registry, Mobile forensic tools, difference between Digital and Electronic Forensic, Hands-on using tools-Autopsy, Scalpel and Binwalk for data carving, extracting Botnet from memory, RAM triage., Network Miner and Wireshark for traffic analysis, Registry acquisition using FTK Imager, Shellbag explorer ,Registry viewer. Anti-forensic methods, Steganography tools-Openstego.

Module 3: **Ethical Hacking -**White hat hackers, Big bounty programs, familiarization with Common Vulnerabilities and Exploits (CVE), Nmap to locate attack vectors, Metasploit framework, Burp Suite for automated scanning. **Threat Intelligence -**Attackers vs Defenders, TI cycle, Online Anonymity, Trend analysis-Webscapper, Elastic search, Monitoring and alerting.

Text Books:

1. Introduction to Cybersecurity: Guide to World of Cybersecurity-Anand Shinde, Notionpress, India
2. Cryptography and Network security-Atul Kahate, Second Edition, Tata Mc Graw Hill.

Online Resources:

1. https://www.nist.gov/cyberframework
2. https://www.cyberseek.org/
3. https://www.wireshark.org/
4. https://www.splunk.com/en_us/download
5. https://www.volatilityfoundation.org/

Course Articulation Matrix: (Mapping of COs with POs)

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
EE1219.1.	1			2									2			2	1
EE1219.2.						1			2							2	2
EE1219.3.						1			2							2	2
EE1219.4	2		1			1					1					2	2
EE1219.5.			1							2						2	2
EE1219.6	2														2	1	2

1. **Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation**

Course Title and Code: Disaster Management: CE1206	
Hours per Week	**L-T-P: 3-1-0**
Credits	**4**
Students who can take	B.Tech Sem VI sem (2019-2023) (OE)
Course Objective: This course aims to develop understanding of various natural and manmade disasters. Natural disasters include earthquake, Tsunami, Flood, forest fires and Land Slides. Manmade disasters include fire, Industrial Pollution, embankment failure, structural failure and due to electric supply. Topics includes the causes for these disasters and remedial measures which can minimize the losses to the life and property. The course also includes the identification and description of electric supply resilience and restoration.	

Course Outcomes

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

CE1206.1 Asses the types of disasters, causes and their impacts.

CE1206.2 Assess vulnerability and various methods of risk reduction measures and mitigation.

CE1206.3 Draw the hazard and vulnerability profile of a given region.

CE1206.4 Analyze the impact of Storms and Severe Weather on electric utility.

CE1206.5 Plan and execute framework to black start and restoration procedure with considering security criteria and power system reliability.

Prerequisites		
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	15
7	Theory Exam-III	35
8	Report-I/ Case Study	5
9	Report-II/Case Study	5
10	Report-III/Case Study	5
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
17	Presentation	10
18	Viva	10
	Total (100)	
	Evaluation scheme for retest	
	Theory Exam III	35

Syllabus (Theory)

Unit-1 Introduction to Disasters, Various types of disaster, Natural: Flood, Earthquake, cyclone, Land slide, Manmade: Fire, Industrial Pollution, embankment failure, structural failure, Loss of resources.

Unit-2

Risk and Vulnerability:

Risk: Its concept and analysis, Risk reduction, Vulnerability: Its concept and analysis, strategic development for vulnerability reduction

Unit 3

Disaster Management in Electrical Systems:

Causes of Extended Outages, System Impact of the Loss of Major Components, Methods to Reduce Energy System Vulnerability, Development of an On-Site and Off-site Disaster management Plan, Accident prevention techniques and Reporting procedures, Investigation reports, Impacts of Blackouts.

Unit – 4

Management- Objectives, Processes, Events, analysis, base-line data, forecasting and Warnings. Disaster preparedness plan concept and nature, Emergency operation center and IT aids- physical environment, Applications.Public-private agency co-ordination- federal, state and local disaster response organization and network, Citizen and community role in disaster response and recovery.

Case Studies

1. A Case study on flood Hazard
2. A case study on Tsunami Hazard
3. A case study on Earthquake
4. A case study on Forest fire
5. A case study on structural failure
6. A case study on Electrical Disaster Recovery Operations for a Hospital
7. A Case study of Impacts of Cyclones on the Power Sector in India.
8. Impact assessment of Storms and Severe Weather on electric utility infrastructure.

Text /Reference Books:

1. M. Pandey, “Disaster Management” Wiley India Pvt. Ltd.
2. Tushar Bhattacharya, “Disaster Science and Management” McGraw Hill Education (India) Pvt. Ltd.
3. Crisis and disaster management plan for power sector by central electricity authority of India
4. N. Malla, S. Poudel, N. R. Karki and N. Gyawali, "Resilience of electrical power delivery system in response to natural disasters," 2017 7th International Conference on Power Systems (ICPS), Pune, 2017, pp. 806-811.doi: 10.1109/ICPES.2017.8387400
5. Sahni, Pardeepet. al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.

Course Articulation Matrix: (Mapping of COs with POs) (CSE)

CO		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
CE1206.1	2	2	2					2	2		2	2		1	1		
CE1206.2	2	2	2	1				1	1	1	2	2		1	1	1	1
CE1206.3		1	1	1	1	1	1	2	2	2	2	2		1	1	1	1
CE1206.4					1	1	1									1	1
CE1206.5					2	2	2										

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	AI with IBM Watson; CS1314
Hours per Week	L-T-P: 3-0-2
Credits	4
Students who can take	B.Tech. CSE Sem VII (IBM Course)

Course Objective- The course will introduce the platforms like IBM Watson Assistant and Watson Knowledge Studio to build applications to solve complex real-world problems using Artificial Intelligence and Machine Learning techniques. This course builds upon the foundations laid in course on AI and ML.

Course Outcomes (Provided by IBM):

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

CS1314.1. Understand the vision of AI from a global context.
CS1314.2. To understand and apply IBM Watson Services in Market perspective of Big Data.
CS1314.3. Applying and analyzing architecture and APIs with use of WKS and Watson Assistant.
CS1314.4. To evaluate the application of AI and ML in Industrial and Commercial sectors.
CS1314.5. Building and creating the service instances using IBM services and using APIs.

Prerequisites	Linux, SQL, Java/Python

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 (Certification Exam by IBM)	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	20
12	Project-II	20
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

01	Quiz	15
02	Project-II	20
	Total	**35**

UNIT-I: Artificial Intelligence Overview, Eras of Computing, types & main focus of AI, ML & its types, Neural Networks, NLP and processes, Use Cases, Computer Vision tools and use cases, Cognitive Computing, Setting up of IBM Bluemix Account.

UNIT-II: Artificial Intelligence Foundation, IBM Watson and real-world problems, Deep QA Architecture, Commercialization of Watson, Watson Services – capabilities of each Watson service, Watson Knowledge Studio, Usage of Watson API explorer.

UNIT-III: NLP and NLC, NLP – Processes, Tools and services of NLP, NLP Use cases, Different components of NLP, Challenges with NLU, NLP Pipeline. Capabilities of IBM Watson NLC, NLU and its capabilities, Watson Tone Analyzer, Watson Discovery Service, Using Discovery API

UNIT-IV: Chatbots, Chatbot and its applications, growing popularity of chatbots, tools and services for chatbots, Workspace, Intent, entity and dialog nodes. Nodes in a dialog, Advanced Features of a chatbot, Creation of Watson Assistant Instance, Add Intents and test in slack.

UNIT-V: Computer Vision, CV – history and advancement with AI, CU Use Cases, Pipeline with in a CV application, Feature Extraction, image classification and recognition, IBM Visual Recognition Service.

Text Material & Resources: IBM AP Skills Academy

Reference Books:

- Elaine A Rich, "Artificial Intelligence", Tata McGraw-Hill Publishing Company Limited.
- Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems", Shroff Publishers & Distributors Pvt. Ltd.
- Artificial Intelligence: A Modern Approach" by Stuart Russell and Peter Norvig.
- Artificial Intelligence: A New Synthesis" by Nils J Nilsson.

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
CS1314.1	1													1			
CS1314.2														1	2		
CS1314.3					1	1	2									2	
CS1314.4					2	2	3									2	
CS1314.5					2	2	3									2	

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Minor Project; PR1103**
Hours per Week	**L-T-P: 0-0-2**
Credits	**4**
Students who can take	B.Tech Sem VII

Course Objective- This course offers an opportunity to apply and extend knowledge learned throughout the program to solve real world issues. The minor projects undertaken span a diverse range of topics, including design, simulation, and experimental studies. The course emphasizes, facilitating student learning in technical, project implementation and presentation spheres.

Course Outcome:

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

PR1103.1. Identify and formulate industrial and societal problems.
PR1103.2. Design engineering solutions for complex problems.
PR1103.3. Develop/fabricate, and implement solutions for identified problem.
PR1103.4. Demonstrate the knowledge, skills and attitudes of a professional engineer.

Operation Procedure:

Students are expected to achieve the objective of the project work. The students are expected to submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The students are expected to report to their mentor(s) frequently and will be evaluated continuously. Department committee will evaluate the work through seminars and progress reports as per the evaluation scheme. At the end there would be a demonstration of the solution and possible future work for the work done.

- Student must devote full semester for Minor Project.
- Student must report to the mentor(s) regularly.
- Seminar evaluation must be carried out in the presence of at least two-committee members.
- Experts in the relevant area constituted by the supervisor.
- Final Seminar Report to be submitted must be in formal hard bound cover bearing of the Institute emblem.
- Assessment is by means of a synopsis presentation, submission of a thesis, and a public demonstration of work undertaken.

Prerequisites

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**

Course Articulation Matrix: (Mapping of COs with POs) (CSE)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO 1	PSO 2
PR1103.1	1			2	1	2	1	2	2							1	1
PR1103.2			1	2	2	1		1	2		1	2		2	2	2	2
PR1103.3	1			2	1		1									2	1
PR1103.4			1	2	2	1	2				1	2		2	2	2	2

Course Title and Code:	**Advanced Data Structures and Algorithms; CS1213**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech Sem VII CSE

Course Objective- The course aims to develop deeper understanding about algorithm design paradigms and advanced data structures for solving complex algorithmic problems. This course complements the learning of the courses on data structures and design and analysis of algorithms.

Course Outcome:

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

CS1213.1. Argue the correctness of algorithms using inductive proofs and loop invariants.

CS1213.2. Analyse algorithms using amortized analysis, including the accounting method and the potential method, as required.

CS1213.3. Write program to solve algorithmic problems using divide-and-conquer and dynamic-programming paradigm.

CS1213.4. Implement variants of the self-balancing tree.

CS1213.5. Analyse, implement and use heap structures and hashing techniques.

CS1213.6. Apply and implement the disjoint set data structures to solve problems modelled by graph.

CS1213.7. Evaluate and apply appropriate energy efficient algorithmic design technique for solving complex algorithmic problem.

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	20
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	10
07	Theory Exam-III	20
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 (Test)	10
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam -III	20
2	Lab Evaluation-I (Test)	10

Syllabus (Theory):

Unit 1: Amortized Analysis: Aggregate, Accounting and Potential Method, Dynamic tables, **External Sorting**: Introduction to external sorting. Selection trees & k-way merging. Run generation. Optimal merging of runs.

Unit 2: Trees Variants: B Tree (2-3/2-3-4 Tree), RB Tree, Optimal Binary Search Tree, Splay tree, AA-Tree, Treap. **Indexed Tree**: Queaps

Unit 3: String Matching Algorithms: Knuth Morris Prat, and Boyer Moore. **String Processing Data Structures**: Tries, Suffix Tree, **Disjoint Set Data Structures:** Disjoint-set operations, representation of disjoint sets, Disjoint-set forests

Unit 4: Heaps: Binomial Heap, Fibonacci Heap, Pairing heap, Beap, **Space partitioning tree**: Binary space partitioning, KD tree, Quad tree, Interval Tree, Segment Tree, Priority Search Tree.

Unit 5: Hashes: Introduction, Perfect hash function - Cuckoo hashing, Coalesced hashing, Universal Hashing. **Applications**: Searching, Memory Indexing, Computer Graphics, Image Data Structures, Computational Biology.

LAB

Practical work will be based on programming exercises on topics covered in the theory syllabus. A tentative list of programs is given below for reference.

1. Write a program in C to sort a small sequence using the recursive merge sort algorithm.
2. Write a program in C to sort a small sequence using the iterative merge sort algorithm.
3. Write a program in C to implement a K-way merge sort for external sorting of divide conquer and combine approach. Analyze and compare the complexity of it with any other sorting technique using asymptotic and amortized analysis.
4. Write a program in C to check if a binary tree is subtree of another binary tree.
5. Write a program in C to implement a BST with menu-driven operations using array/linked list.
6. Write a program in C/C++ to implement a Splay tree for 20 user-defined integers. Search for a specific key and display the preorder traversal on the splay tree to see the search effect on self-balancing BST.
7. Write a program in C/C++ to implement trie data structure most widely used for long strings processing.
8. Write a program in C to search a pattern P in a text T using Boyer Moore pattern matching algorithm.
9. Write a program to implement a suffix tree for pattern matching, use the same pattern P and text T as in question 8.
10. Write a program in C++ to implement KD tree and search the minimum in tree. Compare the running time complexity with minimum search in BST of similar elements.
11. Use C++/Python STL to implement Hash/Map/Dictionary for optimal searching.

Text Material & Resources:

Text Books:

1. Saha, Suman, and Shailendra Shukla. Advanced Data Structures: Theory and Applications. CRC Press, 2019.
2. Sartaj, Sahni. "Data Structures, Algorithms and Applications in C++." Computer Science, Singapore: McGraw-Hill (1998), reprint 2005.
3. Samet, Hanan. Foundations of multidimensional and metric data structures. M. Kaufmann, 2006.
4. Mehlhorn, Kurt. "Sorting and Searching, volume 1 of Data Structures and Algorithms." (1984).
5. Mehta, Dinesh P., and Sartaj Sahni. Handbook of data structures and applications. Chapman and Hall/CRC, 2004.
6. Langsam, Yedidyah, Moshe Augenstein, and Aaron M. Tenenbaum. Data Structures using C and C++. Vol. 2. New Jersey: Prentice Hall, 2001.
7. Robert, L. Krune, Clovis L. Tondo, and Bruce P. Leung. "Data structures & Program Design in C." In O'Dougherty (production process staff workers) (second (hc) textbook ed.). Prentice-Hall, Inc. div. of Simon & Schuster, 2002.

Reeference Books:

1. Allen, Weiss Mark. Data structures and algorithm analysis in C++. Pearson Education India, 2007.

2. Cormen, T. H., Charles E. Leiserson, R. L. Rivest, and C. Stein. "Introduction to algorithms 2nd edition. chapter 9: Medians and order statistics."
3. Hopcroft, John E., and Jeffrey D. Ullman. Data structures and algorithms. 1983 reprint 2001.
4. Standish, Thomas A. Data structures in Java. Addison-Wesley Longman Publishing Co., Inc., 1997. Reprint Pearson Education Asia (Adisson Wesley), New Delhi, 2000
5. Knuth, Donald E. "The art of computer programming. Vol. 1: Fundamental algorithms." Atmospheric Chemistry & Physics (1978).
6. Heileman, Gregory L. "Data Structures, Algorithms, and Object-Oriented Programming. 1996.", Tata Mc-Graw Hill, 2002
7. Tremblay, Jean-Paul, and Paul G. Sorenson. "An introduction to data structures with applications." McGraw-Hill Computer Science Series, New York: McGraw-Hill, 1976 (1976).

Recommended MooC :

https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-851-advanced-data-structures-spring-2012/

https://www.coursera.org/learn/advanced-algorithms-and-complexity?

https://www.coursera.org/learn/advanced-data-structures

Course Articulation Matrix: (Mapping of COs with POs) (CSE)

CO		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
CS1213.1	3		2		2	2	1									3	3
CS1213.2	2		2		2	2	1		1							3	3
CS1213.3	2		2		2	2	2		1							3	3
CS1213.4	2		2		2	2	2		1							2	2
CS1213.5	2		2		2	2	2		1							1	2
CS1213.6	2		1		1											2	2
CS1213.7	2		2		2	2	2		2							3	3

Course Title and Code: Blockchain Technology and Applications CS1203	
Hours per Week	**L-T-P:3-0-2**
Credits	**4**
Students who can take	**B. Tech(VII sem) Elective**

Course Objectives: This course aims to provide an understanding of the essential concepts of blockchain technology by initially exploring the Bitcoin protocol followed by the Ethereum protocol to lay the foundation necessary for developing applications and programming for Blockchain Technology.

Course Outcome:

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

CS1203.1. Recognize foundational concepts of blockchain, and apply these program concepts on the blockchain.

CS1203.2. Develop, Test and Execute a smart contract.

CS1203.3. Apply the consensus mechanism on application.

CS1203.4. Identify use cases and develop, execute and test the application.

CS1203.5. Recognize the differences between the most prominent blockchain structures and permissioned blockchain service providers.

Evaluation Scheme:

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

Retest:-

1	Theory Exam -3	30
2	Lab	Nil

Course Contents

Introduction to Blockchain: - History: Digital Money to Distributed Ledgers, Design Primitives: Protocols, Security, Consensus, Permissions, Privacy. Blockchain Architecture and Design: - Basic crypto primitives: Hash, Signature, Hash chain to Blockchain, Basic consensus mechanisms: Requirements for the consensus protocols, Proof of Work (PoW), Scalability aspects of Blockchain consensus protocols. Permissioned Blockchains: Design goals, Consensus protocols for Permissioned Blockchains. Ethereum network, EVM, Transaction fee, Ether, gas, Solidity.

Smart contracts, Use case I: Blockchain in Financial Software and Systems (FSS): (a) Settlements, (b) KYC, (c) Capital markets, (d) Insurance. Use case II: Blockchain in the trade supply chain: (a) Provenance of goods, visibility, trade supply chain finance, invoice management discounting, etc. Blockchain Cryptography. Research aspects I (a) Scalability of Blockchain consensus protocols (b) Case Study various recent works on scalability, Research aspects II (a) Secure cryptographic protocols on Blockchain (b) Case Study Secured Multiparty Computation, Blockchain for science: making better use of the data-mining network, Case Studies: Comparing Ecosystems - Bitcoin, Hyperledger, Ethereum and more.

Reference / Textbooks

(1.) Imran Bashir: Mastering Blockchain. O'Reilly, Packt Publishing, 2017.
(2.) Narayanan, Arvind, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. *Bitcoin and cryptocurrency technologies: A comprehensive introduction*. Princeton University Press, 2016.
(3.) Mougayar, William. *The business blockchain: promise, practice, and application of the next Internet technology*. John Wiley & Sons, 2016.

MOOC course

Blockchain Basics by Coursera (University at Buffalo & The State University of New York)
https://www.coursera.org/learn/blockchain-basics/home/welcome

CO		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
CS1203.1	3		2		2	2	1									3	3
CS1203.2	2		2		2	2	1		1							3	3
CS1203.3	2		2		2	2	2		1							3	3
CS1203.4	2		2		2	2	2		1							2	2
CS1203.5	2		2		2	2	2		1							1	2

Course Title and Code:	Natural Language Processing; CS2203
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech. Semester VII

Course Objective- This course will cover the latest advances in natural language processing, primarily through the applications of deep learning using programming in Python and Tensorflow/Keras and/or PyTorch. It will cover basics of natural language processing through word vector representations, language models for neural machine translation and various other tasks like summarization, question answering, chatbots, etc.

Course Outcome:

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

CS2203.1. Analyze how words are represented as vectors for natural language processing.
CS2203.2. Model NLP problems using tools from calculus, linear algebra and probability.
CS2203.3. Design RNNs for various NLP tasks like machine translation.
CS2203.4. Design transformer and BERT models for various NLP tasks.
CS2203.5. Design and analyze their own algorithms and implement them using Tensorflow/Keras or PyTorch.

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

Retest

1	Theory Exam-III	20
2	Lab Evaluation-II	10
	Total	**30**

Syllabus (Theory):

UNIT – I: Review

Basics related to Calculus, Linear Algebra, probability, optimization for deep learning.

UNIT – II: Basics of Deep Learning

Simple and advanced word vector representations: word2vec and GloVe. Softmax and single layer neural networks. Deep neural networks and backpropagation, overfitting, regularization, activation functions. Introduction to Tensorflow/Keras and PyTorch.

UNIT – III: Recurrent Neural Networks
Recurrent Neural Networks for natural language processing, Seq2Seq and Large-scale deep learning, GRUs and LSTMs. Implementations using Tensorflow/Keras and PyTorch.

UNIT – IV: Advanced Architectures for NLP
Transformers and BERT model for language translation and question answering and their implementations, chatbots, etc. Discussion on the future of natural language processing using deep learning.

Text Books:

There is no text book for the course. However, we will closely follow the following course taught at Stanford University.

1. CS224n: Natural Language Processing with Deep Learning

Reference Books:

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning", MIT Press. Online available at http://www.deeplearningbook.org/
2. Stanford CS230: Deep Learning
3. Coursera specialization on Deep Learning
4. Coursera Specialization on Natural Language Processing
5. Speech and Language Processing (3rd ed. draft)
6. Transactions of the Association for Computational Linguistics

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
CS2203.1	3		2		2	2	1									3	3
CS2203.2	2		2		2	2	1		1							3	3
CS2203.3	2		2		2	2	2		1							3	3
CS2203.4	2		2		2	2	2		1							2	2
CS2203.5	2		2		2	2	2		1							1	2

Course Title and Code: Cross-Platform App Development: CS1215	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B. Tech. CSE Sem VII

Course Objective: This course will equip the students with understanding and skills for native components of mobile app using MongoDB database, NodeJS, Express and React Native. This course complements learning of the course on mobile application development.

Course Outcome:

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

CS1215.1. Develop high-level plans for script solutions for mobile app to evaluate the post-production outcome.

CS1215.2. Implement front end app design in React Native.

CS1215.3. Design scripts to meet given interface and media control requirements.

CS1215.4. Devise, carry out and evaluate functional test strategies of app design.

CS1215.5. Implement and evaluate techniques for the installation of cross platform mobile applications and delivery via various channels.

CS1215.6. Implement NoSQL databases using MongoDB, work within a Node.js environment and Express framework.

CS1215.7. Communicate to the client side through a RESTful API.

Prerequisites		**JavaScript**
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	10
7	Theory Exam-III	20
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	30
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
Re-Test Evaluation		
	Theory Exam-III	20
	Lab Evaluation-I	10
	Total:	30

Syllabus (Theory)

Module I – Multiplatform Mobile App Development with React Native

This module introduces you to hybrid mobile application development. You will learn about React Native and explore some of the features of React Native to implement a mobile app based on the React application that was implemented in the previous course on React.

Module II – React Native UI Elements and Redux

This module introduces you to various React Native UI elements. We will look at how we can make use of these elements in designing the various views of our application. You will get an overview of the Flux architecture and introduced to Redux as a way of realizing the Flux architecture

Module III – React Native Alerts, Animations, Gestures, and Persist Redux Store
In this module we look at enhancing the user experience through the use of animations and support for gesture-based interaction. We also look at persisting the redux state, and alerting the users

Module IV – Accessing Native Capabilities of Devices
In this module you will explore the Expo SDK that enables you to access the native capabilities of the mobile devices. You will use a few SDK APIs in order to understand the general concepts and the patterns for using these APIs within your React Native application

Text Books and References:

1. Fullstack React Native: Create beautiful mobile apps with JavaScript and React Native
2. React Native in Action: Developing iOS and Android Apps with JavaScript
3. Practical React Native: Build Two Full Projects and One Full Game using React Native
4. https://reactnative.dev/docs/getting-started

Course Articulation Matrix: (Mapping of COs with POs)

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	PS O-2
CS1215.1	3		2		2	2	1									3	3
CS1215.2	2		2		2	2	1		1							3	3
CS1215.3	2		2		2	2	2		1							3	3
CS1215.4	2		2		2	2	2		1							2	2
CS1215.5	2		2		2	2	2		1							1	2
CS1215.6	2		1		1											2	2
CS1215.7	2		2		2	2	2		2							3	3

Course Title and Code:	**EE1217 Machine Vision**
Hours per Week	**L-T-P: 3-0-0**
Credits	**4**
Students who can take	B.Tech Sem VII EEE/CSE

Course Objective- This course imparts knowledge on image preprocessing and machine learning for image recognition and classification. It develops understanding various fundamental concepts for design of Convolutional Neural Networks (CNN) for image classification. Various advanced Neural networks developed during ImageNet challenges are introduced.

Course Outcome:

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

EE1217.1 Implement Image Processing Algorithms using OpenCV tools.

EE1217.2 Design, Train and Test Neural Networks and deploy suitable activation functions using Keras/Tensorflow libraries.

EE1217.3 Identify suitable Performance Parameters and evaluate technique for best performance.

EE1217.4 Use transfer learning from existing trained networks to develop innovative solutions.

		Nil
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	10
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	30
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**

Retest

1	Theory Exam	30

Syllabus:

Module 1: Introduction to Image Processing system- Thresholding, Image Enhancement, Contrast Stretching- Linear, Logarithmic, Power Law, Image Histograms, Filters, Image Sharpening. Edge Detection and Segmentation

Module 2: Deep Learning for Computer Vision, Gradient Descent, Stochastic Gradient Descent and Backpropagation, pooling, dropout and optimization of learning rates. Convolutional Neural Networks, CNN architecture, Designing CNN architecture for image classification / object detection

Module 3: Applications using Transfer Learning from ILSVRC networks, Generative Adversarial Networks, and its applications.

References:

1. Digital Image Processing- S Jayaraman, S Esakkirajan, T Veerakumar
2. Deep Learning book by Ian Goodfellow, Yoshua Bengio, and Aaron Courville

Course Articulation Matrix: (Mapping of COs with POs)

CO		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
EE1217.1					2											2	1
EE1217.2					2		2									2	2
EE1217.3	2				2			2								1	2
EE1217.4	1						2							2		2	2

Course Title and Code: Geographical Information System (GIS): CE1214	
Hours per Week	**L-T-P: 3 0 2**
Credits	**4**
Students who can take	B. Tech Sem VII sem (All Branches)
Course Objective: This course aims to develop understanding of various methods of remote sensing, satellite images data acquisition, data format and data output. It also explains the major applications of GIS i.e., climate change, natural resources management and water resources management.	
Course Outcomes: **On completion of the course, the student should be able to:** CE1214.1. Asses the various sources for remote sensing data. CE1214.2. Analyze the data from various type of images. CE1214.3. Analyze the data acquisition and data output through GIS and GPS. CE1214.4. Incorporate GIS in resources management and climate changes.	

Prerequisites		
Teaching Scheme (Hours per Week)		3 0 2
Credits		4
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	Nil
2	Assignment	5
3	Class Participation	5
4	Quiz (2)	10
5	Theory Exam-I	15
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report-I	5
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	10
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	20
15	Lab Evaluation-II	Nil
16	Course Portfolio	
	Total (100)	
	Evaluation scheme for retest	
	Theory Exam III	30

Syllabus (Theory)

1. Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves and resolution

2. Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Supervised Classification
3. Basic concepts of geographic data, GIS and its components, Data acquisition, Raster and Vector formats, topology and Data models, Spatial modelling, Data output
4. Application of GIS: Climate change, Natural resources management, Forest management, Water Resources management, Drought Management

5. GPS: Introduction, coordinates and time system, Satellites, Mathematical model of GPS observables, Methods of processing GPS data

Syllabus (Practical)

1. Creating and Exploring a Basic Map
2. Classifying and Creating Vector Data
3. Laying Out of the Maps
4. Classifying and Creating Raster Data
5. Terrain Analysis
6. Raster to Vector Conversion
7. Hydrologic Analysis

Text /Reference Books:

1. Bhatta B., "Remote sensing and GIS ", Oxford University Press, 2011,
2. Satish G., "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson, 2011,
3. Joseph George, "Fundamentals of Remote Sensing", University Press, 2011.
4. Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. GPS Theory and Practice. Springer, 1994. ISBN: 9780387824772.

https://nptel.ac.in/courses/105/108/105108077/

Course Articulation Matrix: (Mapping of COs with POs) (CSE)

CO		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
CE1214.1					1	1	2	2	1	2	1	2				1	1
CE1214.2					2	1	2	2	2	1				1	1	1	
CE1214.3	2	1	2		2	1	3	1	1	2				2	2	2	1
CE1214.4	2		2		2	2	2				2	2		1	2		2

Course Title: Fintech in Retail Banking and Insurance
Course Code: FA1151
Credits: 3
Semester: V, BBA, Btech Sem VII

Course Objective:

The course provides overview of how fintech is transforming retail banking and insurance in India.
It provides an overview of various retail banking products (liabilities, 3rd party sales, assets) and insurance products covering in brief product features, sales channels and associates risks.
The course will help prepare students for career in retail financial services industry,

Course Outcomes:

a. Introduction to retail banking & its various facets
b. Introduction to insurance and its various facets
c. How Fintech is transforming functions across insurance and retail banking and opportunities ahead

Course Content/Topics to be covered:

- Chapter 1: History of banking and evolution of retail banking
- Chapter 2: History of Insurance and introduction to Insurance business
- Chapter 3: Evolution of Fintech and introduction to Fintech
- Chapter 4: Retail liability products
- Chapter 5: Third party products
- Chapter 6: Loan calculator
- Chapter 7: Retail asset products
- Chapter 8: Credit Bureau
- Chapter 9: Life insurance products & roadmap
- Chapter 10: General insurance products and roadmap
- Guest lecture by Insurance experts
- Chapter 11: Fintech… payment gateways
- Chapter 12: Fintech… lending
- Chapter 13: Fintech… third party products brokerage, insurance, mutual funds
- Guest lecture by Fintech industry experts
- Chapter 14: Life journey of an individual… saving, insurance and retirement planning
- Chapter 15: Introduction to financial inclusion, small finance banks, microfinance and guest lecture by Small Finance Bank/ MFI expert… Optional
    - Presentation by students

Evaluation Scheme:

Component	Weightage (100)
Minor Projects (5, 10% each)	50%
Mid Term Quiz (30th Sep)	10%
End Term Exam	40%

References (Textbooks/case studies/articles):

Retail Banking by Indian Institute of Banking by Mocmillan Education… 2018 edition
India Fintech Report 2020-> presentations shared with students Project works assigned
Course Material presented by the instructor Praveen Arora

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
FA1151.1	1				1								1	1			
FA1151.2	1				1								1	1			
FA1151.3	1				1		1	1	1				1	1			

Course Title and Code:	**Advanced Statistics; AS1202**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Sem VII (Open Elective)

Course Objective- To familiarize students with concepts of probability theory and random variables and use them to analyze real life problems. This course also focuses on developing an understanding of regression models, data analysis, model building, interpretation of results and statistical computation.

Course Outcome:

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

AS1202.1. Identify and formulate fundamental probability distributions and density functions.

AS1202.2. Analyze continuous and discrete-time random variables and processes.

AS1202.3. Analyze system of multiple random variables.

AS1202.4. Compute cumulative distribution function and normalizing constant for the probability density function of one or more random variables.

AS1202.5. Apply the concept of algebra of random variables to analyze various linear systems.

AS1202.6. Design experiments as processes and analyze these using appropriate statistical tool.

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	**5**
03	Class Participation	**10**
04	Quiz	**15**
05	Theory Exam-I	**Nil**
06	Theory Exam-II	**20**
07	Theory Exam-III	**30**
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	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30

Syllabus (Theory):

RANDOM VARIABLES

Random variables, Distribution and density functions of random variables, Discrete and continuous random variables, Gaussian, Exponential, Rayleigh, Uniform, discrete Uniform and conditional distributions, distribution mean, variance, moments and characteristics functions.

MULTIPLE RANDOM VARIABLES

Function of two random variables, Distributions of two random variables, correlation coefficient, Joint moments, Joint characteristics functions, Conditional distributions, conditional expected values, statistical independence. Multiple random variables, distribution of sums of random variables, Central limit theorem.

OPERATIONS ON MULTIPLE RANDOM VARIABLES

Mean or expected value of multiple random variables, Variance, standard deviation, moments, Chebyshev's Inequality, moment generating function, characteristic function, covariance, variance of a linear combination of random variables.

REGRESSION ANALYSIS
Introduction to regression model, Types of regression models, Estimation of the regression coefficients and error variance, Inferences for the regression coefficients, Predicting future observations, Inverse prediction and regulation. An introduction to multiple linear regression models.

DESIGN OF EXPERIMENTS
Analysis of variance, one way classification, two-way classification.

Reference Books:

- J. Susan Milton and Jesse C. Arnold, 'Introduction to Probability and Statistics', McGraw Hill Education.
- Papoulis, 'Probability, Random Variables and Stochastic Processes', TMH.
- VK Rohatgi and AK Saleh, 'An Introduction to Probability and Statistics', Wiley India.
- Ross, 'Stochastic Processes', 2ed, Wiley.
- Shumway & Stoffer (2011) Time Series Analysis and its applications, with examples in R, 3rd edition, Springer.
- K. L. Chung, 'Introduction to Probability Theory with Stochastic Processes', Springer International Student Edition.
- Applied Linear Statistical Models by Kutner, Nachtsteim, Neter and Li (5th edition).

Course Articulation Matrix: (Mapping of COs with POs and PSOs (CSE))

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
AS1202.1						1		1									
AS1202.2					1	1		1		1						1	1
AS1202.3		1			1	1	1	1		1			1	1		1	1
AS1202.4						2		1									
AS1202.5						2		2	1	2						1	
AS1202.6	1	1	1		2	2	1	2		2	1		1	2	1	2	1

PS1102/PR1105/ PR1104

Practice School-II/ Entrepreneurial Project/ Research Project/Semester at a partner University

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/ PR1105/ PR1104	Practice School-II/ Entrepreneurial Project/ Research Project/Semester at a partner University	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

Program Articulation Matrix - (B. Tech CSE) Batch 2019-23

S.No.	Course Code	Course Title	Credit	Year	Semester	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
1	ES1101	Computational Data Analysis	10	1	1	0.00	0.33	0.56	0.00	1.00	0.78	0.00	0.67	0.00	0.33	0.89	0.00	0.56	0.56	0.00	0.00	0.00
2	ES1102	Design and Prototyping	6	1	1	1.17	0.17	0.17	0.17	1.17	0.67	0.67	0.17	0.00	0.00	0.33	0.33	0.33	0.67	0.00	0.00	0.00
3	AS1101	Experimental Science	3	1	1	1.00	0.00	0.25	0.00	0.38	0.13	0.25	0.00	0.00	0.00	0.50	0.00	0.25	0.13	0.13	0.00	0.00
4	CC1101	Fundamentals of Communication	2	1	1	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.60	0.00	0.40	0.00	0.00	0.00	0.00
5	ES1103	Calculus and Applied Mechanics	6	1	2	0.50	0.00	0.00	0.00	0.38	1.75	1.38	0.00	0.25	0.00	0.88	0.00	0.75	0.00	0.00	0.00	0.00
6	ES1104	Fundamentals of Automation Engineering	6	1	2	0.50	0.00	0.00	0.00	0.92	0.33	0.25	0.33	0.25	0.00	0.00	0.50	0.17	0.67	0.00	0.00	0.00
7	CS1101	Object Oriented Programming	3	1	2	0.00	0.00	0.00	0.00	0.50	0.50	0.25	0.00	0.00	0.00	0.50	0.50	0.00	0.50	0.00	0.00	0.00
8	ES1105	Energy and Environment Studies	2	1	2	0.67	0.33	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00
9	CC1102	Critical Thinking and Story telling	2	1	2	0.00	0.00	0.50	0.00	0.00	0.25	0.00	0.25	0.00	0.00	0.25	0.00	0.75	0.00	0.00	0.00	0.00
10	AS1102	Scientific Perspectives	2	1	2	0.50	0.25	0.00	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00
11	CS1102	Data Structures	4	2	3	0.83	0.17	0.33	0.33	1.00	0.50	0.33	0.00	0.00	0.17	0.17	0.50	0.33	0.00	0.00	1.33	2.00
12	CS1103	Theoretical Foundation of Computer Science	4	2	3	0.00	0.00	0.00	0.00	1.00	0.43	0.29	1.00	0.29	0.29	0.00	0.00	0.57	0.43	0.00	1.43	1.00
13	IL1101	Management Perspectives	2	2	3	1.25	0.25	0.25	0.25	0.50	0.00	0.00	0.00	0.00	0.00	0.75	0.25	0.50	0.00	0.00	0.00	0.00
14	ES1106	Computational Engineering Analysis-I	5	2	3	0.10	0.10	0.00	0.00	1.40	1.00	0.80	1.00	0.40	0.20	0.60	0.60	0.00	0.10	0.10	0.00	0.00
15	ES1107	Engineering Measurements and Machines	5	2	3	0.80	0.40	0.40	0.20	1.20	1.20	1.00	0.80	0.60	0.00	0.80	0.40	0.40	0.20	0.00	0.00	0.00
16	CC1103	Perspectives on Contemporary Issues	2	2	3	0.50	0.00	0.50	0.00	0.00	0.25	0.00	0.25	0.00	0.00	0.75	1.00	0.75	0.00	0.00	0.00	0.00
17	CS1105	Design and Analysis of Algorithms	4	2	4	1.25	0.00	0.67	0.00	1.00	0.00	0.00	0.42	0.58	0.00	0.00	0.00	0.00	0.42	0.08	1.50	1.83
18	CS1106	Database Systems	5	2	4	1.00	0.36	0.18	0.00	0.64	0.82	0.91	0.55	0.64	0.00	0.45	0.09	0.45	0.00	0.00	1.18	1.18
19	CS1107	Computer Architecture and Organization	4	2	4	0.40	0.50	0.40	0.30	0.30	0.30	0.20	0.30	0.30	0.10	0.20	0.40	0.20	0.30	0.20	0.70	0.80
20	ES1109	Computational Engineering Analysis-II	5	2	4	0.57	0.14	0.43	0.00	1.00	1.43	1.00	1.00	0.00	0.29	0.57	0.00	0.14	0.71	0.00	0.00	0.00
21	CC1104	Communication and Identity	2	2	4	0.25	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.75	0.00	0.00	0.00
22	IL1102	Introduction to Design	2	2	4	1.14	0.00	0.14	0.00	0.00	0.14	0.86	0.43	0.14	0.14	0.00	0.00	0.57	0.43	0.00	0.00	0.00
23	CC1105	Understanding and Managing Conflict	2	3	5	0.07	0.00	0.00	0.00	0.27	0.07	0.13	0.20	0.00	0.00	0.00	0.07	0.07	0.00	0.00	0.00	0.20
24	CS1108	Operating System	4	3	5	1.44	0.00	0.00	0.00	1.44	1.44	0.67	1.00	1.00	0.00	0.00	0.00	0.56	0.00	0.44	1.56	1.33
25	CS1110	Artificial Intelligence and Machine Learning	4	3	5	0.70	0.30	0.40	0.40	0.10	0.80	0.60	0.80	0.90	0.30	0.90	1.10	0.60	0.60	0.30	1.50	1.70
26	EE1111	Introduction to Internet of Things (IoT)	2	3	5	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.71	0.57	0.86	0.71	0.00	0.29	0.43	0.00	0.00	0.00
27	PR1101	Automation Projects	2	3	5	0.80	0.00	0.00	0.00	0.80	0.40	0.80	0.00	0.40	0.40	0.00	0.40	0.00	0.60	0.00	0.00	0.00
28	CS1111	Computer Networks and Distributed Systems	4	3	6	0.60	0.00	0.00	0.20	0.20	0.80	1.20	1.20	0.80	1.20	1.00	0.80	0.00	0.40	0.20	0.40	0.60
29	CC1106	Critical Thinking for Decisions at Workplace	2	3	6	0.07	0.00	0.00	0.00	0.13	0.07	0.07	0.07	0.00	0.00	0.07	0.07	0.07	0.00	0.00	0.07	0.00
30		Flexi Core (CS1112, CS1113)	4	3	6	0.6	0.5	0.4	0.5	0.2	0.4	0.4	0	0.6	0	0.6	0.6	0.4	0.5	0.2	1	1.4
31		Emerging Tech Week (CS1125, CE1114)	4	3	6	0.333	0	0	0	0.333	0.333	0.167	0	0	0.167	0	0	0	0.167	0	1	1
32	PR1103	Minor Project	4	4	7	0.5	0	0.5	2	1.5	1	1	0.75	1	0	0.5	1	0	1	1	1.75	1.5
33		DE-I (CS1205, CS1214)	4	3	5	0.00	0.00	0.00	0.00	1.00	0.50	0.33	0.40	0.30	0.30	0.00	0.00	0.30	0.50	0.00	0.80	0.80
34		DE-II (CS1217, CS1218, CS1112, CS1113)	4	3	6	0.20	0.00	0.00	0.20	0.20	0.40	0.40	0.00	0.60	0.00	0.60	0.60	0.00	0.40	0.00	1.00	1.20
35		DE-III (CS1212, EE1219)	4	3	6	0.57	0.00	0.33	0.29	0.00	0.29	0.00	0.00	0.43	0.33	0.17	0.00	0.33	0.00	0.33	1.80	1.80
36		DE-IV	4	4	7	* TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	2.00	2.00
37		DE-V	4	4	7	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	2.00	2.00
38		DE-VI	4	4	7	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	2.00	2.00
					Total	17.11	3.80	6.07	2.60	16.35	14.59	12.11	10.81	7.59	4.27	12.41	8.17	10.61	8.38	1.65	19.42	20.62
Desired Competence Level (N - Novice, AB - Advanced Beginner, C - Competent)						C	N	N	N	C	AB	AB	AB	AB	N	AB	AB	AB	AB	N	C	C

Note:
The above-mentioned contributions of the already taught flexicore/emerging tech and department elective courses is the minimum contribution out of multiple options given to students.
Contribution of courses to be taught is specified as minimum expected contribution.
Open Electives, Practice School 1 and Practice School 2 are excluded from above calculation and their contribution towards attainment of PO and PSO is in addition.
* TBD: To be decided.