HAND BOOK

of

CURRICULUM STRUCTURE AND SYLLABUS

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

Batch: 2018-22

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 2018-2022

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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 2018-22.

It includes Programme Outcomes, Curriculum Structure and collation of Semester wise Course Description prepared by respective faculty members.

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

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Program Outcomes

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

a. Ability to apply knowledge of mathematics, science, and engineering.
b. Ability to design and conduct experiments, as well as to analyze and interpret data.
c. Ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
d. Ability to function on multi-disciplinary teams.
e. Ability to identify, formulate, and solve engineering problems.
f. Understanding of professional and ethical responsibility.
g. Ability to communicate effectively.
h. Broad education necessary to understand the impact of engineering solutions in a global, Economic, environmental, and societal context.
i. Recognition of the need for, and an ability to engage in life-long learning.
j. Knowledge of contemporary issues.
k. Ability to utilize experimental, statistical and computational methods and tools necessary for Engineering practice.
l. Ability to analyze and interpret data and also an ability to design digital and analog systems and programming them.

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology
Curriculum Structure
B. Tech-Computer Science and Engineering (Batch 2018-2022)

Sem	Courses							Credits
I	Calculus and Applied Mechanics BES101 (6s 2 0) 6	Design And Proto-typing BES102 (6s 2 0) 6	The Power of Story Telling CCT101 (2 1 0) 3					**15**
II	Computational Data Analysis BES201 (10s 2 0) 10	Fundamentals of Automation Engineering BES202 (6s 2 0) 6	Experimental Physics PH202 (1 0 4) 3	Environmental Studies ID201 (2 0 0) 1	Articulation and Elocution CCT202 (2 0 0) Audit	*IBM SP-I Python Programming* CSESP202 (2 0 0) 2	Fundamentals of Critical Thinking CCT201 (2 0 0) 2	**22/24***
III	Data Structures CS1102 (3 0 2) 4	Computational Engineering Analysis-I ES1106 (3 1 2) 5	Engineering Measurements and Machines ES1107 (3 0 4) 5	Theoretical Foundation of Computer Science CS1103 (3 1 0) 4	Programming Week CS1104 2	*IBM SP-II Cognitive Dashboard* CS1302 (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	Computational Engineering Analysis-II ES1109 (3 1 2) 5	Database Systems CS1106 (3 0 2) 4	Computer Architecture and Organization CS1107 (3 0 2) 4	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) 5	Introduction to IoT EE1111 (1 0 2) 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		**21**
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	Automation Project PR1101 2	Critical Thinking for Decisions at Workplace CC1106 (2 0 0) 2	DE-II*/*IBM SP-V (Business Intelligence-CS1305)* (3 0 2) 4	DE-III*/ OE-II*/*IBM SP-VI (Data Science-CS1313)* (3 0 2) 4	**22**
VII	Minor Project - PR1103/ *IBM SP-VII (Big Data Engineering-CS1312)* (3 0 2) 4	DE-IV*/ *IBM SP-VIII (AI with IBM Watson-CS1314)* (3 0 2) 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							**163-171**

- 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	Design and Manufacturing
Information Retrieval and Data Mining- CS1204	Infrastructure and Urban Planning- CE1212
Real Time Operating Systems (Curated MOOC)- EE1214	Digital and Embedded Systems
	Idea to Business Model- ED1102
	Numerical Methods- AS1204
Sem VI	
Emerging Tech week	
Building RPA Applications- CS1121	
DE-II, III	**OE-II**
Software Engineering- CS1113	Disaster Management- CE1206
Full Stack Web Development with REACT- CS1212	Municipal and Urban Engineering- CE1202
Applied Algorithms- CS1211	Green Energy- IL1202
	Optimization Techniques- AS1203
	Business Model to Product-Market Fit- ED1103
	Design of Wearable Electronics
Sem VII	
DE-IV, V, VI	**OE-III**
Advanced Data Structures and Algorithms- CS1213	Geographical Information System- CE1214
Blockchain Technology and Applications- CS1203	Mechatronics- ME1207
Natural Language Processing- CS2203	Electrical Safety
Cross-Platform App Development- CS1215	Operations Research- AS1201
Machine Vision- EE1217	Fintech in Retail Banking and Insurance- FA1151
	Introduction to User-Experience- IL1204
	Industrial Safety
	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 (through electives/minor project, 16 Credits) or a Concentration (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 BTech students (2018-22)

B Tech-Computer Science and Engineering			
Sem	**Code**	**Course Name**	**Credits**
IV	CS1207	Introduction to Networks	Audit
IV	CS1402	Data Analytics using Python (MOOC)	4
V	EE1401	Digital Circuits (MOOC)	4
V	CS1412	Laplace Transform (MOOC)	2
V	CS1413	Introduction to Ordinary Differential Equations (MOOC)	2
VI	AS1401	Discrete Mathematics (MOOC)	4

- 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
B. Tech (CSE) (Batch: 2018-2022)

Course Title and Code Calculus and Applied Mechanics BES101	
Hours per Week	**L-T-P: 6-2-0**
Credits	**6**
Students who can take	**B. Tech Semester-II(Compulsory)**

Course Objective:

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

Course Outcomes:

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

BES101.1. apply analytical techniques to determine forces in structures

BES101.2. use commercial software (STAAD Pro.) to simulate a structure/frame and determine force in the members

BES101.3. model physical phenomena using calculus and solve using appropriate method

BES101.4. apply Newton's laws of motion and understand the concepts of dynamics concepts (force, momentum, work and energy)

BES101.5. interpret the geometrical significance of differential and integral calculus

BES101.6. solve problems of vector differentiation and integration

BES101.7. calculate the buoyant forces of a objects with various shape and carryout the stability analysis

BES101.8. apply the concept of partial differentiation to solve optimization problems

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**

Evaluation policy for 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, kinematics and kinetics of particle, impulse-momentum (linear, angular); impact, projectile motion.

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 Title and Code: Design and Proto-typing: BES102		
Course Description The objective of this course is to open the students to learn free and lateral thinking and initiate creative problem-solving. The course will encourage students to learn through hands-on experience and break away from traditional learning methods. This course will initiate by introducing the role of design thinking in process of designing a product and it will emphasize the role of research in the design process. The course will run by providing the operational skills to conduct design research and how to use the research insights for creating a product. Students will also get the exposure to manufacturing techniques such as casting, forging, joining, laser cutting, 3D printing etc. In a nutshell, the course will move around the user-centric approach of design research and methods for working out an appropriate solution for a problem space.		
Prerequisites		**None**
Hours per Week		**L-T-P: 6-2-0**
Credits		**6**
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	20
04	Quiz	05
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	Nil
08	Report-1	10
09	Report-2	10
10	Report-3	10
11	Project -1	15
12	Project -2	15
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	05
	Total (100)	**100**

Syllabus

Basics engineering drawing with AutoCAD, Fundamental manufacturing processes including metal joining, metal cutting, additive manufacturing, laser cutting, casting, sheet metal working etc.

Basic Design cycle, project definition, vision in product designing, base of pyramid model, context mapping, mind mapping, Life cycle analysis, process tree, SWOT analysis, VRIO analysis, perpetual mapping, Fish trap model, SCAMPER, WWWWW, PreMo, C-Box, VALUE, Design Drawing, TecDoc.

Reference / Text Books

1. "The Design of Everyday Things" by Donald A. Norman

The Power of Story Telling **Course Code: CCT101**
Credit: 3 **L-T-P: 2-1-0**

Course Description:

This course gets students started on the journey of storytelling by observing the world and themselves and weaving a narrative. At the end of this course the students will be able to observe, think, create and narrate their stories in an effective manner.

Syllabus:

Concept of a Story- Build common understanding about the course, Introduction of the course and the concept of stories; How Stories Begin- Source of stories in our lives; Story Mapping- Introduction of Story Mapping ,Elements of Story Mapping, Use of elements in creating stories; Story Boarding- Introduction of Story Boarding, How story Boarding is used, Use of Story Boarding in creating stories; Identifying Different Narratives- Everyone and everything has a story, How different stories impact us; Power of Observation - Introduction of sensorium, How sensorium help us to create a story; The Art of Listening- Why listening, Active and passive listening, Be an active listener ; Creating Stories- Detailed practice of different importance components of storytelling- i. Delivery – Overcome stage fear, work on body language, ii. Content – Create story, Edit, iii. Voice - Voice modulation, enunciation, pronunciation

Evaluation Scheme:

Sr. No	Specifications	Marks
01	Attendance	10
02	Assignment	70
03	Class Participation	20
	Total (100)	**100**

References for Reading:

1. Unleash the Power of Storytelling: Win Hearts, Change Minds, Get Results,
Author: Rob Biesenbach, Publisher: Eastlawn Media (19 February 2018)
2. Story worthy: Engage, Teach, Persuade, and Change Your Life through the Power of Storytelling
Author: Mathew Dicks, Publisher: Publisher: New World Library - New World Library - New World Library (15 May 2018)

Course Title: Computational Data Analysis (BES201)

Course Description: This course introduces computational analysis of data based on Linear Algebra Principles and Statistics. The computational analysis will include learning and utilizing Python as a programming language. This course will lead to a technical project that will include learnings from the course duration.

Course Outcome

After course completion, the student will be able to

BES201.1. Write Simple Python programs using Various Datatypes, Control Structures, Decision Statements, Libraries, Functions (M1)

BES201.2. Develop Python programs using Classes and Objects, File Handling, Exception Handling, etc. (M2)

BES201.3. 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)

BES201.4. Model Complex systems as Linear simultaneous equations and analyze the same using Matrix methods (M1)

BES201.5. 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)

BES201.6. Perform Support Vector Decomposition on Matrices (M1)

BES201.7. Summarize and Visualize different datasets (M2)

BES201.8. Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving, e.g., Goodness of Fit (M2)

BES201.9. Formulate and validate parametric hypothesis with reference to different datasets (M2)

BES201.10. Apply correlation, regression, least square method and time series analysis for modeling, analysis, interpretation and forecasting (M2)

Teaching Scheme and Credits

Hrs. per Week		Credits	Duration in Weeks
In Class	Out Class	10	12
10	20		

Evaluation Scheme

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

15	Lab Evaluation	Nil
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, Exception Handling, 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, Singular Vector Decomposition (SVD) and Principal Component Analysis (PCA)

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, Time Series Analysis, Forecasting, Reliability, Quality Control

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, PHI

Fundamentals of Automation Engineering BES202
Credit: 6; Contact Hours – 2 Hrs/week

Course Description: This course aims at building key technical competencies needed by automation engineers. It is focused on basic knowledge and critical understanding of different technologies in the design and maintenance of automation systems.

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

Evaluation Scheme

Sr. No	**Specifications**	Regular student(s)
01	Attendance	Nil
02	Assignment (04)	20
03	Class Participation & Attendance	5
04	Quizzes	5
05	Theory Exam I	10
06	Theory Exam II	Nil
07	Theory Exam III	20
08	Report -I	Included with Project
09	Report-II	Included with Project
10	Report-III	Included with Project
11	Project -I	Included with Project
12	Project -II	10
13	Project -III	10
14	Lab Evaluation I (End Term)	20
15	Lab Evaluation II	Nil
16	Course portfolio	Nil
	Total (100)	**100**

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

Syllabus:

- Electric Circuit Analysis: Application of network Theorems, Laplace Transform, Application of network Theorems. Laplace Transform for solving equations for reactive components. Concept of Phasors and Phasor diagrams, power factor calculations. Smart energy meter. Single phase and three phase wiring and balancing of loads.
- Transformers and power supply(rectifiers). Safety in handling Electrical equipment.
- Working principle of DC Motors, PWM for speed control, Principle of working of Servomotors, Introduction to control system: open and closed loops. Block diagrams, PID control of servomotors, Mechanical models. Actuators, DC motor. PWM. DC servomotor, Brushless motors - AC motor, Introduction to Feedback Controllers
- Digital circuits for automation: Boolean Algebra, Karnaugh map, Logic gates, Decoders and Multiplexers, Displays, Counters and Timers (555) and applications. Architecture of ATMega328 (concepts on ALU, memory, ports). Implementing logical functions using microcontroller programs.
- Familiarization with standards on Instrumentation and Measurements. Significance of SCADA and HMI in automation projects. Working principle of Sensors and their interfacing to microcontrollers Movement detection, gyro motors, vision, sonar, laser, tactile, calibration of few analog sensors.

Textbooks:

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

Reference Books:

1. B. L. Theraja, A. K. Theraja, "A Textbook of Electrical Technology, Volume I: Basic Electrical Engineering", S. Chand Publication.
2. C. L. Wadhwa, "Basic Electrical Engineering", New Age Int. (P) Limited, Publishers.
3. Giorgio Rizzon, "Fundamentals of Electrical Engineering", McGraw-Hill Higher Education.
4. Charles A. Gross Thaddeus A. Roppel, "Fundamentals of Electrical Engineering", CRC press.
5. B. K. Ghosh, Ning Xi, T. J. Tarn, "Control in Robotics and Automation: *Sensor- Based Integration*" Academic Press.
6. Boris J. Lurie, Paul J. Enright, "Classical Feedback Control" Marcel Dekker Inc. publication.
7. Digital Logic and Computer Design Fundamental by Morris Mano, Pearson Publication, 5th Edition.
8. Programming and Customizing the AVR Microcontroller by Dhananjay Gadre, 1st Edition, Mc Graw Hill Publication, ISBN-13: 978-0071346665
9. Computer based industrial control, Kant, Krishna, New Delhi: PHI, 2013, c2010, ISBN-9788120339880
10. Modern control system, Richard C Dorf and Robert H Bishop, New Delhi Pearson c2008, ISBN: 9788131718872

Fundamentals of Critical Thinking **Course Code: CCT201**
Credit: 2 **L-T-P: 2-0-0**

Course Description:

This course will train students to observe and think from multiple perspectives, examine information and knowledge critically, analyze skillfully, evaluate and take a well-reasoned position.

Course Outcomes:

Students will be able to

- Formulate intelligent questions
- Evaluate information and evidence for correctness, consistency, and relevance
- Compose well-structured and well-reasoned arguments
- Evaluate an argument for consistency, logical validity, coherence, breadth and width, and relevance.

Course Content:

- **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.
- **Application of Critical Thinking-** Students will learn to use critical thinking in workplace and business scenarios, case studies and write with a critical voice. They will learn to critique the information they gather.

Evaluation Scheme:

Sr. No	**Specifications**	**Weightage (in percentage)**
01	Attendance	10
02	Assignments (4)	35
03	Class Participation	10
04	Theory Exam	25
05	Report-1	10
06	Project -1	10
	Total (100)	**100**

References for Readings:

- Fisher, A. (2011). *Critical thinking: An introduction*. Cambridge University Press.
- Fisher, A., & Scriven, M. (1997). *Critical thinking its definition and assessment*. Centre for research in Critical Thinking.
- 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.

Course Title and Code: Experimental Physics: PH202	
Hours per Week	**L-T-P: 1-0-4**
Credits	**3**

Course Objective

This course is designed to familiarize the student with the fundamental concepts of different phenomenon related with optics, electromagnetism, and modern physics. This course will expose the students with experimental methods of physics and integrates theoretical knowledge and concepts to practical experience.

Course Outcomes:

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

1. analyze ferromagnetic properties of any magnetic material and differentiate Soft and hard materials.
2. analyze thermoelectric effect of metal junctions due to temperature difference.
3. analyze nuclear radiation with respect to distance and thickness of absorbing media.
4. measure electrical properties e.g. specific resistance, high resistance, dielectric constant, time constant of various electrical components.
5. measure resolving power of telescope, dispersive power of prism, specific rotation of optically active medium, e.g., sugar solution, wavelength of radiation, height of objects, coherent length and coherent time of Lasers.
6. measure numerical aperture of Optical Fibre and classify its structures.
7. use Schroedinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials.

Prerequisites		**Knowledge of Basic Science**
Sr. No	**Specifications**	**Marks**
01	Attendance	5
02	Assignment	Nil
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	10
14	Lab Evaluation-1	20
15	Lab Evaluation-2	20
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus

1. To determine the ferromagnetic constants retentivity, permeability and susceptibility by tracing I-H curve using C.R.O.

Description: CRO, ferromagnetic property of materials, retentivity, permeability and susceptibility, hysteresis loop, Soft and hard materials.

2. To study the variation of thermo-e. m. f. of iron copper thermocouple with temperature.
   Description: Thermocouple, thermos-emf, Seeback effect, Peltier Effect, Thomson effect, Effect of temperature difference on metal junctions.
3. To study the Charge & Discharge of a capacitor and determine time constant.
   Description: Capacitor, types, time constant of RC and LR Circuits, application
4. To determine the high resistance by method of leakage, using a Ballistic Galvanometer.
   Description: Ballistic Galvanometer, high resistance determination.
5. To determine dielectric constant of a material using moving coil Ballistic Galvanometer.
   Description: Property of Insulators and Dielectric materials, dielectric constant and dielectric loss
6. To determine the specific resistance of the material of a wire by Carey Fosters Bridge.
   Description: Carey Fosters Bridge, Cell, Specific resistance determination of different materials and study of material property.
7. To convert a Galvanometer into an Ammeter of range 1.5/3 amp and calibrate it.
   Description: Working principle and different types of Galvanometer and Ammeter and conversion
8. To convert a Galvanometer into a Voltmeter of range 1.5/3 volt and calibrate it.
   Description: Working principle and different types of Galvanometer and Voltmeter and conversion
9. To study characteristics of G.M. Counting System.
   Description: Nuclear Detectors and Counters, GM Counter, dead time, quenching process, Characteristics, Quantitative analysis of nuclear radiation with distance.
10. To determine the absorption coefficient of lead using lead sheet by G.M. Counting System.
    Description: Nuclear Detectors and Counters, GM Counter, dead time, quenching process, Absorption Coefficient.
11. To measure the Numerical Aperture of an Optical Fibre.
    Description: Optical Fibre, Numerical Aperture, and Maximum Angle of Acceptance.
12. To determine coherent length and coherent time of laser using He-Ne Laser
    Description: Coherence, Coherence length, Coherence time and 'Q' factor for light, Theory of Laser Action, Threshold Conditions for Laser Action, He-Ne Laser, Semiconductor Lasers.
13. To verify the expression for the resolving power of a Telescope.
    Description: Diffraction, Resolving Power, Rayleigh Criterion for resolution
14. To determine the wave length of prominent lines of mercury by plane diffraction Grating with the help of spectrometer.
    Description: Diffraction, Grating, determine the wave length of radiations, intensity analysis, XRD, spectrometer
15. To determine the dispersive power of material of a Prism for Violet Red and Yellow colours of Mercury light with the help of a spectrometer.
    Description: Diffraction, dispersion, Grating, determine the wave length of radiations, spectrometer
16. To determine the wave length of monochromatic light with the help of Fresnel's Biprism
    Description: Interference, Determination of wavelength of unknown light
17. To determine the wave length of sodium light by Newton's Ring
    Description: Interference, Determination of wavelength of unknown light, Determination of refractive index of unknown medium.
18. To determine the wavelength of sodium light by Michelson Interferometer
    Description: Interference, Determination of wavelength of unknown light
19. To determine the specific rotation of Glucose (Sugar) solution using a Polarimeter.
    Description: Polarization, Half Wave plate, Quarter wave plate, Optical Activity, Specific Rotation.
20. To determine the height of object with the help of a Sextant.
    Description: Principle, Sextant

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. Lab Manuals for Physics

Reference Books:

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

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
ID201	Environmental Studies	2	0	0	0	1

Evaluation Scheme (Theory)					Evaluation Scheme (Practical)				
Mid Term Test – I	Mid Term Test – II	End Term Test	Class Participation / Additional Continuous Evaluation*	Total Marks	Mid Term Test - I	End Term Test	Class Participation	Additional Continuous Evaluation *	Total Marks
20	20	40	20	100	-	-	-	-	-

*Additional Continuous Evaluation: Quizzes/Assignments/Presentations/Practical Records/Mock Interviews/others

Course Syllabi (Theory):

- Understanding environment, The global crisis, Basic Concepts
- Forest and Grassland ecosystems, Desert Ecosystems, Aquatic Ecosystems
- Introduction to Biodiversity, Biodiversity Conservation
- Water Resources, Energy Resources, Forest Resources
- Land, Food, and Mineral Resources
- Air and Noise Pollution, Water, Soil, and Marine Pollution
- Solid Waste Management and Disaster Management
- Population Growth, Environment and Human Health, Sustainable Development
- Global Warming, Acid Rain, and Ozone Depletion
- Different types of laws and regulations

Text Books:

1. Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, New Delhi, 2e, 2011.

Reference Books:

1. Ranjit Daniels & J. Krishnaswamy "Environmental Studies", Wiley India.
2. Davis & Cornwell "Environmental Engineering", Mc-Graw Hill.

Articulation and Elocution **Course Code: CCT202**
Credit: 2* Audit Course **Contact Hours: 6 Hrs.**

Course Outcomes:
On successful completion of this course, the students should be able to:
- Use richer vocabulary in their communication appropriate to the context.
- Use appropriate grammar, vocabulary and style which are essential to professional-level reading, writing, speaking, listening, and editing.
- Apply various strategies to make the speeches/ conversation interesting and captivating.
- Using the sentence structure effectively and connect ideas logically within a paragraph.
- Write descriptions on various objects and topics.

Evaluation Scheme:

Sr. No.	Evaluation Component	Weightage (%)
1	Attendance	10
2	Assignment(s)	30
3	Class Participation	10
4	Quiz	10
5	Project-I	15
6	Lab Evaluation-I	25
	Total (100)	100

Course Outline (Tentative Session Plan):

Sessions	Content	Activities
1	Listening	• To inculcate the skills of content prediction, inference and discourse coherence. • Acquire proficiency in Prosodic Features (Pronunciation, enunciation, pitch, intonation/voice modulation)
2	Ideation and Expression	• Proving situation/context to trigger thinking process • Just Minutes • Role Play/ Situational Dialogues • (Oral Narration) Describing people, places, events and things
3	Reading	• Distinguishing the main idea and supporting ideas • Transcoding information to diagrammatic display, recognizing indicators in discourse, understanding conceptual meaning and summarizing. • Reading and writing skills will be targeted simultaneously.
4.	Writing	• To throw some light on the features of the connected speech/ composition such as use transitional words, connectives, etc. • To explain various strategies for the organization of ideas such as introduction, development, transition, conclusion, emphasis, explanation and anticipation.
5	Vocabulary Building	• Introducing Idioms, Proverbs, Phrasal verbs and asking them to use the same. • Connotative and denotative meaning of the words.

6	Collecting and Analyzing Information	• Assigning students to read books, newspapers, magazines and stories to learn from, assess and improve analytical ability. • Allotment will be done before the class.

References for Reading:

- Sanjay Kumar & Pushp Lata "Communication Skills". New Delhi: Oxford University Press, 2011.
- M Ashraf Rizvi "Effective Technical Communication". Chennai, McGraw Hill Education, 2018

CSESP202: Python Programming
Course Name - Python Programming
Course Code – CSESP202, **Credits**: 2

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

Evaluation Scheme:

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

Syllabus - Running Python Scripts, Using the interpreter interactively, Using variables, String types: normal, raw and Unicode, String operators and expressions, Math, operators and expressions, Writing to the screen, Reading from the keyboard, Indenting, The if and elif statements, While Loops, Using List, Dictionaries, Using the for statement, Opening, reading and writing a text file, Using Pandas, the python

data analysis library and data frames, Grouping, aggregating and applying, merging and joining, Dealing with syntax errors, Exceptions, Handling exceptions with try/except. Recursion Concept, Programs using recursion, RE Pattern Matching, Parsing Data, Basics of text analytics, Introduction to graphics using Python, Basic animation using Python. Introduction to Regression, Types of Regression, Use Cases, Exploratory data analysis, Correlation Matrix, Visualization using Matplotlib, Implementing linear regression. Machine Learning – Algorithm, Algorithms – Random Forest, Support vector Machine, Random Forest, Build your own model in python, Solve classification problem with real-world dataset, Comparison between random forest and decision tree.

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 Outcome:

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

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.
2. Use and design appropriate data structures for solving a variety of computational problem.
3. Develop test cases for their programs and debug the code.
4. Analyze the algorithms in terms of asymptotic time and space complexity.
5. Implement and compare various searching and sorting algorithms
6. Convert a recursive algorithm to non-recursive algorithm.

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

Syllabus (Theory)

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

Unit II: Stacks and Queues: Operations and Applications, conversion of expression from one form to other form using stack (with & without parenthesis), Evaluation of expression in infix, postfix & prefix

forms using stack, Queues: Operations and Applications, Circular Queues: Operations and Applications, De-queue and Priority queue, Recursion.

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

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

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

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

Syllabus (Lab):

DS Lab:

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

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

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

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

iv. Delete a node before specified position.

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

i. Insert a node at the end of the linked list.

ii. Insert a node before specified position.

iii. Delete a first node of the linked list.

iv. Delete a node after specified position.

14. Write a program which create binary search tree.

15. Implement recursive and non-recursive tree traversing methods in-order, pre-order and post-order traversal.

16. Write a program to implement Binary Search Tree.

17. Write a program to implement BFS in a given Graph.

18. Write a program to implement DFS in a given Graph.

19. Write a program to implement stack using linked Dijkstra's Algorithm for given graph.

20. Write a program to implement Kruskal's Algorithm for the given graph.

21. Write a program to implement Prim's Algorithm for the given graph.

22. Write a program to implement Bubble Sort, Selection sort, Insertion Sort in an array.

23. Write a program to implement Merge Sort in an array.

24. Write a program to implement Quick Sort in an array.

25. Write a program to implement Binary Search in an array.

Text Books:

T1. Sahni, Sartaj. Data structures, algorithms, and applications in Java. Universities Press, 2005.

T2. Goodrich, Michael T., Roberto Tamassia, and Michael H. Goldwasser. Data structures and algorithms in Java. John Wiley & Sons, 2014.

T3. Data Structures and Algorithms in Java -- Robert Lafore second edition Sams Publication, 2003

Reference Books:

R1. Introduction to Algorithms, by Cormen, Leiserson, Rivest, and Stein.

R2. Alfred V. Aho, Jeffrey D. Ullman, John E. Hop croft, Data Structures and Algorithms. Pearson Education, 2012

Course Title and Code: Computational Engineering Analysis – I: ES1106	
Teaching Scheme	**L-T-P: 1-0-1**
Credits	**5**

Course Objective

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

Course Outcomes:

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

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

Prerequisites		**Nil**
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:

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

References:

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. T.K. Nagsarkar, M. S. Sukhija," Basic Electrical Engineering", Oxford University press, 2nd edition, 2011.
5. Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.
6. Edminister Joseph A., "Electrical Circuits, Schaum's Outline Series", Tata McGraw Hill, 3rd edition, 2012.
7. Hayt W.H., Kemmerly J. E., Durbin S. M., "Engineering Circuit Analysis", Tata McGraw Hill, 6th edition, 2006.
8. Beer, F.P., Johnston, E.R., DeWolf, J.T., "Mechanics of Materials", 4th edition, McGraw Hill. Craig, R.R., "Mechanics of Materials", 2nd edition, John Wiley and Sons.

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

Course Objectives:

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

Course Outcomes:

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

1. Evaluate suitable electrical and non-electrical instruments for measuring physical quantities.
2. Analyze the construction, characteristics and applications of various types of rotating machines.
3. Analyze the working of any mechanical and electrical machine using mathematical model.
4. Integrate the sensors for monitoring and automation of electrical and mechanical systems.
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 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:

1. construct and validate simple computing models which play a crucial role in compiler design, algorithms, etc.
2. construct conceptual models using discrete mathematics in various application areas such as linguistic, business, internet, etc.
3. develop problem solving and critical thinking skills to solve complex computing problems
4. use logics and proofs in order to read, comprehend and construct mathematical arguments
5. develop mathematical models of computation and describe how they relate to formal languages
6. relate the basic difference between deterministic and nondeterministic computing machines
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:

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

References:

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

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

Evaluation Scheme:

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

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

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

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

- **Nationalist Movement**

There is a sense that excesses of globalization have created an identity crisis across the world, facilitating the rise of nationalist movements. Rising nationalism is seen everywhere, from the election of Donald Trump to Brexit, the success of far-right parties in Italian, German and Austrian elections in 2017 and 2018, nationalism appears to be on rise globally. We will look at its reasons and implication**.**

- **Technology**

Impact of unprecedented technological growth, challenges and opportunities.

- **Social justice and human rights**

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

References for Reading:

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

Course Name: Programming Week
Course Code: CS1104
Credits: 2
Course Description: This course teaches object-oriented programming to those who have learnt basic programming concepts and are ready to learn in-depth programming. It focuses on object-oriented programming using JAVA. The main concepts are: Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, Interfaces, Exception Handling, and Database Connectivity. This course also covers basic concepts for software design and reuse.

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

1. Name and apply some common object-oriented design patterns and give examples of their use.
2. Write programs in Core JAVA.
3. Design, develop and debug software applications taking into account coding and documentation standards.
4. Apply concepts like interfaces and abstract classes in Java program design and implementation.
5. Design and create web based and other applications using practices of object-oriented concepts.
6. Use java collection API.
7. Evaluate different integrated development environment e.g., NetBeans, Eclipse with respect to creation.
8. Use energy saving programming practices.

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

Course Title and Code: Cognitive Dashboard: CS1302		
Hours per Week	**L-T-P: 2-0-2**	
Credits	**3**	
Students who can take	B.Tech Sem III (IBM Specialization)	
Course Objective- This course will prepare students to understand the importance of dashboards as a summarized model of more complex realities and recognizes the use of natural language as the easiest input interface for humans. They will explore visualizations of data in IBM Cognos Analytics tool to discover patterns and relationships that impact businesses and communicate the insights that discovered in a dashboard and share it with others.		
Course Outcome: On successful completion of this course, the students should be able to: 1. Highlights the importance of dashboards as a summarized model of complex realities. 2. Plan the dashboard which recognize and express the data in meaningful way. 3. Outline dashboards which interact using natural language and respond with graphics. 4. Represent the associated and filtered views following the request expressed as a text message by the user. 5. Explore powerful visualizations of data in IBM® Cognos Analytics. 6. Discover patterns and relationships that impact businesses. 7. Communicate the insights that discovered in a dashboard and share it with others		
Prerequisites		-
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	10
07	Theory Exam-III	10
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	10
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
	Total (100)	**100**

Syllabus (Theory)

Dashboard Overview, Dashboards, Cognos Analytics dashboard, uploading data, creating a dashboard, Cognos Analytics, Creating a dashboard, Templates, Changing the template on a tabbed dashboard, Visualization, Creating a visualization in a dashboard, Resetting a dashboard, Creating multilingual dashboards, Working with a data point, Relinking data source connections, Resolving ambiguous data source connections, Zooming in and out.

Visualizations, Using a different visualization type, Highlighting conditionally formatted data with color, Showing data as points in a visualization, Showing data as sizable points in a visualization, Repeating a visualization by row or column, Setting a timer to automatically refresh a

visualization, Widgets, Filtering data, Sorting data, IBM Cognos Analytics, Data Preparation, Changing the axis, Improving the visibility of labels, Working with objects, Data properties, Changing how data is aggregated, Editing column headings, Enabling data caching

Reference Books:

1. Steve Wexler, Jeffrey Shaffer, Andy Cotgreave. *The Big Book Dashboards: Visualizing Your Data Using Real-World Business Scenarios*. Wiley, 2017.
2. Abhishek Sanghani. *First Guide to Dashboards using IBM Cognos Analytics*. Packt Publishing, 2017.

Course Title and Code: Design & Analysis of Algorithms CS1105

Course Description: This course introduces an understanding of the design and analysis of algorithm. The course demonstrates a familiarity with major algorithms and data structures and analyze the asymptotic performance of algorithms. It applies important algorithmic design paradigms and methods of analysis and synthesize efficient algorithms in common engineering design situations.

Course Outcome

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

1. Analyze the complexity of different algorithms using asymptotic analysis.
2. Analyze and select an appropriate data structure for a computing problem.
3. Differentiate between different algorithm designs technique: Divide and Conquer Technique, Greedy, Backtracking, and Dynamic Programming. Also explain when an algorithmic design situation calls for using these.
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.
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 colouring etc.
6. Develop algorithms and programs using Backtracking technique to solve various computing problems, e.g., N queen, M-coloring, Hamiltonian Cycle detection, Travelling salesman, and Network flow.
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.
8. Apply Query optimization algorithms using Greedy and Dynamic programming approaches.
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*).
10. Evaluate and apply appropriate energy efficient algorithmic design technique for solving complex computing problem.
11. Explain the ways to analyze randomized algorithms (expected running time, probability of error).

Apply differentiation between P, NP, NP-Complete, and NP-Hard problems.

Prerequisites	**Nil**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**

Sr. No	**Specifications**	**Marks (Post- covid)**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	Nil
04	Quiz	20
05	Theory Exam (Mid Term)	10
06	Theory Exam	Nil
07	Theory Exam (Final)	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil

13	Project -3	Nil
14	Lab Evaluation (Final)	20
15	Course portfolio	20
	Total (100)	Nil

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, Graph Coloring, Hamiltonian Cycles and Sum of subsets.

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

Syllabus (Practical):

1. SEARCHING AND SORTING BASED PROBLEMS

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

2. DIVIDE AND CONQUER

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

3. GREEDY AND DYNAMIC PROGRAMMING

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

4. BACKTRACKING AND BRANCH-BOUND TECHNIQUES

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

III. To implement Travelling Salesman problem using backtracking.

5. STRING MATCHING

I. To implement naïve String-Matching algorithm.

II. To implement Rabin Karp algorithm using.

III. To implement Knuth Morris Pratt algorithm and analyze its time complexity.

6. PROBLEM SOLVING BY SEARCH

I. To implement uninformed and informed search techniques for problem solving

II. To solve 8 puzzle problem

III. To solve n-queen problem

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.

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 software i.e., ANSYS Fluent and 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:

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

Assessment Scheme:

Prerequisites	**Elementary Calculus**
Teaching Scheme (Hours per Week)	L T P 3 1 2
Credits	5

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

Evaluation Scheme for Re-Test		
1	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 m-derived 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:

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

Reference Books –

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

Course Title and Code: Database Systems; CS1106	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	Sem IV (2018-2022)

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:

1. Outline database system components and their functions
2. Model the real-world systems from the given requirements specification using Entity Relationship Diagrams/Unified Modelling Language
3. Convert the ER model into a relational logical schema using various mapping algorithms
4. Apply SQL commands to define, query and manipulate a relational database
5. Apply SQL coding standards to embed SQL in an application program
6. Write relational algebra expressions and optimize the same for given query
7. Convert relational algebra expressions into SQL commands and vice versa
8. Normalize a given database up to Boyce Codd Normal Form (BCNF) based on identified keys and functional dependencies
9. Determine the transaction atomicity, consistency, isolation, and durability for a given transaction-processing system.
10. Determine the deadlock in transaction-processing system. Apply the method of deadlock avoidance and deadlock detection and recovery
11. Apply various concurrency control protocol like two phase locking, timestamping and the method of log base recovery in case of failure

Prerequisites	**Nil**

Evaluation Scheme

Sr. No	**Specifications**	**Marks (Pre-covid)**	**Post covid**
01	Attendance	Nil	Nil
02	Assignment	Nil	Nil
03	Class Participation	Nil	Nil
04	Quiz	Nil	20
05	Theory Exam-I	10	10
06	Theory Exam-II	15	Nil
07	Theory Exam-III	25	20
08	Report-1	Nil	10
09	Report-2	Nil	Nil
10	Report-3	Nil	Nil

11	Project -1	20	30
12	Project -2	Nil	Nil
13	Project -3	Nil	Nil
14	Lab Evaluation I (Continuous)	10	10
15	Lab Evaluation II	20	Nil
16	Course portfolio	Nil	Nil
	Total (100)	100	100

Evaluation Scheme for Retest			
1	Theory Exam-III	25	
2	Lab Evaluation II	20	
	Total	**45**	

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

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

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

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

Failure, Storage Structure and Transaction Log and Log-Based Recovery (Deferred Database Modification, Immediate Database Modification, Checkpoints).

Syllabus (Practical)

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

Reference Books:

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

Course Title and Code: Computer Architecture and Organization**:** CS1107			
Hours per Week		**L-T-P: 3-0-2**	
Credits		**4**	
Students who can take		B. Tech Sem IV (2017-2021)	
Course Objective: In this course, students will be introduced to the basics of hardware components from basic gates to memory and I/O devices, instruction set architectures and assembly language to improve performance.			
Course Outcome: On successful completion of this course, the students should be able to: 1. Explain the instruction set of 8086 microprocessors, addressing modes, instruction execution cycle and interpretation of instructions. 2. Summarize and compare the architecture of different computer systems. 3. Analyze memory hierarchy and its impact on computer cost/performance. 4. Develop assembly language programs using various data transfer instructions, addressing modes, status register and stack. 5. Detect pipeline hazards and identify possible solutions to those hazards 6. Design high-performance computer architecture using cache memory, virtual memory, pipelining, parallelism and RISC methodology. 7. Evaluate performance and energy efficiency using Standard Performance Evaluation Corporation (SPEC) tools. Describe and compare various standard computer ports and buses such as USB, PS/2, ATA, IDE, SCSI, AGP etc. defined by Industry Standard Architecture (ISA), PCMCIA and IEEE.			
Prerequisites		**Nil**	
Sr. No	**Specifications**	**Marks (pre- covid)**	**Marks (post- covid)**
01	Attendance	Nil	Nil
02	Assignment	10	30
03	Class Participation	Nil	Nil
04	Quiz	10	40
05	Theory Exam-I	10	Nil
06	Theory Exam-II	Nil	Nil
07	Theory Exam-III	25	20
08	Report-I (Case Study)	05	Nil
09	Report-II	Nil	Nil
10	Report-III	Nil	Nil
11	Project-I	20	Nil
12	Project-II	Nil	Nil
13	Project-III	Nil	Nil
14	Lab Evaluation-I	Nil	Nil
15	Lab Evaluation-II	20	10
16	Course Portfolio	Nil	Nil
	Total (100)	100	100

Syllabus (Theory)

UNIT I: Basic structure of Computer Systems: Functional units, Basic operational concepts, Bus structures, Performance and metrics, Instructions and instruction sequencing, Hardware, Software Interface, Instruction set architecture, Addressing modes, RISC, CISC, ALU design, fixed point and floating-point operations.

UNIT II: 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 systems: Basic concepts, 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, Comparison of various standard computer ports and buses such as USB, PS/2, ATA, IDE, SCSI, AGP etc. defined by Industry Standard Architecture (ISA), PCMCIA and IEEE

Reference Books:

1. Stallings, William. Computer organization and architecture: designing for performance. Pearson Education India, 2003.
2. Mano, Morris M. "Computer systems architecture." (2006).
3. Patterson, David A., and John L. Hennessy. Computer Organization and Design MIPS Edition: The Hardware/Software Interface. Newnes, 2013.
4. Hayes, John P., Trevor N. Mudge, Quentin F. Stout, Stephen Colley, and John Palmer. "Architecture of a Hypercube Supercomputer." In ICPP, pp. 653-660. 1986.

Communication and Identity

Course Code: CC1104 Credit: 2 L-T-P: 2-0-1

Course Description:

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

Course Outcomes:

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

Evaluation Scheme:

Sr. No	Specifications	Weightage	
		Original	Revised (post covid 19)
01	Attendance	Nil	Nil
02	Assignment	30	30
03	Class Participation	30	30
04	Quiz	Nil	Nil
05	Theory Exam II	Nil	Nil
06	Theory Exam III	20	25 (Continuous Evaluation)
07	Theory Exam	20	15 (Evaluation Based on MOOC Course Completed)
	Total (100)	**100**	**100**

Course Contents

1. **Self- identity**
2. **Personal Statement**
3. **Internal confidence or "principle centered living"**
4. **External and internal locus of Identity**
5. **Steps to build Personal Identity**
6. **Online presence**
7. **Elevator Pitch, Cover Letter**

References for Reading:

- O'Brien, T. (2019). When your job is your identity, professional failure hurts more. *Harvard Business Review*.
- Anca, C., & Aragón, S. (2018). The 3 types of diversity that shape our identities. *Harvard Business Review*.
- Craig, N., & Snook, S. (2014). From purpose to impact. *Harvard business review*, *92*(5), 104-111.
- Detert, J. R. (2018). Cultivating everyday courage. *Harvard Business Review*, *96*(6), 128-135.
- Dutta, S. (2010). What's your personal social media strategy? *Harvard business review*, *88*(11), 127-30.

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

Course Objective: Taking an idea forward from an intangible thought to a material-based product or visually communicable form requires a definitive plan of action. Using the methods of design thinking and design process the students will be able to bring their ideas to life.

Course Outcome:

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

CS1212.1. Sketch their ideas on paper to visualize and assess viability.
CS1212.2. Create a plan for process and management to materialize the desired idea.
CS1212.3. Test the material for possibilities and capabilities.
CS1212.4. Develop skills of joinery, material manipulation and various hand tools.
CS1212.5. Develop technical and narrative skills useful for both film and animation.
CS1212.6. 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:

Introduction to Design Process.
Material properties – wire and wood.
Material joinery – Mortise and Tenon, Dowel Joints.
Use of tools – plier, grinder, saw.
Developing creative thinking.
Basic drawing and visualisation skills including 2D to 3D - Form exploration.
Principles of animation.
Technical aspects of animation and film making (Frame rate, persistence of vision).
Building a Narrative – Start, Middle and End of a story.
Mediums of animation.

Suggested Reading Materials:

1. https://www.familyhandyman.com/woodworking/wood-joints/simple-joinery-options/

2. Simple wooden toymaking by Mathias, available at MP Ranjan LRC Call number: 745.592
3. https://www.hsn.com/article/wire-working-how-to-manipulate-wire-to-create-art/449
4. https://savedbylovecreations.com/2013/10/50-awesome-things-to-make-from-wire.html
(Craft based, to be used as a reference for wire malleability)
5. https://in.pinterest.com/pin/768004542687478864/
6. https://in.pinterest.com/pin/619174648753039614/
7. https://www.youtube.com/watch?v=_ppedXZHhE0 (Stop Motion Basics)
8. https://www.youtube.com/watch?v=p5SygzMSLhM (Stop Motion in Movies)
9. https://www.youtube.com/watch?v=GcryIdriSe4 (12 principles of animation)

CS1303: Enterprise Programming using Java
Course Name - Enterprise Programming using Java
Course Code – CS1303
Credits -- 3

Evaluation Scheme (Theory)					Evaluation Scheme (Practical)			
Mid Term Test - I	**Mid Term Test - II**	**End Term Test**	**Class Participation/ Additional Continuous Evaluation***	**Total Marks ****	**Mid Term Test - I**	**End Term Test**	**Class Participation/ Additional Continuous Evaluation***	**Total Marks ****
20	20	50	10	100	20	50	30	100

Sr. No	Specifications	Marks (pre- covid)	Marks (post- covid)
01	Attendance	Nil	Nil
02	Assignment	20	20
03	Class Participation	5	5
04	Quiz	10	10
05	Theory Exam-I	10	10
06	Theory Exam-II	Nil	Nil
07	Theory Exam-III	20	20
08	Report-I (Case Study)	5	5
09	Report-II	Nil	Nil
10	Report-III	Nil	Nil
11	Project-I	20	20
12	Project-II	Nil	Nil
13	Project-III	Nil	Nil
14	Lab Evaluation-I	10	10
15	Lab Evaluation-II	Nil	Nil
16	Course Portfolio	Nil	Nil
	Total (100)	100	**100**

Syllabus (Theory)

Introduction to Java EE Web Component, Overview of Servlets, Java EE Perspective of the Rational Application Developer, Java EE Container Services Overview, Servlet API, Library Case Study, Overview of JavaServer Pages, JavaServer Pages Specification and Syntax, Page Designer in Rational Application Developer, Debugging Web Applications, Web Archive Deployment Descriptor, Session State Storage Issues, Cookie API, HttpSession: Management of Application Data, URL Rewriting, Best Practices for Session Management, JavaBeans and the MVC Pattern, JavaServer Pages with JavaBeans, JSP Expression Language, JSP Custom Tags, JSP Tag Files, Servlet Filtering, Servlet Listeners, Best Practices for Server-Side Application Development, Java EE Packaging and Deployment, Installing an application in WebSphere Application Server V7.0, Web Application Security.

Course Title and Code: Introduction to Networks CS1207 CISCO		
Hours per Week		**L-T-P: 0-0-2**
Credits		**Audit Course**
Students who can take		B.Tech Sem IV Semester
Course Objectives: This course aims to impart detailed knowledge of Computer Networks, various protocols used in Communication, Managing and configuring Cisco Switches and Routers and various WAN technologies. By the end of the course, students can build simple local area networks (LANs) that integrate IP addressing schemes, foundational network security, and perform basic configurations for routers and switches.		
Course Outcome: On successful completion of this course, the students should be able to: 8. Build simple LANs, perform basic configurations for routers and switches, and implement IPv4 and IPv6 addressing schemes. 9. Define the role of a centralized Security Intelligence solution and how it integrates with other IT enterprise security components 10. Configure routers, switches, and end devices to provide access to local and remote network resources and to enable end-to-end connectivity between remote devices. 11. Configure and troubleshoot connectivity a small network using security best practices. 12. Configure a small network with security best practices. 13. Troubleshoot connectivity in a small network. 14. Develop critical thinking and problem-solving skills using real equipment and Cisco Packet Tracer. 15. Develop basic skills of routing, switching, and advanced technologies to prepare for the Cisco CCNA exam, networking related degree programs, and entry-level networking careers.		
Prerequisites		
Evaluation Scheme		
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	Nil
4	Quiz (CISCO Chapter Test)	**40**
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III (CISCO Certificate Test)	**40**
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	**10**
16	Course Portfolio	Nil
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	40
2	Lab Evaluation-II	10

	Total	50

Syllabus (Theory + Practical)

Networking Today, Basic Switch and End Device Configuration, Protocols and Models, Physical Layer, Number Systems, Data Link Layer, Ethernet Switching, Network Layer, Address Resolution, Basic Router Configuration, IPV4 Addressing, IPV6 Addressing, ICMP, Transport Layer, Application Layer, Network Security Fundamentals, Build a small network.

Text Books:

1. Lammle, T. (2016). CCNA Routing and Switching Complete Study Guide: Exam 100-105, Exam 200-105, Exam 200-125. John Wiley & Sons.
2. Lammle, T. (2013). CCNA routing and switching study guide: exams 100-101, 200-101, and 200-120. John Wiley & Sons.
3. Lammle, T. Cisco Certified Network Associate Study Guide. 2nd. Edition

Reference Books:

1. Stallings, W. (2004). Computer networking with Internet protocols and technology. Upper Saddle River, NJ, USA: Pearson/Prentice Hall.
2. Kurose, J., & Ross, K. (2010). Computer networks: A top-down approach featuring the internet. Peorsoim Addison Wesley.
3. Lammle, T. (2011). CCNA Cisco Certified Network Associate Deluxe Study Guide. John Wiley & Sons.

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.

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

1. Write Simple Python programs using various datatypes, control structures, decision statements, libraries, functions
2. Summarize and Visualize different datasets using python
3. Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving
4. Formulate and validate hypothesis with reference to different datasets
5. Apply correlation, regression, least square method, cluster analysis for interpretation and forecasting
6. Develop Programs for analyzing and interpreting Complex situations in various domains including sustainable development by combining various, Statistical techniques

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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:

BOOKS AND REFERENCES

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

Course Objectives:

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

Course Outcome:

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

1. Use basic LINUX commands: file/directory handling, standard I/O, redirection, pipes and filters.
2. Analyze the structure of OS and its interface with hardware.
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.
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.
5. Implement and Assess the performance of different types of scheduling algorithms.
6. Examine process synchronization and Inter process communication- Race condition, semaphores, monitors, inter process communication through message passing.
7. Categorize the conditions that cause deadlock in resource allocation. Implement deadlock handling strategies.
8. Analyze paging, segmentation, and segmentation with paging for VM support in memory management. Implement different page replacement algorithms.
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	NIL
04	Quiz	20
05	Theory Exam-I	NIL
06	Theory Exam-II	NIL
07	Theory Exam-III	30
08	Report-I	NIL
09	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	20
15	Lab Evaluation-II	30
16	Course Portfolio	NIL
	Total (100)	100
Evaluation Scheme for Retest		
1	Theory Exam-III	30
	Total	**30**

Syllabus (Theory)

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

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

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

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

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

Contents (Lab)

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

Reference/Text Books:

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

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

Course Objective:

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

Course Outcomes:

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

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

Prerequisites	Programming, Linear Algebra, Statistics

Evaluation Scheme

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

Evaluation Scheme for Retest

1	Theory Exam-III	30
	Total	**30**

Syllabus:

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

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

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

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

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

Reference Books

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

Course Objectives:

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

Course Outcomes:

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

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

Assessment Scheme:

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

Course Syllabi (Theory):

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

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

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

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

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

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

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

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

Course Outcome:

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

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

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

Retest

1	Theory Exam	30
2	Lab Evaluation	10

Syllabus (Theory):

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

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

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

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

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

LAB

- Create an IBM Cloud Account

ACME AIRLINE CLOUD ADOPTION

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

MAINTENANCE CREW CLOUD APP

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

ADD AI TO MAINTENANCE CREW APP

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

ADD MULTI-CHANNEL SUPPORT

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

SECURE THE MAINTENANCE CREW APP

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

EXPLORE TOOLCHAINS

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

DEVELOP & TEST MICROSERVICES

- Create Microservices Toolchain
- Configure Tool Integrations
- View Build & Deployment Activity
- Manager Access
- Configure Pager Duty
- Submit an Issue

- Modify Code Identify an Error
- Fix the Problem and Deploy
- Explore the DevOps Insights
- Improve Deployment Management
- Improve Visibility
- Delete Tools and Artifacts

Suggested Reading Materials:

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

Recommended MOOC:

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

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

Course Title and Code – Understanding and Managing Conflict| CC1105|

Course Description

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

Course Outcomes

The students will be able to:

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

Prerequisites		**N/A**
Hours per Week		**L-T-P: 2-0-0**
Credits		**2**
Sr. No	**Specifications**	**Marks**
1.	Attendance	Nil
2.	Assignment	30
3.	Class Participation	20
4.	Quiz	20
5.	Theory Exam-I	Nil
6.	Theory Exam-II	Nil
7.	Theory Exam-III	30
8.	Report-I	Nil
9.	Report-II	Nil
10.	Report-III	Nil
11.	Project-I	Nil
12.	Project-II	Nil
13.	Project-III	Nil
14.	Lab Evaluation-I	Nil
15.	Lab Evaluation-II	Nil
16.	Course Portfolio	Nil
	Total (100)	100

Course outline

Course Content

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.

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

Syllabus:

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

IDEA TO BUSINESS MODEL
ED1102
COURSE OUTLINE
SEMESTER V (All Branches B.Tech.)

L-T-P: 4-0-0 COURSE CREDITS: 4

COURSE DESCRIPTION

This is an open course for all the II[nd] Year management students (BBA & B. Com) and III[rd] Year Engineering Students. It is one of the fastest growing subjects in colleges and Universities across the world. It has been identified as one of the major trends shaping business, economy and even society. This course is about creating, managing and leading an entrepreneurial organisation. It would enable students to start dreaming big, visualizing and working towards the realization of their dreams. The programme imparts essential knowledge of how to start one's own business venture and the various facets that influence successful set up and operations. The teaching/ learning of entrepreneurship require greater focus on experiential learning. Engagements such as interactive sessions, cases, games, exercise, role plays, films, projects, assignments, simulation and group activities play a vital role in teaching this course. This course is supported by Wadhwani Foundation and facilitated through Learn wise.

COURSE OBJECTIVES

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

COURSE OUTCOMES

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

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

1. TOPICS

- **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**

COURSE OUTLINE (TENTATIVE SESSION PLAN)

Session No.	Topics
1-1	Introduction
2-3	Overview of Entrepreneur and Entrepreneurship
4-5	Self-Discovery
6-6	**Activity**
7-10	Opportunity Discovery
11-11	**Activity**
12-13	Identify Customer
14-14	**Activity**
15-16	Craft Value Preposition Canvas
17- 19	Business Model
20-20	**Activity**
21-22	Validation
23-24	Money (Revenue, Costs, Pricing)
25-25	Team Building
26-27	Marketing and Sales
28-28	Sources of Fund
29-29	Support (Institutional and Government policies)
30-30	Project Presentations

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

TEACHING METHODOLOGY/PEDAGOGY

The teaching/ learning of entrepreneurship require greater focus on experiential learning. Engagements such as interactive sessions, cases, games, exercise, role plays, films, projects, assignments, simulation and group activities play a vital role in teaching this course.

EVALUATION COMPONENT

Assessment Components	% Weightage
Continuous Assessment (Presentations, Assignments, Activities and Quiz)	40 %
Project	20%
End Term Exams	40%

Course Title and Course Code	Infrastructure and Urban Planning CE1212
Hours per week	**L T P: 3 0 2**
Credits	4
Students who can take	**B. Tech (V Sem) OE**
Course Objective: To understand various components of infrastructure, their requirements and management. It also includes the planning principles, evaluation, economics and benefit cost ratio of these projects.	

Course Outcomes:

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

1. Asses the need of various types of infrastructures in urban areas.
2. Analyze the various types of plans and their implementing agencies.
3. Analyze the various components of water supply, sanitation, transportation and waste management.
4. Analyze the planning of various types of social infrastructure projects.

Evaluation Scheme:

Prerequisites		**None**
Sr. No	**Specifications**	**Marks**
1.	Attendance	Nil
2.	Assignment	20 (4 No.)
3.	Class Participation	Nil
4.	Quiz	15 (3 No.)
5.	Theory Exam-I	Nil
6.	Theory Exam-II	15
7.	Theory Exam-III	25
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	5
15.	Lab Evaluation-II	10
16.	Course Portfolio	Nil
Total		**100**
Evaluation scheme for retest		
Theory Exam III		25
Lab Evaluation-II		10
Total		35

COURSE 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

Waste Management System: Types of solid wastes, collection of waste, segregation of wastes, various methods of disposal, energy generation from waste

Social Infrastructure: Typologies; Planning norms and space standards for educational, health, recreational and socio-cultural facilities; amenities for urban settlements.

Lab Syllabus:

1) Introduction to Auto CAD
2) Symbols used in Civil Engineering drawing, Masonry Bonds.
3) All 2D and 3D commands with short keys
4) Practice exercises on AUTOCAD software
5) Drawing of plans of buildings using software (a) Single storied buildings (2D drawing)

Text books:

1. Hutchinson, B.G., Principles of Urban Transport Systems Planning, Scripta, McGraw-Hill, New York, 1974.
2. Claire, Handbook 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. Roberts M., 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).

Course Title and Code: Numerical Methods: AS1204	
Teaching Scheme	**L-T-P: 3-0-2**
Credits	**4**

Course Objective

The course is aimed to provide students with an understanding of basic concepts of numerical methods for drawing conclusions and making decisions under uncertainty in engineering contexts. The course is focused on solving transcendental and polynomial equations, numerical differentiation and integration, and solution of ODEs & PDEs.

Course Outcomes:

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

1. demonstrate a basic knowledge of the numerical methods for accurate and efficient solution of models based on linear and nonlinear systems of equations, ordinary differential equations and partial differential equations, etc.
2. apply these numerical methods to practical problems in Engineering
3. write effectively mathematical solutions and their interpretation in a clear and concise manner.
4. analyze and evaluate the accuracy of common numerical methods.

Prerequisites		Calculus
Evaluation Scheme:		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	Nil
03	Class Participation	5
04	Quiz	10
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-1	25
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation-1	Nil
15	Lab Evaluation-2	10
16	Course portfolio	20 (MOOC)
	Total (100)	**100**
Re-Test		
1	Theory Exam-III	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 equation: 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 book

1. Srimanta Pal, Numerical Methods: Principles, Analysis, and Algorithms, Oxford University Press, 2014.

Reference MOOC

https://www.coursera.org/learn/intro-to-numerical-analysis

Reference books

2. Rishard A. Johnson, Miller and Freund's probability and Statistics for Engineers, PHI.

3. K. E. Atkinson, Introduction to Numerical Analysis, John Wiley and Sons.

4. M.K. Jain, S. R. K. Iyengar, R. K. Jain, Numerical Methods for Scientific and Engineering Computation, New age international publishers, New Delhi.

5. Cheney and Kincaid, Numerical Methods and Applications, Cengage Publications, New Delhi.

6. Cleve B. Moler, Numerical Computing with MATLAB, Prentice Hall of India, New Delhi.

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
EE1401	Digital Circuits (Curated MOOC)	1	0	0	0	4

Course Objectives: The objective of this course is to develop understanding of fundamental concepts in digital design.

Course Outcomes:

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

1. Appreciate the usage of Digital Number System and their interconversion.
2. Use Boolean algebra and graphical techniques for minimization of digital logic.
3. Design different types of combinational and Sequential logic circuits with aim of achieving high performance, low cost, user friendly and socially useful solutions.
4. Explain different types of memory devices and data convertors.
5. Design sequential logic circuits for real world application.
6. Develop programs for 8085 microprocessor using assembly language.

Assessment Scheme:

Prerequisites		**12th Maths**
Teaching Scheme (Hours per Week)		5 hrs. Approximate
Credits		4
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	Nil
2	Assignment (MOOC)	40
3	Class Participation	Nil
4	Quiz	Nil
5	Theory Exam I	Nil
6	Theory Exam II	15
7	Theory Exam (End Term)	25
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	Nil
15	Lab Evaluation2	Nil
16	Course portfolio (**SWAYAM** E-Certificate)	20
	Total (100)	100
Retest		
1	Theory Exam	25
2	Total	25

Course Syllabi (Theory):

Introduction, Number System Boolean Algebra Combinational function minimization – K Map, Boolean identities Logic Gates Arithmetic circuits, Code converters Multiplexers, Decoders, PLA

Sequential Circuits – Latches and Flip-Fops Counters, Shift Registers, Finite State Machines Data Converters – Sample and hold circuits, ADCs, DACs Semiconductor Memories – ROM, SRAM, DRAM Microprocessor 8085 – Part I Microprocessor 8085 – Part II
References: 1. M. Morris Mano, Michael D. Ciletti, "Digital Design", Pearson, 2013. 2. A.K. Maini, "Digital Electronics: Principles, Devices and Applications, Wiley, 2007. 3. R. Gaonkar, "Microprocessor Architecture, Programming and Applications with the 8085", Prentice Hall, 2014.

Note: This course would be delivered on SWAYAM from 14th September 2020 to 4th January 2020 by Prof. Santanu Chattopadhyay, IIT Kharagpur
https://swayam.gov.in/nd1_noc20_ee70/preview

Course Title and Code: Laplace Transform: CS1412	
Hours per Week	**Curated MOOC (approx. 3 hrs. per week)**
Credits	**2**
Students who can take	**B.Tech.**

Course Objective: This course will cover Laplace transform which is a fundamental tool in integral calculus and its application in solving various types of differential equations, difference equations and integral equations etc., which arise naturally in engineering and basic sciences.

Course Outcome:

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

- Find Laplace and inverse Laplace transforms of given function
- Model various engineering problems mathematically in terms of ordinary differential equations, system of ODEs or integral equations and solve them using Laplace transform method

Prerequisites: Mathematics of Grade 12

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	20
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	Nil
15	Lab Evaluation2	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam (End Term)	30

Course Contents:

Introduction and basic definitions, functions of exponential order and existence theorem for Laplace transforms- with examples and some non-examples, properties of Laplace transform with applications in computing them for various functions

Inverse Laplace transforms, criteria for uniqueness, computation of inverse Laplace transform via various examples, convolution theorem.

Applications of Laplace transform techniques for solving integrals, differential equations, difference equations.

BOOKS AND REFERENCES

- Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India. Introduction to Laplace Transforms and Fourier Series, Philip Dyke, Springer.
- Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.

- Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.

This course would be delivered on SWAYAM from 14th September 2020 to 18th Dec. 2020 by Prof. Indava Roy, IMSC Chennai.

Course name: course code- Introduction to Ordinary Differential Equations: CS1413	
Hours per Week	**Curated MOOC (approx. 3 hrs. per week)**
Credits	**2**
Students who can take	**B.Tech.**

Course Objective: The course will cover the basic components of Ordinary Differential Equations (ODE) and methods for solving various types of first order differential equations and then second order linear differential equations. We also discuss some related concrete mathematical modeling problems

Course Outcome:

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

- Solve ordinary differential equations of first order through various techniques.
- Solve ordinary differential equations of second order through various techniques
- Model various engineering problems mathematically in terms of ordinary differential equations and solve them using the appropriate method.

Prerequisites: Mathematics of Grade 12

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	10
3	Class Participation	Nil
4	Quiz	40
5	Theory Exam I	Nil
6	Theory Exam	20
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	Nil
15	Lab Evaluation2	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam (End Term)	30

Course Contents:

Introduction to Ordinary differential equations (ODE), solving ODEs of first order and first degree using various methods like variable separable method, integrating factor method, homogeneous equation method etc. Solving higher order ODEs with constant coefficients. Differential equation of second order with variable coefficients using variation of parameters method and Cauchy's method.

BOOKS AND REFERENCES

- Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India.
- Thomas' Calculus, M.D. Weir and J. Hass, Pearson.
- Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, NewDelhi.
- Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.

This course would be delivered on Coursera by Prof. Kwon Kil Hyun, KAIST.

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. Learners would be introduced to different cross platforms like IONIC, REACT NATIVE, and TABRIS.JS. 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.		
Learning Outcome: On successful completion of this course, the students should be able to: 1. develop high-level plans for script solutions for mobile and evaluate the post-production outcome; 2. design scripts to meet given interface and media control requirements; 3. use variables, properties and other code elements appropriately to implement the code design; 4. devise carry out and evaluate functional test strategies of mobile design; 5. implement and evaluate techniques for the installation of mobile applications and delivery via various channels; 6. explain the principles of technologies which support media production and delivery on a variety of platforms; 7. create event listeners for responding to events; 8. administer permissions and Android manifests; 9. integrate Android XML resources with Java code; 10. create a Google Play Store account and preparing apps for the Play Store.		
Prerequisites		**Basics of Computer Networks**
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	**20 (Coursera)**
3	Class Participation	Nil
4	Quiz	**10 (Google Classroom)**
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	Nil
15	Lab Evaluation-II	**10**
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:

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

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

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

Course Outcomes:

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

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

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

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

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

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

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

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

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

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

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

Evaluation Scheme

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

Syllabus (Theory)

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

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

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

Session Layer- Design issues, remote procedure call. Presentation Layer-Design issues, Application Layer: Application Layer: File Transfer, Access and Management, Electronic mail, Virtual Terminals etc.

Characterization of Distributed Systems: Introduction, Examples of distributed Systems, Resource sharing and the Web Challenges. Limitation of Distributed system, absence of global clock, shared memory, Logical clocks, Lamport's & vectors logical clocks, Causal ordering of messages, global state, termination detection. Agreement Protocols: Introduction, System models, classification of Agreement Problem, Byzantine agreement problem, Consensus problem, Interactive consistency Problem, Solution to Byzantine Agreement problem, Application of Agreement problem

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

Text Book(s)

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

Course Title and Code: Compiler Design CS1112

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

Course Objective- This course aims to familiarize the students with the design of a compiler including its phases and components, develop a compiler.

Course Outcome:

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

CS1112.1. Specify and analyze the lexical, syntactic and semantic structures of programming language features

CS1112.2. Separate the lexical, syntactic and semantic analysis into meaningful phases for a compiler to undertake language translation

CS1112.3. Write scanners, parsers, and semantic analyzers without the aid of automatic generators

CS1112.4. Utilize the compiler design concept to write efficient programs

CS1112.5. Design the structures and support required for compiling advanced language features.

Prerequisites		**Nil**
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignments	10
03	Class Participation	Nil
04	Quiz (4)	10
05	Theory Exam	Nil
06	Theory Exam (midterm-II)	20
07	Theory Exam (Final)	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project-1	Nil
12	Project-2	Nil
13	Project-3	Nil
14	Lab Evaluation1	20
15	Lab Evaluation2(Final)	20
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus (Theory):

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

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

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

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

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

Syllabus (Practical):

1 Program to implement a Deterministic Finite Automata.
2 Program for a lexical analyzer to recognize a few patterns in PASCAL and C.
3 Program to generate a lexical analyser using LEX.
4 Program to recognize a valid variable which starts with a letter followed by any number of letters or digits.
6 Program to recognize the grammar (anb n|>=10)
7 Program to recognize a valid arithmetic expression that uses operator +, -, * and /.
8 8 Program to develop a recursive descent parser.
9 Program to find FIRST of NON-TERMINALS of the given grammar
10 Program to find out FOLLOW of NONTERMINALS of given productions.
11 Program for generating for various intermediate code forms:
● Three address code ●Quadruple
12 Program to generate the intermediate code in the form of Polish Notation.
13 Program to implement code optimization techniques to optimize given intermediate code (Three Address Code) form.
14 Program to Simulate Heap storage allocation strategy.

Textbook(s):

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

Reference Book(s):

1. Compilers- Principles, Techniques and Tools, Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman – 2nd Edition, Addison-Wesley, 2007.
2. Allen I. Holub “Compiler Design in C”, Prentice Hall of India, 2003.
3. C. N. Fischer and R. J. LeBlanc, “Crafting a compiler with C”, Benjamin Cummings, 2003.

Web Resources:

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

Course Title and Code: Software Engineering**:** CS1113	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Sem VI

Course Objective: In this course, students will gain a broad understanding of the discipline of software engineering and apply theories, models, and techniques to solve real-world problems.

Course Outcome:

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

1. Use software development lifecycle models for project development.
2. Explain the advantages of agile software development over traditional software engineering methods.
3. Apply agile development method namely Extreme Programming (XP), Adaptive software development (ASD), Scrum and Crystal for software development.
4. Design solutions in various application domains using software engineering approaches that integrate ethical and economic concerns.
5. Elicit and Evaluate functional and non-functional requirements for a software system.
6. Design, represent and document software requirements specification according to IEEE standards.
7. Apply UML modelling for software design.
8. Apply coding standards and guidelines.
9. Prepare code checklist and perform code inspections, code reviews and walkthrough.
10. Develop and implement various manual and automated testing procedures.
11. Estimate the cost of software project.
12. Evaluate software in terms of software quality and quality assurance according to ISO standards.
13. Execute activities for software project such as re-engineering, reverse engineering and software configuration.

Prerequisites: : C, C++ or Java programming

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

Evaluation Scheme for Retest

1	Theory Exam-III	30
2	Quiz	20
	Total	**50**

Syllabus (Theory)

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

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

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

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

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

Course Syllabus (Practical):

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

Design Approach: Object Oriented

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

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

Reference/Text Books:

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

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

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

Course Outcomes

The students will be able to:

CC1106.1. Apply techniques of Critical Thinking to analyse organisational problems through positive inquiry
CC1106.2. Describe and analyse appropriate problem-solving and ethical decision-making processes
CC1106.3. Choose the most effective and logical decision among multiple alternatives
CC1106.4. Evaluate solutions and anticipate likely risks based on purpose, context and ethics

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

Evaluation scheme for re-test

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

SYLLABUS

	Topic	**Sub-topics**
1	Decision Making: Definition and Type	• Organisational decision-making • Concept of thinking triangle • Importance of decision-making at work place
2	Barriers to Sound Reasoning	• Identifying barriers to Critical Thinking • Biases, prejudices, facts, opinions, assumptions.

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

Suggested Readings

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

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

Course Objective-

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

Course Outcomes (Provided by IBM):

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

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

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

Syllabus

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

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

IBM Cognos Analytics: Author Reports Advanced – Introduction, Create query models, Create reports based on query relationships, Create advanced dynamic reports, Design effective prompts, Create additional advanced reports, Examine the report specification, Distribute reports through bursting, Enhance user interaction with HTML,

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

Reference Books:

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

Suggested MOOC:

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

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

Course Objective-

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

Course Outcomes (Provided by IBM):

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

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

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

Syllabus

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

UNIT II: Explore and Prepare Data - Business understanding, Explore data, Prepare data, Understanding data; Represent and Transform Data - Statistics and representation techniques, Data transformation, Represent and transform unstructured data, Data transformation tools; Data Visualization and Presentation - Decision-centered Visualization, Fundamentals of Visualizations, Common Graphs, Common Tools

UNIT III: Data Modelling - Overview of modeling techniques, Machine learning techniques, Accuracy, precision and recall, Model Deployment; Machine Learning Algorithms - About Machine Learning, From Regression to Neural Nets, Decision Tree Classifier, Machine Learning Framework

LAB

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

Reference Books:

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

Suggested MOOC:

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

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

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

Course Outcomes:

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

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

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

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

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

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

Assessment Scheme:

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)	Nil
121	Project II	Nil
13	Project III (With working model)	40
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 Title and Code: Applied Algorithms CS1211	
Hours per Week	**L-T-P: 2-0-2**
Credits	**4**
Students who can take	B.Tech. Odd Sem (VII)

Course Objective-

The course, Applied Algorithms, offered for 3rd year undergraduate aims to develop practical knowledge of interesting and widely used algorithms and their applications to solve real life problems. It emphasizes approaches with practical relevance and discusses several recent applications of leading algorithms in areas like information retrieval, intelligent systems, cryptography, computer vision and automations. Extensive lab and an open research project are a major part of the course.

Learning Outcome:

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

- Implement the hashing of MD5, SSH, Blockchain and Hashgraph.
- Apply heuristic search in constrain environment.
- Explore network algorithms and compression algorithms.
- Experiment algorithms of crawling, ranking, community, contagion, and inference.
- Implement an interesting real-life project using learned algorithms.

Prerequisites		**Basic Machine learning, Linear algebra, Probability, Statistics, Python programming**
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignments	20
03	Class Participation	Nil
04	Quiz	10
05	Theory Exam	Nil
06	Theory Exam (Mid)	20
07	Theory Exam (Final)	20
08	Report-1	Nil
09	Report-2	Nil
10	Report	Nil
11	Project-1	10
12	Project-2	Nil
13	Project-3	Nil
14	Lab Evaluation (Mid)	10
15	Lab Evaluation (Final)	10
16	Course portfolio	Nil
	Total (100)	**100**

Retest

1	Quiz	20
2	Theory Exam (Final)	20

Syllabus (Theory)

1 Hashing - > SSH -> Cryptocurrency
2 Binary search -> BFS/DFS -> A* -> AlphaGo
3 MST -> Flow -> TSP -> VANET
4 Huffman -> JPG -> Compressed Sensing
5 Web -> PageRank -> Social Network
6 Least square -> Gradient Descent -> Deep Learning
7 Dynamic programming -> Reinforcement Learning -> self-drive car
8 Clustering -> Image segmentation -> LIDAR
9 B-Tree -> Database -> Distributed computing
10 Trie-> Inverted index -> Map Reduce

Syllabus (Practical)

1. Implementation: Bloom Filter, Cuckoo Hashing, MD5, SSH, Blockchain, Hash Graph.
2. Implementation: Heuristic search, Constraint search, RL, DRL, Deep-mind.
3. Implementation: Crawling, indexing, MapReduce and PageRank.
4. Implementation: Encoding and encryptions
5. Implementation: Optimization algorithms of graph

Text Books:

- Real-World Algorithms: A Beginner's Guide, Panos Louridas, MIT Press.
- Handbook of Applied Algorithms_ Solving Scientific, Engineering, and Practical Problems [Nayak & Stojmenović 2008-03-03]
- Algorithm Design, Jon Kleinberg, Éva Tardos, Cornell University, Pearson.

Reference Courses:

1. Algorithms in the "Real World" - CMU. http://www.cs.cmu.edu/~guyb/realworld.html
2. CS 602 Applied Algorithms- IIT Bombay, https://www.cse.iitb.ac.in/~aad/cs602/

Reference Materials:

- The Anatomy of a Large-Scale Hypertextual Web Search Engine, http://infolab.stanford.edu/~backrub/google.html
- MapReduce: Simplified Data Processing on Large Clusters, https://research.google.com/archive/mapreduce-osdi04.pdf
- HDFS: https://hadoop.apache.org/docs/r1.2.1/hdfs_design.html
- DeepMind Lab, https://deepmind.com/research/open-source/deepmind-lab
- LIDAR, https://arxiv.org/ftp/arxiv/papers/1603/1603.00912.pdf

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 (End Term)	**30**
8	Report-1	Nil
9	Report-2	Nil
10	Report-3	Nil
11	Project -1	**30**
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation1	Nil
15	Lab Evaluation2	**10**
16	Course portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam (End Term)	**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 Title and Code: Building RPA Applications CS1121	
Hours per Week	**L-T-P: 2-0-0**
Credits	**2**
Students who can take	B.Tech.(CSE/EEE/ME – VI) Even Sem

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

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

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

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

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

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

Syllabus (Theory):

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

Unit II: **RPA Projects:** Types of Projects in RPA: Sequence, Flowcharts, and State machines; Variables, Arguments, Data Types and Control flow: flow chart activities and sequences activities. **Data**

Manipulation: Text and Data Manipulation**,** Data tables, clipboard management, file operation, importing from and exporting to CSV/Excel file and data table.

Unit III: **Control of Controls:** Attach window activity, Finding the control, Waiting for a control, Act on Control- mouse and keyboard activity. Handling event driven controls as working with UiExplorer handling events. Recording and Advanced UI Interaction: Definition, what can be recorded, Components, Automatic & Manual Recording Activities, Basic, Desktop & Web Recording, OCR, types of OCR and Screen Scrapping Using OCR. **Selectors:** Selectors, Defining and Assessing Selectors, Customization, Debugging, Dynamic Selectors, Partial Selectors. RPA Challenge.

Unit IV: **Application with Plugins and Extensions:** Java plugins, Citrix automation, Mail plugins, PDF plugins, Web integration, excel and word plugins. Extensions- Java, chrome, firefox, and Silverlight. Image and Text automation; **Excel Data Tables, PDF, Word:** Data Tables in RPA, Excel and Data Table basics, Data Manipulation in excel, Extracting Data from PDF, Extracting a single piece of data, Anchors, Word automation. **Email Automation:** Incoming Email automation, Sending Email automation.

Unit V: **Debugging and Exception Handling:** Common exceptions and ways to tackle them, Strategies for solving issues, Catching errors. **Introduction to Orchestrator:** Tenants, Authentication, Robots, Environments, Asset. **Capstone Project.**

Syllabus (Practical):

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

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

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

Managing Arguments:

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

Create a project to Manage the control Flow:

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

The Recording toolbar Activity:

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

Data Scrapping:

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

Text Books:

T1 Tripathi, Alok Mani. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool–UiPath. Packt Publishing Ltd, 2018.

T2. Murdoch, Richard. "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant." Middletown, DE. Omakustanne (2018).

Reference Books:

R1. Abhinav Sabharwal, “Introduction To RPA”, Independently Published Kindle Edition on Amazon Asia-Pacific Holdings Private Limited, 201 8
R2. Gerardus Blokdyk, “Rpa Robotic Process Automation”, 5Starcook, Second Edition, 2018
R3. Kelly Wibbenmeyer, “The Simple Implementation Guide to Robotic Process Automation (Rpa): How to Best Implement Rpa in an Organization” Paperback, iUniverse, 2018
R4. Willcocks, Leslie P., Mary Lacity, and Andrew Craig. "The IT function and robotic process automation." (2015).

Course Title and Code: Disaster Management CE1206	
Hours per Week	**L-T-P: 3-1-0**
Credits	**4**
Students who can take	B.Tech Sem VI sem (2018-2022) (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 a power grid collapse.
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	20
3	Class Participation	5
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	15
7	Theory Exam-III	30
8	Report-I/ Case Study	10
9	Report-II/Case Study	10
10	Report-III/Case Study	10
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	
	Total (100)	
	Evaluation scheme for retest	
	Theory Exam III	30

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 Power Utilities and Power grid collapse:

Power System Blackout, Causes and Impact, Indian Grid System, power collapse, Impact of COVID-19 on the Indian Power Sector, Lessons from the Covid-19 crisis for Indian power sector, Vulnerability Program, Electric Power Grid Restoration, Impact of blackout in day-to-day life

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 the 2003 North American Power Outage with Exercises

Text /Reference Books:

- M. Pandey, “Disaster Management” Wiley India Pvt. Ltd.
- Tushar Bhattacharya, “Disaster Science and Management” McGraw Hill Education (India) Pvt. Ltd.
- Crisis and disaster management plan for power sector by central electricity authority of India
- 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
- Sahni, Pardeepet. al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.

BUSINESS MODEL TO PRODUCT MARKET FIT
Course Code: ED1103
SEMESTER VI (All Branches B.Tech.)

L-T-P: 4-0-0 COURSE CREDITS: 4

COURSE DESCRIPTION

This course is the second of a two-part entrepreneurship development curriculum from Wadhwani Foundation. The first part i.e., 'Idea to Business Model' is the prerequisite for this course. In this course, students will learn how to grow a venture by pivoting, refining business models, and business planning. This course is supported by Wadhwani Foundation and facilitated through Learnwise.

COURSE OBJECTIVES

This course aims to teach the students the necessary skills to develop ventures beyond the idea/prototype stage.

COURSE OUTCOMES

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

ED1103.1. Refine business models and expand customer segments.
ED1103.2. Design business plan for the venture.
ED1103.3. Explore and develop the strategies to grow revenue and market.
ED1103.4. Understand funding process and what investor look for.
ED1103.5. Learn to build an A- Team and how to pitch the venture
ED1103.6. Develop brand strategy and channel strategy for customer outreach.
ED1103.7. Understand the key metrics to measure & track the venture progress.
ED1103.8. Select the right type of legal form of the venture and understand the legal issues related to it.

EVALUATION COMPONENT

Assessment Components	% Weightage
Continuous Assessment (Presentations, Assignments, Activities and Quiz)	40 %
Final Project	20%
End Term Exams	40%

TOPICS

- Recap and Review the Fundamentals
- Refining the Business Model and Product/Service
- Business Planning
- Exploring Ways to Increase Revenue
- Funding the Growth
- The Art of Pitching
- Building the A-Team
- Creating a Branding and Channel Strategy
- Leveraging Technologies and Available Platforms
- Measuring Your Progress
- Legal Matters
- Seeking Support (Mentors & Advisors)
- Final Project Presentation

COURSE OUTLINE (TENTATIVE SESSION PLAN)

Session No.	Topics
1-1	Introduction
2-3	Recap and Review the Fundamentals
4-5	Refining the Business Model and Product/Service
6-6	**Activity**
7-10	Business Planning
11-11	**Activity**
12-13	Exploring Ways to Increase Revenue
14-14	**Activity**
15-16	Funding the Growth
17- 18	Building the A-Team
19-19	The Art of Pitching
20-20	**Activity**
21-22	Creating a Branding and Channel Strategy
23-23	Leveraging Technologies and Available Platforms
24-25	Measuring Your Progress
26-27	Legal Matters
28-28	Seeking Support
29-30	Project Presentations

TEXT BOOK AND ADDITIONAL READING MATERIALS

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

Additional Reading Material

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

TEACHING METHODOLOGY/PEDAGOGY

The teaching/ learning of entrepreneurship require greater focus on experiential learning. Engagements such as interactive sessions, cases, games, exercise, role plays, films, projects, assignments, simulation and group activities play a vital role in teaching this course.

Course Title and Code: Discrete Mathematics: AS1401	
Teaching Scheme	**L-T-P: 3-1-0**
Credits	**4**

Course Objective

This course is aimed to learn the concepts of discrete mathematics such as counting, set theory, relations and functions, mathematical induction, generating functions and recurrence relations, logic and proof, 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.

Learning Outcomes:

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

5. construct and validate simple computing models which play a crucial role in compiler design, algorithms, etc.
6. construct conceptual models using discrete mathematics in various application areas such as linguistic, business, internet, etc.
7. develop problem solving and critical thinking skills to solve complex computing problems
8. use logic and proofs in order to read, comprehend and construct mathematical arguments
9. develop mathematical models of computation and describe how they relate to formal languages
10. relate the basic difference between deterministic and nondeterministic computing machines
11. Interpret the language accepted by Turing machine.

Prerequisites	**Nil**

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	25
03	Class Participation	Nil
04	Quiz	25
05	Theory Exam - I	Nil
06	Theory Exam - II	20
07	Theory Exam - III	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-1 (Viva)	Nil
15	Lab Evaluation-2 (Viva)	Nil
16	Course portfolio	Nil
	Total	**100**
	Retest	
01	Theory Exam - III	30
	Total	**30**

Syllabus

Mathematical Logics: Proposition, Compound proposition, Operations, Inverse & Contrapositive, Bi-conditional statements, Mathematical arguments, Methods of proofs

Sets and relations: Sets: Definition and types, Set operations, Partition of set, Countable & Uncountable Sets, Binary Relation, Properties of Relations, Operations on Relations, Equivalence relations, Partial order relations, lattices

Counting: Permutations and combinations, Pigeonhole principle, Generating function, Recurrence relation

Regular languages and Context free grammar: Regular expressions, non-regular languages, Context free languages, Derivation, Derivation trees, Ambiguity, Ambiguous to Unambiguous CFG,

Finite Automata: DFA, NFA, NFA to DFA conversion, Finite automata with output

Push Down Automata (PDA): Equivalence of PDA and CFG, CFG to PDA and PDA to CFG

Turing machines (TM): Basic model, definition and representation

Text Books:

3. Kenneth Rosen, Discrete Mathematics and its applications, 5th edition, Tata-McGraw Hill, 2002

4. Hopcroft, Ullman, "Introduction to Automata Theory, Languages and Computation", Pearson Education

References:

14. C.L. Liu, Elements of Discrete mathematics, McGraw-Hill
15. K.L.P. Mishra and N. Chandrasekaran, "Theory of Computer Science: Automata, Languages and Computation", PHI
16. Martin J. C., "Introduction to Languages and Theory of Computations", TMH
17. Papadimitrou, C. and Lewis, C.L., "Elements of the Theory of Computation", PHI.
18. MOOC Course

    https://onlinecourses.nptel.ac.in/noc21_cs34/preview

Note: Partial percentage of marks for quizzes and assignments will be taken from the score, students will secure from above MOOC course.

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:

1. Argue the correctness of algorithms using inductive proofs and loop invariants.
2. Analyse algorithms using amortized analysis, including the accounting method and the potential method, as required.
3. Write program to solve algorithmic problems using divide-and-conquer and dynamic-programming paradigm.
4. Implement variants of the self-balancing tree.
5. Analyse, implement and use heap structures and hashing techniques.
6. Apply and implement the disjoint set data structures to solve problems modelled by graph.
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 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:

1. Recognize foundational concepts of blockchain, and apply these program concepts on the blockchain.
2. Develop, Test and Execute a smart contract.
3. Apply the consensus mechanism on application.
4. Identify use cases and develop, execute and test the application.
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

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:

1. Analyze how words are represented as vectors for natural language processing.
2. Model NLP problems using tools from calculus, linear algebra and probability.
3. Design RNNs for various NLP tasks like machine translation.
4. Design transformer and BERT models for various NLP tasks.
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 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.

SKILLS YOU WILL GAIN

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

1. Develop high-level plans for script solutions for mobile app to evaluate the post-production outcome.
2. Implement front end app design in **React Native**.
3. Design scripts to meet given interface and media control requirements.
4. Devise, carry out and evaluate functional test strategies of app design.
5. Implement and evaluate techniques for the installation of cross platform mobile applications and delivery via various channels.
6. Implement NoSQL databases using **MongoDB**, work within a **Node.js** environment and **Express** framework.
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 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 Title and Code:	Introduction to User-Experience**; IL1204**
Hours per Week	**2-2-0:**
Credits	**4**
Students who can take	B.Tech Sem 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:

IL1204.1. Appreciate UX holistically with respect to different types of user-needs.
IL1204.2. Conduct User-Studies.
IL1204.3. Synthesize a Problem-Statement.
IL1204.4. Conduct Creative Design-Exploration.
IL1204.5. 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
2	Report-I	20

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, Analysing 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 Title and Code **Geographical Information System (GIS): CE 1214**	
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:** 1. Asses the various sources for remote sensing data. 2. Analyze the data from various type of images. 3. Analyze the data acquisition and data output through GIS and GPS. 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)

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

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Course Description:

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 Learning 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 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:

1. Identify and formulate fundamental probability distributions and density functions.
2. Analyze continuous and discrete-time random variables and processes.
3. Analyze system of multiple random variables.
4. Compute cumulative distribution function and normalizing constant for the probability density function of one or more random variables.
5. Apply the concept of algebra of random variables to analyze various linear systems.
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 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 VII (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:

1. Identify the characteristics of datasets and compare the trivial data and big data for various applications.
2. Select and implement machine learning techniques and computing environment that are suitable for the applications under consideration.
3. Integrate Data Science libraries in Python with big data technologies.
4. Use different SciKit package ML Algorithms.
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	25
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**
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, the industry sectors that are using Big Data and it's Use Cases; Hadoop overview: Hadoop

Introduction, Hadoop architecture, HDFS Introduction, HDFS architecture, MapReduce v 1.0 and YARN differences and their architecture

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 command 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.

Recommended MOOC: Short online courses @ cognitiveclass.ai (an IBM initiative)

S#	Course Name	Level	Effort (hr)
1	Big Data 101	B	3
2	Hadoop 101	B	5

3	MapReduce and YARN	I	5
4	Apache Pig 101	B	5
5	Simplifying Data Pipelines with Apache Kafka	I	3
6	Moving Data into Hadoop	I	4
7	Accessing Hadoop Data Using Hive	I	5
8	Using HBase for Real-time Access to your Big Data	I	5
9	SQL Access for Hadoop	I	3
10	Controlling Hadoop Jobs Using Oozie	I	4
11	Developing Distributed Applications Using ZooKeeper	I	4
12	Spark Fundamentals I	B	5
13	Spark Fundamentals II	I	4

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:

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

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

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:

1. Identify and formulate industrial and societal problems.
2. Design engineering solutions for complex problems.
3. Develop/fabricate, and implement solutions for identified problem.
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.

Evaluation Scheme:

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

PS1102/ 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