

KARNATAK LAW SOCIETY'S
GOGTE INSTITUTE OF TECHNOLOGY

UDYAMBAG, BELAGAVI-590008

(An Autonomous Institution under Visvesvaraya Technological University, Belagavi)

(APPROVED BY AICTE, NEW DELHI)



**Third to Eighth semester B.E.
(2022 Scheme)
INFORMATION SCIENCE AND ENGINEERING**

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

DEPARTMENT VISION
Department of Information Science & Engineering shall provide excellent learning environment with focus on innovation, research and entrepreneurship among aspiring engineers to contribute to the workforce of the nation

MISSION
To impart Quality Technical Education in the field of Information Technology and enhance intellectual and professional competence among the aspiring engineers

PROGRAM OUTCOMES (POs)	
1.	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2.	Problem analysis: Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3.	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4.	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5.	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6.	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7.	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8.	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9.	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10.	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11.	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12.	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

	PROGRAM SPECIFIC OUTCOMES (PSOs)
1	Problem solving Skills: An ability to analyze a problem design, implement and evaluate software solutions related to algorithms, system software, web design big data analytics & networking.
2	Professional skills: An ability to develop standard software solutions for existing and emerging industry verticals and research domains
3	Career Skills: An ability to harness Information Science & Engineering knowledge with ethics and societal concern for career and further educational abilities along with entrepreneurial skills.

KLS Gogte Institute of Technology
3rd to 8th sem B.E.
Scheme of Teaching and Examination- 2022

Outcome-Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2023-24)

Total credits for B.E. Program: 160

Credit definition:

Offline Courses	Online Courses
1-hour Lecture (L) per week = 1 Credit 2 hours Tutorial (T) per week = 1 Credit, 2 hours Practical /Drawing (P) per week = 1 Credit	04 weeks =1 Credit 08 weeks = 2 Credit 12 weeks = 3 Credit

Semester wise distribution of credits for B.E program

Year	Semester	Credits	Total/Year	Cumulative Credits
1st	I	20	40	40
	II	20		
2nd	III	20	40	80
	IV	20		
3rd	V	22	40	120
	VI	18		
4th	VII	24	40	160
	VIII	16		
Total			160	

Curriculum frame work:

Structure of Undergraduate Engineering program

S.No.	Category of courses	VTU Breakup of credits	KLSGIT Breakup of credits
1	Humanities and Social Sciences including Management courses (English, Kannada, Indian Constitution, Environmental Sciences, Health and Management)	9	10
2	Basic Science courses	22	22
3	Engineering Science courses including ETC, PLC & Drawing	24	24
4	Professional Core Courses	54	54
5	Professional Elective courses relevant to chosen	12	12

	specialization/branch		
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6	Open subjects – Electives from other technical, emerging, arts, commerce	9	9
7	Mini, Project, Major Project work and Seminar	10	10
8	Summer Internship and Research /Industrial Internship	10	10
9	Ability Enhancement Courses, including Research Methodology, NCC/NSS/ Sports/Ex- Curricular, Online Certification Course	8	7
10	Universal Human Values	2	2
	TOTAL	160	160

L-T-P Model for Courses

	Contact Hours				Credits	
S.No.	L-T-P	Lecture	Tutorial	Practical	L-T-P	Total
1	3 - 0 - 0	3	0	0	3 - 0 - 0	3
2	3 - 2 - 0	3	2	0	3 - 1 - 0	4
3	3 - 0 - 2	3	0	2	3 - 0 - 1	4
4	2 - 0 - 2	2	0	2	2 - 0 - 1	3
5	1 - 0 - 4	1	0	4	1 - 0 - 2	3

Theory courses having the corresponding lab are converted to integrated type course. Also, the electives (if possible) can also be made integrated type.

Integrated courses (Professional Core/Electives): Integrated courses will have **Theory Syllabus with Practical Syllabus of the same course**. In such a course there could be **no Semester End Examination (SEE) for the practical syllabus** of the course, however, Continuous Internal Evaluation (CIE) will be conducted for the practical topics. **SEE can include questions from practical topics.**

SDA-Skill Development Activities, TD/PSB- Teaching Department / Paper Setting Board, ASC-Applied Science Course, ESC- Engineering Science Courses, ETC- Emerging Technology Course, AEC- Ability Enhancement Course, HSMS-Humanity and Social Science and Management Course, SDC- Skill Development Course,

KLS Gogte Institute of Technology
3rdYear B.E. Scheme of Teaching and Examination
2022

6 th Semester					Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	IPCC	22IS61	Artificial Intelligence and Machine Learning	ISE	3	0	2	05	4	100	100	200
2	PCC	22IS62	Cloud Computing	ISE	3	1	0	04	4	100	100	200
3	PEC	22IS63X	Professional Elective Course	ISE	3	0	0	03	3	100	100	200
4	OEC	22IS64X	Open Elective Course	ISE	3	0	0	03	3	100	100	200
5	PROJ	22IS65	Major Project Phase I	ISE	0	0	4	04	2	100	--	100
6	AEC/SDC	22AECIS66	Employability Skills -2	Bizotic	1	0	0	01	1	100	--	100
7	MC	22IS671	National Service Scheme (NSS)	NSS coordinator	0	0	2	02	0	100	--	100
		22IS672	Physical Education (PE) (Sports and Athletics) and Yoga	Physical Education dept& Yoga instructor								
		22IS673	Clubs- Social, Cultural & Academic	Coordinators								
8	PCCL	22ISL68	Robotic Process Automation Lab	ISE	0	0	2	02	1	50	50	100
Total									18	750	450	1200

Professional Elective Course			
22IS631	Distributed Computing Systems	22IS634	Operations Research
22IS632	Agile Software Development	22IS635	Compiler Design
22IS633	Introduction to Sales Force		
Open Elective Course			
22IS641	Introduction to Data Structures	22MAT661	Linear Algebra
22IS642	IOT- A practical Approach	22MAT662	Applied Statistics
22IS643	Introduction to Big Data	22CH641	Nanoscience and Nanotechnology
22IS644	Introduction to Artificial Intelligence and Machine Learning	22INT61	Marketing Management

PCC: Professional Core Course, PCCL: Professional Core Course laboratory, UHV: Universal Human Value Course, MC: Mandatory Course (Non-credit), AEC: Ability Enhancement Course, SEC: Skill Enhancement Course, L: Lecture, T: Tutorial, P: Practical S= SDA: Skill Development Activity, CIE: Continuous Internal Evaluation, SEE: Semester End Evaluation. PROJ: Project /Mini Project. PEC: Professional Elective Course. PROJ: Project Phase -I, OEC: Open Elective Course
Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's of the same course. Credit for IPCC can be 04 and its Teaching–Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23 National Service Scheme /Physical Education/Yoga/Clubs: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), Yoga(YOG) and Clubs with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, Yoga and Club activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.
Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.
Open Elective Courses: Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor. The minimum numbers of students' strength for offering Open Elective Course is 10. However, this condition shall not be applicable to class where the admission to the program is less than 10.
Project Phase-I : Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	22IS61	Course type	IPCC	Credits L-T-P	3 - 0 - 1
Hours/week: L - T- P	3 - 0 - 2			Total credits	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course learning objectives

1.	To understand the fundamental concepts and principles of Artificial Intelligence & Machine Learning.
2.	To apply mathematical concepts to machine learning algorithms and models.
3.	To learn designing, training, and evaluating deep learning models.
4.	To develop AI solutions for real world problems.
5.	To gain proficiency in using MATLAB as an environment for AI and ML tasks.

Required Knowledge of: Linear Algebra, Probability and Statistics, Introduction to Programming, Multivariable Calculus.

Unit – I	Contact Hours = 8 Hours
Introduction to AI - Supervised vs unsupervised learning, Applications of machine learning, Introduction to Programming, Linear Algebra, Probability & Statistics.	

Unit – II	Contact Hours = 8 Hours
Gradient Descent, Supervised Learning Regression, Feature Engineering - PCA, SVD Overfitting, Bias and Variance.	

Unit – III	Contact Hours = 8 Hours
Supervised Learning Classification - naive Bayes, Decision Tree, Logistic Regression, Support Vector machines .Unsupervised Learning Clustering - kNN, hierarchical clustering.	

Unit – IV	Contact Hours = 8 Hours
Fundamentals of Neural Networks - neuron, backpropagation, activation functions, loss function Introduction to Image Processing - Basics, thresholding, filtering, edge detection, convolution.	

Unit – V	Contact Hours = 8 Hours
Deep Learning CNN - CNN fundamentals, CNN layers, building CNN from scratch, transfer learning Deep Learning RNN - RNN fundamentals, RNN layers, building CNN from scratch, transfer learning AI deployment on low-cost hardware, mobile phone.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	Week 1-Intro to Programming	Week 2-Mathematics	Week 7-Supervised Learning	Week 11-Image Processing	Week 12-Deep Learning

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
I	1	Intro to programming
II	3	Gradient Descent, Regression, Bias and Variance
III	2	Classification, Clustering
IV	1	Shallow neural networks
V	3	CNN, RNN, deployment of AI algorithms to hardware

Unit No.	Self-Study Topics
I	Linear Algebra
III	KNN algorithm
V	Recurrent Neural Network

Books	
	Text Books:
1.	Kevin P. Murphy - "Machine Learning: A Probabilistic Perspective" - MIT Press, 2012.
2.	Introduction to Linear Algebra 5th edition by Gilbert Strang
3.	"Deep Learning" by Ian Goodfellow, Yoshua Bengio and Aaron Courville
	Reference Books:
1.	Trevor Hastie, Robert Tibshirani, and Jerome Friedman - "Elements of Statistical Learning: Data Mining, Inference, and Prediction" - Springer, 2nd Edition, 2009.
2.	Introduction to Probability theory 2nd edition by Bertsekas and Tsitsiklis
3.	"An Introduction to Statistical Learning" by Gareth James et al
	E-resources
1.	Neural Networks: https://github.com/ppotoc/Fundamentals-of-Neural-Networks

2.	Build a network from scratch to assess Brain MRI https://github.com/matlab-deep-learning/Brain-MRI-Age-Classification-using-Deep- Learning
3.	End to end implementation of AI for Computer Vision to classify Pills using different Deep Learning networks https://github.com/mathworks/AI-Workshop-for-Visual-Inspection

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Lab Project/ Industry assignment/Certification/ Course project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome(COs)				
Learning Levels:				
Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Understand the fundamental concepts and principles of Artificial Intelligence.	Un	1	1
2.	Analyze , Apply and Evaluate various machine learning and deep learning models using MATLAB.	An,Ap,Ev	1,2,3,4,5	1,2
3.	Develop practical AI solutions for real world problems to demonstrate effective teamwork , communication and problem solving skills in AI project.	Ap	3,4,5,9,10	1,2
4.	Critically evaluate AI applications and ethical considerations.	Ev	6	3

Scheme of Continuous Internal Evaluation (CIE):				
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test (COMPULSORY) will be part of the CIE. No SEE for Lab.				
THEORY (60 marks)		LAB (40 marks)		Total
IA test 1	IA test 2	Conduction	Lab test	
30 marks	30 marks	10 marks	30 marks	100 marks
IA Test: 1. No objective part in IA question paper 2. All questions descriptive				
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks				
Lab test: (Batch wise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Timetable, Batch details and examiners will be declared by Exam section 3. Conducting the experiment and writing report: 5 marks 4. Calculations, results, graph and conclusion: 15 marks 5. Viva voce: 10 marks				
Eligibility for SEE: 1. Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. Lack of minimum score in IA test will make the student Not Eligible for SEE 2. Student should score minimum 40% of 30 marks (i.e. 12 marks) in Lab test & should score 40% of 40 marks (i.e. 16 marks) in Lab component. 3. Lab test is COMPULSORY 4. Minimum score in CIE to be eligible for SEE: 40 OUT OF 100. 5. Not eligible in any one of the two components will make the student Not Eligible for SEE				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be ≥ 35 &, however overall score of CIE+SEE should be $\geq 40\%$.
3.	Question paper contains three parts A,B and C . Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
C O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓												✓		
2	✓	✓	✓		✓								✓	✓	
3		✓	✓	✓	✓								✓	✓	
4	✓	✓			✓								✓	✓	
5			✓	✓	✓				✓	✓			✓	✓	
6						✓									✓

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	A good understanding of what AI is, its applications, and its use cases.	Healthcare, Education	AI Engineer, AI Data Analyst, Computer Vision Engineer.
2	Ability to explain terms such as machine learning, deep learning and neural networks.		
3	Develop practical AI solutions for real world problems to demonstrate effective teamwork, communication and problem solving skills in AI project		

CLOUD COMPUTING

Course Code	22IS62	Course type	PCC	Credits L-T-P	3 – 1 - 0
Hours/week: L - T- P	3 – 2 – 0			Total credits	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course learning objectives	
1.	To understand various cloud services.
2.	To realize the importance of cloud virtualization.
3.	To study case study of AWS (Amazon Web Services).

Pre-requisites: Fundamentals of networking.
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Unit – I	Contact Hours = 8 Hours
Introduction to Cloud Computing: Cloud Computing in a Nutshell, Roots of Cloud Computing, Layers and Types of Clouds, Desired Features of a Cloud, Cloud Infrastructure Management.	
Migrating into a Cloud: Introduction, The Promise of the Cloud, Cloud Service Offerings and Deployment Models: IaaS, PaaS, SaaS, Challenges in the Cloud, Broad Approaches to Migrating into the Cloud: Cloudonomics, Deciding on the Cloud Migration, The Seven-Step Model of Migration into a Cloud: Migration Risks and Mitigation, seven Step illustrations and Iteration, Conclusions.	

Unit – II	Contact Hours = 8 Hours
Cloud Computing Architecture: Introduction, Architecture, Infrastructure / Hardware as a Service , Platform as a Service, ,Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud.	

Unit – III	Contact Hours = 8 Hours
Virtualization: Introduction, Characteristics of Virtualized Environments, Taxonomy of Virtualization Techniques, Executing Virtualization, Other Types of Virtualization, Virtualization and Cloud Computing, Pros and Cons of Virtualization Technology with Examples.	

Unit – IV	Contact Hours = 8 Hours
Cloud Platforms in Industry: Amazon Web Services, Compute Services, Storage Services, Communication Services, Additional Services, Google AppEngine, Architecture and Core Concepts, Application Life-Cycle, Cost Model.	

Unit – V	Contact Hours = 8 Hours
Hardware-Enhanced Security for Cloud Computing: Introduction, Security Concerns, Approaches to Securing Cloud Computing, Hardware-Enhanced Security with HyperWall, HyperWall Architecture Summary, Trust Evidence. Further Research Directions.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	01	01	01	01	01

Unit No.	Self-Study Topics
1.	The Seven-Step Model of Migration into a Cloud
2.	Economics of the Cloud.

Books	
	Text Books:
1.	Rajkumar Buyya, James Broberg, Andrzej Goscinski.- Cloud Computing Principles and Paradigms - Wiley Series 2016
2.	Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, —Mastering Cloud Computing , Tata Mcgraw Hill, 2013.
3.	Sushil Jajodia · Krishna Kant, Pierangela Samarati · Anoop Singhal, Vipin Swarup · Cli-WangSecure Cloud Computing- Springer publication, 2019
	Reference Books:
1.	George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice), O'Reilly
2.	JJ Geewax - Google Cloud Platform in Action-Manning Publications Co. 2018
	E-resources :
1.	IBM Cloud Computing- http://www.ibm.com/cloud-computing/us/en/

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Interpret the main concepts, key technologies, strengths and limitations of cloud computing.	Re, Un	1,2,12	1,2
2.	Apply cloud computing services to the application of IoT.	Un, Ap	2,3	1,2

3.	Analyze various virtualization techniques.	An	2,3	1,2
4.	Apply the learnings through a course activity.	Ap	9,10	1

Scheme of Continuous Internal Evaluation (CIE):				
Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
3.	Question paper contains three parts A,B and C . Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓	✓											✓	✓	
2		✓	✓										✓	✓	
3		✓	✓										✓	✓	
4									✓	✓			✓		

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Cloud Computing Application Developer	IT	Android Application Developer

DISTRIBUTED COMPUTING SYSTEM

Course Code	22IS631	Course type	PEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course learning objectives	
1.	To learn the concepts of Distributed Systems.
2.	To understand File Sharing, Distributed File System implementation.
3.	To understand the concepts of Crypt analysis, Access control.
4.	To understand the concepts of Distributed Multimedia Systems.

Pre-requisites: Basics Computer Concepts, Operating Systems.

Unit – I	Contact Hours = 8 Hours
Characterization of Distributed Systems: Introduction, Examples of Distributed Systems, Challenges: Heterogeneity, Openness, Security, Scalability, Failure Handling. System Model: Architectural Models, Fundamental models. Case study : world wide web.	

Unit – II	Contact Hours = 8 Hours
Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication. Distributed Object and RMI: Introduction, Communication between Distributed Objects, RPC.	

Unit – III	Contact Hours = 8 Hours
Distributed File System: Introduction, File Service architecture. Security in distributed systems: Introduction, Overview of security techniques: Cryptography, Certificates, Access control. Cryptographic Algorithm: Symmetric: Ex Substitution algorithm. , Asymmetric: RSA	

Unit – IV	Contact Hours = 8 Hours
Time and Global states: clocks, Logical time and logical clocks, Global states. Coordination and Agreement: Introduction, Distributed mutual exclusion-The central server algorithm, A ring-based algorithm.	

Unit – V	Contact Hours = 8 Hours
Distributed Multimedia Systems: Introduction, Characteristics of multimedia data, Quality service management, resource management, stream adaption. Case study :BitTorrent.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Unit No.	Self-Study Topics
1	Fundamental models.
2	Events and Notifications.
3	Clocks,events and process states.

Books	
	Text Books:
1.	George Coulouris, Jean Dollimore, Tim Kindberg: Distributed Systems Concepts and Design, Pearson Education, Third edition.
2.	Dan Marinescu : Cloud Computing Theory and Practice, ELSEVIER.
	Reference Books:
	Name of the author(s), Title of the Book, Publisher, Edition/Year _____and onwards
1.	Kai Hwang, Geoffrey C, Fox, Jack J, Dongarra: Distributed and Cloud Computing From Parallel processing to the Internet of Things.
2.	Sunita Mahajan, Seema Shah: Distributing Computing, Published by Oxford University press 2010.
	E-resources: https://nptel.ac.in/courses/106106168/

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		Learning Level	PO(s)	PSO(s)
1.	Explain the importance of Distributed systems.	Un	1,10	2
2.	Explain the inter process communication and security in Distributed systems.	Un	1,10	2
3.	Describe File systems and Remote method invocation in Distributed systems.	Un	1,2,10	2
4.	Explain clocks, coordination and distributed multimedia systems.	Un	1,10	2
5	Apply the learning through a course activity.	Ap	9,10	1

Scheme of Continuous Internal Evaluation (CIE):				
Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.

3.	Question paper contains three parts A,B and C. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.
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CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓									✓					
2	✓									✓					
3	✓	✓								✓					
4	✓									✓					
5	✓	✓								✓					

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Concepts and Algorithms of distributed systems.	Network industry	Network programmer

AGILE SOFTWARE DEVELOPMENT

Course Code	22IS632	Course type	PEC	Credits L-T-P	3 – 0 – 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course learning objectives

1.	To understand the basics of Agile software development technologies.
2.	To apply principles of agile technologies in the real time problem solving.

Pre-requisites: Knowledge of software engineering fundamentals

Unit – I	Contact Hours = 8 Hours
Introduction: Why Agile? Understanding Success, Beyond Deadlines, The Importance of Organizational Success, Enter Agility, How to Be Agile?: Agile Methods, Don't Make Your Own Method, The Road to Mastery, Find a Mentor. The Genesis of Agile, Introduction and background, Agile Manifesto, and Principles, Simple Design, User Stories, Agile Testing, Agile Tools.	

Unit – II	Contact Hours = 8 Hours
Understanding XP: The XP Lifecycle, The XP Team, XP concepts, Adopting XP: Is XP Right for us ?Go!, Assess Your Agility. Overview of Extreme Programming, The Practices of Extreme Programming, Conclusion, Bibliography, Planning Initial Exploration, Release Planning, Iteration Planning, Defining "Done", Task Planning Iterating, Tracking.	

Unit – III	Contact Hours = 8 Hours
Practicing XP: Thinking: Pair Programming, Energized Work, Informative Workspace, Root Cause Analysis, Collaborating: Trust, Sit Together, Real Customer Involvement. Releasing: "Done Done", No Bugs, Version Control,.	

Unit – IV	Contact Hours = 8 Hours
Planning: Vision, Release Planning, The Planning Game, Risk Management, Iteration Planning, Slack, Stories, Estimating.	

Developing:

Incremental requirements, Customer Tests, Test-Driven Development, Refactoring, Simple Design, Incremental Design and Architecture, Spike Solutions, Performance Optimization.

Unit – V**Contact Hours = 8 Hours****Deliver Value:**

Exploit Your Agility, Only Releasable Code Has Value, Deliver Business Results, Deliver Frequently, Seek Technical Excellence: Software Doesn't Exist Design Is For Understanding, Design Trade-offs, Quality with a Name, Great Design.

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Books

	Text Books:
1.	James shore,Chromatic,O'Reilly,TheArtofAgileDevelopment,2007.
	Reference Books:
1.	KenSchawber,MikeBeedle,"AgileSoftwareDevelopmentwithScrum",Pearson,2008.
2.	Agile-Principles-Patterns-and-Practices-in-CbyRobertCMartin&MicMartin
	E-resources:
1.	https://www.nptelvideos.com/video.php?id=904 .
2.	https://www.youtube.com/watch?v=x90kIAFGYKE
3.	http://www.digimat.in/nptel/courses/video/110104073/L02.html
4.	https://onlinecourses.nptel.ac.in/noc19_mg30/preview https://www.edx.org/course/data-analytics-and-learning

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs):**Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**

At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Explain the fundamentals of Agile software development.	Un	2	1
2.	Apply principles of XP Programming in real time scenarios.	Ap	3, 4	2
3.	Compare Agile with the traditional software development.	An	4	2
4.	Apply the learnings through a course activity.	Ap	9,10	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.

-Lack of minimum score in IA test will make the student Not Eligible for SEE

-Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
3.	Question paper contains three parts A,B and C . Students have to answer - From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. - From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. - From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1		✓											✓		
2			✓	✓										✓	
3				✓										✓	
4									✓	✓			✓		

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Apply and adapt agile tools and techniques in the software development lifecycle from product ideation to deployment	IT sector	Software Engineer

INTRODUCTION TO SALESFORCE

Course Code	22IS633	Course type	PEC	Credits L-T-P	2 - 0 - 1
Hours/week: L - T- P	2 - 0 – 2			Total credits	3
Total Contact Hours	L = 30 Hrs; T = 0 Hrs; P = 20 Hrs Total = 50 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To introduce fundamentals of Salesforce and its components used for multiple domains
2.	To gain an understanding of the Salesforce terminologies and the different operations involved in constructing an informative system
3.	To develop ability to access or populate tables as an object in Salesforce database to create new processes based on the demands by users.
4.	Implement Salesforce Lightning tools and components providing solutions to real world problems.

Required Knowledge of: Database Management Systems(DBMS) and Enterprise Management

Unit – I	Contact Hours = 8Hours
Introduction to salesforce & related clouds: Getting Around the App, Salesforce Platform Basics: Get started with salesforce platform. Discover Use Cases for the Platform, Understand the Salesforce Architecture, Navigate Setup, Power Up with AppExchange, Data Model: Understand Custom & Standard Objects, Create Object Relationships, Work with Schema Builder, Lightning Experience: Get Your Bearings, Navigate Around, Work with List Views, Work with Your Data, Company-Wide Org Settings: Learn About Regional Settings, Discover Multiple Currency Settings	

Unit – II	Contact Hours = 8 Hours
Getting Profile Organization Ready for Users: Lightning Experience Productivity: Elevate Your Daily Productivity, Work with Notes and Files, Manage Your Tasks, Events, and Email, Find Your Stuff with Search, Collaborate with Feeds and Groups, Analyze Your Data with Reports and Dashboards, Configuring Search Settings: Choose the Right Search Solution, Optimize Search Results, Setting Up Chatter (Classic): Get Started with Chatter, Enable Feed Tracking, Create Publisher Actions, Approve Records from the Feed, Develop a Rollout Strategy, Support a New Business Unit: Manage User Access, Manage Chatter, Modify Your Data Model, Configure an Email Letterhead and Template, Automate Your Business Process, Mobile Access with Salesforce1	

Unit – III	Contact Hours = 8 Hours
Setting Up and Managing Users: Managing Users and Introduction to Data Security, Activity Management: Activities: Tasks, Events, and Calendars Documentation, Security and Data Access: Data Security, Who Sees What, Object Customizations: Creating Picklist and Picklist Administration, Creating Formula Fields and Validation Rule, Working with Page Layouts, Working with Record Types, Introduction to Business Process, Maintaining Data Quality, Managing Data: Import Wizards, Export Wizards, Use Data Loader To Export Data, Data Loader To Import.	

Unit – IV	Contact Hours = 8 Hours
Lightning Experience Customization: Customize the Lightning Experience user interface without writing any code, Reports and Dashboards: Introduction to Reports and Dashboards, Creating New Reports with the Report Builder, Running and Modifying Reports, Format Reports with Summary, Tabular, Matrix and Joined, Building Dashboards, Email Templates and Letterheads: Email Templates and Letterheads, Automation: Difference Between Workflow Rules and Process Builder, Process Builder, Lead Automation.	

Unit – V	Contact Hours = 8 Hours
Managing the Support Process: Managing and Resolving Cases, Customizing a Support Process, Automating Support, Understanding the Salesforce Console for Service, Collaborating in the Service Cloud, Analyzing Support Data, Lightning App Builder: Build custom pages for Lightning Experience and the Salesforce mobile app quickly with point-and-click tools.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom	2	2	2	2	2

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
I	1	Salesforce Trailhead account/ profile creating and customizing the interface
II	2	Create users & rights, Lightning Experience, Elevate Daily Productivity using tools, Notes and Files, Manage Your Tasks, Events, and Email
III	3	Introduction to Business Process: Who Sees What, Object Customizations: Creating Picklist and Picklist Administration, Creating Formula Fields and Validation Rule, Working with Page Layouts, Working with Record Types
IV	2	Lightning Experience Customization: Customize the Lightning Experience user interface without writing any code, Reports and Dashboards: Introduction to Reports and Dashboards, Creating New Reports with the Report Builder
V	2	Customizing a Support Process, Automating Support, Understanding the Salesforce Console for Service, Collaborating in the Service Cloud, Analyzing Support Data, Lightning App Builder

Unit No.	Self-Study Topics
1	Salesforce platform features and facilities available for business application development. A brief historical background towards customer relationship management (CRM)
2	Getting Profile Organization Ready for Users & Lightning Experience in salesforce
3	Salesforce business use-cases, modular approach to Project design and development
4	Salesforce clouds and interfaces for business development
5	Business support and customer relationship management for business continuity

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Understand the Salesforce terminologies to make use for products of different commodity	Re	1,2,12	1,2
2.	Describe the uses of Salesforce in the business world as a good promotional means for marketing the products.	Un	2,3,5	1,2
3.	Apply the techniques to retrieve the customer needs by means of Salesforce designs and options	Ap	3,4,5,10	1,2,3
4.	Categorize and build the solutions with suitable mode of representation for the domain requirements using the lightning trends.	Ap	3,4,6,9,	2,3

Books	
	Text Books:
1.	Paul Goodey-Salesforce CRM - The Definitive Admin Handbook, 4 th Edition- Packt Publishing © 2016
	Reference Books:
1.	Basics of salesforce- Salesforce Docs @salesforcedocs 19 Dec 2019
2.	Best Practices for Implementing Salesforce CRM- SalesforceDocs @ salesforcedocs 2019
3	Salesforce Solutions Help & Training by Bruce F. Magwn © 2012 Integration Technologies, Inc.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links.
1.	https://salesforce.trailhead.com

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Course End Project Demonstration & Viva
5.	Virtual Labs (if present)		

Scheme of Continuous Internal Evaluation (CIE):					
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test (COMPULSORY) will be part of the CIE. No SEE for Lab.					
THEORY (40 marks)		PROJECT (60 marks)			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks
- Theory IA test should be of one-hour duration. - Lab IA test should be of two/three-hour duration. - Project batch will ideally consist of 2 students (maximum of 3). - Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester. - Submitting Project report is compulsory.					
Eligibility for SEE: 1. 40% and above (16 marks and above) in theory component 2. 40% and above (24 marks and above) in project component 3. Not eligible in any one of the two components will make the student Not Eligible for SEE					

Semester End Examination (SEE):			
1.	It will be conducted for 100 marks having 3 hours duration.		
2.	Lab Open ended program/problem/experiment Write-up & execution (1 open ended expt.)- (20 algorithm and flowchart + 20 marks write-up method / mode + 10 marks) execution)	50 marks	100 marks
	Project evaluation a. Initial write up stating the objectives, methodology and the outcome	10 marks	
	b. Hardware project: Exhibiting and demonstration of working of Project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project.	30 marks	
	c. Viva-voce	10 marks	
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.		
4.	SEE will be conducted in project batches by Internal & External examiners together.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓	✓										✓	✓	✓	-
2		✓	✓		✓								✓	✓	-
3			✓	✓	✓					✓			✓	✓	✓
4			✓	✓		✓			✓					✓	✓

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Skills of customer relationship management	IT Industry	Business Administrator
2	Architect, Business process automations	Commercial Domain	Consultant

OPERATIONS RESEARCH

Course Code	22IS634	Course type	PEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course Learning Objectives	
1.	To introduce the basic concepts and techniques of Operations Research.
2.	To provide knowledge and skills to formulate and solve optimization problems using mathematical models.
3.	To familiarize with various optimization techniques and algorithms applicable to engineering problems.

Pre-requisites: Basic knowledge of mathematics.
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Unit – I	Contact Hours = 8 Hours
Introduction to Operations Research: Overview of Operations Research, History and development of Operations Research, Scope and applications in Computer/Information Science and Engineering, Introduction to modeling and optimization.	

Unit – II	Contact Hours = 8 Hours
Linear Programming: Formulation of linear programming problems, Graphical method for solving LP problems, Simplex method and its variants, Duality theory and sensitivity analysis, Applications of LP in resource allocation, production planning, and transportation problems.	

Unit – III	Contact Hours = 8 Hours
Integer Programming : Introduction to integer programming, Formulation of integer programming problems, Branch and bound algorithm, Applications in project scheduling, network design/optimization, facility location problems and resource allocation.	

Unit – IV	Contact Hours = 8 Hours
Network Optimization: Introduction to network optimization problems, Shortest path problems, Minimum spanning tree, Maximum flow problems, Applications in Network Design and Routing. Nonlinear Optimization: Introduction to nonlinear optimization, Unconstrained optimization methods (gradient descent, Newton's method), Constrained optimization and Lagrange multipliers, Applications in machine learning and data fitting.	

Unit – V	Contact Hours = 8 Hours
Queuing Theory: Introduction to Queuing Systems, Characteristics of Queues, Markovian Queues, Applications in Computer Networks and System Design Dynamic Programming: Introduction to dynamic programming, Principle of optimality, Bellman's principle and Bellman equations, Applications in sequence alignment, shortest path problems, and resource allocation.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Books	
	Text Books:
1.	Taha.H.A , "Operation Research : An Introduction", McMilan publishing Co., 1982. 7th edition onwards.
	Reference Books:
1.	Hillier.F.S & Liberman.G.J, "Operation Research", Second Edition onwards, Holden Day Inc, 1974.
2.	S.D.Sharma, , Kedarnath, Ramnath, "Operations Research" 2015 onwards
3.	Winston, Wayne L, "Operations Research Applications".
	E-resources:
1.	https://onlinecourses.swayam2.ac.in/cec24_ma05/preview
2.	https://www.coursera.org/learn/operations-research-modeling

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to (Highlight the action verb representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr – Create		Learning Level	PO(s)	PSO(s)
1.	Explain the history, development, and scope of Operations Research.	Un	1	1

2.	Formulate and solve problems from real-world scenarios using different techniques.	Ap	1,2	1
3.	Analyze and solve network optimization problems, Queuing Systems and Dynamic Programming Problems	An	1,2	1
4.	Apply the learnings through a course activity.	Ap	9,10	1

Scheme of Continuous Internal Evaluation (CIE):				
Components	Addition of two IA tests	Two Assignments – (Open/Industry/ Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours' duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
3.	Question paper contains three parts A, B and C. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓												✓		
2	✓	✓											✓		
3	✓	✓											✓		
4	✓	✓											✓		
5									✓	✓			✓		

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Analytical skills , Critical-thinking skills , Problem-solving skills.	Logistics, healthcare, manufacturing, finance etc.	Operations Research Analysts

COMPLIER DESIGN

Course Code	22IS635	Course type	PEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	5 Hours			SEE Marks	100

Course learning objectives

1.	To familiarize the structure of a compiler and activities of different phases of compilation process.
2.	To provide an insight into the design strategy for front end of a compiler.
3.	To learn to implement code generator.

Pre-requisites: Basic knowledge Formal languages and Automata theory

Unit – I

Contact Hours = 8 Hours

Introduction and Lexical Analysis

Overview of the Translation Process, A Simple Compiler, Difference between interpreter, assembler and compiler. Types of Compiler, The Phases of a Compiler.

Lexical Analysis: The Role of Lexical Analyzer, Input Buffering, Specifications of tokens, Recognition of Tokens.

Unit – II

Contact Hours = 8 Hours

Syntax Analysis-1:

Introduction, Context free Grammar, Writing Grammar, ambiguity, associativity, precedence, Un ambiguous Grammars, Top-down Parsing.

Unit – III

Contact Hours = 8 Hours

Syntax Analysis-2:

Bottom-up Parsing, Simple LR, More Powerful LR Parsers (upto constructing LALR parsing tables)

Unit – IV

Contact Hours = 8 Hours

Syntax Directed Translation and Intermediate Code Generation:

Syntax Directed Translation: Syntax-directed Definitions, Evaluation Order for SDD, Application of Syntax-directed translation: Construction of Syntax trees(Only S-attributed SDD).

Intermediate Code Generation: Intermediate Languages, Declarations, Assignments.

Unit – V	Contact Hours = 8 Hours
Code Generation Issues in the design of code generator, the target language, Basic blocks and Flow graphs, optimization of basic blocks, a simple code generator.	

Flipped Classroom Details:

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Unit No.	Self-Study Topics
1	Applications of compiler technology.
2	Intermediate Code Generation: Boolean Expressions.

Books	
	Text Books:
1.	Alfred V Aho, Monica S. Lam, Ravi Sethi, Jeffrey D Ullman- Compilers- Principles, Techniques and Tools”, 2/E, Addison-Wesley, 2007 onwards.
	Reference Books:
1.	Andrew W Apple,” Modern Compiler Implementation in C”, Cambridge University Press,1997 onwards.
	E-resources
1.	https://onlinecourses.nptel.ac.in/noc21_cs07/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Analyze and categorize the given grammar to build suitable parser.	Un	1,2, 5, 10	1
2.	Apply the concept of syntax directed translation schemes to aid intermediate code generation.	An	1,2,3,5,10	1
3.	Develop intermediate code for any high level construct and generate optimized target code .	Un, Ap	1,3, 5,10	1,2

4.	Utilize Compiler design to build software considering real world problem.	Ap	1,3,5,10	1,2
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Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments– (Open/Industry/Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.
 -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
 -Lack of minimum score in IA test will make the student Not Eligible for SEE
 -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
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CO-PO Mapping(planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓	✓			✓					✓			✓		
2	✓	✓	✓		✓					✓			✓		
3	✓		✓		✓					✓			✓	✓	
4	✓		✓		✓					✓			✓	✓	

Sl No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Communication, Design skills, usage of Tools	System Software, Tools operations	Software Design

INTRODUCTION TO DATA STRUCTURES

Course Code	22IS641	Course type	OEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	5 Hours			SEE Marks	100

Course learning objectives	
1.	To introduce elementary data structures.
2.	To provide an insight to linear and nonlinear data structures and their applications.
3.	To provide understanding of selection of appropriate data structures for given problem scenarios.

Pre-requisites: C Programming

Unit – I	Contact Hours = 8 Hours
Introduction to Data Structures: Introduction to data structures, Characteristics of data structures, types of data structures Arrays: Introduction, Types of arrays, Representation of 1-D array in memory, Array Traversal, Insertion and deletion, Sorting and Searching, 2-D arrays, Matrix Operations.	

Unit – II	Contact Hours =7 Hours
Linear Data Structures-Stacks: Introduction, Stack representation in Memory, Stack Operations, Stack Implementation.	

Unit – III	Contact Hours = 7 Hours
Linear Data Structures-Queues: Introduction, Queues-Basic concept, Logical representation of Queues, Queue Operations, Queue Implementation, Circular Queues.	

Unit – IV	Contact Hours = 8 Hours
Linked Lists: Introduction, Linked list-Basic Concept, Implementation, Types of linked lists, Circular linked list Doubly linked list.	

Unit – V	Contact Hours = 10 Hours
Non Linear Data Structures: Trees: Introduction, Basic concept, Binary Tree, Binary Tree Representation, Binary Tree Traversal, Binary Search tree, Expression Trees. Heaps: Min Heap and Max Heap and their applications.	

Flipped Classroom Details:

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Books	
	Text Books:
1.	E. Balguruswamy, Data Structures, McGraw Hill Education(india) Private Limited.
2.	Langsam, Augenstein and Tenenbaum—Data Structures using C and C++, Prentice Hall India, Second edition and onwards.
	Reference Books:
1.	Ellis Horowitz, Sarataj Sahani, Fundamentals of Data Structures, Computer Science Press, Second edition and onwards.
	E-resources :
1.	1. https://nptel.ac.in/courses/106/102/106102064/
2.	https://www.edx.org/course/introduction-to-data-structures

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Define and discuss basics of linear and nonlinear data structures and their applications.	Un	1,10	1
2.	Discuss advantages and disadvantages of specific data structure.	Un	1,3,10	1
3.	Justify the use of dynamic memory blocks for design and development of different data structures.	Ap	1,3,10	2
4.	Apply appropriate data structures for solving world problems and demonstrate the same through course activities.	Ap	1,3,5,9,10	2

Scheme of Continuous Internal Evaluation (CIE):				
Components	Addition of two IA tests	Two Assignments (Open / Industry/ Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
3.	Question paper contains three parts A, B and C. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓									✓			✓		
2	✓		✓							✓			✓		
3	✓		✓							✓				✓	
4	✓		✓		✓				✓	✓				✓	

Sl. No.	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Design and implementation of efficient software as per user requirements	IT Sector/Software Industry	Software Engineer

INTERNET OF THINGS- A PRACTICAL APPROACH

Course Code	22IS642	Course type	OEC	Credits L-T-P	2-0-1
Hours/week: L - T- P	2 - 0 - 2			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course learning objectives	
1.	To design embedded system using microcontroller and peripheral circuit
2.	To demonstrate technique of interfacing the sensors and actuators with IoT development boards

Required Knowledge of: Basic electronics.

Unit – I	Contact Hours = 8 Hours
Embedded Computing: Introduction, Complex Systems and Microprocessors, Embedded Systems Design Process.	

Unit – II	Contact Hours = 8 Hours
Introduction To Internet of Things: Definition and Characteristics of IoT, physical design of IoT, IoT Protocols, IoT communication models, , IoT Levels and Templates.	

Unit – III	Contact Hours = 8 Hours
Prototyping IoT: IoT Key Features, Advantages & Disadvantages, Hardware: Sensors, Smart Wearable Devices, Standard Devices. Software, Technology & Protocols. Domain Specific IoTs: Home Automation.	

Unit – IV	Contact Hours = 8 Hours
IoT Architecture and Protocols: Architecture Reference Model- Introduction Protocols- 6LowPAN, RPL, CoAP, MQTT.	

Unit – V	Contact Hours = 8 Hours
Case Study: System design of Moving Map Requirements Analysis of a GPS Moving Map, Specification, Architecture design, Designing hardware and software components, System integration, Formalisms for system design, Structural description, Behavioral description.	

Flipped Classroom Details:

Unit No.	I	II	III	IV	V
No. of flipped Classroom Sessions	1	1	1	1	1

List of Experiments:

Unit No.	No. of Experiments	Topic(s) related to Experiment
I	2	Blinking LED / LEDs Controlling electromagnetic relay / relays
II	2	Temperature sensor. Humidity sensor.
III.	2	PIR Human Motion Detection. Ultrasound distance Measurement.
IV	1	Bluetooth module – wireless connectivity.
V	1	Device and web / cloud connectivity.

Unit No.	Self-Study Topics
1	IoT Key Features, Advantages & Disadvantages, Hardware: Sensors, Smart Wearable Devices, Standard Devices. Software
2	CPU Power Consumption.
3	Basics of Sensors and actuators.
4	Device Discovery capabilities – Registering a device, De-register a device, Querying for devices, Intel IoTivity, XMPP Discovery extension.

Books	
	Text Books:
1.	Wayne Wolf: Computers as Components, Principles of Embedded Computing Systems Design, 2nd Edition, Elsevier, 2008.
2.	Arshdeep Bahga, Vijay Madisetti, “Internet of Things (A Hands-on-Approach)” , 1st Edition, VPT, 2014.
3.	Internet of Things Quick Guide – PDF https://www.tutorialspoint.com/internet_of_things/internet_of_things_quick_guide.htm
	Reference Books:
1.	Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.
2.	Marco Schwartz, “Internet of Things with Arduino: Build Internet of Things Projects With the Arduino Platform”
	E-resources:
1.	https://blp.ieee.org/courses/sensor-networks-for-internet-of-things/

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Assignment (OA)/ Lab Project/ Industry assignment/Certification/ Course project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs		

Course Outcome (COs)

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Explain and Apply domain specific knowledge for developing IoT application.	Un, Ap	2,3,5	1
2.	Explain and Apply skills of interfacing sensors and actuators to develop IoT applications.	Un, Ap	2,3,5	1
3.	Analyze various web IoT web services.	An	2,3,5	1
4.	Apply the learnings through a course activity.	Ap	9,10	3

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab.**

THEORY (40 marks)		PROJECT (60 marks)			Total
IA test (Theory)	IA test (Lab)	Project Phase 1	Project Phase 2	Project report	
25 marks	15 marks	25 marks	25 marks	10 marks	100 marks

-Theory IA test should be of one-hour duration.

-Lab IA test should be of two/three-hour duration.

-Project batch will ideally consist of 2 students (maximum of 3).

-Project Phase 1 presentation will be conducted after 6 weeks and Project Phase 2 presentation will be conducted after 13 weeks from the start of the semester.

-Submission of Project report is compulsory.

Eligibility for SEE:

1. 40% and above (16 marks and above) in theory component

2. 40% and above (24 marks and above) in project component

3. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Semester End Examination (SEE):

1.	It will be conducted for 100 marks having 3 hours duration.		
	Lab Open ended program/problem/experiment Write-up & execution (1 open ended expt)- (20 marks write-up + 20 marks algorithm/flowchart + 10 marks execution)	50 marks	

2.	Project evaluation a. Initial write up stating the objectives, methodology and the outcome b. Hardware project: Exhibiting and demonstration of working of project. Software project: Demonstration of the programming capabilities by writing flowchart, algorithm and codes related to a section of the project. c. Viva-voce	10 marks 30 marks 10 marks	100 marks
3.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.		
4.	SEE will be conducted in project batches by Internal & External examiners together.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1		✓	✓		✓								✓		
2		✓	✓		✓								✓		
3		✓	✓		✓								✓		
4									✓	✓					✓

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	IoT application design skills	Telecommunication	Project manager
2	Networking	Automobiles	Network Designer

INTRODUCTION TO BIG DATA

Course Code	22IS643	Course type	OEC	Credits L-T-P	3 - 0 - 0
Hours/week: L - T- P	3 - 0 - 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 00 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course Learning Objectives:	
1.	To understand Big Data technology and its use in processing huge commercial data
2.	To recognize Hadoop components for data analytics
3.	To be able to analyze data with Spark
4.	To apply data transformation tools

Required Knowledge: Relational Database Management System and basics of Programming language.

Unit – I: Understanding Big Data	Contact Hours = 8 Hours
Introduction: Introduction to Big Data, Characteristics of Data and Big Data, Evolution of Big Data, Definition of Big Data, Challenges with big data, Why Big data? Data Warehouse environment, Traditional Business Intelligence versus Big Data. State of Practice in Analytics, Key roles for New Big Data Ecosystems, Examples of Big Data Analytics. (Text Book 1: Chap 1,2 & Text Book 2: Chap. 1)	

Unit – II: All About Hadoop	Contact Hours = 8 Hours
Just the Facts: The History of Hadoop; Components of Hadoop: The Hadoop Distributed File System, The Basics of MapReduce, Hadoop Common Components; Getting Data into Hadoop: Basic Copy Data, Flume (Text Book 1: Chap.4)	

Unit – III: MapReduce	Contact Hours = 8 Hours
Data Format, Analyzing the Data with Hadoop, Scaling out, Hadoop Streaming; How MapReduce Works: Anatomy of a MapReduce Job Run, Failures, Job Scheduling, Shuffle and sort (Text Book 3: Chap. 2, 6)	

Unit-IV: Introduction to Data Analysis with Spark	Contact Hours = 8 Hours
What is Apache Spark?; A unified stack; Who uses Spark, and for what?; Introduction to core spark concepts; Standalone applications (Text book 4: Chap 1,2)	

Unit-V: Programming with RDDs	Contact Hours = 8 Hours
RDD Basics; Creating RDDs; RDD operations; Passing functions to Spark; Common Transformations and actions; Persistence(caching) (Text book 4: Chap 3,4)	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Unit No.	Self-Study Topics
1	Introduction & Characteristics of NoSQL, Types of NoSQL Data Models
2	Introduction and classification of Big data analytics and Enterprise Class Hadoop
3	Task Execution in MapReduce

Books	
	Text Books:
1.	Paul C. Zikopoulos Chris Eaton Dirk deRoos Thomas Deutsch George Lapis- Understanding Big Data-Analytics for Enterprise Class & Hadoop and Streaming Data - McGraw-Hill Companies Copyright © 2018
2.	Seema Acharya, Subhashini Chellappan- Big Data & Analytics 2 nd Edition - Wiley Publishing Copyright ©2016
3.	Tom White- Hadoop: The Definitive Guide- 5 th Edition - O'Reilly Apr '23
4.	Andy Konwinski, Patrick Wendell, Holden Karau, Matei Zaharia-Learning Spark- Lightning-Fast Data Analysis- O'REILLY 2 nd Edition
	References:
1	Newton & Richard- Project management step by step: how to plan and manage a highly successful project: Willy's Publication 2020
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://nptel.ac.in/courses/106/104/106104189/

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)				
Learning Levels: 1- Remember; 2- Understand; 3- Apply; 4 - Analysis; 5 - Evaluate; 6- Create				
At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Explain Big Data and describe Characteristics useful in different fields of computations.	Re	1,12	1,2,3

2.	Interpret significance of Big Data as NoSQL non-tabular databases by learning Hadoop components and HDFS	Un	2,4,5	1,2, 3
3.	Make use of MapReduce component in Big data Processing	Ap	4, 5	1,2,3
4.	Analyze the real world dataset using Spark tool	An	1,2,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments – (Open /Industry/Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10+10 =20	20 mark (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be > 35%, however overall score of CIE + SEE should be > 40%.
3.	Question paper contains three parts A,B and C. Students have to answer

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
C O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	P O 10	P O 11	P O 12	PSO 1	PSO 2	PSO 3
1	√											√	√	√	√
2		√		√	√								√	√	√
3				√	√								√	√	√
4	√	√										√	√	√	√

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the Course
1	Big data management & its associated applications in intelligent business and scientific computing	Telecommunications, Advertising and marketing, transportation	Data Scientists Analytics Managers/Directors
2	Acquire fundamental data analytical techniques using Hadoop, Map Reduce, NoSQL	Banking and Financial Services, Government, Media and Entertainment	Business Analysts Big Data Architects
3	Interpret business models, apply software tools to big data analytics.	Meteorology, Healthcare Cyber security, Education	NoSQL DBAs Hadoop Experts

INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Course Code	22IS644	Course type	OEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	05 Hours			SEE Marks	100

Course learning objectives

1.	To understand the fundamental concepts and principles of Artificial Intelligence and Machine Learning.
2.	Explore various supervised and unsupervised learning algorithms and their usage in solving problems related to the current scenario.
3.	To learn designing, training, and evaluating deep learning models.

Pre-requisites: NIL

Unit – I

Contact Hours = 8 Hours

Introduction to AI. What is AI, Foundations of AI, Early history of AI, Future of AI, Intelligence of AI. Brain size and performance, sensing and movement, Comparative Intelligence.

Unit – II

Contact Hours = 8 Hours

Introduction to Machine Learning, What and why ?, Types of Machine Learning, Supervised and Unsupervised, Reinforcement Learning, Theory of learning , Feasibility of learning , error and noise , Training versus testing.

Unit – III

Contact Hours = 8 Hours

Supervised Learning- Linear and non linear examples, Linear regression ,Naïve Bayes classifier, decision Trees, KNN classifier, Support Vector Machines. Clustering basics, K-means Clustering, self-organizing maps.

Unit – IV

Contact Hours = 8 Hours

Fundamentals of Neural Networks - neuron, activation functions, loss functions, Introduction to Image Processing.

Unit – V	Contact Hours = 8 Hours
Deep Learning CNN - CNN fundamentals, CNN layers, building CNN from scratch, transfer learning. Deep Learning RNN - RNN fundamentals, RNN layers.	

Flipped Classroom Details:

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Unit No.	Self-Study Topics
III	Linear Algebra, Principle Component Analysis.
IV	Back propagation.

Books	
	Text Books:
1.	Kevin Warwick, "Artificial Intelligence the basics", Typeset in Bembo by Wearset Ltd, Boldon, Tyne and Wear, Library of Congress Cataloging in Publication Data Warwick,K. ISBN: 978-0-415-56482-3 (hbk).
2.	Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
3.	Ethem Alpaydin, Introduction to Machine Learning, MIT Press, Pearson, Third Edition, 2014.
4.	"Deep Learning" by Ian Goodfellow, Yoshua Bengio and Aaron Courville
	Reference Books:
1.	Peter Flach, "Machine Learning: The Art and Science of Algorithms that Make Sense of Data", Cambridge University Press, 2012.
	E-resources
1.	https://www.udemy.com/artificial-intelligence
2.	https://www.edx.org/course/artificial-intelligence-ai-columbiacx-csmm-101x-4
3.	https://in.mathworks.com/
4.	https://www.classcentral.com/course/independent-practical-deep-learning-for-coders-7887

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs) Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Explain and apply AI and ML algorithms to address various requirements of real-world problems.	Un, Ap	1,2,3	1
2.	Use modern tools to create AI and ML solutions and Analyze the results.	Ap ,An	1,2,3,5	1,2
3.	Develop practical AI solutions for real world problems to demonstrate effective teamwork , communication and problem solving skills in AI Project.	Ap	3,4,5,9,10,12	1,2

Scheme of Continuous Internal Evaluation (CIE):				
Components	Addition of two IA tests	Two Aassignments – (Open /Industry/Certification etc.)	Course project (CP)/ Case study etc.	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
3.	Question paper contains three parts A,B and C . Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
C O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓	✓	✓										✓		
2	✓	✓	✓										✓	✓	
3			✓	✓	✓				✓	✓		✓			
5															

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	A good understanding of what AI and ML is, its applications, and its use cases	Healthcare, Education, Manufacturing, Marketing, Retail	AI Engineer, AI Data Analyst

LINEAR ALGEBRA

Course Code	22MAT661	Course type	OEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives

This course will enable students to:

1.	Basics in Abstract Algebra.
2.	Find the solution of the system of linear equations using matrix operations.
3.	Identify vector spaces and subspaces
4.	Transform a vector space of one dimension into another
5.	Factorize a given matrix using different methods

Pre-requisites: Basic algebra. Matrix theory

Unit – I	Contact Hours = 8 Hours
Basic Abstract Algebra: Groups, Permutation Groups, Isomorphism, Fields, finite fields and examples.	

Unit – II	Contact Hours = 8 Hours
Vector Spaces: Vector spaces; subspaces; bases and dimension; coordinates; summary of row-equivalence; computations concerning subspaces.	

Unit – III	Contact Hours = 8 Hours
Linear Transformations: Linear transformations; algebra of linear transformations; isomorphism; representation of transformations by matrices; linear functional; Inverse of a linear transformation.	

Unit – IV	Contact Hours = 8 Hours
Inner Product Spaces: Inner products; inner product spaces; orthogonal sets and projections; Gram-Schmidt process; QR-factorization.	

Unit – V	Contact Hours = 8 Hours
Symmetric Matrices and Quadratic Forms: Diagonalization; quadratic forms; constrained optimization; Singular value decomposition.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. of Flipped Classroom Sessions	2	2	2	2	2

Unit No.	Self-Study Topics
1	Fields and Rings with examples
2	Rank, nullity, Column space, Row space
3	Kernel of transformation, Inverse linear transformation
4	Applications of orthogonal vectors.
5	Least square solution of linear system of equations.

Books	
	Text Books:
1.	John B. Fraleigh, "A First Course in Abstract Algebra," Narosa Publication 3rd edition onwards.
2.	David C. Lay, "Linear Algebra and its Applications," Pearson Education (Asia) Pte. Ltd, 2005 3rd edition onwards.
3.	Kenneth Hoffman and Ray Kunze, "Linear Algebra," Pearson Education (Asia) Pte. Ltd/2004 2nd edition onwards.
	Reference Books:
1.	Bernard Kolman and David R. Hill, "Introductory Linear Algebra with Applications", Pearson Education (Asia) Pte. Ltd, 7th edition 2003 onwards.
2.	Gilbert Strang, "Linear Algebra and its Applications", Thomson Learning Asia, 2003 3rd edition onwards.
	E-resources:
1.	https://onlinecourses.nptel.ac.in/noc24_ee138/preview
2.	https://onlinecourses.nptel.ac.in/noc24_ma69/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	4.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Understand of algebraic structures.	Un	1	1
2.	Find bases and dimension of vector spaces.	Ap	1	1
3.	Understand the matrix theory in Linear transformation and applications	Un	1	1
4.	Apply techniques of constrained optimization and singular value decomposition for problems arising in power/control system analysis, signals and systems.	Ap	1	1

Components	Addition of two IA tests	Two Assignments– (Open/Industry/Certification etc)	Course project(CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

- Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.
- Lack of minimum score in IA test will make the student Not Eligible for SEE
- Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.

Scheme of Semester End Examination (SEE)	
1	It will be conducted for 100 marks of 3 hours duration.
2	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
3	Question paper contains three parts A,B and C. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

[illegible]

APPLIED STATISTICS

Course Code	22MAT662	Course type	OEC	Credits L-T-P	3 – 0 – 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	Understand different terminology in statistics
2.	Get knowledge about various Dispersion parameters moments skewness
3.	Get familiar with Multiple Correlation and Regression
4.	Get acquainted with various Analysis of Variance (ANOVA) designs .One way and two way .
	Understand Non Parametric Tests processes.

Pre-requisites : : Basic statistics, Basic probability
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Unit – I	Contact Hours = 8 Hours
Descriptive Statistics: Discrete and continuous data, Simple descriptive statistics - Mean, Median, Quantiles, percentiles, and quartiles, Variance, and standard deviation, Standard errors of estimates, Inter quartile range. Graphical statistics - Histogram, frequency polygon, and ogives, Stem-and-leaf plot, Box plot, Scatter plots, and time plots.	

Unit – II	Contact Hours = 8 Hours
Moments, Skewness and Kurtosis: Introduction to moments, Moments about the mean, Skewness , Negative Skewness , Positive Skewness, Kurtosis, Mesokurtic, Leptokurtic, Platykurtic -Practical, engineering related examples	

Unit – III	Contact Hours = 8 Hours
Multiple Correlation and Regression, Curve fitting: Multiple correlation and regression. Bivariate, Trivariate. Probable error of correlation coefficient. Spearman's rank correlation coefficient. Curvilinear regression. Standard error of estimate or residual variance. Least square Curve fitting and related error computation.Engineering related examples	

Unit – IV	Contact Hours = 8 Hours
Analysis of Variance (ANOVA): The Purpose of Analysis of Variance. One_ Way Classification. Variation within treatments. Variation between treatments. Total Variation. Expected values of the variation. Distribution of variations' ANOVA Tables. Two-way classification Variations for two-way classification. Experiments with replication. Experimental Design	

Unit – V	Contact Hours = 8 Hours
Non Parametric Tests: Introduction The Sign Test. The Mann-Whitney U Test. The Kruskal- Wallis H Test corrected for Ties. The run test for randomness. Further Applications of the Run test. Spear man's Rank Correlation	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Unit No.	Self-Study Topics
1	Percentile ranks, quartile ranks.
2	Skewness and Kurtosis in Data Science.
3	Multiple regression in Machine Learning.
4	Calculate ANOVA using MS excel.
5	Wilcoxon's signed rank test, Kolmogorov-Smirnov test, Jonckheer test

Books	
	Text Books:
1.	B. S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42 nd Edition, 2012 and onwards.
2.	Fundamentals of Mathematical Statistics by S.C.Gupta and V.K.Kapoor., Sultan Chand and Sons, 2009 and onwards.
	Reference Books:
1.	Probability and statistics Schaum series second edition TAT Mc Graw Hill publication
2.	R Ganeshan -Research Methodology MJP Publishers
	E-resources:
1.	https://archive.nptel.ac.in/courses/111/102/111102111/ (Prob and Stochastic)
2.	https://archive.nptel.ac.in/courses/111/104/111104147/ (Sampling and Linear regression)

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Assignment (OA)/ Certification
4.	Online classes	4.	Course Project
		5.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	To Understand different measures of Statistics	Un	1	1
2.	To Understand the concept Moments, Skewness and Kurtosis	Un	1	1
3.	To Apply methods of Multiple Correlation & Regression, Curve fitting and Analysis of Variance(ANOVA) for tabular data.	Ap	1	1
4.	To Understand the Non Parametric Tests	Un	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments– (Open/Industry/ Certification etc)	Course project(CP) / Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100

-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks.

-Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests.

-Lack of minimum score in IA test will make the student Not Eligible for SEE

-Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.

Scheme of Semester End Examination (SEE)	
1	It will be conducted for 100 marks of 3 hours duration.
2	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
3	Question paper contains three parts A, B and C. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

[illegible]

NANOSCIENCE AND NANOTECHNOLOGY

Course Code	22CH641	Course type	OEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives

1.	To provide a comprehensive overview of synthesis and characterization of nanoparticles, nanocomposites and hierarchical materials with nanoscale features.
2.	To provide the engineering students with necessary background for understanding various nanomaterials characterization techniques
3.	To develop an understanding of the basis of the choice of material for device applications
4.	To give an insight into complete systems where nanotechnology can be used to improve our everyday life

Pre-requisites: NIL

Unit – I	Contact Hours = 8 Hours
Nanotechnology, Frontier of future-an overview, Length Scales, Variation of physical properties from bulk to thin films to nanomaterials, Confinement of electron in 0D, 1D, 2D and 3D systems Synthesis of Nanomaterials: Bottom-Up approach: Chemical Routes for Synthesis of nanomaterials- Sol-gel, Precipitation, Solution Combustion synthesis, SILAR Technique, Hydrothermal method. LABORATORY ACTIVITIES PLANNED 1) Preparation of silver nanoparticles and characterization of particle size by optical spectroscopy 2) Preparation of ZnO nanoparticles by combustion technique 3) Preparation of Al₂O₃ nanoparticles by precipitation method 4) Preparation of Silica nanoparticles by sol-gel method 5) Hydrothermal synthesis of metal oxide nanoparticles	

Unit – II	Contact Hours = 8 Hours
Basic principles and instrumentations of Electron Microscopy –Transmission Electron Microscope, Scanning Electron Microscope, Scanning Probes- Scanning Tunneling microscope, Atomic Force Microscope –different imaging modes, comparison of SEM and TEM, AFM and STM, AFM and SEM, Porosity (BET method), Zeta potential Basic principles of working of X-ray diffraction, derivation of Debye-Scherrer equation, numericals on Debye Scherrer equation,	

Unit – III	Contact Hours = 8 Hours
Electronic and optoelectronic properties: Explanation of Ballistic transport-comparison with superconductor, Coulomb blockade-property-in quantum dot circuit/single electron transistor, Diffusive transport Dielectric Properties: Polarization, Ferroelectric Behaviour Optical Properties: Photoconductivity, Optical absorption and transmission, Plasmons and Excitons, Luminescence- Phosphorescence and Fluorescence.	

Unit – IV	Contact Hours = 8 Hours
Solar cells: First generation, Second generation and third generation solar cells: Construction and working of Dye sensitized and Quantum dot sensitized solar cells. Batteries: Lithium ion battery- working, Requirements of anodic and cathodic materials, classification based on ion storage mechanisms, limitations of graphite anodes, Advances in Cathodic materials, Anodic materials, Separators Fuel Cells: Introduction, construction, working of fuel cells and nanotechnology in hydrogen storage and proton exchange membranes	

Unit – V	Contact Hours = 8 Hours
Switching glasses, Semiconductor devices including LEDs and Photonic crystals (1D, 2D and 3D) and their applications, Display devices TiO₂ and ZnO based photo catalysts, Photocatalysis Mechanism, Nano filtration membranes-Dead end filtration method, Super hydrophobic materials-Lotus effect	

Flipped Classroom Details:

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Unit No.	Self-Study Topics
1.	Top-Down approach- Ball milling technique, Sputtering, Laser Ablation.
2.	Optical Spectroscopy- Instrumentation and application of IR, UV/VIS (Band gap measurement)
3.	Magnetic properties: Nanomagnetism, Magnetoresistance, Super Para Magnetism-Neel Relaxation time, blocking temperature etc. Mechanical Properties of nanomaterials
4.	Super capacitors: Introduction, construction and working of supercapacitor
5.	Nanosensors: Electrochemical sensors, Temperature Sensors, Chemical and gas Sensors, Light and radiation sensors.

Books	
	Text Books:
1.	Nano Materials – A.K. Bandyopadhyay/ New Age Publishers
2.	Nanocrystals: Synthesis, Properties and Applications – C.N.R. Rao, P. John Thomas and G. U. Kulkarni, Springer Series in Materials Science
3.	Nano Essentials- T. Pradeep/TMH

	Reference Books:
1.	Introduction to Nanotechnology, C. P. Poole and F. J. Owens, Wiley, 2003
2.	Understanding Nanotechnology, Scientific American 2002
3.	Nanotechnology, M. Ratner and D. Ratner, Prentice Hall 2003
4.	Nanotechnology, M. Wildon, K. Kannagara, G. Smith, M. Simmons and B. Raguse, CRC Press Boca Raton 2002

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	4.	Semester End Examination

Course Outcome (COs)

Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Demonstrate the synthesis of nanoparticles by various techniques.	[L2]	1	1
2.	Explain working of basic instruments used in characterization of nanoparticles.	[L2]	1	1
3.	Discuss the application of nanotechnology to mechanical and civil domains	[L2]	1,4	1
4.	Classify the nanomaterials based on the dimensions.	[L3]	1	1
5.	Assess the suitability of nanomaterials for various device applications.	[L4]	1,6,12	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments (Open/Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of at least 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.

3.	Question paper contains three parts A,B and C. Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.
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CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	✓														
2	✓														
3	✓			✓											
4	✓														
5	✓					✓						✓			

MARKETING MANAGEMENT

Course Code	22INT61	Course type	OEC	Credits L-T-P	3 – 0 - 0
Hours/week: L - T- P	3 – 0 – 0			Total credits	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To make students understand the fundamental concepts of marketing and environment in which marketing system operates.
2.	To gain knowledge on consumer buying behavior and influencing factors
3.	To describe major bases for segment marketing, target marketing, and market positioning.
4.	To develop a Conceptual framework, covering basic elements of the marketing mix.
5.	To understand fundamental premise underlying market driven strategies and hands on practical approach.

Pre-requisites: The student should have basic awareness of market, products, services, buying-selling transaction and promotional activities

Unit – I	Contact Hours = 8 Hours
Introduction to Marketing: Importance of marketing, Definitions of market and marketing, Types of Needs, Elements of Marketing Concept, Functions of Marketing, Marketing V/s Selling, 4P's of Marketing, 7P's of service marketing, Marketing Environment.	

Unit – II	Contact Hours = 8 Hours
Analyzing Consumer Behavior: Meaning and Characteristics, Importance of consumer behavior, Factors influencing Consumer Behavior, buying behavior, personal factors, psychological factors and cultural factors. Consumer Buying Decision Process, Buying Roles, Buying Motives, The black box model of consumer behavior. Characteristics of generation Z consumers	

Unit – III	Contact Hours = 8 Hours
Product Management, Pricing and Branding: product levels, product hierarchy, classification of products, Managing Product Life Cycle, New Product Development, Packing as a marketing tool, Role of labeling in packaging. Types of Pricing Strategies Concept of Branding, Brand Equity, branding strategies	

Unit – IV	Contact Hours = 8 Hours
Distribution and Promotion: Roles and purpose of Marketing Channels, Factors Affecting Channel Choice, Integrated Marketing Communications (IMC)-Tools-Advantages, Disadvantages, Advertising Objectives, Advertising Budget, Advertising Copy, AIDA model,	

Unit – V	Contact Hours = 8 Hours
Market Segmentation, Targeting and Brand Positioning: Concept of Market Segmentation, Benefits, Requisites of Effective Segmentation, Bases for Segmenting Consumer Markets, Market Segmentation Strategies. Types of Segmentation. Targeting - Bases for identifying target Customer target Marketing strategies, Positioning - Meaning, Tasks involved in Positioning.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

Unit No.	Self-Study Topics
1	Elements of Digital and social media Marketing, Green Marketing, Neuro Marketing, Sensory Marketing and societal marketing concept
2	Study the buying pattern based on demographics of consumers
3	Take any FMCG product and study the PLC, branding equity and pricing of that product.
4	Draft advertising copy

Books	
	Text Books:
1.	Kotler, P., Keller, K. L., Ang, S. H., Tan, C. T., & Leong, S. M. Marketing management: an Asian Perspective. Pearson Publication, (2018).
2.	Kotler, P., Kartajaya, H., & Setiawan, I. Marketing 4.0: Moving from traditional to digital. John Wiley & Sons, (2016).
3.	Ramaswamy, Namakumari, Marketing Management: Global Perspective, McGraw-Hill, (2019)
	Reference Books:
1.	Dhruv Grewal, Michael Levy, Marketing Management, McGraw-Hill, (2018)
2.	Baines, P., Fill, C, Page, K. and Sinha, P.K, Marketing, Asian edition, Oxford University Press, New Delhi (2013)
	E-resources:
1.	https://youtu.be/5fdx5Laavkc
2.	https://youtu.be/ob5KWs3I3aY?t=131

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignment- Open/Industry/Certification
3.	Flipped Classes	3.	Course Project
4.	Online classes	4.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create.)				
At the end of the course, the student will be able to :		Learning Level	PO(s)	PSO(s)
1.	Understand the basics concepts for Marketing and business environment	2	1	1
2.	Demonstrate the application of the knowledge with respect to strategic and tactical use of the primary decision-making areas of marketing	2	2	1
3.	Demonstrate and Apply the critical thinking ability needed to ensure Product and Brand sustainability	3	1	2
4.	Evaluate the needed strategies for distribution and promotion of products and services	4	6	3

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Two Assignments (Open/Industry/Certification etc)	Course project (CP)/ Case study etc	Total Marks
Marks	30+30 = 60	10 + 10 = 20	20 marks (with report & presentation)	100
-Certification earned by passing the standard Online MOOCs course (1 course of atleast 8 hours defined by BOS) can be considered as a Course activity and awarded maximum of 10 marks. -Student should score minimum 40% of 60 marks (i.e. 24 marks) in IA tests. -Lack of minimum score in IA test will make the student Not Eligible for SEE -Minimum score in CIE to be eligible for SEE: 40 OUT OF 100.				

Scheme of Semester End Examination (SEE):

1.	It will be conducted for 100 marks of 3 hours duration.
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE + SEE should be $\geq 40\%$.
3.	Question paper contains three parts A,B and C . Students have to answer 1. From Part A answer any 5 out of 7 questions, each Question Carries 6 Marks. 2. From Part B answer 5 out of 10 questions choosing any one full question from each unit, each Question Carries 10 Marks. 3. From Part C answer 1 out of 2 questions, each Question Carries 20 Marks.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	✓												✓		
2		✓											✓		
3	✓													✓	
4						✓									✓

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Strategic decision making	Retail, Service	Product Managers
2	Branding knowledge	Retail, Service	Brand Managers
3	Business Communication	Retail, Service, Branding	Advertising Consultants

EMPLOYABILITY SKILLS II

Course Code	22AESIS66	Course type	AEC	Credits L-T-P	1 – 0 – 0
Hours/week: L - T- P	1 – 0 – 0			Total credits	1
Total Contact Hours	L = 30 Hrs; T = 0 Hrs; P = 0 Hrs Total = 30 Hrs			CIE Marks	100

Course learning objectives

1.	Skill development is/are personal attributes that influence how well an individual works or interacts with others.
2.	These skills make it easier to form relationships with people, create trust and dependability, and lead teams.
3.	In essence, they are essential for individual success in the workplace, their company's success, and their personal life also

Pre-requisites: NA

Unit – I	Contact Hours = 4 Hours
Quantitative Aptitude: Ratios, Proportions and Variations (2 Hours), Partnership (1 Hour), Time and Work (2 Hours)	
Logical Reasoning: Seating Arrangement (1 Hour)	

Unit – II	Contact Hours = 4 Hours
Quantitative Aptitude: Time, Speed and Distance (2 Hours), Trains, Boats and Streams (2 Hours)	
Verbal Ability: Reading Comprehension (2 Hours)	

Unit – III	Contact Hours = 4 Hours
Quantitative Aptitude: Permutation and Combination (2 Hours), Ages (1 Hour)	
Logical Reasoning: Data Arrangement (1 Hour)	
Soft Skills: Interview Skills (1 Hour), Resume Building (1 Hour).	

Unit – IV	Contact Hours = 4 Hours
Quantitative Aptitude: Probability (2 Hours)	
Logical Reasoning: Clocks and Calendars (2 Hours), Syllogisms (2 Hours)	

Unit – V	Contact Hours = 4 Hours
Quantitative Aptitude: Data Interpretation (2 Hours)	
Logical Reasoning: Data Sufficiency (2 Hours)	
Verbal Ability: Ordering of Sentences (1 Hour), Critical Reasoning (1 Hour)	

Books	
	Text Books:
	Name of the author(s), Title of the Book, Publisher, Edition/Year _____ and onwards
1.	The Aptitude Triad , BIZOTIC
2.	How to prepare for Quantitative Aptitude for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 4 th Edition, 2018.
3.	How to prepare for Logical Reasoning for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8 th Edition, 2018.
4.	How to prepare for Verbal Ability and Reading Comprehension for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 8 th Edition, 2018.
5.	How to prepare for Data Interpretation for CAT & other Management Examinations, Arun Sharma, McGraw Hill Education(India) Private Limited, 5 th Edition, 2018.

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes
		3.	Assignments
		4.	Seminar

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply;An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Clear the Aptitude round of recruiters during placements	L2	10,12	1
2.	Perform confidently during the Interview process	L2	10,12	1
3.	Develop resumes that are grammatically correct and written in Business English	L2	10,12	1
4.	Develop behaviors that are appropriate for a professional	L2	10,12	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two Assignments	Total Marks
Marks	30+30 = 60	20	10+10 =20	100

- Writing 2 IA tests are compulsory

-Student should score minimum 40% of 100 marks to pass the course.

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1										✓		✓			
2										✓		✓			
3										✓		✓			
4										✓		✓			

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Logical Thinking	IT Industry	Software Engineer
2	Problem Solving	Automotive	Developer
3	Communication Skills	Education Sector	Project Manager

ROBOTIC PROCESS AUTOMATION LAB

Course Code	22ISL68	Course type	PCCL	Credits L-T-P	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			Total credits	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content	-			SEE Marks	50

Course learning objectives	
1.	To understand importance and need of automation in view point with RPA.
2.	To discuss the different types of variables, Control Flow and data manipulation techniques
3.	To Understand Image, Text , Data Tables, Recording and Email automation using RPA tool
4.	To build and develop real time automation scenarios using RPA tool

Required Knowledge of : any programming language

Lab Experiment – I	Contact Hours = 2 Hours
Managing Variables	
Lab Experiment – 2	Contact Hours = 2 Hours
Using Arguments and Importing New Namespaces	
Lab Experiment – 3	Contact Hours = 2 Hours
If Else Statements, The Switch Activity – control statements	
Lab Experiment – 4	Contact Hours = 2 Hours
Do While Activity, For activity - loops	
Lab Experiment – 5	Contact Hours = 2 Hours
Data Manipulation - Scalar variables, collections	
Lab Experiment – 6	Contact Hours = 2 Hours
Data Manipulation - collections and Tables	
Lab Experiment – 7	Contact Hours = 2 Hours
Basic and Desktop Recording	
Lab Experiment – 8	Contact Hours = 2 Hours
Web Recording - Input/output Methods - Screen Scraping - Data Scraping	
Lab Experiment – 9	Contact Hours = 2 Hours
Exception Handling	
Lab Experiment – 10	Contact Hours = 2 Hours
Email Automation	

Books	
	Text Books:
1.	Alok Mani Tripathi, Learning Robotic Process Automation, Publisher: Packt Publishing Release Date: March 2018 ISBN: 9781788470940
2.	Richard Murdoch, Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant
	E-resources:
1.	https://www.uipath.com/rpa/robotic-process-automation

Course delivery methods		Assessment methods	
1.	Practice session/Demonstrations in Labs	1.	Conduction of Experiments
2.	Virtual Labs (if present)	2.	Journal writing
3.	Chalk and Talk	3.	Lab project/ Open ended experiment
4.		4.	Lab Test
5.		5.	Semester End Examination

Course Outcome (COs)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create				
At the end of the course, the student will be able to:		Learning Level	PO(s)	PSO(s)
1.	Understand the Basic Programming concepts and the underlying logic/structure and applications of RPA in automation.	Un	1,2	1
2.	Understand variables, control flow and data manipulation technique used in RPA tool.	Un	1,5	1,2
3.	Apply the RPA recording and advanced automation techniques and exception handling to given applications.	Ap, Cr	3,4,5	1,2,3
4.	Apply the RPA concepts to develop solutions for a real time programs/applications .	Ap, Cr	1,2,3,4,5,6,8,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

Conduction of experiments & viva-voce	Journal	Lab project/ Open ended expt	Lab Test	Total
20 marks	5 marks	10 marks	15	50 marks
Conduct of Lab: 1. Conduction of the experiment: 15 marks + Viva voce: 5 marks 2. Calculations, results, graph, conclusion and Outcome recorded in Journal: 5 marks 3. Lab project/ Open ended expt: 10 marks 3. Lab Test: 15 marks				
Eligibility for SEE: 1. 40% and above (20 marks and above) 2. Lab test is COMPULSORY				

Scheme of Semester End Examination (SEE):			
1.	It will be conducted for 50 marks of 2/3 hours duration.		
2.	Minimum marks required in SEE to pass: Score should be $\geq 35\%$, however overall score of CIE+SEE should be $\geq 40\%$.		
2.	One or Two experiments to be conducted.		
3.	Minimum marks required in SEE to pass: 20 out of 50		
4.	Initial write up	10 marks	50 marks
	Conduct of experiments, results and conclusion	20 marks	
	One mark question	10 marks	
	Viva- voce	10 marks	
5.	Viva-voce shall be conducted for individual student and not in a group.		

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
1	✓	✓											✓		
2	✓				✓								✓	✓	
3			✓	✓	✓								✓	✓	✓
4	✓	✓	✓	✓	✓	✓		✓	✓	✓		✓	✓	✓	✓

SI No	Skill & competence enhanced after undergoing the course	Applicable Industry Sectors & domains	Job roles students can take up after undergoing the course
1	Process Automation Skills	Software/ IT	RPA developer
2	AI and Process Management skills	Software/ IT	Automation Expert