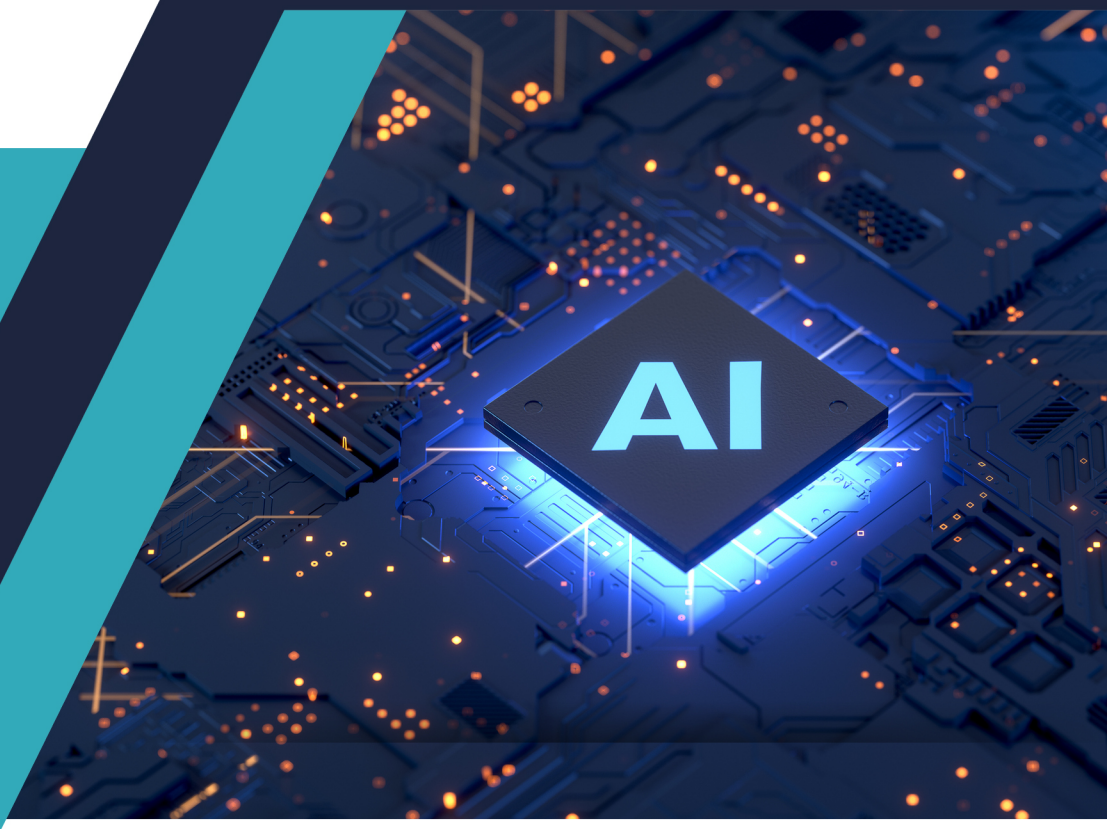
NEW HORIZON
COLLEGE OF ENGINEERING

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Academic Year 2023-24



5th and 6th Semester

Scheme and Syllabus

BATCH – 2021-2025

CREDITS: 160

CONTENTS

INSTITUTION

Vision

To emerge as an institute of eminence in the fields of engineering, technology and management in serving the industry and the nation by empowering students with a high degree of technical, managerial and practical competence.

Mission

To strengthen the theoretical, practical and ethical dimensions of the learning process by fostering a culture of research and innovation among faculty members and students.

To encourage long-term interaction between the academia and industry through their involvement in the design of curriculum and its hands-on implementation.

To strengthen and mould students in professional, ethical, social and environmental dimensions by encouraging participation in co-curricular and extracurricular activities.

Quality Policy

To provide educational services of the highest quality both curricular and co-curricular to enable students integrate skills and serve the industry and society equally well at global level

Values

- Academic Freedom
- Innovation
- Integrity
- Professionalism
- Inclusiveness
- Social Responsibility

DEPARTMENT of AI & ML

Vision

To develop an outstanding AI and ML professionals with profound practical, research & managerial skills to meet ever changing Industrial Social and Technological needs of the Society

Mission

To disseminate strong theoretical and practical exposure to meet the emerging trends in the industry.

To promote a freethinking environment with innovative research and teaching-learning pedagogy.

To develop value based socially responsible professionals with high degree of leadership skills will support for betterment of the society.

Program Educational Objectives (PEOs)

PEO1	Develop and excel in their chosen profession on technical front and progress towards advanced continuing education or Inter-disciplinary Research and Entrepreneurship
PEO2	Become a reputed innovative solution provider- to complex system problems or towards research or challenges relevant to Artificial Intelligence and Machine learning
PEO3	Progress as skilled team members achieving leadership qualities with trust and professional ethics, pro-active citizens for progress and overall welfare of the society

PEO to Mission Statement Mapping

Mission Statements	PEO1	PEO2	PEO3
To disseminate strong theoretical and practical exposure to meetthe emerging trends in the industry.	3	3	2
To promote a freethinking environment with innovative researchand teaching-learning pedagogy.	2	3	2
To develop value based socially responsible professionals with high degree of leadership skills will support for betterment of the society.	2	3	3

Program Outcomes (POs) with Graduate Attributes

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems in Computer Engineering.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex Engineering problems in Computer Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and Engineering sciences.

PO3 **Design / Development of Solutions:** Design solutions for complex Engineering problems anddesign system components or processes of Computer Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.

PO4 **Conduct Investigations of Complex Problems:** Use research based knowledge and research methods including design of experiments in Computer Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern Engineering and IT tools including prediction and modeling to complex Engineering activities in Computer Engineering with an understanding of the limitations.

PO6 **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 in Computer Engineering.

PO7 **Environment and Sustainability:** Understand the impact of the professional Engineering solutions of Computer Engineering in societal and Environmental contexts, demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and normsof the Engineering practice.

PO9 **Individual and Team Work:** Function effectively as an individual, and as a member or leaderin diverse teams, and in multidisciplinary settings.

PO10 **Communication Skills:** Communicate effectively on complex Engineering activities with the Engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clearinstructions.

PO11 **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.

PO12 **Life-long Learning:** Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

A graduate of the Computer Engineering Program will demonstrate

PSO1: Develop models in Data Science, Machine learning, Deep learning and Bigdata technologies, using acquired AI knowledge and modern tools.

PSO2: Formulate solutions for interdisciplinary problems through acquired programming knowledge in the respective domains complying with real-time constraints.

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations for 2021- 2025 BATCH (2021 Scheme)

V Semester													
S. No.	**Course and Course Code**		**Course Title**	**BOS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	PCC	21AIM51	Machine Learning	AI&ML	3	0	0	0	3	3	50	50	**100**
2	PCCL	21AIL51	Machine Learning Lab	AI&ML	0	0	1	0	1	2	50	50	**100**
3	PCC	21AIM52	Big Data Technologies	AI&ML	3	0	0	0	3	3	50	50	**100**
4	PCCL	21AIL52	Big Data Technologies Lab	AI&ML	0	0	1	0	1	2	50	50	**100**
5	PCC	21AIM53	Computer Network	AI&ML	3	0	0	0	3	3	50	50	**100**
6	PEC	21AIM54X	Professional ElectiveCourse-I	AI&ML	3	0	0	0	3	3	50	50	**100**
7	AEC	21AIL55X	Ability Enhancement Course-V	AI&ML	0	0	1	0	1	2	50	50	**100**
8	MP	21AIM56	Mini Project	AI&ML	0	0	1	0	1	0	50	50	**100**
9	AEC	21AIK57	Research Methodologyand IPR	AI&ML	1	0	0	0	1	2	50	50	**100**
10	UHV	21AIK58	Innovation and Design Thinking	Any Dept.	1	0	0	0	1	1	50	50	**100**
								Total	**18**	**21**	**500**	**500**	**1000**

NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator	All students have to register for anyone of the courses namely National Service Scheme, Physical Education (PE) (Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of V semester. The activities shall be carried out from (for 4 semesters) between V semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successfulcompletionoftheregisteredcourseismandatoryfort heawardofthedegree. The events shall to be reflected in the calendar prepared for the NSS, PE and Yoga activities.
	21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director	
	21YOG84	Yoga	Yoga Teacher	

PCC: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **NCMC**: Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **PROJ**: Mini Project work **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation

Professional Elective Course-I			
21AIM541	Information Storage and Retrieval	21AIM542	Operating Systems
21AIM543	Introduction to Sensor and IoT	21AIM544	Information Security
21AIM545	Parallel Processing		

Ability Enhancement Course-V			
21AIL551	Unix and Shell Programming	21AIL552	Cloud Computing using AWS
21AIL553	Data Visualization	21AIL554	Perl Programming
21AIL555	Basics for Digital and Image Processing		

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 supplementthe latest trend and advanced technology in the selected stream of engineering.

Mini-project work: Mini Project is a laboratory-oriented/hand on course that will provide a platform to students to enhance their practical knowledge and skills bythe development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor. A student can do mini project as

(i) A group of 2 if mini project work is single discipline (applicable to all IT allied branches)

(ii) A group of 2-4 if mini project work is single discipline (applicable to all Core Branches)

(iii) A group of 2 -4 students if the Mini Project work is a multidisciplinary (Applicable to all Branches)

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question and answer session inthe ratioof50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of the project report, project presentation skill, and question and answer session in the percentage ratioof50:25:25. The marks awarded for the project report shall be the same for all the batch mates

Credit Definition:	03-Credits courses are to be designed for 40 hours inTeaching-Learning Session
1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week = 1 Credit	02- Credits courses are to be designed for 25 hours ofTeaching-Learning Session 01-Credit courses are to be designed for 15 hours ofTeaching-Learning Sessions

NEW HORIZON COLLEGE OF ENGINEERING

B. E. in Artificial Intelligence and Machine Learning

Scheme of Teaching and Examinations for 2021- 2025 BATCH (2021 Scheme)

VI Semester													
S. No	**Course and Course Code**		**Course Title**	**BOS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	HSMC	21AIM61	Software Engineering and Project Management	AI&ML	3	0	0	0	3	3	50	50	**100**
2	PCC	21AIM62	Deep Learning	AI&ML	3	0	0	0	3	3	50	50	**100**
3	PCCL	21AIL62	Deep Learning Lab	AI&ML	0	0	1	0	1	2	50	50	**100**
4	PCC	21AIM63	Web Technology	AI&ML	3	0	0	0	3	3	50	50	**100**
5	PCCL	21AIL63	Web Technology lab	AI&ML	0	0	1	0	1	2	50	50	**100**
6	PEC	21AIM64X	Professional Elective Course-II	AI&ML	3	0	0	0	3	3	50	50	**100**
7	UHV	21AIK65	Social Connect and Responsibility	AI&ML	0	0	1	0	1	2	50	50	**100**
8	INT	21AIM66	Innovation/Entrepreneurship/ Societal Internship	AI&ML	0	0	3	0	3	0	50	50	**100**
9	MP	21AIM67	Mini project	AI&ML	0	0	1	0	1	2	50	50	**100**
10	OEC	21NHOP6XX	Industrial Open Elective Course-I	Offering Dept.	3	0	0	0	3	3	50	50	**100**
Total									**22**	**23**	**500**	**500**	**1000**

NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator	All students have to register for anyone of the courses namely National Service Scheme, Physical Education (PE) (Sports and Athletics) and Yoga with the concerned coordinator of the course during the first week of V semester. The activities shall be carried out from (for 4 semesters) between V semester to VIII semester. SEE in the above courses shall be conducted during VIII semester examinations and the accumulated CIE marks shall be added to the SEE marks. Successfulcompletionoftheregisteredcourseismandatoryfort heawardofthedegree. The events shall to be reflected in the calendar prepared for the NSS, PE and Yoga activities.
	21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director	
	21YOG84	Yoga	Yoga Teacher	

HSMC: Humanity and Social Science & Management Course, **PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **NCMC:** Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PROJ**: Project work**, L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, C**IE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Industrial Open Elective Course (OEC): Credit for OEC is 03 (L: T: P:S) can be considered as(3: 0:0 : 0). The teaching and learning of these Courses will be based on hands-on. The Course Assessment will be based on CIE and SEE in practical mode. These Courses will be offered by Centre of Excellence to students of all the branches. Registration to Industrial open electives shall be documented and monitored on college level.

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.

21XXX61 (HSMC)- This course must be pertaining to economics and management of the concerned degree program. The course syllabus should have both economics and management topics and the course title should bear the word Management.
For IT allied Branches: Software Product Management

For Core Branches: Engineering Economics and Management / Industrial Management/ Construction Management

Professional Elective Course- II			
21AIM641	Social Network Analysis	21AIM642	Human Computer Interaction
21AIM643	Cyber Security	21AIM644	Bio Inspired Design and Innovation
21AIM645	Soft computing		

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hous Self Study for Skill Development (SDA) per week =1 Credit	03-Credits courses are to be designed for 40 hours in Teaching-Learning Session 02- Credits courses are to be designed for 25 hours of Teaching-Learning Session 01-Credit courses are to be designed for 15 hours of

V SEMESTER

MACHINE LEARNING			
Course Code	**21AIM51**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs. / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM51.1	Understand the basic principles of machine learning.
21AIM51.2	Apply the different learning algorithms for prediction
21AIM51.3	Examine different linear model for tuning parameter and feature extraction.
21AIM51.4	Design a model to solve classification /clustering problems using supervised or unsupervised machine learning algorithms.
21AIM51.5	Evaluate the performance of various machine learning algorithms using different real-world data sets.
21AIM51.6	Conduct practical experiments to solve problems using appropriate machine learning techniques using Python.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM51.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIM51.2	3	-	-	-	-	-	-	-	-	-	-	-	3	2
21AIM51.3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
21AIM51.4	3	3	3	-	-	-	-	-	-	-	-	-	3	3
21AIM51.5	3	3	3	3	-	-	-	-	-	-	-	3	3	3
21AIM51.6	3	3	3	3	3	-	-	-	-	-	-	3	3	3

MODULE-1	**INTRODUCTION**	**21AIM51.1, 21AIM51.2**	**8 Hours**

Terminologies in machine learning, Applications, Types of machine learning: supervised, unsupervised, semi-supervised learning, Reinforcement Learning. Features: Types of Data (Qualitative and Quantitative), Scales of Measurement (Nominal, Ordinal, Interval, Ratio), Concept of Feature, Feature construction, Feature Selection and Transformation, Curse of Dimensionality. Linear discriminate Analysis (LDA).

Text Book	Text Book 2: Ch 1

MODULE-2	**SUPERVISEDLEARNING, I:**	**21AIM51.1, 21AIM51.2 21AIM51.3, 21AIM51.5**	**8 Hours**

Binary Classification: Linear Classification model, Performance Evaluation-Confusion Matrix, Accuracy, Precision, Recall, ROC Curves, F-Measure. Support Vector Machines-Large margin classifiers, Non-linear SVM, kernel Functions. Multi-class Classification: Model, Performance Evaluation Metrics – Multiclass Classification Techniques-One vs. One, One vs. Rest

Text Book	Text Book 2: Ch 2

MODULE-3	**SUPERVISED LEARNING II:**	**21AIM51.2, 21AIM51.3, 21AIM51.5, 21AIM51.6**	**8 Hours**

Decision Trees: Concept sand Terminologies, Classification and Regression Tree (CART). Regression: Introduction, Univariate Regression – Least-Square Method, Model Representation, Cost Functions: MSE, MAE, R-Square, Performance Evaluation, Estimating the values of the regression coefficients. Multivariate Regression: Model Representation. Naïve Bayes Classifier. K-Nearest Neighbor for Classification. Over fitting and Under fitting, Bias and Variance

Text Book	Text Book 1: Ch:3.1,3.2,3.3,6.3,8.2,

MODULE-4	**UNSUPERVISED LEARNING:**	**21AIM51.3, 21AIM51.4, 21AIM51.5, 21AIM51.6**	**8 Hours**

Distance Based Models: Distance Metrics (Euclidean, Manhattan, Hamming, Minkowski Distance Metric), Clustering as Learning task: K-means clustering Algorithm-with example, k-medoid algorithm-with example. Principal Component analysis (PCA).

Text Book	Text Book 1: Ch:6.12

MODULE-5	**TRENDS IN MACHINE LEARNING**	**CO 21AIM51.3, CO 21AIM51.4, CO 21AIM51.5, CO 21AIM51.6**	**8 Hours**

Ensemble Learning- Combining Multiple model, bagging, boosting, stacking-Algorithms- Random

forest, ada-boost. Introduction to Reinforcement Learning –Exploration, exploitation, rewards, penalties.

Text Book	Text Book 1: Ch 13, Text Book 2: Ch 17

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test	Assessment(s) *	MCQ
		25	**15**	**10**
L1	**Remember**	5		**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	5	**5**	
L4	**Analyze**	5	**10**	
L5	**Evaluate**	5	**-**	
L6	**Create**	-	**-**	

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	10
L2	**Understand**	10
L3	**Apply**	10
L4	**Analyze**	10
L5	**Evaluate**	10
L6	**Create**	-

Suggested Learning Resources:

Text Books:

1) Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.
2) E. Alpaydin, "Introduction to Machine Learning", PHI, 2005.

Reference Books:

1) Aurolien Geron, "Hands-On Machine Learning with Scikit-Learn and Tensor Flow, Shroff/O'Reilly",2017
2) Andreas Muller and Sarah Guido, "Introduction to Machine Learning with Python: A Guide for Data Scientists", Shroff/O'Reilly, 2016
3) Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
4) Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Inter-science, 2000. ISBN: 9780471056690.
5) Hastie, T., R. Tibshirani, and J. H. Friedman. The Elements of Statistical Learning: Data Mining, Inference and Prediction. New York, NY: Springer, 2001. ISBN: 9780387952840.
6) MacKay, David. Information Theory, Inference, and Learning Algorithms. Cambridge, UK: Cambridge University Press, 2003. ISBN: 9780521642989.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=dGNJ-feQLC4
- https://onlinecourses.nptel.ac.in/noc21_cs24/preview
- https://www.bing.com/videos/search?q=nptel+video+for+machine+learning&docid=603533022127208368&mid=AB277E56159B28616C87AB277E56159B28616C87&view=detail&FORM=VIRE
- https://www.bing.com/videos/search?&q=nptel+video+for+machine+learning&docid=603533022127208368&mid=8697D5CA9F3EB1F2CA108697D5CA9F3EB1F2CA10&view=detail&FORM=VDRVRV&rvsmid=AB277E56159B28616C87AB277E56159B28616C87&ajaxhist=0

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Online Class using Jeopardy Lab
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to read research topics on Machine Learning
  - Class Presentation.

MACHINE LEARNING LAB			
Course Code	**21AIL51**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL51.1	Understand the implementation of procedures for machine learning algorithms
21AIL51.2	Analyze various machine learning models with appropriate data sets to improve the accuracy in real world problem
21AIL51.3	Design Java/Python programs for various Learning algorithms.
21AIL51.4	Evaluate the performance of different Learning models.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIL51.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
21AIL51.2	3	3	-	-	-	-	-	-	-	-	-	3	3	3
21AIL51.3	3	3	3	-	3	-	-	-	-	-	-	3	3	3
21AIL51.4	3	**3**	**3**	3	3	-	-	-	-	-	-	3	3	3

Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	• Basic Python program using libraries • Read and write a CSV file using python	2	NA
	PART-A		
1	Implement and demonstrate the Linear discriminant Analysis (LDA).	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
2	Develop a Support Vector Machine model considering a Sample Dataset and evaluate the model	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
3	Write a program to demonstrate the working of the decision tree Based CART algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new Sample.	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
4	Develop a simple regression model for the given dataset and evaluate its performance.	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
5	Develop a multiple regression model for the given data set and evaluate its performance.	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
6	Develop a program for logistics regression model for the given data and compare performance with other regression model.	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
	PART-B		
7	Implement a program in python to illustrate the Bias Variance Trade-off in a machine learning model	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4

8	Apply k-means algorithm to generate clusters for the given dataset and evaluate its performance.	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
9	Implement and demonstrate the Principal Component analysis (PCA)	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
10	Develop a program for Random Forest algorithm for given data set	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
11	Implement Reinforcement learning with suitable example	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4
12	Implement text classification model using suitable algorithm.	2	21AIL51.1, 21AIL51.2, 21AIL51.3, 21AIL51.4

PART-C

Beyond Syllabus Virtual Lab Content

1. K-means algorithm: https://vlab.spit.ac.in/ai/#/experiments/3
2. Linear Regressions methods: https://vlab.spit.ac.in/ai/#/experiments/10
3. SVM Algorithm: https://vlab.spit.ac.in/ai/#/experiments/5
4. K-nearest neighbors (KNN) algorithm: https://vlab.spit.ac.in/ai/#/experiments/4

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s) (20)	Weekly Assessment (30)
L1	**Remember**	**-**	**-**
L2	**Understand**	5	5
L3	**Apply**	**5**	10
L4	**Analyze**	10	10
L5	**Evaluate**	-	5
L6	**Create**		-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1.Tom Mitchell, "Machine Learning", McGraw Hill, 1997

2. E. Alpaydin, "Introduction to Machine Learning", PHI, 2005.

BIG DATA TECHNOLOGIES			
Course Code	**21AIM52**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs./ Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM52.1	Understand the Big Data Technologies like HDFS and others.
21AIM52.2	Apply the Map Reduce Concepts to solve Big Data problem
21AIM52.3	Analyze the performance of Iterative processing algorithms using Spark.
21AIM52.4	Design a model to analyze the Transformation of data in Big Data Analytics
21AIM52.5	Conduct experiment using Big Data algorithm for given problem or statement using Spark RDD
21AIM52.6	Use Hadoop-related tools such as Pig, and Hive for big data analysis.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM52.1	2	-	-	-	-	-	-	-	-	-	-	-	3	3
21AIM52.2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
21AIM52.3	3	3	-	-	3	-	-	-	-	-	-	-	3	3
21AIM52.4	3	3	3	-	3	-	-	-	-	-	-	3	3	3
21AIM52.5	3	3	3	3	3	-	-	-	-	-	-	3	3	3
21AIM52.6	3	3	3	3	3	-	-	-	-	-	-	3	3	3

MODULE-1	**INTRODUCTION TO BIG DATA AND HADOOP**	**21AIM52.1, 21AIM52.2**	**8 Hours**

Introduction to Big Data, Data Storage and Analysis, Comparison with other Systems, A brief History of Hadoop, Hadoop Releases, Apache Hadoop and Eco System, Analyzing Data with Unix tools, Analyzing Data with Hadoop, Scaling Out, Hadoop Streaming

Text Book	Textbook 1: Chapter:1, 2

MODULE-2	**HDFS AND MAP REDUCE**	**21AIM52.1, 21AIM52.2**	**8 Hours**

The Design of HDFS, HDFS Concepts, Command Line Interface, Hadoop file system, interfaces, Data flow Hadoop Archives, Limitations. **Map Reduce**: Anatomy of a Map Reduce Job Run, Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce Types and Input and Output Formats, Map Reduce Features

Text Book	Textbook 1: Chapter: 3, 6, 7, 8

MODULE-3	**APACHE SPARK**	**21AIM52.3, 21AIM52.5**	**8 Hours**

What is Apache Spark, Spark's Philosophy, History of Spark, Spark's Basic Architecture, Spark's API , Data Frames, Spark's Toolset, Structures API – Data sets, Data Frames, SQL tables and views, Basic Structured operations, Different types of Data, Aggregations, Joins.

Text Book	Text Book 2 : Chapter: 1, 2, 3, 4, 5, 6, 7, 8,

MODULE-4	**SPARK RDDS**	**21AIM52.3, 21AIM52.4, 21AIM52.5**	**8 Hours**

Introduction, Creating RDDs, Manipulating RDDs, Advanced RDDs-Key-value Basics, Aggregations, Co-Groups, Joins, Controlling Partitions, Custom Serialization, Distributed Shared Variables, how spark Runs on a cluster, Streaming- Introduction, Stream Processing Design Points, Spark's Streaming APIs.

Text Book	Text Book 2 : Chapter : 12, 13, 14, 15, 20

MODULE-5	**APACHE PIG AND APACHE HIVE**	**21AIM52.3, 21AIM52.5,21AIM52.6**	**8 Hours**

Apache Pig: Introduction to PIG, Pig on Hadoop, Pig Philosophy, Pig's History, Installing and Running Pig, Grunt, Pig's Data Model, Introduction to Pig Latin, Developing and Testing Pig Latin Scripts.
Apache Hive: Introduction, Hive in Hadoop Ecosystem, Data Types and File Formats, HiveQL-Data Definition, Data Manipulation, Queries, Views, Indexes.

Text Book	Textbook 3: Chapter: 1, 2, 3, 4, 5, 7. Textbook 4: Chapter: 1, 3, 4, 5, 6, 7, 8

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test	Assessment(s) *	MCQ
		25	**15**	**10**
L1	**Remember**	5		**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	10	**5**	
L4	**Analyze**	5	**10**	
L5	**Evaluate**	-	**-**	
L6	**Create**	-	**-**	

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	10
L2	**Understand**	10
L3	**Apply**	20
L4	**Analyze**	10
L5	**Evaluate**	-
L6	**Create**	-

Suggested Learning Resources:

Text Books:

1) Tom White“ Hadoop: The Definitive Guide” Third Edition, O’reily Media, 2012
2) Bill Chambers and Matei Zaharia “Spark: The Definitive Guide” First Edition O’reily Media, 2018
3) Alan Gates “Programming Pig” Second Edition O’reily Media Inc, 2011
4) Edward Capriolo, Dean Wampler and Jason Rutherglen “Programming Hive” Third Edition, O’reily Media, 2012

Reference Books:

1) Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015
2) Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
3) Paul Zikopoulos ,Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

Web links and Video Lectures (e-Resources):

- IIT Khanpur Lecture Video:
- https://www.youtube.com/watch?v=rvJgArru8dI
- IIT Kharagpur: https://www.youtube.com/watch?v=cTZVK7CK1gs
- IIT Kharagpur: https://www.youtube.com/watch?v=mNP44rZYiAU
- MIT: https://www.youtube.com/watch?v=mzIoSW-cInA

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Online classes using Jeopardy Lab
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to read research papers on Big Data Analytics and have a discussion.
  - Presentations

BIG DATA TECHNOLOGIES LAB			
Course Code	**21AIL52**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL52.1	Understand Map Reduce Paradigm and develop data applications using variety of systems
21AIL52.2	Analyze different operations on data using Pig Latin scripts
21AIL52.3	Asses different operations on relations and databases using Hive
21AIL52.4	Create applications for Big Data Analytics using Spark

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIL52.1	2	-	-	-	-	-	-	-	-	-	-	-	3	3
21AIL52.2	3	3	-	-	-	-	-	-	-	-	-	-	3	3
21AIL52.3	3	3	3	3	3	-	-	-	-	-	-	-	3	3
21AIL52.4	3	3	3	3	3	-	-	-	-	-	-	-	3	3

Ex. No	Experiments	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Basic Python program using libraries **Basics of SQL**	**2**	**NA**
	Part A		
1.	Execute Word count program in Map Reduce	**2**	21AIL52.1
2.	Analyze the Titanic Disaster dataset, for finding the average age of male and female persons died in this disaster with MapReduce Hadoop. Titanic disaster dataset: https://drive.google.com/file/d/1DT1BU7cJTiaYdeWVRHnlTG5u79hE2zU5/view	**2**	21AIL52.1, 21AIL52.2
3.	Using Pig, find the most occurred start letter in dataset	**2**	21AIL52.2, 21AIL52.3
4.	Create partitioned Hive table	**2**	21AIL52.3 21AIL52.4
5.	Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files	**2**	21AIL52.1, 21AIL52.2
6.	Implement of Matrix Multiplication with Hadoop Map Reduce	**2**	21AIL52.1 21AIL52.2
	Part B		
7.	Implement Spark read CSV file into Data Frame and write Data Frame to CSV file	**2**	21AIL52.3 21AIL52.4
8.	Convert Spark RDD to Data Frame and Dataset	**2**	21AIL52.3 21AIL52.4
9.	Using Apache Spark, load data into Mongo DB database	**2**	21AIL52.3 21AIL52.4
10.	Using Spark - Read and Write Data with MongoDB	**2**	21AIL52.3 21AIL52.4
11.	Case Study: Real-time health monitoring	**2**	21AIL52.3 21AIL52.4
12.	Practice importing and exporting data from various databases.	**2**	21AIL52.3 21AIL52.4

PART-C

Beyond Syllabus Virtual Lab Content

1. Spark and RDD Program: https://sparkbyexamples.com/spark/spark-rdd-transformations-2/
   https://sparkbyexamples.com/pyspark-rdd/
   https://www.bing.com/videos/search?q=spark+rdd+experiments+video&view=detail&mid=395879D64250FA3C2B47395879D64250FA3C2B47&FORM=VIRE
2. Hive-Program:
   https://www.bing.com/videos/search?q=video+for+spark+RDD+programs+using+python&&view=detail&mi

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s) (20)	Weekly Assessment (30)
L1	**Remember**	**-**	**-**
L2	**Understand**	5	5
L3	**Apply**	**5**	10
L4	**Analyze**	5	10
L5	**Evaluate**	5	5
L6	**Create**		-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1) Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015
2) Jay Liebowitz, “Big Data and Business Analytics” Auerbach Publications, CRC press (2013)
3) Paul Zikopoulos, Dirk DeRoos , Krishnan Parasuraman , Thomas Deutsch , James Giles , David Corigan , "Harness the Power of Big Data The IBM Big Data Platform ", Tata McGraw Hill Publications, 2012.

COMPUTER NETWORKS			
Course Code	**21AIM53**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs. / Week	**3**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM53.1	Understand the basic structure of an abstract layered Network protocol model for any Networking environment
21AIM53.2	Analyze the functionality of OSI and TCP/IP reference models.
21AIM53.3	Assess different network layer protocols
21AIM53.4	Determine the architecture for application layer protocols.
21AIM53.5	Choose appropriate protocol for desired communication service
21AIM53.6	Evaluate a different range of protocols to setup or implement cryptography and firewalls.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM53.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIM53.2	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21AIM53.3	3	3	3	3	3	-	-	-	-	-	-	-	3	-
21AIM53.4	3	3	3	3	**3**	-	-	-	-	-	-	-	3	-
21AIM53.5	3	3	3	3	**3**	-	-	-	-	-	-	-	3	-
21AIM53.6	3	3	3	3	3	-	-	-	-	-	-	-	3	

MODULE-1	**INTRODUCTION**	**21AIM53.1, 21AIM53.2**	**8 Hours**

OSI, TCP/IP and other networks models, Network Topologies WAN, LAN, and MAN. Transmission media copper, twisted pair wireless, switching and Multiplexing and De-multiplexing, Networking Devices.

Text Book	Text Book 1: 2.2,2.4 Text Book 2: 1.4,1.5

MODULE-2	**DATA LINK LAYER**	**21AIM53.1, 21AIM53.2**	**8 Hours**

Framing, Error detection and correction, Flow Control. Multiple Access Protocols – Data Link Layer Addressing, ARP, RARP, DHCP, Ethernet standards. Media Access Control Protocols. MAC addresses. Wireless LANS. High Level Data Link Control, Asynchronous Transfer Mode.

Text Book	Text Book 1:3.10-3.18 Text Book 2: 3.1,3.2,4.1-4.6

MODULE-3	**NETWORK LAYER**	**21AIM53.3**	**8 Hours**

Internet Protocol (IP), IPv4 and IPv6, Sub-netting and Super-netting, ICMP, Unicast Routing Protocols: Link State Routing, Distance Vector Routing, Hierarchical Routing, RIP,OSPF, BGP Multicast Routing, Multicast Routing Protocols: DVMRP, MOSPF, CBT, PIM, MBONE, Mobile IP, IPsec.

Text Book	Text Book 1:Ch 19,20,21,22.

MODULE-4	**TRANSPORT LAYER**	**21AIM53.2, 21AIM53.3, 21AIM53.4**	**8 Hours**

Transport Layer Services Connectionless Protocols: UDP, UDP segment, Reliable Data Transfer, Connection-Oriented Protocols: TCP Segment Structure, RTT estimation, Flow Control, Connection Management, Congestion Control, Integrated and Differentiated Services: Intserv– Diffserv.

Text Book	Text Book 1: 23,24 Text Book 2: 6.1-6.4

MODULE-5	**APPLICATION LAYER**	**21AIM53.2, 21AIM53.4, 21AIM53.5,21AIM53.6**	**8 Hours**

Principles of Network Applications, The Web and HTTP, FTP, Electronic Mail, SMTP, Mail Message Formats and MIME, DNS, Socket Programming with TCP and UDP. Multimedia Networking: Internet Telephony, RTP, RTCP, RTSP. Network Security: Principles of Cryptography, Firewalls, Attacks and Counter measures.

Text Book	Text Book 1:25-29, Text Book 2: 7. 1-7.7

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test	Assessment(s) *	MCQ
		25	**15**	**10**
L1	**Remember**	5		**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	10	**5**	
L4	**Analyze**	5	**10**	
L5	**Evaluate**	-	**-**	
L6	**Create**	-	**-**	

* Assessments are to be selected from the assessment list attached to Appendix A

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	10
L2	**Understand**	10
L3	**Apply**	20
L4	**Analyze**	10
L5	**Evaluate**	-
L6	**Create**	-

Suggested Learning Resources:

Text Books:

1) Data Communications and Networking–Behrouz A. Forouzan. Third Edition TMH
2) Computer Networks—Andrew S Tanenbaum, 4thEdition.Pearson Education/PHI

Reference Books:

1) James F. Kurose and Keith W.Ross,—Computer Networking: A Top-Down Approach Featuring The Internet‖,
Pearson Education, Third edition, 2006
2) An Engineering Approach to Computer Networks-S.Keshav,2nd Edition, Pearson Education

Web links and Video Lectures (e-Resources):

- https://youtu.be/O--rkQNKqls (nptel)
- https://youtu.be/lnU-Zw3NEEQ (nptel)
- https://youtu.be/aP346youQOk (nptel)
- Introduction to TCP/IP Course (YSU) | Coursera (coursera)
- https://youtu.be/qiQR5rTSshw (freecodecamp)

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of various networking devices.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare the model for various layers of OSI model.
  - Flipped classroom methodology

INFORMATION STORAGE AND RETRIEVAL			
Course Code	**21AIM541**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs. / Week	**3**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM541.1	Demonstrate the concept of Information retrieval
21AIM541.2	Analyze the storage and retrieval process of Text /Image data using different strategies.
21AIM541.3	Design a new strategy to evaluate the performance of any information retrieval system
21AIM541.4	Develop a system to do experiment for retrieval system to improve/evaluate the performance.
21AIM541.5	Use modern tools for information retrieval on different platforms, like search engines, Web data mining, etc.
21AIM541.6	Evaluate the developed IRS performance with different search engines.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM541.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
21AIM541.2	3	3	-	-	-	-	-	-	-	-	-	-	3	3
21AIM541.3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
21AIM541.4	3	3	3	3	3	-	-	-	-	-	-	3	3	3
21AIM541.5	3	3	3	3	3	-	-	-	-	-	-	3	3	3
21AIM541.6	3	3	3	3	3	-	-	-	-	-	-	3	3	3

MODULE-1	**BASIC CONCEPTS OF IR**	**21AIM541.1, 21AIM541.2**	**8 Hours**

Basic Concepts of IR, Data Retrieval & Information Retrieval, Text mining and IR relation, IR system block diagram. Automatic Text Analysis: Luhn's ideas, Conflation Algorithm, Indexing and Index Term Weighing, Probabilistic Indexing Inverted file, Suffix trees & suffix arrays, Signature Files, Scatter storage or hash addressing, Clustered files.

Text Book	Text Book 1: Ch 1

MODULE-2	**RETRIEVAL STRATEGIES**	**21AIM541.1, 21AIM541.2, 21AIM541.3**	**8 Hours**

Vector Space model, Probabilistic retrieval strategies, Language models, Inference networks, Boolean retrieval, Latent semantic indexing, Neural networks, Fuzzy set retrieval. Retrieval utilities: Relevance feedback, Cluster Hypothesis, Clustering Algorithms: Single Pass Algorithm, Single Link Algorithm.

Text Book	Text Book 1: CH 3

MODULE-3	**PERFORMANCE EVALUATION**	**21AIM541.3, 21AIM541.4**	**8 Hours**

Precision and recall, MRR, F-Score, NDCG, user-oriented measures, cross fold evaluation. Visualization in Information System: Starting points, document context, User relevance judgment, Interface support for search process

Text Book	Text Book 1: Ch 5

MODULE-4	**DISTRIBUTED IR**	**21AIM541.4, 21AIM541.5**	**8 Hours**

Introduction, Collection Partitioning, Source Selection Query Processing, web issues. MULTIMEDIA IR: Introduction, Data Modeling, Query languages, Generic multimedia indexing approach, One dimensional time series, two-dimensional color images, Automatic feature extraction

Text Book	Text Book 1: Ch 8

MODULE-5	**SEARCHING THE WEB**	**21AIM541.5, 21AIM541.6**	**8 Hours**

Challenges, Characterizing the Web, Search Engines, Browsing, Web crawlers, Web data mining, Searching using Hyperlinks, Web Graph, Page ranking algorithms

Text Book	Text Book 1: Ch 9:

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1) David A. Grossman, Ophir Frieder, Information Retrieval – Algorithms and Heuristics, Springer, 2nd Edition (Distributed by Universal Press), 2004

Reference Books:

1) Soumen Chakrabarti, Mining the Web: Discovering Knowledge from Hypertext Data, Morgan – Kaufmann Publishers, 2002.
2) Gerald J Kowalski, Mark T Maybury Information Storage and Retrieval Systems: Theory and Implementation, Springer, 2004.

Web links and Video Lectures (e-Resources):

- https://www.geeksforgeeks.org/what-is-information-retrieval/
- https://www.youtube.com/watch?v=fFxpSmyICwI

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of various image retrieval algorithms.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare the model for various IR algorithms.
  - Flipped classroom methodology

OPERATING SYSTEM			
Course Code	**21AIM542**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM542.1	Demonstrate the functions of traditional and modern operating systems
21AIM542.2	Apply the concept of process and its management which includes CPU scheduling Algorithms.
21AIM542.3	Analyze the problems related to concurrency, different synchronization mechanisms and dead lock handling.
21AIM542.4	Assess various memory management techniques.
21AIM542.5	Evaluate the various file-system interface techniques.
21AIM542.6	Estimate the efficiency of disk scheduling algorithms.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM542.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIM542.2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIM542.3	3	3	3	-	-	-	-	-	-	-	-	-	3	-
21AIM542.4	3	3	3	3	-	-	-	-	-	-	-	-	3	-
21AIM542.5	3	3	3	3	**3**	-	-	-	-	-	-	-	3	-
21AIM542.6	3	3	3	3	3	-	-	-	-	-	-	-	3	

MODULE-1	**INTRODUCTION AND OPERATING SYSTEM SERVICES**	**21AIM542.1, 21AIM542.2**	**8 Hours**

Basics of Operating Systems: Definition-Operating System structure; Operating System operations Dual-Mode and Multi-Mode; Kernel Data Structure Lists, Stacks, and Queues, Trees; Computing Environments Mobile Computing, Distributed Systems, Client-Server Computing, Peer-to-Peer, Virtualization, Cloud Computing, Real-Time Embedded Systems. OS Services; System Calls; Types of System Calls; OS Design and Implementation. Design Goals Mechanisms and Policies Implementation.

Text Book	Text Book 1 :Ch 1

MODULE-2	**PROCESS MANAGEMENT**	**21AIM542.2, 21AIM542.3**	**8 Hours**

Process: Process Concept The Processes, Process States, PCB; Process Scheduling Queues, Schedulers, Context Switch; Operation; Operation on Process; Inter-Process Communication Shared-Memory System, Message Passing System.

CPU Scheduling: Basic Concepts, CPU-I/O Burst Cycle; CPU Scheduler Pre-emptive Scheduling, Dispatcher; Scheduling Criteria; Scheduling Algorithms FCFS Scheduling, SJF Scheduling, Round-Robin Scheduling, Priority Scheduling

Text Book	Text Book 1: Ch 1,2

MODULE-3	**PROCESS SYNCHRONIZATION**	**21AIM542.3**	**8 Hours**

Background; The Critical Section Problem; Solution; Synchronization Hardware; Mutex Locks; Semaphores Semaphore Usage, Semaphore Implementation, Dead lock and Starvation; Classical Problems of Synchronization. The Reader-Writer Problem, Dining-Philosopher Problem. **Deadlocks:** System Model; Deadlock Characterization Necessary Conditions, Resource- Allocation Graph; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance; Deadlock Detection and Recovery from Deadlock

Text Book	Text Book 1: Ch3,4

MODULE-4	**MEMORY MANAGEMENT**	**21AIM542.3, 21AIM542.4**	**8 Hours**

Background: Swapping; Contiguous Memory Allocation Memory Protection, Memory Allocation, Fragmentation; Paging Basic Method, Hardware Support, Protection; Structure of Page Table Hierarchical Paging, Hash-Page Table; Segmentation Basic Method, Segmentation Hardware. **Virtual Memory:** Background; Demand Paging; Page Replacement Basic Page Replacement FIFO Page Replacement, Optimal Page Replacement, LRU Page Replacement; Allocation of Frames Minimum Number of Frames, Allocation Algorithms, Global Vs Local; Thrashing Causes of Thrashing

Text Book	Text Book 1: Ch 4

MODULE-5	**FILE SYSTEM INTERFACE AND IMPLEMENTATION**	**21AIM542.5, 21AIM542.6**	**8 Hours**

File-System Interface: File Structure; Access methods Sequential Access, Direct Access, Other Access Methods; **Implementation:** Overview, Partitions and Mounting, Directory Implementation Linear List, Hash Table; Allocation Methods Contiguous Allocation, Linked Allocation, Indexed allocation; **Mass Storage Structures:** Overview; Disk Structure; Disk Scheduling FCFS, SSTF, SCAN Scheduling, CS CAN Scheduling, LOOK Scheduling, Selection of Disk Scheduling Algorithm.

Text Book	Text Book 1: Ch 4,5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	**10**
L6	Create	-

Suggested Learning Resources:

Text Books:

1) Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley &Sons, Inc.,9thEdition,2012, ISBN9781118063330

Reference Books:

1) Willian Stallings, Operating Systems: Internals and Design Principles", 8th Edition, Prentice Hall, 2015

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/105/106105214/
- https://www.geeksforgeeks.org/operating-systems/
- https://www.tutorialspoint.com/operating_system/index.htm

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of various CPU Scheduling algorithms.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare the model for various paging techniques.
  - Flipped classroom methodology

INTRODUCTION TO SENSOR AND IOT			
Course Code	**21AIM543**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs. / Week	**3**	**Total Marks**	**100**
Credits	**3**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM543.1	Explain basic issues, policies, and challenges in the IoT.
21AIM543.2	Distinguish the various types of sensors used in IOT.
21AIM543.3	Analyse the connection of sensors to processing devices.
21AIM543.4	Determine the mechanisms and key technologies in the IoT.
21AIM543.5	Implement the latest technologies that are standards of the IoT.
21AIM543.6	Evaluate the Internet Protocol version 6 technologies for the IoT in terms of tunneling, QOS, and header compression schemes.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM543.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
21AIM543.2	3	3	-	-	-	-	-	-	-	-	-	-	3	3
21AIM543.3	3	3	-	-	-	-	-	-	-	-	-	-	3	3
21AIM543.4	3	3	3	3	3	-	-	-	-	-	-	-	3	3
21AIM543.5	3	3	3	3	3	-	-	-	-	-	-	3	3	3
21AIM543.6	3	3	3	3	3	-	-	-	-	-	-	3	3	3

MODULE-1	**INTRODUCTION**	**21AIM543.1**	**8 Hours**

Introduction: What are sensors/transducers, Principles, Classification, Parameters, Environmental Parameters, Electrical characterization, Mechanical and thermal characterization, Optical characterization, chemical/biological characterization.

Text Book	Text Book 1: 1.1,1.2,1.3,1.4,1.5,1.6.

MODULE-2	**TYPES OF SENSORS**	**21AIM543.2**	**8 Hours**

Mechanical and Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain gauge, Force/Stress sensors, Ultrasonic Sensors. Thermal Sensors: Introduction, Gas Thermometric Sensors, Thermal Expansion type thermometric sensors

Text Book	Text Book 1: 2.1,2.2,2.3,3.1,3.2,3.3

MODULE-3	**INTRODUCTION TO INTERNET OF THINGS (IOT)**	**21AIM543.2 21AIM543.3**	**8 Hours**

What is The Internet of Things? Overview and Motivations, Examples of Applications, IPV6 Role. Internet of Things Application Examples: - Overview, Smart Metering/Advanced Metering Infrastructure e-Health/Body Area Networks, City Automation, Automotive Applications, Home Automation, Smart Cards, Tracking, Over-The-Air-Passive Surveillance/Ring of Steel, Control Application Examples, Myriad

Text Book	Text Book 2: 2.1,2.2,2.3,3.1-3.11

MODULE-4	**FUNDAMENTAL IOT MECHANISM AND KEY TECHNOLOGIES**	**21AIM543.4**	**8Hours**

Identification of IoT Object and Services, Structural Aspects of the IoT, Key IoT Technologies. Evolving IoT Standards: - Overview and Approaches, IETF IPV6 Routing Protocol for RPL Roll, Constrained Application Protocol, Representational State Transfer

Text Book	Text Book 2: 4.1,4.2,5.1,5.2,5.3,5.4,5.5-5.10

MODULE-5	**LAYER 3 CONNECTIVITY**	**21AIM543.5, 21AIM543.6**	**8 Hours**

IPv6 Technologies for the IoT: Overview and Motivations. Address Capabilities, IPv6 Protocol Overview, IPv6 Tunneling, IPsec in IPv6, Header Compression Schemes, Quality of Service in IPv6, Migration Strategies to IPv6

Text Book	Text Book 2:7.1-7.8

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Patranabis D, "Sensors and Transducers," Prentice Hall
2) Daniel Minoli," Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", Wiley, 2013
3) ArshdeepBahga, Vijay Madisetti," Internet of Things: A Hands on Approach" Universities Press., 2015

Reference Books:

1) Callaway EH, "Wireless Sensor Networks: Architecture and Protocols," Auerbach Publications.
2) Michael Miller," The Internet of Things", First Edition, Pearson, 2015.

Web links and Video Lectures (e-Resources):

- https://www.educba.com/introduction-to-iot/
- https://www.geeksforgeeks.org/introduction-to-internet-of-things-iot-set-1/
- https://onlinecourses.nptel.ac.in/noc22_cs53/preview
- https://www.simplilearn.com/iot-devices-article

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Visit to any open source IOT lab
- Demonstration of Thermal sensors
- Demonstration of chemical characterization
- Demonstration of strain gauge sensors
- Video demonstration of latest IOT applications
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare various sensors and its description
  - Organizing Group wise discussions on real time issues
  - Seminars

INFORMATION SECURITY														
Course Code	**21AIM544**										**CIE Marks**		**50**	
L:T:P:S	**3:0:0:0**										**SEE Marks**		**50**	
Hrs./ Week	**3**										**Total Marks**		**100**	
Credits	**03**										**Exam Hours**		**03**	
Course outcomes: At the end of the course, the student will be able to:														
21AIM544.1	Understand the security parameters and access control methods in information security.													
21AIM544.2	Apply the legal, ethical, and professional issues in information security.													
21AIM544.3	Examine fault tolerance and failure recovery.													
21AIM544.4	Analyse the fundamental policies with the design principle of computing resources.													
21AIM544.5	Classify the different security policies in system design.													
21AIM544.6	Design the system with all security measures.													
Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:														
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21AIM544.1	2	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIM544.2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
21AIM544.3	3	3										2	3	
21AIM544.4	3	3	-	-	-	-	-	-	-	-	-	3	3	-
21AIM544.5	3	3	-	-	-	-	-	-	-	-	-	3	3	-
21AIM544.6	3	3	3	-	2	-	-	-	-	-	-	3	3	-
MODULE-1	**OVERVIEW OF SECURITY PARAMETERS**										**21AIM544.1, 21AIM544.2**		**8 Hours**	
Confidentiality, integrity and availability; Security violation and threats; Security policy and procedure; Assumptions and Trust; Security Assurance, Implementation and Operational Issues; Security Life Cycle.														
Textbook	Text Book 1: 1.2, 1.4, 4,													
MODULE-2	**ACCESS CONTROL MODELS**										**21AIM544.2, 21AIM544.3**		**8 Hours**	
Operating system access controls, Hardware protection, Distributed Systems: Concurrency, Fault tolerance and failure recovery, Naming.														
Textbook	Text Book 2: 6.2, 6.3,7,7.1, 7.3, 7.4													
MODULE-3	**SECURITY POLICIES**										**21AIM544.4**		**8 Hours**	
Confidentiality policies, integrity policies, hybrid policies, non-interference and policy composition, international standards.														
Textbook	Text Book 1: 5, 6,7,8,9													
MODULE-4	**SYSTEMS DESIGN**										**21AIM544.5**		**8 Hours**	
Design principles, representing identity, control of access and information flow, confinement problem. Assurance: Building systems with assurance, formal methods, evaluating systems														
Textbook	Text Book 1: 14,15,16,17,18,19,20,21,22													
MODULE-5	**LOGIC-BASED SYSTEM**										**21AIM544.6**		**8 Hours**	
Malicious logic, vulnerability analysis, auditing, intrusion detection. Applications: Network security, operating system security, user security, program security.														
Self-study	Data privacy, introduction to digital forensics, enterprise security specification													
Textbook	Text Book 1: 23,24,25,26,28,29,30,31													

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**.

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	**10**
L5	Evaluate	**10**
L6	Create	-

Suggested Learning Resources

Text Books:

1) Computer Security Art and Science, 2nd Edition, Matt Bishop, November 2018
2) Security Engineering, A guide building dependable distribution systems, 3rd Edition by Ross Anderson,2020.

Reference Books:

1) Micki Krause, Harold F. Tipton, ― Handbook of Information Security Management‖, Vol 1-3 CRC Press LLC, 2004.
2) Stuart McClure, Joel Scrambray, George Kurtz, ―Hacking Exposed‖, Tata McGraw- Hill, 2003

Web links and Video Lectures (e-Resources):

https://archive.nptel.ac.in/courses/106/106/106106129/

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning:

- Online class using Jeopardy Lab
- Demonstration of Cloud Computing through online Video.
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to read research papers on Information Security and have a discussion.
- Presentations

PARALLEL PROCESSING			
Course Code	**21AIM545**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM545.1	Understand parallel computer architecture and models.
21AIM545.2	Apply principles of parallel algorithms to design.
21AIM545.3	Analyze parallel programming with various performance metrics.
21AIM545.4	Use Message Passing Library for communication among processes running in parallel.
21AIM545.5	Design parallel algorithms for shared address space platform using multithreading.
21AIM545.6	Develop efficient high performance parallel programming.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21AIM545.1	2	**-**	**-**	**-**	**---**	-	-	-	-	-	-	**-**	**-**	--
21AIM545.2	3	**-**	**-**	**-**		-	-	-	-	-	-	-	3	3
21AIM545.3	**3**	**3**	-	-	2	-	-	-	-	-	-	2	3	3
21AIM545.4	**3**	**-**	**-**	-	2	-	-	-	-	-	-	2	3	3
21AIM545.5	3	**3**	3	-	2	-	-	-	-	-	-	2	3	3
21AIM454.6	3	**3**	3	3	3	-	-	-	-	-	-	3	2	3

MODULE-1	**PARALLEL COMPUTER ARCHITECTURE**	**21AIM545.1**	**8 Hours**

Processor Architecture and Technology Trends, Flynn's Taxonomy of Parallel Architecture, Thread-Level Parallelism, Caches and memory Hierarchy, Models for Parallel Systems, Parallelization of Programs, Levels of Parallelism, SIMD Computations.

Text Book	Text Book 1: 2.1, 2.2, 2.3, 2.4 , 2.7,3.2, 3.3, 3.4

MODULE-2	**PRINCIPLES OF PARALLEL ALGORITHM DESIGN**	**21AIM545.2**	**8 Hours**

Preliminaries, Decomposition Techniques, Characteristics of Tasks and Interactions, Mapping Techniques for Load Balancing, Methods for Containing Interaction Overheads, Parallel Algorithm Models.

Text Book	Text Book 2: 3.1 to 3.6

MODULE-3	**PERFORMANCE ANALYSIS OF PARALLEL PROGRAMS**	**21AIM545.3**	**8 Hours**

Performance Evaluation of Computer Systems, Performance Metrics for Parallel Programs, Asymptotic Times for Global Communication, Analysis of Parallel Execution Times, Parallel Computational Models, Loop Scheduling and Loop Tiling. Hands-on-Training: write a program to demonstrate parallelize the loops using OpenMP

Text Book	Text Book 1: 4.1 to 4.6

MODULE-4	**PROGRAMMING USING THE MESSAGE PASSING PARADIGM**	**21AIM545.4,21AIM545.6**	**8 Hours**

Principles of Message, Passing Programming, The Building Blocks: Send and Receive Operations, MPI: The Message Passing Interface, Collective Communication and Computation Operations, Groups and Communicators. Hands-on-Training: Write an OpenMP program to compute approximation of pi.

Text Book	Text Book 2: 6.1 to 6.3, 6.6, 6.7

MODULE-5	**PROGRAMMING SHARED ADDRESS SPACE PLATFORMS**	**21AIM545.5,21AIM545.6**	**8 Hours**

Thread Basics, Threads- the POSIX Thread Application Programme Interface, Synchronization Primitives in Pthreads, Controlling Thread and Synchronization Attributes, Thread Cancellation, Composite Synchronization Constructs. Hands-on- Training: Demonstrate the fork-and-Join model of parallel execution using OpenMP.

Text Book	Text Book 2: 7.1 to 7.8

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Introduction to parallel programming, Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Publisher : Pearson Publication, 2nd Edition, ISBN-978-81-317,0807-1

2) Parallel Programming, Thomas Rauber, Gudula Runger, Publisher: Springer, 2nd Edition, 2012, ISBN- 978-3-642-37800-3.

Reference Books:

1) John L. Hennessy and David A. Patterson. Computer Architecture, Sixth Edition: A Quantitative Approach. Morgan Kaufmann, 2017

2) V. Rajaraman And C. Siva Ram Murthy, "Parallel Computers – Architecture And Programming", PHI Publication.

3) Introduction to Parallel Processing, M. SasiKumar, Dinesh Shikhare P.Raviprakash, PHI Publication.

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/102/106102163/
- https://www.g2.com/glossary/parallel-processing-definition
- https://www.youtube.com/watch?v=KH89uETpwxI
- https://www.youtube.com/watch?v=txAyA_UozmM
- https://www.op.inria.fr/oasis/Denis/ProgRpt/COURS/IntroductionToParallelProgramming.pdf

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest GPU Programming/OpenMP Programming
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars /Presentations

UNIX AND SHELL PROGRAMMING

Course Code	**21AIL551**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs/Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL551.1	Understand the basic concepts of UNIX Architecture, File system and basic commands
21AIL551.2	Apply the basic file system commands, concepts of Shell programming.
21AIL551.3	Analyze the concepts of UNIX API's and process control.
21AIL551.4	Compare the concepts of process accounting, User identification and different IPC mechanisms

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIL551.1	2	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIL551.2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIL551.3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21AIL551.4	3	3	-	-	-	-	-	-	-	-	-	-	3	-

Pgm. No.	**List of Experiments / Programs**	**Hours**	**COs**
	Prerequisite Experiments/Programs/ Demo		
	Basics of DOS Commands and Programming	**2**	**NA**
	PART-A		
1	1. Execute the following commands with options (if any) : a. Date with all options, cal, calendar, who, whoami, tty, stty, clear and tput. b. Man, echo, whatis, Uname with all options Note: Discuss the all-important basics commands	2	21AIL551.1
2	a. Execute the following commands, bc with scale factor, using bc convert from one base to another b. Base (eg binary to decimal, decimal to octal, decimal to hexa etc), password, history, alias and script. c. write simple program combining two or more commands and print the output in console. Note: Discuss the decimal, binary and octal number systems.	2	21AIL551.1
3	*a.* Execute the following directory related commands (i)create the directory, change the directory, print the current directory, display the disk space usage, compress the content of the file and archive the file b. Practice file related commands like cat, cp, mv, rm commands. Note: Discuss the directory and File related commands.	2	21AIL551.1
4	*a.* Write a simple program using wc command. b. Practice od file command. c. Write a simple program using pwd, mkdir and rmdir.	2	21AIL551.1 21AIL551.2
5	Execute ls command and display all the attribute of the file with all options, display the content of the file, copy and move the file from one place to another, remove the file. Note: Discuss the list commands and other command.	2	21AIL551.1 21AIL551.2
6	a. Write a simple program using pipe command b. Practice the grep commands with all attributes/ options. Note: Discuss the usage of Pipe and grep commands	2	21AIL551.1 21AIL551.2
	PART B		
7	Create the student/employee data base with 5 fields and apply the grep command with all options to display the pattern or records using regular expressions.	2	21AIL551.1 21AIL551.2
8	a. Create a file using vi editor and practice basic operation of vi editor. b. Write a program to search and replace string using pattern matching commands. Note: Discuss the vi editor concepts.	2	21AIL551.1 21AIL551.2
9	Display the user process and system processes and kill the process using process ids.	2	21AIL551.1 21AIL551.2

	Note: Discuss the process creation and kill process.		21AIL551.3
10	Identify and use the command to execute the jobs in foreground and background at the same time	2	21AIL551.1 21AIL551.2 21AIL551.3
11	a. Write a simple program using vi editor to combine more than one commands using shell script. b. Write a shell program using if and case statements. Note: Discuss the shell programming concepts.	2	21AIL551.1 21AIL551.2 21AIL551.3 21AIL551.4
12	a. Write a shell script that takes pattern and filename as input from the user to search a string in the file. b. Write a shell script which displays a list of all the files in the current directory to which you have read, write and execute permissions	2	21AIL551.1 21AIL551.2 21AIL551.3 21AIL551.4

PART-C

Beyond Syllabus/ Virtual Lab Content

1. Basics Unix Commands: https://www.unixtutorial.org/basic-unix-commands.
2. Shell Programming: https://www.shellscript.sh/
3. Advanced Concepts: https://www.tutorialspoint.com/unix/unix_tutorial.pdf.

CIE Assessment Pattern (50 Marks–Lab)

RBT Levels		**Test(s)** 20	**Weekly Assessment (30)**
L1	**Remember**	-	-
L2	**Understand**	5	5
L3	**Apply**	5	10
L4	**Analyze**	10	10
L5	**Evaluate**	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks–Lab)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1) UNIX – Concepts & Applications, SUMITABHA DAS, TATA McGraw Hill Edition, Fourth edition, 26th reprint 2015, McGraw Hill
2) Advanced Programming in the UNIX Environment, W Richard Stevens and Stephen A Rago, Addison Wesley Publications, Third Edition
3) UNIX and SHELL Programming, Richard F Gilberg and Behrouz A Forouzan, 15th impression, 2015, Cengage Learning

Web links and Video Lectures (e-Resources):

- Linux Full Course In 5 Hours | Linux Tutorial For Beginners | Linux Training | Edureka - YouTube
- **https://www.udemy.com/course/learn-linux-in-5-days/**
- Linux Operating System - Crash Course for Beginners - YouTube
- The Complete Linux Course: Beginner to Power User! - YouTube
- NPTEL or **https://nptel.ac.in/courses/117106113/**

Activity-Based Learning /Practical Based learning

- For active participation of students, instruct the students to prepare questions and discuss in open form.
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Handouts Organizing Group wise discussions on use-cases.

CLOUD COMPUTING USING AWS			
Course Code	**21AIL552**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs /Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL552.1	Understand the core concepts of the cloud computing paradigm.
21AIL552.2	Apply the different AWS storage service concepts.
21AIL552.3	Analyze the concept of Virtual Private Cloud and Elastic Compute Cloud.
21AIL552.4	Develop database using DynamoDB

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIL552.1	2	-	-	-	-	-	-	-	-	-	--	3	3	-
21AIL552.2	3	-	-	-	-	-	-	-	-	-	-	3	3	-
21AIL552.3	3	3	-	-	-	-	-	-	-	-	--	3	3	-
21AIL552.4	3	3	3	3	3	-	-	-	-	-	-	3	3	-

Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments/Programs/ Demo		
	Basic of Cloud Computing and Basic Java Program	**2**	**NA**
	PART-A		
1	Create a bucket and upload the file in AWS. Note: Discuss the Basics of AWS.	**2**	21AIL552.1 21AIL552.2
2	Host Static website on Amazon S3.	2	21AIL552.1 21AIL552.2
3	Implement Cross Region Replications in Amazon S3 through an example.	2	21AIL552.1 21AIL552.2
4	Creating a VPC using AWS console. Note: Discuss the subnets, gateways, route tables	2	21AIL552.2 21AIL552.3
5	Creating a Non-Default VPC and creating a private and public subnet inside the VPC.	2	21AIL552.2 21AIL552.3
6	Implement ACL Note: Discuss the Inbound Traffic-Outbound Traffic.	2	21AIL552.2 21AIL552.3
	PART-B		
7	Creating Auto Scaling Group and Scaling policy. Note: Discuss the Virtual machines and compute Services in AWS.	**2**	21AIL552.3
8	Implement Access Key and IAM Roles with EC2. Note: Discuss the EC2.	2	21AIL552.3
9	Implement Elastic load balancing.	2	21AIL552.3
10	Creating and working with DynamoDB in AWS. Note: Amazon Relational Databases services, Amazon Dynamo DB.	2	21AIL552.4
11	Create and Modify then list all tables in DynamoDB	2	21AIL552.4
12	Implement Autoscaling in AWS. Note: Discuss the Autoscaling	2	21AIL552.4

PART-C

Beyond Syllabus/ Virtual Lab Content

1.DynamoDB Tutorials: https://aws.amazon.com/tutorials/create-nosql-table/
https://dynobase.dev/dynamodb-tutorials/
2. EC2: https://www.javatpoint.com/aws-ec2
3. VPC https://docs.aws.amazon.com/vpc/latest/userguide/how-it-works.html

CIE Assessment Pattern (50 Marks–Lab)

RBT Levels		Test(s) 20 marks	Weekly Assessments (30) marks
L1	**Remember**	**-**	**-**
L2	**Understand**	5	5
L3	**Apply**	5	10
L4	**Analyze**	10	10
L5	**Evaluate**	-	5
L6	**Create**	-	-

SEE Assessment Pattern (50 Marks–Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Book:

1. Cloud Computing with AWS: Everything You need to know to be an AWS Cloud Practitioner, Pravin Mishra, Apress,2023.

Weblinks and Video Lectures(e-Resources):

- **https://www.cloudways.com/blog/aws-for-beginners/**
- **https://www.javatpoint.com/aws-tutorial**
- **https://www.geeksforgeeks.org/aws-tutorial/?ref=lbp**
- **https://www.w3schools.com/aws/index.php**

DATA VISUALIZATION

Course Code	**21AIL553**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs /Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL553.1	Understand basic concepts and terminology of the Power BI service.
21AIL553.2	Apply the concept of data importing, charts and data cleaning.
21AIL553.3	Analyze the concept of View and export data from dashboards and reports.
21AIL553.4	Design the relationship between dash boards and reports, visualizations, and tiles.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIL553.1	**2**	-	-	-	-	-	-	-	**-**	**-**	-	-	3	3
21AIL553.2	3	**-**	-	-	-	-	-	-	**-**	**-**	-	-	3	3
21AIL553.3	3	3	**-**	-	3	-	-	-	**-**	**-**	-	-	3	3
21AIL553.4	**3**	**3**	3	-	3	-	-	-	**-**	**-**	-	-	3	3

Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments/Programs/ Demo		
	Basic of Data Science Algorithms and Python	**2**	**NA**
	PART-A		
1	Visualize different groups of data using bar chart. Note: Discuss the different types of data and choosing appropriate chart type.	**2**	21AIL553.1 21AIL553.2
2	Visualize many different items and the composition of each item? (Stacked Bar) Note: Discuss the Design principles for effective visualizations	2	21AIL553.1 21AIL553.2
3	Import external data files of formats like excel, CSV into Power BI **Note:** Discuss the Importing different data sources in Power BI	2	21AIL553.2 21AIL553.3
4	Handle data errors and missing values on the imported data **Note:** Discuss the Dealing with errors and inconsistent data	2	21AIL553.2 21AIL553.3
5	Create interactive report with filters **Note:** Discuss the inking visualizations through interactions	2	21AIL553.2 21AIL553.3
6	Create a dashboard report for the given dataset **Note:** Discuss the arranging visuals in dashboards	2	21AIL553.1 21AIL553.2
	PART-B		
7	Create a new column or metrics and display in the report **Note:** Discuss the Basic DAX functions and formulas	**2**	21AIL553.3 21AIL553.4
8	Create a report with parameters which accepts user input **Note:** Discuss the parameterizing reports for dynamics analysis	2	21AIL553.3 21AIL553.4
9	Demonstrate conditional colour formatting in the report **Note:** Discuss the Visual formatting	2	21AIL553.3 21AIL553.4
10	Demonstrate the heat map report **Note:** Discuss the Heat maps	2	21AIL553.3 21AIL553.4
11	Demonstrate the drillthrough report	2	21AIL553.4
12	Creative effective report for the given dataset.	2	21AIL553.4

PART-C

Beyond Syllabus/ Virtual Lab Content

1. Charts for visualization: https://windsor.ai/power-bi-visualization-Charts
2. Heatmaps: https://intellipaat.com/blog/power-bi-heatmap/
3. ColourFormatting: https://intellipaat.com/blog/power-bi-heatmap/
4. https://databear.com/changing-colours-using-dax-and-conditional-formatting-in-power-bi/

CIE Assessment Pattern (50 Marks–Lab)

RBT Levels		Test(s) 20 marks	Weekly Assessments (30) marks
L1	**Remember**	**-**	**-**
L2	**Understand**	5	5
L3	**Apply**	5	10
L4	**Analyze**	10	10
L5	**Evaluate**	-	5
L6	**Create**	-	

SEE Assessment Pattern (50 Marks–Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1)Introducing Microsoft PowerBI, Alberto Ferrari and Marco Russo, Microsoft Press, 2016.

Weblinks and Video Lectures(e-Resources):

- https://www.datacamp.com/tutorial/tutorial-power-bi-for-beginners
- https://www.bing.com/videos/search?q=power+bi+tutorial+for+beginners&docid=603533498868517438&mid=D73791A4A441F7A262C4D73791A4A441F7A262C4&view=detail&FORM=VIRE
- https://www.geeksforgeeks.org/power-bi-tutorial

PERL PROGRAMMING			
Course Code	**21AIL554**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs /Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL554.1	Understand the basic concepts of Perl programming.
21AIL554.2	Apply the Concept of Loops and control statements in Subroutine
21AIL554.3	Analyze the working of List, sort, File I/O and Debug Output.
21AIL554.4	Design Object Oriented Perl programming to solve real time problems.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIL554.1	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
21AIL554.2	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
21AIL554.3	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**
21AIL554.4	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**

Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments/Programs/ Demo		
	C Program/C++ Program/Java Programming Concepts	**2**	**NA**
	PART-A		
1	a. Write a program for converts between numbers and string on the fly. b. Write a program to print array of elements.	**2**	21AIL554.1 21AIL554.2
2	Write a program in Perl for typeglob, sigils and Hashes Note: Discuss the sigils and Hash concepts.	2	21AIL554.1 21AIL554.2
3	Write a simple program using conditional statement to precede or succeed the code to be executed.	2	21AIL554.1 21AIL554.2
4	a. Write a program for swap two numbers using subroutine. b. Write a program to print sum of integers using for loop statement.	2	21AIL554.1 21AIL554.2
5	Write a program to display the output in specified format using Data: Show method. Note: Discuss the available format in Perl language	2	21AIL554.1 21AIL554.2 21AIL554.3
6	***a.*** Write a program to pass list to subroutine. b. Write a program to get list elements from subroutine.	2	21AIL554.3
	PART B		
7	Write a program to display array list value using Dumper. Note: Discuss the Dumper concepts.	**2**	21AIL554.3
8	Write a program to sort elements using Lexical sort.	2	21AIL554.3
9	Write a program to read and write from /to compressed file. Note: Discuss the file operation and its syntax with I/O files.	2	21AIL554.3
10	a. Write a program to write content into a file using autidie function. b. Write a program using Perl to rewind a filehandle method	2	21AIL554.3

11	Implement inheritance concept using Perl programming. Notes: Discuss the OOPs Concepts.	2	21AIL554.3 21AIL554.4
12	Write a program for methods resolution using Perl programming.	2	21AIL554.3 21AIL554.4

PART-C

Beyond Syllabus/ Virtual Lab Content

1. Introduction to Perl language: https://freevideolectures.com/course/4988/nptel-linux-programming-scripting/12
2.Programming Fundamentals: https://nptel.ac.in/courses/106102067
3.Advanced Perl Programming Concepts:
https://www.oreilly.com/library/view/advanced-perl- programming/0596004567/ch01.html

CIE Assessment Pattern (50 Marks–Lab)

RBT Levels		Test(s)	Weekly Assessment
		20 marks	30 marks
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	10	10
L5	Evaluate	-	5
L6	Create	-	-

SEE Assessment Pattern (50 Marks–Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Books:

1. 1) Perl Notes for Professionals from Stack Overflow Documentation-Online

Web links and Video Lectures (e-Resources):

- **https://archive.nptel.ac.in/courses/106/105/106105084/**

Activity-Based Learning /Practical Based learning

- For active participation of students, instruct the students to prepare Flowcharts and Handouts
- Organizing Group wise discussions on issues
- Presentation

BASICS FOR DIGITAL AND IMAGE PROCESSING			
Course Code	**21AIL555**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs /Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL555.1	Understand the basic concepts of Digital Signals and Image Processing System.
21AIL555.2	Apply the different techniques of Image Processing to solve the problem.
21AIL555.3	Analyze the Image Properties and signals with different DIP/Image Functions.
21AIL555.4	Develop a new algorithm in Signal and Image Processing Applications.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIL555.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIL555.2	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIL555.3	3	3	-	-	-	-	-	-	-	-	-	-	3	-
21AIL555.4	3	3	3	-	-	-	-	-	-	-	-	-	3	-

Pgm. No.	List of Experiments / Programs	Hours	COs
	Prerequisite Experiments/Programs/ Demo		
	C Programming Concepts	**2**	**NA**
1	Reading an image and display the Gray scale, colour and B/W image using MATLAB/Python. Note: Discuss about the steps of Image Processing and its models.	**2**	21AIL555.1
2	Reading and RGB Image and extract the colour components using MATLAB/Python. Note: Discuss the Quantization, pixel Relationship.	2	21AIL555.1 21AIL555.2
3	Develop a program using MATLAB/Python for enhance the Brightness and Contrast of an image.	2	21AIL555.1 21AIL555.2
4	Develop a MATLAB/Python program for image smoothing and sharpening using different mask.	2	21AIL555.1 21AIL555.2
5	Develop a MATLAB/Python program for Image noising using different noise distribution.	2	21AIL555.1 21AIL555.2
6	Write a program using MATLAB/Python for De-noising the image using Arithmetic mean and median filter.	2	21AIL555.1 21AIL555.2
	PART-B		
7	Implement order statistics filter to De-nosing the image.	**2**	21AIL555.1 21AIL555.2
8	Write a MATLAB/Python program to generate signal.	2	21AIL555.3 21AIL555.4
9	Write a Program in MATLAB/Python for analysis the properties of the Z Transforms.	2	21AIL555.3 21AIL555.4
10	Write a program in MATLAB/Python for analysis of LTI system. .	2	21AIL555.3 21AIL555.4
11	Write a program in MATLAB/Python for DFT.	2	21AIL555.3 21AIL555.4
12	Write a program in MATLAB/Python for FFT and DIT.	**2**	21AIL555.3 21AIL555.4

PART-C

Beyond Syllabus/ Virtual Lab Content

1.OpenCV :
https://www.bing.com/videos/riverview/relatedvideo?q=digital%20image%20processing%20tutorials&mid=39145CDAF75FB2A8994E39145CDAF75FB2A8994E&ajaxhist=0

2. Introduction to Image Processing:
https://www.tutorialspoint.com/dip/image_processing_introduction.htm

CIE Assessment Pattern (50 Marks–Lab)

RBT Levels		Test(s)	Weekly Assessment
		20	30
L1	Remember	-	-
L2	Understand	5	5
L3	Apply	5	10
L4	Analyze	10	10
L5	Evaluate	-	5
L6	Create	-	

SEE Assessment Pattern (50 Marks–Lab)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	-
L2	Understand	10
L3	Apply	10
L4	Analyze	20
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Reference Book:

1.Gonzalez, Rafael C., and Richard E. Woods, "Digital Image Processing" 2nd Edition, Pearson Edu 2002.

Weblinks and Video Lectures(e-Resources):

- http://nptelvideos.com/course.php?id=541
- **https://www.youtube.com/watch?v=xUCsfKA8bi0**
- **https://in.mathworks.com/videos/image-processing-made-easy-81718.html**

Activity-Based Learning /Practical Based learning

- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Ha
  - Organizing Group wise discussions on issues
  - Seminars

MINI PROJECT			
Course Code	**21AIM56**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM56.1	Understand the technological needs and/or societal needs and sustainability of the environment
21AIM56.2	Apply practical knowledge and latest tools usage along with project development.
21AIM56.3	Analyze the outcome of the application project using Big Data concepts/ techniques
21AIM56.4	Design application using Big Data concepts/ techniques
21AIM56.5	Implement the project and provide solutions within the context of the Legel framework, addressing social concerns and upholding ethical issues
21AIM56.6	Present the Report for implemented problem and its solutions as a team.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM56.1	2	-	-	-	-	1	1	1	-	-	-	3	3	2
21AIM56.2	3	-	-	-	3	-	-	-	-	-	-	-	-	-
21AIM56.3	3	3	-	-	3	-	-	-	-	-	-	-	-	-
21AIM56.4	3	3	3	-	-	-	-	-	-	-	-	3	3	2
21AIM56.5	3	3	3	3	3	2	2	2	2	-	-	3	3	2
21AIM56.6	-	-	-	-	3	1	1	1	2	2	-	3	-	-

Each team capable of identifying a problem and carry out a mini project on the problem defined. A panel of experts will review the code developed towards the project during the course of the semester. Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the team will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Review (50 marks)
		50
L1	**Remember**	**-**
L2	**Understand**	-
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	10
L6	**Create**	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	-
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	10
L6	**Create**	-

RESEARCH METHODOLOGY AND IPR			
Course Code	**21AIK57**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes: At the end of the course, the student will be able to:

21AIK57.1	Characterize the significance and suitability of research in engineering applications
21AIK57.2	Demonstrate the various processing techniques of research
21AIK57.3	Evaluate the research in the development of engineering materials, process and tools
21AIK57.4	Analyze criteria to fit own intellectual work in particular form of IPR
21AIK57.5	Apply statutory provisions to protect particular form of research
21AIK57.6	Develop the art of scholarly writing and evaluate its quality

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIK57.1	3	3	3	-	-	-	-	-	3	3	2	3	3	3
21AIK57.2	3	3	3	1	2	-	-	-	3	3	2	3	2	2
21AIK57.3	3	3	3	1	2	-	-	2	3	3	2	3	3	3
21AIK57.4	3	3	-	-	-	-	-	2	3	3	2	3	3	3
21AIK57.5	3	-	-	-	-	-	-	2	3	3	2	3	3	3
21AIK57.6	3	3	3	1	2	-	-	1	3	3	2	3	3	3

MODULE-1	**RESEARCH FORMULATION AND DESIGN**	**21AIK57.1, 21AIK57.2**	**3 Hours**

Definition and objective of research, types of research, steps in research process, research design, concept and types of research design, defining and formulating the research problems, importance of literature review- primary and secondary sources, reviews, monographs, patent, research database, web sources, identifying gap areas from the literature and research data base, surveying synthesis, Interpretation.

Self-study	Multiple choice question based on reading comprehension and lecture content
Text Book	Text Book 1: Ch. 1, 2& 6

MODULE-2	**SAMPLING & DATA INTERPRETATION**	**21AIK57.2, 21AIK57.3**	**3 Hours**

Mathematical tools for analysis, statistical analysis of data, regression analysis, correlation, concept of best fit and exact fit, exact fit, theory, examples from linear regression with one and more unknowns.

Self-study	Programming exercise and assignments
Text Book	Text Book 1: Ch. 4& 7

MODULE-3	**PATENT RIGHTS AND IPR**	**21AIK57.3, 21AIK57.4**	**3 Hours**

Patents and its basics, process of filing patent at national and international level, Introduction and significance of intellectual property rights, commercialization, royalty, copyright, trade related aspects of IPR, Administration of patent system in India, licensing and transfer of technology, case studies.

Case Study	CASE STUDIES ON IPR DISPUTES: 1. COCO COLA Vs BISLERI,2. WALMART AND HEALTH PARTNERS,3. COCO COLA Vs PEPSI 4. 'ZANDU BALM' sues 'DABANGG' producers.
Text Book	Text Book 2: Ch. 1 & 2/ IPR India website

MODULE-4	**RESEARCH AND PUBLICATIONETHICS**	**21AIK57.4, 21AIK57.5**	**3 Hours**

Research and Integrity, Scientific mis conduct: Falsification, Fabrication and Plagiarism (FFP), Conflict of research, Predatory publishers and Journals, Open access publication, citation and acknowledgement, reproducibility and accountability, software tools for similarity check

Case Study	Case study of any five instances of plagiarism detected between 2016 and 2023.
Text Book	Text Book 1: Ch. 14 & 15

MODULE-5	**REPORT WRITING**	**21AIK57.5, 21AIK57.6**	**3 Hours**

Structure and components of research report, types of report, layout of research report, mechanism of writing a research report, referencing in academic writing, Abstracting, Bibliography

Self-study	**1.Literature Review Report:** Summarizes and synthesizes existing research on a specific topic. **2 Technical Report:** Focuses on technical details, often used in engineering and scientific research
Text Book	Text Book 1: Ch. 14

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution		
		Test (s) 25	Qualitative Assessment (s) 15	MCQ's 10
L1	Remember	5	-	-
L2	Understand	5	-	-
L3	Apply	5	5	5
L4	Analyze	5	5	5
L5	Evaluate	5	5	-
L6	Create	-	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) Kothari, C.R., "Research Methodology: Methods and Techniques". New Age International, 2018, ISBN-13: 978-8122436235
2) Ramakrishna Chintakunta, A Text book of Intellectual Property rights, Blue Hill Publication, ASIN: B09T6YDB5N, 2022

Reference Books:

1) Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K, An introduction to Research Methodology, RBSA Publishers. 2015, ISBN-13:978-8176111652
2) Ranjith Kumar, Research methodology, Saga publications,4th edition, 2014, ISBN-13- 978-9351501336Anderson, T. W., "An Introduction to Multivariate Statistical Analysis", Wiley Eastern Pvt., Ltd., New Delhi, 2011, ISBN-13: 978-8126524488
3) Montgomary, Douglas C. & Runger, George C. (2016) 6/e, Applied Statistics & probability for Engineers (Wiley India) ISBN-13: 978-1118539712
4) Montgomary, Douglas C. (2012) 8th edition, Design and Analysis of Experiments (Wiley India) ISBN: 978-1-118-14692-7
5) Sinha, S.C. and Dhiman, A.K., 2012. Research Methodology, EssEss Publications. 2 volumes. ISBN : 81-7000-324-5, 81-7000-334-2

Web links and Video Lectures (e-Resources):

[1] https://onlinecourses.nptel.ac.in/noc23_ge36/preview
[2] https://nptel.ac.in/courses/121106007
[3]http://silver.nitt.edu/~esgopi/pdf/Statistical test.pdf
[4] https://www.youtube.com/@ShashiKS

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

1.Student Summary of another Student's Answer: This is an activity that tests the active listening of a student. First, ask a question to a student and then ask the next student to summarize the first student's response. This promotes the idea that learning is a shared enterprise and enables them to actively listen to everything discussed in classrooms.

2. Open-ended questions: Students will be given **a** problem/subject and provided a time frame by which they have to come up with solutions.

Such questions would gear up their thinking process and enable them to think from different perspectives to reach a solution. They can also use it as an option to showcase their understanding.

3.Sketchnoting: This activity asks them to draw pictures and how they visualize, to represent the information discussed in class. This gives them a chance to visualize their understanding and learn a subject from a different perspective.

INNOVATION AND DESIGN THINKING			
Course Code	**21AIK58**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**01**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**01**

Course outcomes: At the end of the course, the student will be able to:

21AIK58.1	Articulate a comprehensive understanding of the concept of Design Thinking
21AIK58.2	Apply Design Thinking methodologies to solve complex and ambiguous problems effectively
21AIK58.3	Utilize design thinking tools for creative solutions
21AIK58.4	Implement design thinking in IT that showcase the ability to drive meaningful innovation
21AIK58.5	Develop strategic innovation for Business Model Design
21AIK58.6	Create the Minimum Viable Product to solve societal needs using Design Thinking

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIK58.1	3	-	-	-	-	-	-	-	3	3	-	3	3	-
21AIK58.2	3	3	2	-	-	-	-	-	3	3	-	3	-	3
21AIK58.3	3	3	2	-	2	-	-	-	3	3	-	3	-	-
21AIK58.4	3	3	2	2	2	-	-	-	3	3	-	3	3	3
21AIK58.5	3	3	2	2	-	-	-	-	3	3	-	3	3	3
21AIK58.6	3	3	2	2	2	1	1	1	3	3	1	3	3	3

MODULE-1	**UNDERSTANDING DESIGN THINKING**	**21AIK58.1, 21AIK58.2**	**3 Hours**

Definition, Origin and features of Design Thinking, Design thinker in organization, Principles and stages of Design thinking. Design Shared model in team-based design, Theory and practice in Design thinking. Collaborative design thinking. Live examples of MVP or Prototyping

Self-study / Case Study / Applications	1. Analyze real-world examples of Minimum Viable Products (MVPs) or prototypes used in product development. What were the goals, challenges, and outcomes of these initiatives? 2. How have emerging technologies, such as 3D printing or virtual reality, influenced the design and testing of prototypes and MVPs in various domains?

MODULE-2	**TOOLS FOR DESIGN THINKING**	**21AIK58.3**	**3 Hours**

Visualization, Journey mapping, Value Chain Analysis, The mind map, Rapid Concept development, Assumption testing, Prototype, Co creation, Learning launches and Storytelling.

Self-study / Case Study / Applications	1. Explore the potential of data visualization in healthcare. How can interactive visualizations empower both patients and healthcare professionals to make informed decisions about treatment plans and wellness? 2. Beyond customer journeys, how can journey mapping be applied to understand and enhance employee experiences within organizations, leading to improved productivity and engagement?

MODULE-3	**DESIGN THINKING IN IT**	**21AIK58.4**	**3 Hours**

Business process modelling (BPM). Agile in Virtual collaboration environment. Scenario based Prototyping. Case studies on Design thinking

Self-study / Case Study / Applications	1. Select a well-known company that has embraced Design Thinking as a core part of its innovation strategy (e.g., Apple, Airbnb, IBM). Analyze how Design Thinking principles have influenced their product development and customer experiences. 2. Investigate how Design Thinking has been utilized in industries beyond traditional design, such as finance, healthcare, or government, and how it has transformed their approaches to problem-solving. 3. Analyze a failed Design Thinking initiative or project. What were the reasons for its failure, and what lessons can be learned from it?

MODULE-4	**DESIGN THINKING FOR STRATEGIC INNOVATION**	**21AIK58.5**	**3 Hours**

Strategic management and Innovation management, Types of Innovations, Features and Scope of strategic innovations, Design thinking and strategic innovation, Practices of integrating Design thinking in Strategic Innovation.	
Self-study / Case Study / Applications	1. Explore the various practices and methodologies for integrating design thinking into strategic innovation, such as design sprints and innovation labs.

MODULE-5	**DESIGN THINKING WORK SHOP**	**21AIK58.6**	**3 Hours**

Focus, Need and stages of Design thinking workshop. Empathize, Design, Ideate, Prototype and Test

Self-study / Case Study / Applications	1. What are the key challenges in transitioning from ideation to prototyping in Design Thinking workshops, and how can organizations overcome these challenges effectively? **2.** Explore the role of rapid prototyping in the design process. How do organizations balance the need for speed with the desire for high-fidelity prototypes?

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Marks Distribution**		
		Test (s)(15)	**Assignment (10)**	**Seminar/Activity (25)**
L1	**Remember**	**5**	**-**	**-**
L2	**Understand**	**5**	**-**	**5**
L3	**Apply**	**5**	**5**	**5**
L4	**Analyze**	**-**	**5**	**10**
L5	**Evaluate**	**-**	**-**	**5**
L6	**Create**	**-**	**-**	**-**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**10**
L2	**Understand**	**25**
L3	**Apply**	**15**
L4	**Analyze**	**--**
L5	**Evaluate**	**--**
L6	**Create**	**--**

Suggested Learning Resources:

1. Christian Mueller-Roterberg, Handbook of Design Thinking - Tips & Tools for how to design thinking.
2. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design",Cengage learning (International edition) Second Edition, 2013.
3. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage",Harvard Business Press, 2009.
4. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve - Apply", Springer, 2011
5. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", CengageLearning, SecondEdition, 2011.
6. Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia BusinessSchool Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author)

Web links and Video Lectures (e-Resources):

- **https://www.ibm.com/design/thinking/**
- **https://www.ideou.com/pages/design-thinking**
- **https://www.youtube.com/watch?v=3RemkU4BH8U**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes & Assignments
- Video demonstration of latest trends.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Handouts /Questions.
  - Organizing Group wise discussions.
  - Seminars

VI SEMESTER

SOFTWARE ENGINEERING AND PROJECT MANAGEMENT			
Course Code	**21AIM61**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM61.1	Understand software systems by applying advanced critical thinking and problem-solving abilities to enhance their effectiveness and efficiency.
21AIM61.2	Design innovative software solutions, utilizing advanced techniques, skills, and cutting-edge engineering tools.
21AIM61.3	Develop an appreciation of the cost, quality, and management issues involved in software construction and Translate the Use Cases into design architecture
21AIM61.4	Apply advanced Software Project Planning and Evaluation knowledge to craft comprehensive project plans and evaluation strategies
21AIM61.5	Deploy software projects through its development life cycle and utilize advanced project management skills by showcasing expertise in activity planning and risk management principles.
21AIM61.6	Create and deliver successful software projects that not only meet but strategically advance the organization's goals, showcasing mastery in achieving meaningful outcomes in software engineering.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM61.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
21AIM61.2	3	3	3	-	2	-	-	-	-	-	-	-	3	3
21AIM61.3	3	3	-	3	3	-		-	-	-	-	-	3	3
21AIM61.4	3	-	-	2	3	-	-	-	-	-	-	-	3	3
21AIM61.5	3	-	2	-	3	-	-	-	-	-	-	-	3	3
21AIM61.6	3	3	3	3	3	-		-	-	-	-	-	3	3

MODULE-1	**SOFTWARE ENGINEERING – INTRODUCTION**	**21AIM61.1,21AIM61.2**	**8 Hours**

Software Engineering – Definition, Software life cycle activities, Challenges in System Development, Software process models: Waterfall, Prototyping, Evolutionary, spiral, unified and agile model, Software development methodology.

Self-study / Case Study / Applications	Investigate the Challenges of System Development, Compare any two Modern software development paradigms
Text Book	Text Book 4: Ch-1, 2

MODULE-2	**SYSTEM ENGINEERING**	**21AIM61.2,21AIM61.3**	**8 Hours**

System Requirement Definition, System Architectural design, System configuration management, System Requirements

Self-study / Case Study / Applications	Investigate Architectural design and compare any two testing techniques
Text Book	Text Book 4: Ch-7,9, 17,22

MODULE-3	**MANAGING SOFTWARE PROJECT**	**21AIM61.3, 21AIM61.4**	**8 Hours**

Project Management Concepts, Process and Project Metrics-Estimation for Software Projects- Project Scheduling- Maintenance and Reengineering.

Self-study / Case Study	Numerical Problems and case studies on: 1.Basic Effort Estimation 2. Function Points Estimation 3. CoCoMo II Estimation 4. Cost Benefit Analysis 5. Agile Estimation
Text Book	Text Book 4: Ch:24-29

MODULE-4	**RISK MANAGEMENT**	**21AIM61.5 21AIM61.6**	**8 Hours**

Risk identification – Assessment – Risk Planning –Risk Management – – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical paths – Cost schedules.			
Self-study / Case Study	**Numerical problems and case studies on:** PERT/ CPM 2. Monte Carlo Simulation		
Text Book	Text Book 4: Ch:24-29		
MODULE-5	**PROJECT EXECUTION AND CLOSURE**	**21AIM61.5 ,21AIM61.6**	**8 Hours**
Project monitoring and control- Project Closure-Reviews-Emerging trends in Software Engineering.			
Text Book	Text Book 5: Ch 9,10,11 Text Bool 4: Ch 31		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test	Assessment(s) *	MCQ
		25	**15**	**10**
L1	**Remember**	5		**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	10	**5**	
L4	**Analyze**	5	**10**	
L5	**Evaluate**	-	**-**	
L6	**Create**	-	**-**	

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**10**
L2	**Understand**	**10**
L3	**Apply**	**20**
L4	**Analyze**	**10**
L5	**Evaluate**	**-**
L6	**Create**	**-**

Suggested Learning Resources:

Text Books:

1. Object Oriented Software Engineering, By David Kung edition 2018.
2. Software Project Management by Bob Hughes, Mike Cotterell and Rajib Mall, Fifth Edition, Tata McGraw Hill, New Delhi, 2015.
3. Software Engineering by Ian Sommerville,9th edition, 2012, Pearson Edu.
4. Software Engineering – A Practitioner's Approach by Roger S Pressman,7thedition, 2014,
5. Software Project Management in Practice by Pankaj Jalote, 5thedition 2015

Reference Books:

1. Software Project Management: A Unified Framework" by Walker Royce.
2. Managing Global Software Projects McGraw Hill Education (India), Gopalaswamy Ramesh, Fourteenth Reprint 2013.
3. Effective Software Project Management by Robert K. Wysocki – Wiley Publication, 2011.

Web links and Video Lectures (e-Resources):

- https://onlinecourses.nptel.ac.in/noc20_cs68/preview
- https://onlinecourses.nptel.ac.in/noc19_cs70/preview

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning:

- Visit to any software development organization
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

DEEP LEARNING TECHNIQUES			
Course Code	**21AIM62**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM62.1	Understand the concepts of deep learning and formulate the real-life problem by mapping different deep learning techniques
21AIM62.2	Apply deep learning algorithms, neural networks and traverse the layers of data abstraction and empower the student to understand data more precisely.
21AIM62.3	Design convolutional neural networks for image detection and recognition
21AIM62.4	Analyse different deep learning architectures in Tensor Flow and interpret the results
21AIM62.5	Use the language and fundamental concepts of artificial neural networks to model and solve real world problems.
21AIM62.6	Evaluate the application of deep learning using different type of networks

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM62.1	2	-	-	-	1	-	-	-	-	-	-	-	3	3
21AIM62.2	3	-	-	-	1	-	-	-	-	-	-	3	3	2
21AIM62.3	3	3	3	-	2	-	-	-	-	-	-	3	3	2
21AIM62.4	3	3	-	-	2	-	-	-	-	-	-	3	3	3
21AIM62.5	2	3	3	3	3	-	-	-	-	-	-	3	3	3
21AIM62.6	3	3	3	3	3	-	-	-	-	--		-	3	3

MODULE-1	**BASICS OF NEURAL NETWORKS**	**21AIM62.1**	**8 Hours**
Neural Networks – Biological Motivation- Perceptron – Multi-layer Perceptron – Feed Forward Network – Back Propagation-Activation and Loss Functions- Limitations of Machine Learning.			
Textbook	Textbook 1: 1.1,1.2,6.1 Textbook2: Chapter:2		
MODULE-2	**INTRODUCTION TO DEEP LEARNING**	**21AIM62.2**	**8 Hours**
Gradient Descent, Back Propagation Algorithm: Vanishing Gradient problem – Mitigation – RelU Heuristics for Avoiding Bad Local Minima – Heuristics for Faster Training – Nestor's Accelerated Gradient Descent – Regularization – Dropout.			
Textbook	Textbook 1: 3.6,4.3,5.1,5.2,5.4,5.9 Textbook 2: Chapter:3,6,9		
MODULE-3	**CONVOLUTIONAL NEURAL NETWORKS**	**21AIM62.3**	**8 Hours**
CNN Architectures –Convolution – Pooling Layers – Transfer Learning – Image Classification using Transfer Learning, Transfer Learning using Inception Oxford VGG Model			
Textbook	Textbook 1: 9.1-9.5,15.2 Text Book 2: Chapter:6-6.1.6.2,6.3		
MODULE-4	**DEEP LEARNING ARCHITECTURES**	**21AIM62.4**	**8 Hours**
LSTM, GRU, Encoder/Decoder Architectures – Autoencoders for Feature Extraction. Auto Encoders for Classification, Denoising Autoencoders, Sparse Autoencoders, Adversarial Generative Networks – Autoencoder			
Textbook	Textbook1: 14.1-14.9Text Book 2: Chapter:8		
MODULE-5	**APPLICATIONS OF DEEP LEARNING**	**21AIM62.5, 21AIM62.6**	**8 Hours**
Image Segmentation – Object Detection – Automatic Image Captioning – Image generation with Generative Adversarial Networks –Introduction to Attention Models for Computer Vision.			
Textbook	Textbook2: Chapter:5.1 -5.4		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test	Assessment(s) *	MCQ
		25	15	10
L1	Remember	5		5
L2	Understand	5	-	5
L3	Apply	5	5	
L4	Analyze	5	10	
L5	Evaluate	5	-	
L6	Create	-	-	

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1)Ian Good Fellow, YoshuaBengio, Aaron Courville, "Deep Learning", MIT Press, 2017.
2) Andrew W. Trask "Grokking Deep Learning", Manning Publications Co., ISBN: 9781617293702

Reference Books:

1)Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt.Ltd, 2009
2)Golub, G., H., and Van Loan,C.,F., Matrix Computations, JHU Press,

Web links and Video Lectures (e-Resources):

- **http://www.cse.iitm.ac.in/~miteshk/CS7015_2018.html**
- **https://archive.nptel.ac.in/courses/106/106/106106184/**
- **https://faculty.iitmandi.ac.in/~aditya/cs671/cs671_2017/data**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Online Quizzes using Jeopardy Lab
- Demonstration of Deep learning algorithms with Virtual Labs.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to read research papers on deep learning and have a discussion.
  - Presentations

DEEP LEARNING LABORATORY			
Course Code	**21AIL62**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL62.1	Apply the various deep learning algorithms in Python.
21AIL62.2	Analyze and improve deep learning models.
21AIL62.3	Build deep learning models in TensorFlow and interpret the results.
21AIL62.4	Evaluate different deep learning frameworks like Keras, Tensor flow, PyTorch etc.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	P O11	PO12	PSO1	PSO2
21AIL62.1	3	-	-	-	-	-	-	-	-	-	-	3	3	3
21AIL62.2	3	3	-	-	3	-	-	-	-	-	-	3	3	2
21AIL62.3	3	3	2	2	3	-	-	2	-	-	-	3	3	3
21AIL62.4	3	3	2	3	3	-	-	2	-	-	-	3	3	3

Ex. No	Experiments	Hours	COs
	Prerequisite Experiments / Programs / Demo		
	Basics of Machine learning Concepts and Python Programming	**2**	**NA**
	Part A		
1	Familiarization of cloud-based computing like Google co lab	**2**	21AIL62.1 21AIL62.2 21AIL62.3 21AIL62.4
2	Write a program to generate following logic functions using McCulloch-Pitts neuron and appropriate values for weights, bias, and threshold. a. AND logic function b. OR logic function c. NOT logic function d. NOR logic function e. XOR logic function	**2**	21AIL62.1 21AIL62.2 21AIL62.3 21AIL62.4
3	Basic image processing operations: Histogram equalization, thresholding, edge detection, data augmentation, morphological operations	**2**	21AIL62.1 21AIL62.2 21AIL62.3 21AIL62.4
4	Implement classifier modelforCIFAR-10 dataset or MNIST dataset using KNN	**2**	21AIL62.1 21AIL62.2 21AIL62.3 21AIL62.4
5	Implement classifier modelforCIFAR-10 dataset or MNIST dataset using 3-layerneuralnetwork	**2**	21AIL62.1 21AIL62.2 21AIL62.3 21AIL62.4
	Part B		
6	Study the effect of batch normalization and drop out in neural network classifier	**2**	21AIL62.1 21AIL62.2 21AIL62.3 21AIL62.4
7	Familiarization of image labeling tools for object detection	**2**	21AIL62.1 21AIL62.2 21AIL62.3 21AIL62.4
8	Image segmentation using UNet.	**2**	21AIL62.1 21AIL62.2

			21AIL62.3 21AIL62.4
9	Text Classification Using LSTM.	**2**	21AIL62.1 21AIL62.2 21AIL62.3 21AIL62.4
Part B- Virtual Lab			
1	Demonstrate the working of Back propagation: https://vlab.spit.ac.in/ai/#/experiments/1	**NA**	**NA**
2	YOLO CNN for Object Detection: https://vlab.spit.ac.in/ai/#/experiments/6	**NA**	**NA**
3	Handwritten Digit Recognition Using CNN: https://vlab.spit.ac.in/ai/#/experiments/2	**NA**	**NA**

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		**Test (s) (20)**	**Weekly Assessment (30)**
L1	**Remember**	**-**	**-**
L2	**Understand**	5	5
L3	**Apply**	**5**	10
L4	**Analyze**	10	10
L5	**Evaluate**	-	5
L6	**Create**		-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		**Exam Marks Distribution (50)**
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Reference Books:

1)Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt.Ltd, 2009
2)Golub, G., H., and Van Loan,C.,F., Matrix Computations, JHU Press,

WEB TECHNOLOGY			
Course Code	**21AIM63**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM63.1	Understand HTML, XHTML syntax and semantics to build web pages.
21AIM63.2	Apply the XML, CSS concepts to design web page.
21AIM63.3	Classify the different Data Interchange formats in Web
21AIM63 4	Design Client-Side Scripts using Java Script and Server-Side Scripts using PHP to generate and display the contents dynamically.
21AIM63.5	Examine PHP programs to demonstrate Error handling and exceptions.
21AIM63.6	Evaluate the performance and code reusability of Node.js

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM63.1	3	-	-	-	-	-	-	-	-	-	-	-	3	-
21AIM63.2	3	3	-	-	3	-	-	-	-	-	-	3	3	-
21AIM63.3	3	3	-	-	3	-	-	-	-	-	-	3	3	-
21AIM63 4	3	3	3	-	3	-	-	-	-	-	-	3	3	-
21AIM63.5	3	3	-	-	3	-	-	-	-	-	-	3	3	-
21AIM63.6	3	3	3	3	3	-	-	-	-	-	-	3	3	3

MODULE-1	**INTRODUCTION TO HTML/XHTML**	21AIM63.1	**8 Hours**

Origins and Evolution of HTML and XHTML, Basic Syntax of HTML, Standard HTML Document Structure, Basic Text Markup, Images, Hypertext Links, Lists, Tables, Forms, HTML5, Syntactic Differences between HTML and XHTML.

Text Book	Text Book 1:4.1,4.2,4.3,4.6,4.7to 4.11 Textbook 2: 2.1,2.2

MODULE-2	**INTRODUCTION TO STYLES SHEETS AND FRAMEWORKS CASCADING STYLE SHEETS**	21AIM63.2	**8 Hours**

Levels of Style Sheets – Style Specification Formats, Selector Forms, Property-Value Forms, Font Properties, List Properties, Alignment of Text, Color, The Box Model, Background Images, The span and div Tags. Frameworks: Overview and Basics of Responsive CSS Frameworks – Bootstrap

Text Book	Text Book 1: 5.1, 5.2, 5.4-5.13 Textbook 2:3.3,3.4

MODULE-3	**INTRODUCTIONTO DATA INTERCHANGE-FORMATSXML**	21AIM63.2, 21AIM63.3	**8 Hours**

The Syntax of XML, XML Document Structure, Namespaces, XML Schemas, Displaying Raw XML Documents, Displaying XML Documents with CSS, XSLT Style Sheets, XML Applications. **JSON**(Basics Only): Overview, Syntax, Datatypes, Objects, Schema, Comparison with XML.

Text Book	Text Book 1:14.1-14.4

MODULE-4	**JAVA SCRIPT**	21AIM63.3, 21AIM63.4	**8 Hours**

Client-Side Scripting, JavaScript Design Principles, Syntax, JavaScript Objects, The Document Object Model (DOM), JavaScript Events, Forms, Introduction to PHP, PHP Classes and Objects, Object-Oriented Overview, Classes and Objects in PHP, Error Handling and Validation, Errors and Exceptions.

Self-study	Design a PHP program to display a digital clock which displays the current time of the server.
Text Book	Text Book 1: 9.1-9.3,10.1-10.5,11.1,12.1-12.5 Textbook 2:4.1-4.9

MODULE-5	**PHP and Node.js**	21AIM63.5 21AIM63.6	**8 Hours**

Arrays and Super globals: Arrays, $_GET and $_POST, Super global Arrays, $_SERVER Array, $_Files Array, Reading/Writing Files. Node.js: Introduction to Node.js, process model, modules and its types, webserver, files system,

Text Book	Text Book 1:23.1,23.5

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test	Assessment(s) *	MCQ
		25	**15**	**10**
L1	**Remember**	5		**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	10	**5**	
L4	**Analyze**	5	**10**	
L5	**Evaluate**	-	**-**	
L6	**Create**	-	**-**	

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	10
L2	**Understand**	10
L3	**Apply**	20
L4	**Analyze**	10
L5	**Evaluate**	-
L6	**Create**	-

Suggested Learning Resources:

Text Books:

1. P. J. Deitel, H.M. Deitel, Internet &World Wide Web How To Program, 4/e, Pearson International Edition 2010.
2. Robert W Sebesta, Programming the World Wide Web, 7/e, Pearson Education Inc., 2014

Reference Books:

1. Randy Connolly, Ricardo Hoar, "Fundamentals of Web Development", 1st Edition, Pearson Education India. (ISBN:978-9332575271)
2. Robin Nixon, "Learning PHP, MySQL &JavaScript with jQuery, CSS and HTML5", 4th Edition, O'Reilly Publications, 2015. (ISBN:978-9352130153)
3. Chris Bates, Web Programming Building Internet Applications, 3/e, Wiley India Edition 2009
4. Lindsay Bassett, Introduction to JavaScript Object Notation: A To-the-Point Guide to JSON 1st Edition, O'Reilly.[Chapter 1,2,3,4]
5. Luke Welling, LauraThomsonA , "PHP and MySQL Web Development", 5th Edition, Pearson Education,2016. (ISBN:978-9332582736)

Web links and Video Lectures (e-Resources):

- https://youtu.be/QEtWL4lWlL4
- Web Technologies and Security | Coursera
- https://iisdt,in/product/certificate-in-web-technology/
- https://youtu.be/KBT2gmAfav4
- https://youtu.be/5fb2aPlgoys

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Hands on sessions for developing static and dynamic web pages
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students in group to design the web pages
  - Organizing Group wise discussions on issues
  - Seminars

WEB TECHNOLOGY LABORATORY			
Course Code	**21AIL63**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs. / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIL63.1	Apply the concepts of HTML5, CSS, JavaScript, XML, PHP and develop Java Script programs
21AIL63.2	Develop XML program to display student information using CSS.
21AIL63.3	Analyse PHP program to keep of the number of visitors visiting the web page, Digital Clock, Simple calculator, matrix addition, Multiplication, transpose.
21AIL63.4	Design the PHP programs to sort the student records in database using selection sort, string manipulations.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21AIL63.1	3	-	-	-	**2**	-	-	-	-	-	-	2	3	-
21AIL63.2	**3**	**3**	3	-	3	-	-	-	-	-	-	2	3	-
21AIL63.3	**3**	3		-	2	-	-	-	-	-	-	2	3	-
21AIL63.4	3	3	3		3	-	-	-	-	-	-	2	3	-

Ex. No	**Experiments**	**Hours**	**COs**
	Prerequisite Experiments / Programs / Demo		
	Basics Programming Knowledge and HTML	**2**	**NA**
	Part A		
1	Design the following static web pages required for an online book store Home page: Must contain 3 frames 1) Login page 2) Catalogue page: Must contain all books details available in the store and 3) Registration page:	**2**	21AIL63.1 21AIL63.2
2	Develop and demonstrate the usage of inline, internal and external style sheet using CSS.	**2**	21AIL63.1 21AIL63.2
3	Write a JavaScript to design a simple calculator to perform the following operations: sum, product, difference and quotient.	**2**	21AIL63.1 21AIL63.2
4	Write a JavaScript that calculates the squares and cubes of the numbers from 0 to 10 and outputs HTML text that displays the resulting values in an HTML table format.	**2**	21AIL63.1 21AIL63.2 21AIL63.3
5	Write a JavaScript code that displays text "TEXT-GROWING" with increasing font size in the interval of 100ms in RED COLOR, when the font size reaches 50pt it displays "TEXT-SHRINKING" in BLUE color. Then the font size decreases to 5pt.	**2**	21AIL63.1 21AIL63.2 21AIL63.3
6	Design an XML document to store information about a student in an engineering college affiliated to VTU. The information must include USN, Name, and Name of the College, Branch, Year of Joining, and email id. Make up sample data for 3 students. Create a CSS style sheet and use it to display the document.	**2**	21AIL63.1 21AIL63.2 21AIL63.3
	PART B		
7	Write a PHP program to keep track of the number of visitors visiting the web page and to display this count of visitors, with proper headings.	**2**	21AIL63.2 21AIL63.3 21AIL63.4
8	Write a PHP program to display a digital clock which displays the current time of the server	**2**	21AIL63.2 21AIL63.3 21AIL63.4
9	Write the PHP programs to do the following: a. Implement simple calculator operations. b. Find the transpose of a matrix.	**2**	21AIL63.2

	c. Multiplication of two matrices. d. Addition of two matrices.		21AIL63.3 21AIL63.4
10	Write a program to demonstrate working of ‹iframe› tag in HTML.	**3**	21AIL63.1 21AIL63.2 21AIL63.3 21AIL63.4
11	Write a program to demonstrate working of ‹anchor› tag in HTML.	**3**	21AIL63.1 21AIL63.2 21AIL63.3 21AIL63.4
12	Write a program to demonstrate the Node.js to print hello world.	**3**	21AIL63.1 21AIL63.2 21AIL63.3 21AIL63.4
	PART C-Virtual Lab/ on-line Demo 1.PHP Concepts: https://nptelvideos.com/php/php_video_tutorials.php 2.Node.js Tutorials: https://www.youtube.com/watch?v=f2EqECiTBL8		

CIE Assessment Pattern (50 Marks – Lab)

RBT Levels		Test (s) (20)	Weekly Assessment (30)
L1	**Remember**	**-**	**-**
L2	**Understand**	5	5
L3	**Apply**	**5**	10
L4	**Analyze**	10	10
L5	**Evaluate**	-	5
L6	**Create**		-

SEE Assessment Pattern (50 Marks – Lab)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**-**
L2	**Understand**	**10**
L3	**Apply**	**10**
L4	**Analyze**	**20**
L5	**Evaluate**	**10**
L6	**Create**	**-**

Suggested Learning Resources:

Reference Books:

1. Good fellow,I.,Bengio,Y., and Courville,A.,DeepLearning,MITPress,2016.
2. SatishKumar, Neural Networks:A Class room Approach,TataMcGraw-HillEducation,2004.

Reference Books:

1. Yegnanarayana,B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009
2. Golub,G.,H.,andVanLoan,C.,F.,MatrixComputations,JHUPress,2013.

SOCIAL NETWORK ANALYSIS			
Course Code	**21AIM641**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM641.1	Understand the various concepts in social media and also learn to use social media in an ethical manner.
21AIM641.2	Make use of graph theory concepts to model social networks.
21AIM641.3	Analyze the social networks to draw insights on the interactions between/within social groups.
21AIM641.4	Design the structure of a social network and identify the influential entities.
21AIM641.5	Contrast the fundamental principles for analysing social media marketing and its importance.
21AIM641.6	Apply precise data analysis techniques to tackle real-world challenges.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM641.1	2	-	-	-	-	-	-	-	-	-	-	2	3	-
21AIM641.2	3	-	-	-	-	-	-	-	-	-	-	2	3	-
21AIM641.3	3	3	-	-	-	-	-	-	-	-	-	2	3	-
21AIM641.4	3	3	3	-	-	-	-	-	-	-	-	2	3	-
21AIM641.5	3	3	3	3	2	-	-	-	-	-	-	2	3	-
21AIM641.6	3	3	-	-	3	-	-	-	-	-	-	3	3	-

MODULE-1	**SOCIAL NETWORKING ESSENTIALS**	21AIM641.1	**8 Hours**

Understand What Social Networking is, Social Media Characteristics, What is Social Media and Why It is Important, Types of Social Media, Core Values, Challenges, Advantages and Disadvantages, Future of Social Networking, Various social networking sites-FACEBOOK, INSTAGRAM, TWITTER, LINKEDIN - Why and how they matter, Key Features, Marketing - What You Need to Know.

Self-study / Case Study	Select a popular social networking site (e.g., Facebook, Instagram, Twitter) and conduct an analysis of its core features, advantages, and disadvantages.
Textbook	Text Book1: 1,2

MODULE-2	**GRAPHICAL REPRESENTATION AND NETWORK ANALYSIS FUNDAMENTALS**	21AIM641.2	**8 Hours**

Networks as Graphs – Actors, Ties, Networks, Multiplex Networks, Weighted Ties, Group, Geodesic Distance, Graph Connectivity, Degree of an Actor –Indegree and Out degree, Types of nodes– Carrier, Transmitter, Receiver, Isolate, Representation of Social Network Data – Socio matrix and Edge List, Matrix Permutation and Blocks, Network Relationships & Reciprocity, Transitivity, Popularity Structural Equivalence, Clique, Star.

Textbook	Text Book1: 4

MODULE-3	**NETWORK STRUCTURES AND SOCIAL DYNAMICS ANALYSIS**	21AIM641.3	**8 Hours**

Granovetter's strength of weakties, Triads, Clustering Coefficient and Neighbourhood Overlap, Structure of Weak Ties, Bridges and Local Bridges, Embeddedness, Structural Holes, Social Capital, Tie Strength, Social Media and Passive Engagement, Strong and Weak Relationship, Introduction to Homophily, Selection and Social Influence, Foci Closure and Membership Closure.

Self-study / Case Study / Applications	Analyze Social Dynamics in a Student Club Network - To analyze the social dynamics within a student club network, identify the key influencers and understand the flow of information and interactions. Text Book1: 6

Textbook	Text Book1: 5		
MODULE-4	**NETWORK ANALYSIS METRICS**	21AIM641.4	**8 Hours**
Network Density, Properties of Nodes–Degree Centrality, Closeness Centrality, Betweenness Centrality, Centrality of a Network - Network Degree Centrality, Network Closeness Centrality, Network Betweenness Centrality, Page rank centrality			
Textbook	Text Book1: 6		
MODULE-5	**SOCIAL MEDIA ANALYSIS**	21AIM641.5, 21AIM641.6	**8 Hours**
Four Dimension of Analysis, Criteria of Effectiveness, Metrics, Social Network Analysis, Semantic Analysis, Online Sentiment Analysis, Tools, Social Media Management, Centrality Measures, Opinion Mining, Feature Based Sentiment Analysis.			
Textbook	Text Book1: 7, 8		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources

Text Books:

1. Matthew Ganis & Avinash Kohirkar, “Social Media Analytics”, 2015, Pearson, ISBN:: 9780133892949.

Reference Books:

1) James M Cook, University of Maine at Augusta “What is a Social Network”
2) Robert A Hanneman, Department of Sociology, University of California, Riverside, “Introduction to Social Network methods”.
3) Christina Falci, Department of Sociology, University of Nebraska, Lincoln, “Social Network Analysis”
4) Matthew Ganis&AvinashKohirkar, “Social Media Analytics”
5) Bobbi J Carothers , American Evaluation Association, Denver, Colorado, “Network Analysis from Start to finish: Techniques, Tools and Tips for Evaluating your Network”
6) Matthew Denny, Institute for Social Science Research, University of Massachusetts, AMHERST, “Social Network Analysis”
7) Timothy Baldwin, University of Melbourne, “Semantic Analysis of Social Media”
8) The Social Media Analytics Compass: What and How to Measure http://www.razorsocial.com/social-media analytics-tools/

9) https://www.youtube.com/watch?v=P33xa4l4GTM
10) Overview of SNA :https://www.youtube.com/watch?v=fgr_g1q2ikA
11) https://www.teachengineering.org/activities/view/uno_graphtheory_lesson01_activity1
12) The History of Social Media: social Networking Evolution! http://historycooperative.org/ the-history-of-social-media/
13) Social Media Fact Sheet : http://www.pewinternet.org/fact-sheet/social-media/
https://www.meaningcloud.com/solutions/media-analysishttps://www.enotes.com/homework-help/what- hypotheses-social-media-intimate-relationship-488912

Web links and Video Lectures (e-Resources):

- **https://archive.nptel.ac.in/courses/106/106/106106239/**
- **https://www.geeksforgeeks.org/types-of-social-networks-analysis/**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Hands on sessions for developing static and dynamic web pages
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students in group to Analysis the web pages
  - Organizing Group wise discussions on issues.
  - Seminars

HUMAN COMPUTER INTERACTION			
Course Code	**21AIM642**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes:

At the end of the course, the student will be able to:

21AIM642.1	Understand the Design effective dialog for HCI
21AIM642.2	Apply effective HCI concepts to design a system for individuals and persons with disabilities.
21AIM642.3	Assess the importance of user feedback in developing HCI.
21AIM642.4	Explain the HCI implications for designing multimedia/ ecommerce/ e-learning Web sites.
21AIM642.5	Create an insightful user interface..
21AIM642.6	Choose precise, advanced techniques to make HCI more user-friendly.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM642.1	3	-	-	-	-	-	-	-	-	-	-	-	3	2
21AIM642.2	3	-	-	-	2	-	-	-	-	-	-	-	3	2
21AIM642.3	3	3	3	3	2	-	-	-	-	-	-	2	3	3
21AIM642.4	3	-	-	-	2	-	-	-	-	-	-	2	3	3
21AIM642.5	3	3	3	3	2	-	-	-	-	-	-	2	3	3
21AIM642.6	3	3	3	3	3	-	-	-	-	-	-	2	3	3

MODULE-1	**INTRODUCTION**	21AIM642.1	**8 Hours**

The Human – Input-Output Channels – Human Memory – Thinking – Emotions – Psychology & Design of Interactive Systems; Computer – Text Entry Devices- Positioning, Pointing & Drawing – Display Devices for Virtual Reality, 3D; Interaction – Models – Frameworks &HCI, Ergonomics – Interaction Styles – WIMP Interfaces – Context; Paradigms for Interaction

Text Book	Text Book 1: Ch-1-4;

MODULE-2	**SOFTWARE PROCESS & DESIGN RULES**	21AIM642.2	**8 Hours**

Interaction Design Basics – User Focus – Scenarios – Navigation – Screen Design & Layout; HCI In Software Process – Life Cycle – Usability Engineering – Interactive Design &Prototyping; Design Rules – Principles for Usability – Standards – Guidelines – Golden Rules – HCI Patterns.

Text Book	Text Book 1: Ch:5 -7

MODULE-3	**IMPLEMENTATION & USER SUPPORT**	21AIM642.3	**8 Hours**

Implementation Support: Windowing System Elements – Using Tool Kits – User Interface Management; Evaluation Techniques – Goals – Expert Analysis – Choosing a Method; Universal Design Principles – Multimodal Interaction; User Support – Requirements – Approaches – Adaptive Help Systems – Designing User Support System.

Text Book	Text Book 1: Ch-8-11

MODULE-4	**COGNITIVE, COMMUNICATION & COLLABORATIVE MODELS**	21AIM642.4	**8 Hours**

Cognitive Models – Goal & Task Hierarchies – Linguistic Models – Physical & Device Models – Architectures; Communication & Collaboration Models – Face-to-Face Communication –Conversation – Text Based – Group Working; Task Analysis – Difference Between Other Techniques – Task Decomposition – Knowledge Based Analysis – ER Based Techniques –Uses.

Text Book	Text Book 1: ch-12-15

MODULE-5	**UBIQUITOUS COMPUTING and AUGMENTED REALITIES**	21AIM642.5, 21AIM642.6	**8 Hours**

Ubiquitous Computing Application Research – Virtual and Augmented Reality -Information and data visualization-introduction about metaverse concepts.

Text Book	Text Book 1: ch-20

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	-

Suggested Learning Resources:

Text Books:

1. Alan Dix , Janet Finlay, Gregory D.Abowd, Russell Beale, " Human Computer Interaction", Third Edition, Pearson Education, 2004.
2. Brian Fling, —Mobile Design and Development, First Edition, O'Reilly Media Inc., 2009

Reference Books:

1. John M.Carrol, "Human Computer Interaction in the New Millenium", Pearson Education, 2002.

Web links and Video Lectures (e-Resources):

1. https://youtu.be/WW1g3UT2zww
2. https://youtu.be/uB9LaBIAcRs
3. https://youtu.be/azk99gD_2Io
4. https://www.coursera.org/learn/human-computer-interaction

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends in HCI
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
- Seminars

CYBER SECURITY

Course Code	**21AIM643**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM643.1	Understand the basics of cybercrime, Cyber Law and as to how report these crime through prescribed legal and Govt channels.
21AIM643.2	Identify various types of attacks and learn the tools to launch the attacks
21AIM643.3	Apply different prevention methods to protect the system from Hackers/protect data from outsiders using known methods.
21AIM643.4	Develop solution for cyber security attacks in various ways.
21AIM643.5	Evaluate the intrusion technique for its performance in order to detect intrusion.
21AIM643.6	Design a system to prevent intrusion using various intrusion prevention techniques

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM643.1	2	-	-	-	-	-	-	-	-	-	-	-	3	
21AIM643.2	3	3	-	-	-		-	-	-	-	-	-	3	
21AIM643.3	3	-	-	-	-	-	-	-	-	-	-	-	3	
21AIM643.4	3	3	3	-	3	-	-	-	-	-	-	-	3	
21AIM643.5	3	3	3	3	3	-	-	-	-	-	-	-	3	
21AIM643.6	3	3	3	-	3								3	

MODULE-1	**INTRODUCTION**	21AIM643.1	**8 Hours**

Cyber Security – History of Internet – Impact of Internet – CIA Triad; Reason for Cyber Crime – Need for Cyber Security – History of Cyber Crime; Cybercriminals – Classification of Cybercrimes – A Global Perspective on Cyber Crimes; Cyber Laws – The Indian IT Act – Cybercrime and Punishment.

Textbook	Textbook 1: Ch 1 Textbook3: Ch 19

MODULE-2	**ATTACKS AND COUNTERMEASURES:**	21AIM643.2	**8 Hours**

OSWAP; Malicious Attack Threats and Vulnerabilities: Scope of Cyber-Attacks – Security Breach – Types of Malicious Attacks – Malicious Software – Common Attack Vectors – Social engineering Attack – Wireless Network Attack – Web Application Attack – Attack Tools – Counter measures.

Textbook	Textbook 2: Ch 1 ,2

MODULE-3	**RECONNAISSANCE:**	21AIM643.3 21AIM643.4	**8 Hours**

Harvester – Who is – Net craft – Host – Extracting Information from DNS – Extracting Information from E-mail Servers – Social Engineering Reconnaissance; Scanning – Port Scanning – Network Scanning and Vulnerability Scanning – Scanning Methodology – Ping Sweer Techniques – Nmap Command Switches – SYN – Stealth – XMAS – NULL – IDLE – FIN Scans – Banner Grabbing and OS Finger printing Techniques.

Textbook	Textbook 1: Ch 2 Textbook2: Ch 8,9,10

MODULE-4	**INTRUSION DETECTION**	21AIM643.5 21AIM643.6	**8 Hours**

Host -Based Intrusion Detection – Network -Based Intrusion Detection – Distributed or Hybrid Intrusion Detection – Intrusion Detection Exchange Format – Honeypots – Example System Snort

Textbook	Textbook 3 Ch 8

MODULE-5	**INTRUSION PREVENTION:**	21AIM643.5 21AIM643.6	**8 Hours**

Firewalls and Intrusion Prevention Systems: Need for Firewalls – Firewall Characteristics and Access Policy – Types of Firewalls – Firewall Basing – Firewall Location and Configurations – Intrusion Prevention Systems – Example Unified Threat Management Products

Self-study	5G Technologies and its security measures.
Textbook	Textbook 3 Ch 9.

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	**10**
L6	Create	-

Suggested Learning Resources

Text Books:

1) Patrick Engebretson, "The Basics of Hacking and Penetration Testing: Ethical Hacking and Penetration Testing Made easy", Elsevier, 2011.
2) Kimberly Graves, "CEH Official Certified Ethical hacker Review Guide", Wiley Publishers, 2007
3) William Stallings, Lawrie Brown, "Computer Security Principles and Practice", Third Edition, Pearson Education, 2015

Reference Books:

1) Anand Shinde, "Introduction to Cyber Security Guide to the World of Cyber Security", Notion Press, 2021.
2) Nina Godbole, Sunit Belapure, "Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives", Wiley Publishers, 2011.
3) David Kim, Michael G. Solomon, "Fundamentals of Information Systems Security", Jones &Bartlett Learning Publishers, 2013.

Web links and Video Lectures (e-Resources):

- https://www.bing.com/videos/search?q=cyber+security+lessons+video&docid=603501299498039512&mid=107371740B0DED108BC6107371740B0DED108BC6&view=detail&FORM=VIRE
- https://www.bing.com/videos/search?q=cyber+security+lessons+video&docid=603491665886399330&mid=9D4475C0E2A498B7D7E09D4475C0E2A498B7D7E0&view=detail&FORM=VIRE

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Demonstration of various networking devices.
- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to use cyber security related tools for learning the concepts and ask them prepare the research paper in domain.
- Flipped classroom methodology

BIO INSPIRED DESIGN AND INNOVATION

Course Code	**21AIM644**	**CIE Marks**	**50**
L:T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM644.1	Verify the biomimetics principles in relation to the needs at that moment
21AIM644.2	Evaluate the bio-material properties for health care applications
21AIM644.3	Investigate novel bioengineering initiatives by evaluating design and development principles
21AIM644.4	Formulate bio-based solutions for socially vital issues with critical thought
21AIM644.5	Comprehend the bio computing optimization through research and experiential learning
21AIM644.6	Review the fundamental biological ideas through pertinent industrial applications and case studies

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21AIM644.1	3	3	3	3	2	-	-	-	1	1	-	2	**1**	**-**
21AIM644.2	3	3	3	3	2	-	-	-	1	1	-	2	**3**	**2**
21AIM644.3	3	3	3	3	2	-	-	-	1	1	-	2	**2**	**2**
21AIM644.4	3	3	3	3	2	-	-	-	1	1	-	2	**2**	**-**
21AIM644.5	3	3	3	3	2	-	-	-	1	1	-	2	**3**	**3**
21AIM644.6	3	3	3	3	2	-	-	-	1	1	**-**	2	**3**	**3**

MODULE-1	**BIO-INSPIRED DESIGN AND ENGINEERING**	**21AIM644.1**	**8 Hours**

Bio-Inspired Engineering and design, History, Evolution, Basics of Biomimetics and other Disciplines, Rawling's Classifications, Need for Bio-Inspired Designs. Bio inspired Additive manufacturing techniques, (self-healing, self-assembly).

Self-study / Case Study / Applications	Investigate the Challenges of Bio inspired design, Compare with traditional areas of science and engineering.
Text Book	Text Book 1: 1.2, 1.3, 1.4, 1.13, 1.15, 1.16

MODULE-2	**BIO MATERIALS AND BIO HEALTHCARE DESIGN**	**21AIM644.2**	**8 Hours**

Biomaterials, Design of Forms- (Hexagonal unit cells, Intrinsic disorder, anisotropy), Design of materials- (Hierarchy, fracture tough materials, structural colours, Actuating Materials, Bio-Compatible Materials). Bio-Mechanics, Applications of Biomaterials and Bio systems in Health care design (Human Prosthetics, Parasitic Wasp-Inspired Needle, Octopus-Inspired Sucker for Tissue Grafting, Peacock-Inspired Biosensors, Gecko-Inspired Surgical Glue) Robotics, Marine and Aeronautical.

Self-study / Case Study / Applications	Investigate Bio-Compatible alloys and polymers for human implants and health care applications.
Text Book	Text Book 1: 2.2, 2.3, 2.4 to 2.15

MODULE-3	**BIO SUSTAINABLE DEVELOPMENT**	**21AIM644.3, 21AIM644.4**	**8 Hours**

Innovations in Energy (Termite mound inspired shopping malls), Innovations in Resource-Air (purification, filtration), Dew water collection systems, water purification, desalination, Management of spaces, designs for megastructures.

Self-study / Case Study	Explore the Bio inspired environmental constructions and development.
Text Book	Text Book 2: 3.1, 3.3, 3.5, 3.7, 3.10

MODULE-4	**BIO COMPUTING AND OPTIMISATION**	**21AIM644.5**	**8 Hours**

No Free Lunch Theorem, Bat Algorithm, Flower Pollination Algorithm, Genetic Algorithm- Crossover and Mutation Operations. Bio-Inspired Optimisation, Ant Colony Optimisation (ACO), Swam Intelligence- Particle Swam Optimisation (PSO).

Self-study / Case Study	Scrutinize the Different types of Optimization techniques, genetic research.
Text Book	Text Book 1: 6.1, 6.3, 6.5, 6.7, Text Book 2: 10.1, 10.3, 10.5, 10.7

MODULE-5	**APPLICATIONS OF BIO-INSPIRED INNOVATIONS**	**21AIM644.6**	**8 Hours**

Bioinspired innovations in– Automotive, Automation, Materials and Manufacturing, Sensors, Controllers, Communications, Healthcare, Agriculture, food production, and Sports, Environment infrastructure. Carbon Neutral Solutions (Coral Reefs, Eco-cements), Carbon Free Solutions (Lotus leaf inspired paints), eco-restorations (Eco-friendly pesticide).

Self-study / Case Study	Survey on Bio inspired Innovations, design, applications and case studies of the same.
Text Book	Text Book 2: 12.1 to 12.10

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Marks Distribution	
		Test (s) 25	Qualitative Assessment(s) / NPTEL 25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1)Helena Hashemi Farzaneh, Udo Lindemann, "A Practical Guide to Bio-inspired Design", Springer Vieweg, 1st edition 2019, ISBN-10 : 366257683X, ISBN-13 : 978-3662576830

2)Torben A. Lenau, Akhlesh Lakhtakia," Biologically Inspired Design: A Primer (Synthesis Lectures on Engineering, Science, and Technology)", Publisher: Morgan & Claypool Publishers, 2021, ISBN-10: 1636390471, ISBN-13: 978-1636390475

Reference Books:

1)French M, "Invention and evolution: Design in nature and engineering", Publisher: Cambridge University Press, 2020

2)Pan L., Pang S., Song T. and Gong F. eds, "Bio-Inspired Computing: Theories and Applications", 15th International Conference, BIC-TA 2020, Qingdao, China, October 23-25, 2020, Revised Selected Papers (Vol. 1363). Springer Nature, 2021

3)Wann D, "Bio Logic: Designing with nature to protect the environment", Wiley Publisher, 1994

Web links and Video Lectures (e-Resources):

- **https://onlinecourses.nptel.ac.in/noc22_ge24/preview**
- **https://biodesign.berkeley.edu/bioinspired-design-course/**
- https://www.youtube.com/watch?v=cwxXY9Qe8ss
- **https://www.youtube.com/watch?v=V2GvQXvjhLA**
- **https://nsf-gov-resources.nsf.gov/2023-03/Bio-inspired%20Design%20Workshop%20Report_2232327_October%202022_Final.508.pdf**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Video demonstration of latest trends .
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to prepare Flowcharts and Handouts
  - Organizing Group wise discussions on issues
  - Seminars

SOFT COMPUTING			
Course Code	**21AIM645**	**CIE Marks**	**50**
L: T:P:S	**3:0:0:0**	**SEE Marks**	**50**
Hrs. / Week	**3**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM645.1	Understand the basics of soft computing techniques and theories in the creation of intelligent machines.
21AIM645.2	Determine the feasibility of applying metaheuristic algorithm to a particular problem.
21AIM645.3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems.
21AIM645.4	Choose a heuristic algorithm to solve optimization problems.
21AIM645.5	Design fuzzy system for pattern classification and regression problems.
21AIM645.6	Examine the efficiency of hybrid soft computing techniques compared to traditional computing methods.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM645.1	3	-	-	-	-	-	-	-	-	-	-	-	3	3
21AIM645.2	3	3	3	-	-	-	-	-	-	-	-	3	3	2
21AIM645.3	3	-	-	-	-	-	-	-	-	-	-	3	3	2
21AIM645.4	3	3	3	3	--	-		-	-	-	-	3	3	3
21AIM645.5	3	3	3	-	3	-	--	-	-	-	-	3	3	3
21AIM645.6	3	3	-	-	2	-		-	-	--	-	-	3	3

MODULE-1	**INTRODUCTION TO SOFT COMPUTING**	21AIM645.1,21AIM645.2	**8 Hours**

Introduction-Artificial Intelligence-Artificial Neural Networks-Fuzzy Systems-Genetic Algorithm and Evolutionary of Neural Networks-Classification of ANN-McCulloch and Pitts Neuron Model-Learning Rules: Hebbian and Delta-Perceptron Network -Adaline Network-Madaline Network.

Textbook	Textbook 2: Ch 1,2

MODULE-2	**Basics of Metaheuristic Algorithms**	21AIM645.1,21AIM645.2	**8 Hours**

What is a Metaheuristic? Algorithms, Notation. Gradient-based Optimization- Single-State Methods: Hill-Climbing-Single-State Global Optimization Algorithms- Simulated Annealing-Tabu Search- Iterated Local Search.

Textbook	Textbook 3: Ch:1,2.

MODULE-3	**FUZZY SYSTEMS**	21AIM645.3	**8 Hours**

Introduction to fuzzy Logic, Classical Sets and Fuzzy Sets-Classical Relations and Fuzzy relations - Membership Functions-Defuzzification-Fuzzy Arithmetic and Fuzzy Measures-Fuzzy Rule Base and Approximate Reasoning -Introduction to Fuzzy Decision Making.

Textbook	Textbook 2: Ch 6,7

MODULE-4	**GENETIC ALGORITHMS**	21AIM645.2, 21AIM645.4	**8 Hours**

Basic concepts-Working Principle-Procedures of GA-Flow chart of GA -Genetic Representation:(Encoding) Initialization and Selection- Genetic Operators: Mutation, Generational Cycle-Applications.

Textbook	Textbook 2: Ch-8,9

MODULE-5	**HYBRID SOFT COMPUTING TECHNIQUES**	21AIM645.5, 21AIM645.6	**8 Hours**

Neuro-Fuzzy Hybrid Systems-Adaptive Neuro-Fuzzy Inference System (ANFIS)-Genetic Neuro Hybrid Systems-Genetic Fuzzy Hybrid and Fuzzy Genetic Hybrid Systems-Simplified Fuzzy ARTMAP-

Applications	
Textbook	Textbook 2: Ch -10-15

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Marks Distribution	
		Test (s)	Qualitative Assessment(s) / NPTEL
		25	25
L1	Remember	5	5
L2	Understand	5	5
L3	Apply	5	5
L4	Analyze	5	5
L5	Evaluate	5	5
L6	Create	-	-

*Assessments are to be selected from the assessment list attached to **Appendix A.**

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	Remember	10
L2	Understand	10
L3	Apply	10
L4	Analyze	10
L5	Evaluate	10
L6	Create	--

Suggested Learning Resources:

Text Books:

1) S.N. Sivanandam, S.N Deepa," Principles of Soft Computing", Third Edition, Wiley-India,2008
2) S.Rajasekaran, G.A. Vijayalakshmi Pai," Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice Hall of India,2010.
3) Sean Luke, Essentials of Metaheuristics, Lulu, second edition,2013

Reference Books:

4) SimanHaykin,"NeuralNetworks",Prentice Hall of India,1999
5) Timothy Ross,"Fuzzy Logic witth Engineering Applications",Wiley Publications,2016
6) Davis E. Goldberg,"Genetic Algorithms in search,Optimization and Machine Learning",Pearson Education,2008

Web links and Video Lectures (e-Resources):

- **https://archive.nptel.ac.in/courses/106/105/106105173/**

Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning

- Online Quizzes using Jeopardy Lab
- Demonstration of Soft computing algorithms with Virtual Labs.
- Contents related activities (Activity-based discussions)
  - For active participation of students, instruct the students to read research papers on deep learning and have a discussion.
  - Presentations

SOCIAL CONNECT & RESPONSIBILITY			
Course Code	**21AIK65**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**02**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**02**

Course outcomes: At the end of the course, the student will be able to:

21AIK65.1	Realize social responsibility through societal activities
21AIK65.2	Review the history and culture of city through community interaction
21AIK65.3	Develop responsible connection for societal benefits
21AIK65.4	Cultivate the best practices for diverse scenarios
21AIK65.5	Build planning and organizational skills
21AIK65.6	Develop deep drive into societal challenges being addressed by NGO(s), social enterprises & the Government

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIK65.1	-	-	-	-	-	3	2	2	3	2	-	1	-	2
21AIK65.2	-	-	-	-	-	3	2	2	3	2	-	1	-	2
21AIK65.3	-	-	-	-	-	3	2	2	3	2	-	1	-	2
21AIK65.4	-	-	-	-	-	3	2	2	3	2	-	1	-	2
21AIK65.5	-	-	-	-	-	3	2	2	3	2	-	1	-	2
21AIK65.6	-	-	-	-	-	3	2	2	3	2	-	1	-	2

MODULE-1	**PLANTATION AND ADOPTION OF A TREE**	**21AIK65.1, 21AIK65.2**	**3 Hours**

Plantation of a tree that will be adopted for four years by a group of B.E students. They will also execute a documentary or a photoblog describing the plant's origin, its usage in daily life, and its appearance in folklore and literature.

Self-study	Environmental Storytelling Workshops: Conduct storytelling workshops where participants create and share stories or narratives about the natural world. Encourage participants to explore ecological themes, conservation challenges, and solutions through storytelling, whether in written form, oral storytelling, or multimedia presentations.

MODULE-2	**HERITAGE WALK AND CRAFTS CORNER**	**21AIK65.1, 21AIK65.2, 21AIK65.3**	**3 Hours**

Heritage tour, knowing the history and culture of the city, connecting to people around through their history, knowing the city and its craftsman, photoblog and documentary on evolution and practice of various craft forms.

Self-study / Case Study / Applications	• Guided Heritage Walks: Arrange guided tours through historic neighborhoods and landmarks, with knowledgeable guides providing insights into the city's history, architecture, and culture. • Meet and Greet with Artisans: Organize visits to local artisan workshops or craft centers, where participants can interact with craftsmen and learn about traditional craft techniques. • Cultural Performances and Workshops: Host cultural performances, music, dance, or traditional craft workshops to immerse participants in the local culture and heritage. • Historical Lectures and Talks: Invite historians or experts to give talks on the city's history, including its founding, growth, and significant historical events.

MODULE-3	**ORGANIC FARMING AND WASTE MANAGEMENT**	**21AIK65.4, 21AIK65.5**	**3 Hours**

Usefulness of organic farming, wet waste management in neighboring villages, and implementation in the campus

Self-study / Case Study / Applications	• Organic Farm Tours: Arrange tours to local organic farms to educate students and community members about the principles and benefits of organic farming. • On-Campus Organic Garden: Create an organic garden on campus where students can actively participate in planting, tending, and harvesting organic produce. • Waste Segregation Workshops: Conduct workshops in neighbouring villages on the importance of waste segregation at source and teach residents how to separate wet waste from dry waste.		
MODULE-4	**WATER CONSERVATION**	**21AIK65.4, 21AIK65.5, 21AIK65.6**	**3 Hours**
Knowing the present practices in the surrounding villages and implementation in the campus, documentary or photo blog presenting the current practices.			
Self-study / Case Study / Applications	• Research and Documentation: Compile comprehensive documentation of the current agricultural techniques, waste management systems, and sustainable living practices in neighbouring villages. Encourage students and researchers to gather data and anecdotes to enrich the documentation. • Partnerships and Collaboration: Collaborate with local NGOs, community leaders, or experts who are familiar with village practices to gain deeper insights.		
MODULE-5	**FOOD WALK**	**21AIK65.3, 21AIK65.4**	**3 Hours**
City's culinary practices, food lore, and indigenous materials of the region used in cooking.			
Self-study / Case Study / Applications	Food Photography and Recipe Blogging: Encourage participants to document their culinary experiences, recipes, and food photography. Create a blog or website to share these insights with a wider audience. Recipe Compilation and Cookbook: Compile a cookbook featuring traditional recipes, food lore, and stories collected from the community. Include information about where to find indigenous ingredients locally.		

CIE Assessment Pattern (50 Marks – Activity based) –
Each module is evaluatedfor50 Marks and average of all the five modules will be the final marks.

CIE component for each module	Marks
Planning and scheduling the social connect	15
Information/Data collected during the social connect	15
Analysis of the information/data and report writing	20
Total (each module)	**50**

SEE Assessment Pattern (50 Marks – Activity based)

SEE	Marks
Presentation	20
Jamming session / Open Mic	15
Group discussion / debate	15
Total	**50**

Activity-Based Learning / Practical Based learning

- Platform to connect to others and share the stories with others:
  - Jamming session
  - Open mic
  - Poetry
- Share the experience of Social Connect.
- Exhibit the talent like playing instruments, singing, one-act play, art-painting, and fine art.

Pedagogy:

- The students will be divided into groups. Each group will be handled by faculty mentor.
- Faculty mentor will design the activities (particularly Jamming sessions, open mic and poetry)
- The course is mainly activity-based that will offer a set of activities for the student that enables them to connect with fellow human beings, nature, society, and the world at large.
- The course will engage students for interactive sessions, open mic, reading group, storytelling sessions, and semester-long activities conducted by faculty mentors.
- Studentsshouldpresenttheprogressoftheactivitiesasperthescheduleintheprescribedpracticalsession inthefield.
- There should be positive progress in the vertical order for the benefit of society in general through activities.

Plan of Action:

- Each student should do activities according to the scheme and syllabus.
- At the end of semester student performance has to be evaluated by the faculty mentor for the assigned activity progress and its completion.
- At last consolidated report of all activities from 1st to 5th, compiled report should be submitted as per the instructions and scheme.
- Practice Session Description:
  - Lecture session in field to start activities
  - Students Presentation on Ideas
  - Commencement of activity and its progress
  - Execution of Activity
  - Case study-based Assessment, Individual performance
  - Sector/ Teamwise study and its consolidation
  - Videobasedseminarfor10minutes by each student at the end of semester with Report.

Module Name	Group Size	Location	Magnitude	Activity	Reporting
Plantation and adoption of a tree	03–05	Farmers Land or Roadside or Community area or institution's campus, anyone location to be selected.	Students must monitor till end of B Tech degree	Site selection Select suitable species in consultation with horticulture, forest or agriculture department. Interact with NGO/Industry and community to plant Tag the plant for continuous monitoring	Report shall behand written with paintings, sketches, poster, video and/or photograph with Geotag.
Heritage walk and crafts corner	03-05	Preferably Within the city where institution is located or home town of the student group	One or two: One can be a structure or a heritage building the other can be heritage custom or practice	Survey in the form of questioner by connecting to the people and asking. No standard questioner to be given by faculty and has to be evolved involving students. Questions during survey can be asked in local language but report language is English.	
Waste managemen t	03-05 More than	Preferably in the near by villages and	One	Report on importance and benefits of Waste management.	

		one group Can be assigned one task based on magnitude of task.	within the campus.		Report on segregation, collection, transportation and disposal. Suggestion for composting. Visit nearby village/location to sensitize farmers and public about waste management and also document	
	Water Conservation	03–05	Rain water harvesting demonstration available in the campus or surroundings	One	Visit Lakes/pond/river/drywell to involve on rejuvenation activity. Or Assessment of Water budget in the campus / village. Report on traditional water conservation practices(to minimize wastage)	
	Food Walk	03-05	Within the city where institution is located Food culture of student's resident region	One	Survey local food centers and identify the specialty Identify and study the food ingredients Report on the regional foods Report on Medicinals values of the local food grains, and plants.	

INNOVATION/ENTREPRENEURSHIP/ SOCIETAL INTERNSHIP			
Course Code	**21AIM66**	**CIE Marks**	**50**
L: T:P: S	**0:0:3:0**	**SEE Marks**	**50**
Teaching Hrs/Week	**40**	**Total Marks**	**100**
Credits	**03**	**Exam Hours**	**03**

Mandatory Internship Guidelines
(For 2021 -22 Scheme)

Introduction

The rise in global competition has prompted organizations to devise strategies to have a talented and innovative workforce to gain a competitive edge. Developing an internship policy is an impactful strategy for creating a future talent pool for the industry. The internship (a form of experiential learning) program helps fresh pass–outs in gaining professional know-how and benefits corporate sectors. The internship also enhances thestudent's employability skills passing out from Technical Institutions. [AICTE Internship Policy.pdf page 4]

The following list provides a brief illustrative overview of the knowledge, skills, work habits, and character traits commonly associated with 21st-century skills and to be acquired by graduates:

1. Critical thinking, problem-solving, reasoning, analysis, interpretation, synthesizing information.
2. Scientific literacy and reasoning, the scientific method.
3. Research skills and practices, interrogative questioning.
4. Creativity, artistry, curiosity, imagination, innovation, personal expression.
5. Information and communication technology (ICT) literacy, media and internetliteracy, data interpretation, and analysis, computer programming.
6. Oral and written communication, public speaking and presenting, listening.
7. Economic and financial literacy, entrepreneurialism.
8. Global awareness, multicultural literacy, humanitarianism.
9. Environmental and conservation literacy, ecosystems understanding.
10. Civic, ethical, and social-justice literacy.
11. Leadership, teamwork, collaboration, cooperation, facility in using virtualworkspaces.
12. Perseverance, self-direction, planning, self-discipline, adaptability, initiative.
13. Health and wellness literacy, including nutrition, diet, exercise, and publichealth and safety.

The internship experience will augment the outcome-based learning process andinculcate various attributes mentioned above in a student in line with the graduate attributes defined by the NBA and NEP 2020.

Following are the intended objectives of internship training;

(i) Expose Technical students to the industrial environment, which cannot be simulated in the classroom and hence create competent professionals in the industry.

(ii) Provide possible opportunities to learn, understand and sharpen the real-time technical/managerial skills required at the job.

(iii) Get exposed to the current technological developments relevant to the subject area of training.

(iv) Use the experience gained from the industrial internship in discussions held inthe classrooms.

(v) Create conditions conducive to the quest for knowledge and its applicability on the job.

(vi) Learn to apply Technical knowledge in real industrial situations.

(vii) Gain experience in writing reports in Technical works/projects.

(viii) Expose students to the engineer's responsibilities and ethics.

(ix) Familiarize with various materials, processes, products, and applications along with relevant aspects of quality control and safety measures.

(x) Promote academic, career, and/or personal development.

(xi) Expose the students to future employers.

(xii) Make students available to industry for employment.

(xiii) Understand the psychology of the workers and their habits, attitudes, and approach to

problem-solving.

(xiv) Understand the social, economic, and administrative considerations that influence the working environment of industrial organizations.

Internship training helps the institute to:

- **(a)** Build and enhance industrial relations.
- **(b)** Make the placement process easier.
- **(c)** Improve institutional credibility & branding.
- **(d)** Improve the teaching-learning process.
- **(e)** Expose of Staff to Industrial process.
- **(f)** Serve humankind.

Internship - II involving Innovation/ Societal /Entrepreneurship

Scheduled during the intervening period of IV and V semester: During the intervening period of IV and V semesters, students shall be ready for industrial experience. Therefore, they shall choose to undergo an Internship involving Innovation / Entrepreneurship related activities. Students may choose to work on innovation or entrepreneurial activities or both resulting in start-up or undergo internship with industry/ NGO's/ Government organizations/ Micro/ Small/ Medium enterprises to make themselves ready for the industry. In case students want to undergo an internship at his/her family business, he /she shall be permitted provided, a declaration by a parent is submitted directly to the Principal of the institution. [AICTE Internship Policy, Pdf page 8]

With the consent of the internship guide and Principal of the institution, students shall be allowed to carry out the internship at their hometown (within and outside the state), provided favorable facilities are available. [Report and Recommendation of Task Force on Internship in Engineering and Diploma, Task Force Chair Prof Karisiddappa, Hon'ble Vice-Chancellor, VTU, Belagavi]. In case, students wish to take both Innovations, and Entrepreneurship internships, they shall be permitted to take up both. Internship – II period, in such cases, can extend marginally by a few days, provided it will not interfere with the academic calendar ofthe higher semester.

Innovation

Innovation refers to a new or improved product or process or a combination there of that differs marginally or significantly from the unit's previous product.

An innovation center is a place where students are encouraged to implement the innovative ideas formed through imagination, brainstorming sessions, design thinking and associated activities to bring them to reality. It is a place, where creative minds are shaped.

Entrepreneurship

Entrepreneurship refers to setting up a new business or business, taking on financial risks in the hope of profit. It involves investment to undertake production along with arranging inputs like land, labor, material and capital, introducing new techniques and products, identifying new sources for the enterprise, etc.

Incubation Center:

An organized unit designed for innovation as well as to accelerate the growth andsuccess of new entrepreneurial companies through mentorship and an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections.

Startup

An entity that develops a business model based on either product innovation or service innovation and makes it scalable, replicable, and self-reliant. [Gazette Notification No. G.S.R. 127(E)dated February 19, 2019]

An entity shall be considered as a Startup,

(i) Up to a period of ten years from the date of incorporation/ registration, if it is incorporated as a private limited company (as defined in the Companies Act, 2013) or registered as a partnership firm (registered under section 59 of the Partnership Act, 1932) or a limited liability partnership (under the Limited Liability Partnership Act, 2008) in India.

(ii) Turnover of the entity for any of the financial years since incorporation/ registration has not exceeded one hundred crore rupees.

(iii) Entity is working towards innovation, development or improvement of products or processes or services, or if it is a scalable business model witha high potential of employment generation or wealth creation.

Provided that an entity formed by splitting up or reconstruction of an existing business shall not be considered a Startup. [startup_policy_2019.pdf 10]

Places of Innovation/Entrepreneurial Activities

Students shall carry out Innovation or Entrepreneurial activities or both at the IncubationCenter and Entrepreneurship Cell of the parent institution or elsewhere such as ATAL Incubation Centers [A flagship of Atal Innovation Mission (AIM), NITI Aayog for promoting the culture of innovation and entrepreneurship in India], institutes of national importance, public sector units, IT companies, government organizations, and non-governmental organizations, industries including MSME, etc.

Institutes should deter students to opt for internships at places established for commercial benefits.

Assessment Rubrics for Innovation / Entrepreneurship Activities

Once the internship begins, the students are required to maintain diary/journal and submit a report every week to the guide. These reports (which can also be submitted by email) should summarize the activities in which the student was involved during the previous week period. At the end of the internship, each student is required to submit the hard copy of the consolidated diary/journal and report for evaluation. The report should clearly indicate the learning and achievements of the internship.

MINI PROJECT			
Course Code	**21AIM67**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**01**	**Exam Hours**	**03**

Course outcomes: At the end of the course, the student will be able to:

21AIM67.1	Understand the technological needs and/or societal needs and sustainability of the environment
21AIM67.2	Analyze the outcome of the project
21AIM67.3	Design application using Deep learning techniques
21AIM67.4	Evaluate, validate and communicate the identified solutions in a structured way.
21AIM67.5	Implement the project and provide solutions within the context of the Legel framework, addressing social concerns and upholding ethical issues
21AIM67.6	Present the Report for implemented problem and its solutions as a team.

Mapping of Course Outcomes to Program Outcomes and Program Specific Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21AIM67.1	3	-	-	-	-	1	1	1	-	-	-	3	3	2
21AIM67.2	3	3	-	-	3	-	-	-	-	-	-	3	3	2
21AIM67.3	3	3	3	-	3	-	-	-	-	-	-	3	3	2
21AIM67.4	3	**3**	**3**	3	3	-	-	-	3	3	3	3	3	2
21AIM67.5	3	3	3	3	3	2	2	2	2		-	3	3	2
21AIM67.6	-	-	-	-	3	1	1	1	2	2	-	3	-	-

Each team capable of identifying a problem and carry out a mini project on the problem defined. A panel of experts will review the code developed towards the project during the course of the semester Plagiarized projects will automatically get an **"F" GRADE** and the student will be liable for further disciplinary action. At the completion of a project, the team will submit a project report, which will be evaluated by duly appointed examiner(s).

CIE Assessment Pattern (50 Marks – Theory)

		Review (50 marks)
L1	**Remember**	**10**
L2	**Understand**	10
L3	**Apply**	10
L4	**Analyze**	10
L5	**Evaluate**	10
L6	**Create**	-

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels		Exam Marks Distribution (50)
L1	**Remember**	**10**
L2	**Understand**	10
L3	**Apply**	10
L4	**Analyze**	10
L5	**Evaluate**	10
L6	**Create**	-

NATIONAL SERVICE SCHEME (NSS)			
Course Code	**21NSS84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**2**

Course outcomes: At the end of the course, the student will be able to:

21NSS84.1	Understand the importance of his / her responsibilities towards society
21NSS84.2	Analyze the environmental and societal problems/issues and will be able to design solutions for the same.
21NSS84.3	Evaluate the existing system and to propose practical solutions for the same for sustainable development.
21NSS84.4	Implement government or self-driven projects effectively in the field.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21NSS84.1	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.2	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.3	-	-	-	-	-	3	1	1	3	2	2	1
21NSS84.4	-	-	-	-	-	3	1	1	3	2	**2**	1

Semester	CONTENT	HOURS
5th to 8th	**PART A** ONENSS–CAMP @College/University/State or Central Govt Level/ NGO's/General Social Camps **PART B** 1. Organic farming, Indian Agriculture (Past, Present and Future) Connectivity for marketing 2. Waste management–Public, Private and Govtorganization,5R's. 3. Setting of the information imparting club for women leading to contribution in social and economic issues. 4. Water conservation techniques–Role of different stakeholders–Implementation. 5. Preparing an actionable business proposal for enhancing the village income and approach for implementation. 6. Helping local schools to achieve good results and enhance their enrolment in Higher/technical/vocational education. 7. Developing Sustainable Water management system for rural areas and implementation approaches.	Total 32 Hrs/ Semester 2 Hrs/week
	8. Contribution to any national level initiative of Government of India. For. eg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc. 9. Spreading public awareness under rural outreach programs.	

	(minimum5programs). 10. Organize National integration and social harmony events/workshops / Seminars. (Minimum02programs). 11. Govt. school Rejuvenation and helping them to achieve good infrastructure.	

CIE Assessment Pattern (50 Marks – Practical) –

1. **PART A:** Compulsorily students have to attend one camp.
2. **PART B:** Students have to take up anyone activity on the above said topics and have to prepare content for awareness and technical contents for implementation of the projects and have to present strategies for implementation of the same.
3. CIE will be evaluated based on their presentation, approach and implementation strategies.

CIE Components	Marks
Presentation1-Selection of topic-(phase1)	10
Experiential Learning Presentation 2 (phase2)	10
Case Study-based Teaching-Learning	10
Sector-wise study & consolidation	10
Video based seminar (4-5 minutes per student)	10
Total	**50**

SEE Assessment Pattern (50 Marks – Practical)

- Implementation strategies of the project with report duly signed by the Dept's Coordinator, HoD and Principal.
- At last it should be evaluated by the NSS Coordinator.
- Finally consolidated report should be sent to the University.

Suggested Learning Resources:

Reference Books:

1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.

Pre-requisites to take this Course:

1. Students should have a service-oriented mindset and social concern.
2. Students should have dedication to work at any remote place, anytime with available resources and proper time management for the other works.
3. Students should be ready to sacrifice some of the time and wishes to achieve service-oriented targets on time.

PHYSICAL EDUCATION (PE) (SPORTS AND ATHLETICS)			
Course Code	**21PES84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**02**

Course outcomes: At the end of the course, the student will be able to:

21PES84.1	Demonstrate the starting and finishing positions of different track and jump events.
21PES84.2	Demonstrate the holding and releasing stances in various throwing events, and takeoff and landing position in various jumping events of Athletics.
21PES84.3	Demonstrate the specific skills and techniques of the selected game/event.
21PES84.4	Demonstrate and describe the rules and regulations of specific games.

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21PES84.1	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.2	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.3	-	-	-	-	-	-	-	1	2	-	-	1
21PES84.4	-	-	-	-	-	-	-	1	2	-	-	1

Semester	CONTENT	HOURS
5th	**Fitness Components:** Meaning and Importance, Fit India Movement, Definition of fitness, Components of fitness, Benefits of fitness, Types of fitness and Fitness tips. **Practical Components:** Speed, Strength, Endurance, Flexibility, and Agility **Athletics**: 1. Track -Sprints: • Starting Techniques: Standing start and Crouch start(its variations)use of Starting Block. • Acceleration with proper running techniques. • Finishing technique: Run Through, Forward Lunging and Shoulder Shrug. 2. Jumps- Long Jump: Approach Run, Take-off, Flight in the air (Hang Style/Hitch Kick)and Landing 3. Throws- Shot Put: Holding the Shot, Placement, Initial Stance, Glide, Delivery Stance and Recovery (Perry O'Brien Technique) **Kabaddi OR Kho-Kho** **Kabaddi:** A. Fundamental skills 1. Skills in Raiding: Touching with hands, Use of leg-toe touch, squat leg thrust, side kick, mule kick, arrow fly kick, crossing of baulk line. Crossing of Bonus line. 2. Skills of holding the raider: Various formations, catching from particular position, different catches, catching formation and techniques. 3. Additional skills in raiding: Escaping from various holds, techniques of escaping from chain formation, offense and defense. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials.	Total 32 Hrs/ Semester 2 Hrs/week

	Kho-Kho: A Fundamental skills 1. Skills in Chasing: Sit on the box (Parallel &Bullet toe method),Getup from the box(Proximal & Distal foot method),Give Kho(Simple,Early, Late& Judgment),Pole Turn, Pole Dive, Tapping, Hammering, Rectification of foul. 2. Skills in running: Chain Play, Ring play and Chain & Ring mixed play. 3. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of the officials**.**	
6th	**Athletics**: 1. Track -110 Mtrs and 400Mtrs: • Hurdling Technique: Lead leg Technique, Trail leg Technique, Side Hurdling, Over the Hurdles • Crouch start (its variations)use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- High jump: Approach Run, Take-off, Bar Clearance (Straddle) and Landing. 3. Throws- Discus Throw: Holding the Discus, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Volleyball OR Throw Ball** **Volleyball:** A. Fundamental skills 1. Service: Under arm service, Side arm service, Tennis service, Floating service. 2. Pass: Under arm pass, Over-head pass. 3. Spiking and Blocking. 4. Game practice with application of Rules and Regulations B. Rules and their interpretation and duties of officials. **Throw Ball:** A. Fundamental skills: Over hand service, Side arm service, two hand catching, one hand over head return, side arm return. B. Rules and their interpretations and duties of officials **Football OR Hockey** **Football:** A. Fundamental Skills 1. Kicking: Kicking the ball with inside of the foot, Kicking the ball with Full Instep of the foot, Kicking the ball with Inner Instep of the foot, Kicking the ball with Outer Instep of the foot and Lofted Kick. 2. Trapping: Trapping- the Rolling ball, and the Bouncing ball with sole of the foot. 3. Dribbling: Dribbling the ball with Instep of the foot, Dribbling the ball with Inner and Outer Instep of the foot. 4. Heading: In standing, running and jumping condition. 5. Throw-in: Standing throw-in and Running throw-in. 6. Feinting: With the lower limb and upper part of the body. 7. Tackling: Simple Tackling, Slide Tackling. 8. Goal Keeping: Collection of Ball, Ball clearance-kicking, throwing and deflecting. 9. Game practice with application of Rules and Regulations.	

	C. Rules and their interpretation and duties of officials. **Hockey:** A. Fundamental Skills 1. Passing: Short pass, Longpass, pushpass, hit 2. Trapping. 3. Dribbling and Dozing 4. Penalty stroke practice. 5. Penalty corner practice. 6. Tackling: Simple Tackling, Slide Tackling. 7. Goal Keeping, Ball clearance- kicking, and deflecting. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	
7th	**Athletics**: 1. Track -Relay Race: • Starting, Baton Holding/Carrying, Baton Exchange in between zone, and Finishing • Crouch start (its variations) use of Starting Block. • Approach to First Hurdles, In Between Hurdles, Last Hurdles to Finishing. 2. Jumps- Triple Jump: Approach Run, Take-off, Flight in the Hop, Step, Jump and Landing 3. Throws- Javelin Throw: Grip, Carry, and Recovery (3/5 Impulse stride). Release **Cricket OR Baseball** **Cricket:** A. Fundamental skills 1. Batting- Forward Defense Stroke, Backward Defense Stroke, OffDrive, On Drive, Straight Drive, Cover Drive, Square Cut. 2. Bowling-Out-swing, In-swing Off Break, Leg Break and Googly. 3. Fielding: Catching - The High Catch, The Skim Catch, The Close Catch and throwing at the stumps from different angles. Long Barrier and Throw, Short Throw, Long Throw, Throwing on the Turn. 4. Wicket Keeping B. Rules and their interpretation and duties of officials. **Baseball:** A. Fundamental skills: 1. Player Stances – walking, extending walking, L stance, cat stance Grip – standard grip, choke grip 2. Batting – swing and bunt. 3. Pitching 4. Baseball: slider, fast pitch, curve ball, drop ball, rise ball, change up, knuckle ball, screw ball B. Rules and their interpretations and duties of officials **Basketball OR Net Ball** **Basketball:** A. Fundamental Skills 1. Passing: Two hand Chest Pass, Two hands Bounce Pass, One hand Baseball Pass, Side arm Pass, Overhead Pass, Hook Pass. 2. Receiving: Two hand receiving, One hand receiving, Receiving in stationary position, Receiving while Jumping and Receiving while Running. 3. Dribbling: How to start dribble, drop dribble, High Dribble, Low Dribble, Reverse Dribble, Rolling Dribble. 4. Shooting: Lay-up shot and its variations, One hand set shot, Two hands jump shot, Hook shot, Free Throw.	

	5. Rebounding: Defensive rebound and Offensive rebound. 6. Individual Defence: Guarding the player with the ball and without the ball, Pivoting. 7. Game practice with application of Rules and Regulations. **Netball:** A. Fundamental Skills 1. Catching: one handed, two handed, with feet grounded and in flight. 2. Throwing (Different passes and their uses): One hand passes (shoulder, high shoulder, underarm, bounce, lob), two hand passes (Push, overhead and bounce). 3. Footwork: Landing on one foot, landing on two feet, Pivot, Running pass. 4. Shooting: One hand, forward step shot, and backward step shot. 5. Techniques of free dodge and sprint, sudden sprint, sprint and stop, sprinting with change at speed. 6. Defending: Marking the player, marking the ball, blocking, inside the circle, outside the circle. Defending the circle edge against the passing. 7. Intercepting: Pass and shot. 8. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	
8th	**Athletics**: A. Track -Combined Events: a. Heptathlon all the 7 events b. Decathlon: All 10 Events B. Jumps- Pole Vault: Approach Run, Planting the Pole, Take-off, Bar Clearance and Landing. C. Throws- Hammer Throw: Holding the Hammer, Initial Stance Primary Swing, Turn, Release and Recovery (Rotation in the circle). **Shuttle Badminton OR Table Tennis** **Shuttle Badminton:** A. Fundamental skills D. Basic Knowledge: Various parts of the Racket and Grip. E. Service: Short service, Long service, Long-high service. F. Shots: Over head shot, Defensive clear shot, attacking clear shot, Drop shot, Net shot, Smash. G. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials. **Table Tennis:** A. Fundamental skills: 1. Basic Knowledge: Various parts of the Racket and Grip (Shake Hand & PenHold Grip). 2. Stance: Alternate & Parallel. 3. Push and Service: Backhand &Forehand. 4. Chop: Backhand & Forehand. 5. Receive: Push and Chop with both Backhand & Forehand. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Handball OR Ball Badminton** **Handball:** A. Fundamental Skills 1. Catching, Throwing and Ball control, 2. Goal Throws: Jumpshot, Centershot, Diveshot, Reverseshot. 3. Dribbling: High and low. 4. Attack and counter attack, simple counter attack, counter attack	

	from two wings and center. 5. Blocking, Goal Keeping and Defensive skills. 6. Game practice with application of Rules and Regulations. B. Rules and their interpretations and duties of officials **Ball badminton:** A. Fundamental Skills 1. Basic Knowledge: Various parts of the Racket and Grip. 2. Service: Short service, Long service, Long-high service. 3. Shots: Overhead shot, Defensive clearshot, Attacking clearshot, Dropshot, Netshot, Smash. 4. Game practice with application of Rules and Regulations. B. Rules and their interpretation and duties of officials.	

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Sports and Athletics activities learnt in the semester.

CIE	Marks
5th Semester	10
6th Semester	10
7th Semester	15
8th Semester	15
Total	**50**

SEE Assessment Pattern (50 Marks – Practical)

SEE	Marks
Athletics	20
Kabaddi OR Kho-Kho	05
Volleyball / Throw ball	05
Football/Hockey	05
Netball/Basketball	05
Shuttle Badminton / Table Tennis	05
Handball/ Badminton	05
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Saha, A.K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
2. Bandopadhyay,K. Sarir Siksha Parichay, Classic Publishers, Kolkata.
3. Petipus, etal. Athlete's Guide to Career Planning, Human Kinetics.
4. Dharma,P.N. Fundamentals of Track and Field, Khel Sahitya Kendra, NewDelhi.
5. Jain,R. Play and Learn Cricket, Khel Sahitya Kendra, New Delhi.
6. Vivek Thani, Coaching Cricket ,Khel Sahitya Kendra, NewDelhi.
7. Saha,A.K.Sarir SiksherRitiniti,RanaPublishingHouse,Kalyani.
8. Bandopadhyay,K. Sarir Siksha Parichay, Classic Publishers, Kolkata
9. Naveen Jain, Play and Learn Basketball, Khel Sahitya Kendra, NewDelhi.
10. Dubey,H.C. Basketball, Discovery Publishing House, NewDelhi.
11. RachanaJain, Teach Yourself Basketball, Sports Publication.
12. JackNagle,Power Pattern Offences for Winning basketball,ParkerPublishingCo.,NewYork.
13. RenuJain, Play and Learn Basketball, Khel Sahitya Kendra,NewDelhi.
14. SallyKus, Coaching Volleyball Successfully, HumanKinetics.
15. Saha, A. K. Sarir Siksher Ritiniti, Rana Publishing House, Kalyani.
16. Bandopadhyay, K.Sarir Siksha Parichay, Classic Publishers, Kolkata

YOGA			
Course Code	**21YOG84**	**CIE Marks**	**50**
L:T:P:S	**0:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**2**	**Total Marks**	**100**
Credits	**00**	**Exam Hours**	**02**

Course outcomes: At the end of the course, the student will be able to:

21YOG84.1	Use Yogasana practices in an effective manner
21YOG84.2	Become familiar with an authentic foundation of Yogic practices
21YOG84.3	Practice different Yogic methods such as Suryanamaskara, Pranayama and some of the Shat Kriyas
21YOG84.4	Use the teachings of Patanjali in daily life .

Mapping of Course Outcomes to Program Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21YOG84.1	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.2	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.3	-	-	-	-	-	3	-	-	2	-	-	1
21YOG84.4	-	-	-	-	-	3	-	-	2	-	-	1

Semester	CONTENT	HOURS
5th	**Introduction of Yoga:** Aim and Objectives of yoga, Prayer: Yoga,its origin ,history and development. Yoga, its meaning, definitions. Different schools of yoga, importance of prayer **Brief introduction of yogic practices for common man:** Yogic practices for common man to promote positive health **Rules and regulations:** Rules to be followed during yogic practices by practitioner **Misconceptions of yoga:** Yoga its misconceptions, Difference between yogic and non-yogic practices. **Suryanamaskara:** 1. Suryanamaskar prayer and its meaning, Need, importance and bene Suryanamaskar. 2. Suryanamaskar 12 count,2rounds **Kapalabhati:** Meaning, importance and benefits of Kapalabhati - 40strokes/min3rounds **Different types of Asanas**: 1. Sitting: Padmasana, Vajrasana, Sukhasana 2. Standing: Vrikshana, Trikonasana, Ardhakati Chakrasana 3. Prone line: Bhujangasana, Shalabhasana 4. Supineline: Utthitadvipadasana, Ardhahalasana, Halasana **Patanjali's Ashtanga Yoga**: Yama, Niyama **Pranayama:** Suryanuloma –Viloma, Chandranuloma-Viloma	Total 32 Hrs/ Semester 2 Hrs/week
6th	**Suryanamaskara:** Suryanamaskar 12 count,4rounds **Kapalabhati:** Revision of Kapalabhati -60strokes/min3rounds **Different types of Asanas**: 1. Sitting: Paschimottanasana, Ardha Ushtrasana, Vakrasana, Aakarna Dhanurasana 2. Standing: Parshva Chakrasana, Urdhva Hastothanasana, Hastapadasana 3. Prone line: Dhanurasana 4. Supine line: Karna Peedasana, Sarvangasana, Chakraasana	

	Patanjali's Ashtanga Yoga: Asana, Pranayama **Pranayama:** Chandra Bhedana, Nadishodhana, Surya Bhedana	
7th	**Suryanamaskara:** Suryanamaskar 12 count,8rounds **Kapalabhati:** Revision of Kapalabhati - 80strokes/min3rounds **Different types of Asanas**: 1. Sitting: Yogamudra in Padmasana, Vibhakta Paschimottanasana, Yogamudra in Vajrasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Padangushtha Dhanurasana, Poorna Bhujangasana / Rajakapotasana 4. Supine line: Navasana/Noukasana, Pavanamuktasana, Sarvangasana **Patanjali's Ashtanga Yoga**: Pratyahara, Dharana **Pranayama:** Ujjayi, Sheetali, Sheektari	
8th	**Suryanamaskara:** Suryanamaskar 12 count,12rounds **Kapalabhati:** Revision of Kapalabhati - 100strokes/min3rounds **Different types of Asanas**: 1. Sitting: Bakasana, Hanumanasana, Ekapada Rajakapotasana 2. Standing: Parivritta Trikonasana, Utkatasana, Parshvakonasana 3. Prone line: Mayurasana 4. Supine line: Setubandhasana, Shavasanaa (Relaxation posture) 5. Balancing: Sheershasana **Patanjali's AshtangaYoga**: Dhyana (Meditation), Samadhi **Pranayama:** Bhastrika, Bhramari, Ujjai **Shat Kriyas:** Jalaneti and sutraneti, Sheetkarma Kapalabhati	

CIE Assessment Pattern (50 Marks – Practical) –

CIE to be evaluated every semester end based on practical demonstration of Yogasana learnt in the semester.

CIE	Marks
5th Semester	10
6th Semester	10
7th Semester	15
8th Semester	15
Total	**50**

SEE Assessment Pattern (50 Marks – Practical)

SEE	Marks
Suryanamaskara	10
Kapalabhati	10
Asanas	10
Patanjali's Ashtanga Yoga	10
Pranayama / Shat Kriyas	10
Total	**50**

Suggested Learning Resources:

Reference Books:

1. Swami Kuvulyananda: Asma (Kavalyadhama, Lonavala)
2. Tiwari, O P: Asana Why and How
3. Ajitkumar: Yoga Pravesha (Kannada)
4. Swami Satyananda Saraswati: Asana Pranayama, Mudra, Bandha (Bihar School of yoga, Munger)
5. Swami Satyananda Saraswati: Surya Namaskar (Bihar School of yoga, Munger)
6. Nagendra H R: The art and science of Pranayama
7. Tiruka: Shatkriyegalu (Kannada)
8. Iyengar B K S: Yoga Pradipika (Kannada)
9. Iyengar B K S: Light on Yoga (English)

APPENDIX A

LIST OF ASSESSMENT PATTERN			
SNO	Tasks	Blooms category/Level	Remarks
1	Assignments	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
2	Group Discussions	Apply-L3, Analyse-L4	Group
3	Case Studies/ Case Lets	Apply-L3, Analyse-L4, Evaluate-L5	Individual / Group
4	Practical Orientation on Design thinking	Analyse-L4, Create-L6	Creativity & Innovation
5	Participatory & Industry-Integrated Learning	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
6	Practical activities / Problem solving exercises	Apply-L3, Analyse-L4, Evaluate-L5	Individual / Group
7	Class Presentations	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
8	Analysis of Industry / Technical /Business Reports	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
9	Reports on Industrial Visit	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
10	Industrial / Social /Rural Projects	Analyse-L4, Create-L6	Individual / Group
11	Participation in external seminars/ workshops	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
12	Any other academic activity	Understand-L2, Apply-L3, Analyse-L4	Individual / Group
13	Online / Offline Quizzes	Understand-L2, Apply-L3	Individual

Note:
1. The choice or selection of appropriate Tasks for each Assessment Type by the course coordinator
2. Assign / fix the marks for each Assessment Type by course co-ordinator.
3. Students either submit the report for Task or not, as determined by the course coordinator.
4. Need to get final approval from the HoD/BOS Chairman once finalising the mark allocations for Tasks and Assessment types.

APPENDIX B

Outcome Based Education

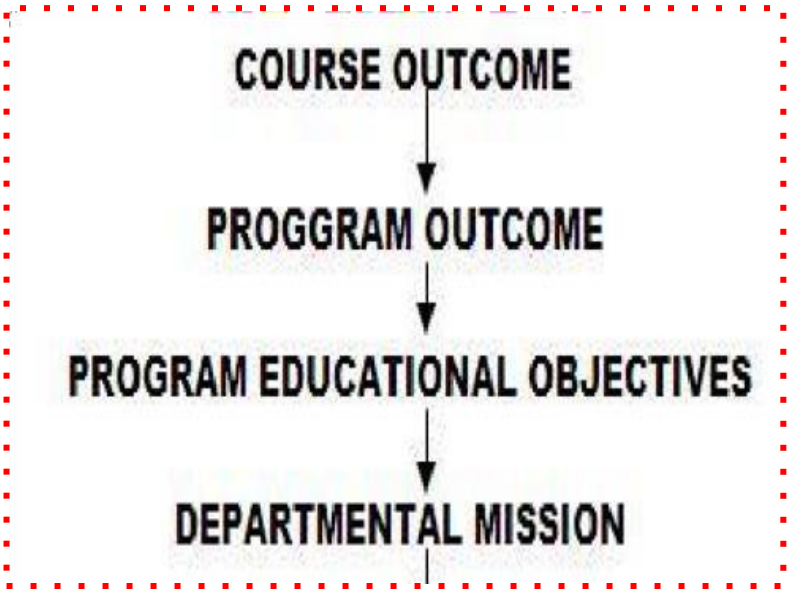
Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead, classes, opportunities, and assessments should all help students achieve the specified outcomes.

There are three educational Outcomes as defined by the National Board of Accreditation: Program Educational Objectives: The Educational objectives of an engineering degree program are the statements that describe the expected achievements of graduate in theircareer and in particular, what the graduates are expected to perform and achieve during thefirst few years after graduation. [nbaindia.org]

Program Outcomes: What the student would demonstrate upon graduation. Graduateattributes are separately listed in Appendix C

Course Outcome: The specific outcome/s of each course/subject that is a part of the programcurriculum. Each subject/course is expected to have a set of Course Outcomes

Mapping of Outcome:



APPENDIX C

The Graduate Attributes of NBA

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, Engineering fundamentals, and an Engineering specialization to the solution of complex Engineering problems in Computer Engineering.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex Engineering problems in Computer Engineering reaching substantiated conclusions using first principles of mathematics, natural sciences, and Engineering sciences.

PO3 **Design / Development of Solutions:** Design solutions for complex Engineering problems and design system components or processes of Computer Engineering that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and Environmental considerations.

PO4 **Conduct Investigations of Complex Problems:** Use research based knowledge and research methods including design of experiments in Computer Engineering, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 **Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, andmodern Engineering and IT tools including prediction and modeling to complexEngineering activities in Computer Engineering with an understanding of the limitations.

PO6 **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 in Computer Engineering.

PO7 **Environment and Sustainability:** Understand the impact of the professional Engineering solutions of Computer Engineering in societal and Environmental contexts, demonstrate the knowledge of, and need for sustainable development.

PO8 **Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the Engineering practice.

PO9 **Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 **Communication Skills:** Communicate effectively on complex Engineering activities with the Engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

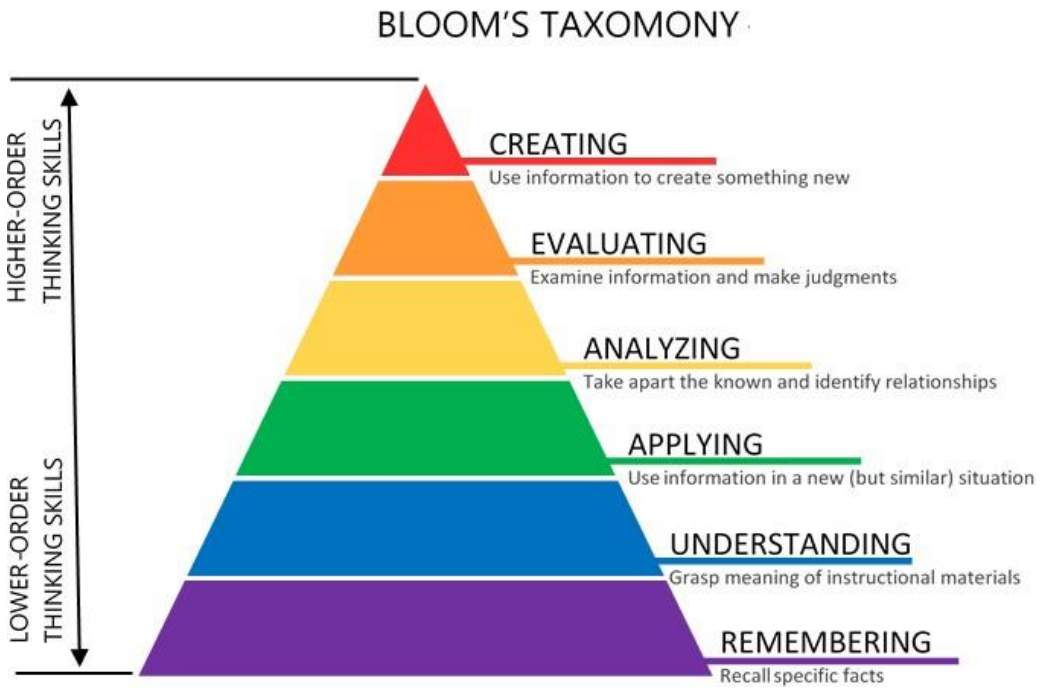
PO11 **Project Management and Finance:** Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments.

PO12 **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.

APPENDIX D

BLOOM'S TAXONOMY

Bloom's taxonomy is a classification system used to define and distinguish different levels ofhuman cognition—i.e., thinking, learning, and understanding. Educators have typically used Bloom's taxonomy to inform or guide the development of assessments (tests and otherevaluations of student learning), curriculum (units, lessons, projects, and other learning activities), and instructional methods such as questioning strategies.



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