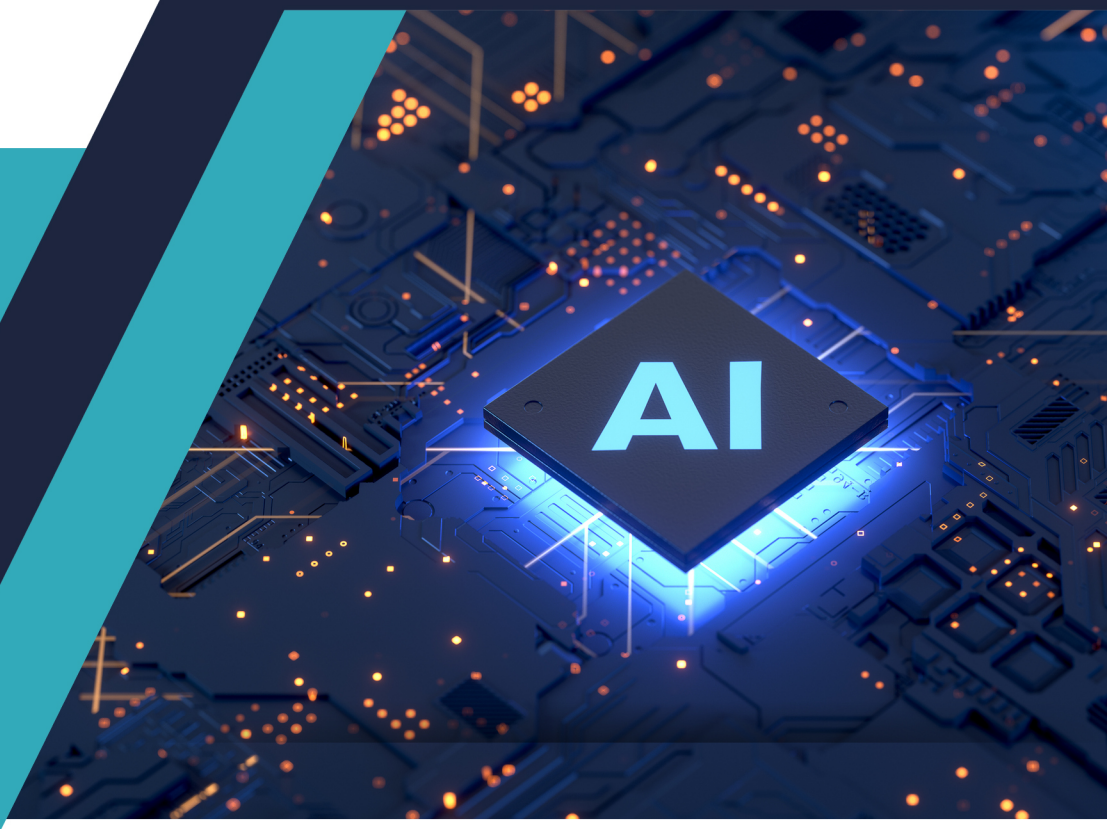
NEW HORIZON
COLLEGE OF ENGINEERING

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Academic Year 2024 - 2025



1st to 8th Semester Scheme & 7th and 8th Semesters Syllabus

BATCH: 2021-25
CREDITS:160
[2021 Scheme]

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Academic Year
2024 - 2025

[2021 Scheme]

1st to 8th Semester Scheme &
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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.

I SEMESTER – PHYSICS CYCLE												
S.No	**Course Code**	**Course**	**BoS**	**Credit Distribution**				**Over all Credit**	**Contact Hours**	**Marks**		
				L	T	P	S			**SEE**	**CIE**	**Total**
1	21MAT11A	Applied Mathematics-1	AS	3	1	0	0	4	5	50	50	100
2	21CHE12A	Engineering Chemistry	AS	2	1	0	0	3	4	50	50	100
3	21CSE13A	Problem solving using Python	CSE	2	1	0	0	3	4	50	50	100
4	21MEE14A	Computer Aided Engineering Drawing	ME	2	0	1	0	3	4	50	50	100
5	21ECE15A	Basic Electronics	ECE	2	1	0	0	3	4	50	50	100
6	21CHL12A	Engineering Chemistry Lab	AS	0	0	1	0	1	2	50	50	100
7	21CSL13A	Problem solving using Python Lab	CSE	0	0	1	0	1	2	50	50	100
8	21AEC11A	Communicative English	HSS	0	0	1	0	1	2	50	50	100
9	21AEC13A	Political Science	HSS	1	0	0	0	1	1	50	50	100
Total								**20**	**28**	**450**	**450**	**900**

II SEMESTER- CHEMISTRY CYCLE												
S. No	**Course Code**	**Course**	**BoS**	**Credit Distribution**				**Over all Credits**	**Contact Hours**	**Marks**		
				L	T	P	S			**SEE**	**CIE**	**Total**
1	21MAT21A	Applied Mathematics-2	AS	3	1	0	0	4	5	50	50	100
2	21PHY22A	Engineering Physics	AS	2	1	0	0	3	4	50	50	100
3	21MEE23A	Elements of Mechanical Engineering	ME	2	1	0	0	3	4	50	50	100
4	21CIV24A	Elements of Civil Engineering	CV	2	1	0	0	3	4	50	50	100
5	21EEE25A	Basic Electrical Engineering	EE	2	1	0	0	3	4	50	50	100
6	21PHL22A	Engineering Physics Lab	AS	0	0	1	0	1	2	50	50	100
7	21EEL25A	Basic Electrical Engineering Lab	EE	0	0	1	0	1	2	50	50	100
8	21AEC21A	Professional Writing Skills in English	HSS	0	0	1	0	1	2	50	50	100
9	21AEC22A	Entrepreneurship Development - 1	MBA	1	0	0	0	1	1	50	50	100
Total								**20**	**28**	**450**	**450**	**900**

III SEMESTER												
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	21AIM31A	Mathematical Foundation of Computing Science	AS	3	0	0	0	3	4	50	50	100
2	21AIM322A*	Introduction to Artificial Intelligence	AI&ML	1	0	1	0	2	3	50	50	100
3	21HSS332A/ 21HSS333A	Aadalitha Kannada / Vyavaharikha Kannada	HSS	1	0	0	0	1	1	50	50	100
4	21HSS342A	Environmental Science	HSS	1	0	0	0	1	1	50	50	100
5	21AIM35A	Digital Electronics for AI	AI&ML	3	0	0	0	3	4	50	50	100
6	21AIL35A	Digital Electronics for AI Lab	AI&ML	0	0	1	0	1	2	50	50	100
7	21AIM36A	Data Structures using C	AI&ML	3	0	0	0	3	4	50	50	100
8	21AIL36A	Data Structures using C Lab	AI&ML	0	0	1	0	1	2	50	50	100
9	21AIM37A	Object-Oriented Programmingwith Java	AI&ML	3	0	0	0	3	4	50	50	100
10	21AIL37A	Object-Oriented Programmingwith Java Lab	AI&ML	0	0	1	0	1	2	50	50	100
11	21AIM38A	Mini Project-1	AI&ML	0	0	2	0	2	4	50	50	100
Total								**21**	**31**	**550**	**550**	**1100**

LATERAL ENTRY STUDENTS

LATERAL ENTRY STUDENTS												
S.No	**Course Code**	**Course**	**BOS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
				L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	21DMAT31A	Basic Applied Mathematics -1	AS	**0**	**0**	**0**	**0**	0	2	50	50	100
2	21DAEC40A	Communicative English	HSS	**0**	**0**	**0**	**0**	0	2	50	50	100
3	21DMAT41A	Basic Applied Mathematic s - 2	AS	**0**	**0**	**0**	**0**	0	2	50	50	100
4	21HSS341A/ 441A	Constitution of India & Professional Ethics	HSS	Mandatory course			**0**	0	2	50	50	100

IV SEMESTER												
S.No	Course Code	Course	BOS	Credit Distribution				Overall Credits	Contact Hours	Marks		
				L	T	P	S			CIE	SEE	Total
1	21AIM41A	Discrete Mathematics and Statistics	AS	3	0	0	0	3	4	50	50	100
2	21HSS421A*	Life Skills for Engineers	HSS	1	0	1	0	2	3	50	50	100
3	21HSS431A	Entrepreneurship Development -2	HSS	1	0	0	0	1	1	50	50	100
4	21HSS441A	Constitution of India & Professional Ethics	HSS	1	0	0	0	1	1	50	50	100
5	21AIM45A	Database Management System	AI&ML	3	0	0	0	3	4	50	50	100
6	21AIL45A	Database Management system Lab	AI&ML	0	0	1	0	1	2	50	50	100
7	21AIM46A	Data Science	AI&ML	3	0	0	0	3	4	50	50	100
8	21AIL46A	Data Science Lab	AI&ML	0	0	1	0	1	2	50	50	100
9	21AIM47A	Design and Analysis of Algorithms	AI&ML	3	0	0	0	3	4	50	50	100
10	21AIL47A	Design and Analysis of Algorithms lab	AI&ML	0	0	1	0	1	2	50	50	100
11	21AIM48A	Summer Internship - I	AI&ML	0	0	0	2	2	0	50	50	100
Total								**21**	**27**	**550**	**550**	**1100**

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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. Successful completion of the registered course is mandatory for the award of the degree. 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	21AIM543	Introduction to Sensor and IoT
21AIM542	Operating Systems	21AIM544	Information Security
21AIM545	Parallel Processing		

Ability Enhancement Course-V			
21AIL551	Unix and Shell Programming	21AIL553	Data Visualization
21AIL552	Cloud Computing using AWS	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 supplement the 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: 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 = 1Credit	03-Credits courses are to be designed for 40 hours inTeaching-Learning Session 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

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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 Techniques	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	**50**
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**	**21**	**500**	**450**	**950**

NCMC	21NSS84	NationalService 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. Successful completion of the registered course is mandatory for the award of the degree. 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.

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

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.

Professional Elective Course- II			
21AIM641	Social Network Analysis	21AIM643	Cyber Security
21AIM642	Human Computer Interaction	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-hours Self Study for Skill Development (SDA) per week =1 Credit

03-Credit courses are to be designed for 40 hours in Teaching-Learning Session

02- Credit courses are to be designed for 25 hours of Teaching-Learning Session

01-Credit courses are to be designed for 15 hours ofTeaching-Learning Sessions

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VII 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	21AIM71	Generative AI	AI&ML	3	0	0	0	3	3	50	50	**100**
2	PCC	21AIM72	Natural Language Processing	AI&ML	3	0	0	0	3	3	50	50	**100**
3	PROJ	21AIM73	Project Work	AI&ML	0	0	12	0	12	0	100	100	**200**
4	AEC	21AIK74	Scientific Foundations of Health	AI&ML	1	0	0	0	1	1	50	50	**100**
5	OEC	23NHOP7XX	Industrial Open Elective Course-II	Offering Dept.	3	0	0	0	3	3	50	50	**100**
								Total	**22**	**10**	**300**	**300**	**600**

NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator	All students have to register for any one 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. Successful completion of the registered course is mandatory for the award of the degree. 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, **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. This 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.

Project Work:

The objective of the Project work is

(i) To encourage independent learning and the innovative attitude of the students.
(ii) To develop interactive attitude, communication skills, organization, time management, and presentation skills.
(iii) To impart flexibility and adaptability.
(iv) To inspire team working.
(v) To expand intellectual capacity, credibility, judgment and intuition.
(vi) To adhere to punctuality, setting and meeting deadlines.
(vii) To install responsibilities to oneself and others.
(viii) To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

CIE procedure for Project Work:

(1) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide.

The CIE marks awarded for the project work, shall be based on the evaluation of the project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(2) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work, shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

SEE procedure for Project Work: SEE for project work will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the evaluation of project work Report, project presentation skill, and question and answer session in the percentage ratio of 50:25:25.

Credit Definition: 1-hour Lecture (L) per week=1Credit 2-hoursTutorial(T) per week=1Credit 2-hours Practical / Drawing (P) per week=1Credit 2-hours 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 Teaching-Learning Sessions

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VIII Semester													
Sl. No	**Course and Course Code**		**Course Title**	**BoS**	**Credit Distribution**				**Overall Credits**	**Contact Hours**	**Marks**		
					L	**T**	**P**	**S**			**CIE**	**SEE**	**Total**
1	PEC	21AIM81X	Professional Elective Course-III	AI&ML	3	0	0	0	3	3	50	50	**100**
2	SEM	21AIM82	Technical Seminar	AI&ML	0	0	1	0	1	0	50	-	**50**
3	INT	21AIM83	Research Internship/ Industry Internship /Rural Internship / Innovation - Incubation Center Internship / Start-up Internship	AI&ML	0	0	12	0	12	0	100	100	**200**
4	NCMC	21NSS84	National Service Scheme (NSS)	NSS coordinator	0	0	0	0	0	0	50	50	**100**
		21PES84	Physical Education (PE) (Sports and Athletics)	Physical Education Director									
		21YOG84	Yoga	Yoga Teacher									
Total									**16**	**3**	**250**	**200**	**450**

NCMC: Non-Credit Mandatory Course, **AEC**: Ability Enhancement Course, **SEM**: Seminar, **INT**: Industry Internship / Research Internship / Rural Internship, **L:** Lecture, **T**: Tutorial, **P**: Practical **S: SDA**: Self Study for Skill Development, , **CIE**: Continuous Internal Evaluation, **SEE**:Semester End Evaluation.

Professional Elective Course-III			
21AIM811	Randomized Algorithms	21AIM812	Advanced Java Programming
21AIM813	Reinforcement Learning	21AIM814	Ethics for AI and ML Engineers
21AIM815	Advanced Machine Learning Algorithms		

Elucidation:

Research/Industry Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and /or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for **24 weeks**. The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent SEE examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavor of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.

With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (**within or outside the state or abroad**), provided favorable facilities are available for the internship and the student remains regularly in contact with the internal guide.

TECHNICAL SEMINAR (21AIM82): The objective of the seminar is to inculcate self-learning, present the seminar topic confidently, enhance communication skill, involve in group discussion for exchange of ideas. Each student, under the guidance of a Faculty, shall choose, preferably, a recent topic of his/her interest relevant to the programme of specialization.

(i) Carry out literature survey, systematically organize the content.
(ii) Prepare the report with own sentences, avoiding a cut and paste act.
(iii) Type the matter to acquaint with the use of Micro-soft equation and drawing tools or any such facilities.
(iv) Present the seminar topic through PowerPoint slides.
(v) Answer the queries and involve in debate/discussion.
(vi) Submit a typed report with a list of references.

The participants shall take part in the discussion to foster a friendly and stimulating environment in which the students are motivated to reach high standards and become self-confident.

Evaluation Procedure:

The CIE marks for the seminar shall be awarded (based on the relevance of the topic, presentation skill, participation in the question-and-answer session, and quality of report) by the committee constituted for the purpose by the Head of the Department. The committee shall consist of three teachers from the department with the senior-most acting as the Chairman.

Marks distribution for CIE of the course:

Seminar Report: 25 marks
Presentation skill: 10 marks
Technical Paper Publication: 15 marks.

Non – credit mandatory courses (NCMC):
National Service Scheme/ Physical Education (Sport and Athletics)/ Yoga:

(1) Securing 40 % or more in CIE,35 % or more marks in SEE and 40 % or more in the sum total of CIE + SEE leads to successful completion of the registered course.

(2)In case, students fail to secure 35 % marks in SEE, they has to appear for SEE during the subsequent examinations conducted by the University.

(3)In case, any student fails to register for NSS, PE or Yoga / fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have not completed the requirements of the course. In such a case, the student has to fulfill the course requirements during subsequently to earn the qualifying CIE marks subject to the maximum programme period.

(4) Successful completion of the course shall be indicated as satisfactory in the grade card. Non-completion of the course shall be indicated as Unsatisfactory.

(5)These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the courses shall be mandatory for the award of degree.

VII Semester

GENERATIVE AI														
Course Code	**21AIM71**								**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:														
21AIM71.1	Understand the fundamental concepts of generative AI													
21AIM71.2	Apply various generative AI techniques for data generation and synthesis													
21AIM71.3	Analyze advanced architectures and algorithms in generative AI													
21AIM71.4	Design generative models in supervised and unsupervised learning													
21AIM71.5	Investigate the effectiveness of generative models in real-world applications													
21AIM71.6	Discover the ethical implications and societal impacts of generative AI.													
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**
21AIM71.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
21AIM71.2	3	-	-	-	-	-	-	-	-	-	-	-	3	2
21AIM71.3	-	3	-	-	-	-	-	-	-	-	-	-	3	3
21AIM71.4	-		3	-	-	-	-	-	-	-	-	-	3	3
21AIM71.5	-	-	3		-	-	-	-	-	-	-	3	3	3
21AIM71.6	-	3	-	-	3	-	-	2	-	-	-	3	3	3
MODULE-1	**INTRODUCTION TO GENERATIVE AI**						21AIM71.1, 21AIM71.2						**8 Hours**	
Overview of Generative AI - History and Evolution - Applications of Generative AI - Key Concepts: Generative Models - Probability Distributions - Autoencoders vs. Generative Adversarial Networks (GANs) vs. Variational Autoencoders (VAEs)														
Applications	Code-based applications, Solving mathematical Problems.													
Text Book	Text Book 1: Ch 1													
MODULE-2	**FUNDAMENTALS OF PROBABILISTIC MODELS**							21AIM71.1, 21AIM71.2					**8 Hours**	
Probability Basics: Probability Distributions Bayes' Theorem Generative Models: Introduction to Probabilistic Graphical Models (PGMs), Gaussian Mixture Models (GMMs), Hidden Markov Models (HMMs), Variational Inference: Introduction to Variational Inference, Variational Autoencoders (VAEs).														
Text Book	Text Book 2: Ch 2													
MODULE-3	**GENERATIVE ADVERSARIAL NETWORKS (GANS)**							21AIM71.3, 21AIM71.4, 21AIM71.5					**8 Hours**	
Understanding GANs: Introduction to Generative Adversarial Networks (GANs)- Generator and Discriminator, GAN Architectures: DCGAN, WGAN, CycleGAN, Training GANs: Challenges and Solutions, Evaluation Metrics Applications of GANs: Image Generation, Style Transfer, Data Augmentation														
Text Book	Text Book 1: Ch:3													
	Code Agent, Security Agent- Gen AI													
MODULE-4	**ADVANCED GENERATIVE AI**							21AIM71.3, 21AIM71.4, 21AIM71.5					**8 Hours**	
Attention Mechanisms: Introduction to Attention, Transformer Models, Generative Models for Text: Recurrent Neural Networks (RNNs), Long Short-Term Memory (LSTM), Transformer-based Models (GPT, BERT), Conditional Generation: Conditional GANs, Conditional VAEs														
Case Study	Transformation with speed and confidence (Code Assistant for Digital Transformation),													
Text Book	Text Book 1: Ch:6.12													
MODULE-5	**ETHICAL AND FUTURE CONSIDERATIONS IN GENERATIVE AI**											21AIM71.6	**8 Hours**	
Ethical Implications: Bias and Fairness Misuse and Security Concerns, Future Directions: Continual Learning, Multi-modal Generation, AI Creativity and Co-creativity, Responsible AI Practices: Guidelines and Best														

Practices, Transparency and Accountability	
Text Book	Text Book 1: Ch 13, Text Book 2: Ch 17
Case Study	Customer Agent- Gen AI

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test	Qualitative Assessment(s) *	MCQ
		25	**15**	**10**
L1	**Remember**	5		**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	5	**10**	
L4	**Analyze**	5	**5**	
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**	20
L4	**Analyze**	10
L5	**Evaluate**	-
L6	**Create**	-

Suggested Learning Resources:

Text Books:

1) David Foster - "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" by O'Reilly Media, 2019: ISBN 9781492041894, 1492041890

2) Ian Goodfellow, Yoshua Bengio, and Aaron Courville - "Deep Learning" (1st Edition) by MIT Press,2016. ISBN: 9780262035613, 0262035618

Reference Books:

1) Daphne Koller and Nir Friedman - "Probabilistic Graphical Models: Principles and Techniques" (1st Edition, Hardcover) by MIT Press, 2009.
2) Kevin P. Murphy - "Machine Learning: A Probabilistic Perspective" (1st Edition, Hardcover) by MIT Press, 2012. ISBN: 9780262018029, 0262018020

Web links and Video Lectures (e-Resources):

- https://www.ibm.com/products/watsonxai?utm_content=SRCWW&p1=Search&p4=43700076605829036&p5=p&gad_source=1&gclid=CjwKCAjwtqmwBhBVEiwALWAYUKRYAYoZn6UHrPClmgtubYSqiHgD9GuksEXOygt-Aj0GDzhRWyZJxoCLHQQAvD_BwE&gclsrc=aw.ds
- https://elearn.nptel.ac.in/shop/iit-workshops/completed/leveraging-generative-ai-for-teaching-programming-courses/?v=c86ee0d9d7ed
- https://www.youtube.com/watch?v=21Cbej-UJuw

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.

NATURAL LANGUAGE PROCESSING			
Course Code	**21AIM72**	**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:

21AIM72.1	Understand basics of linguistics, probability and statistics associated with NLP.
21AIM72.2	Analyze the syntax and semantic of natural language
21AIM72.3	Design an end-to-end NLP application by integrating preprocessing, feature extraction, and model-building techniques,
21AIM72.4	Evaluate the performance of advanced models in various NLP tasks such as text classification, summarization, and topic modeling.
21AIM72.5	Demonstrate the working of sequence models for text processing
21AIM72.6	Implement the NLP applications on emerging trends with ethical implications.

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
21AIM72.1	2	-	-	-	-	-	-	-	-	-	-	-	---	-
21AIM72.2	-	3	-	-	-	-	-	-	-	-	-	2	3	2
21AIM72.3	-	-	3	-	-	-	-	-	-	-	-	2	3	2
21AIM72.4	-	3	-	-	-	-	-	-	-	-	-	-	3	2
21AIM72.5	-	3	-	-	3	-	-	-	-	-	-	2	3	2
21AIM72.6	-	-	3	-	3	-	-	2		-	-	2	3	2

MODULE-1	**INTRODUCTION TO NLP**	21AIM72.1	**8 Hours**

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

Case Study	Case studies of NLP applications in various industries.
Text Book	Text Book 1: Ch 2,3

MODULE-2	**WORD LEVEL ANALYSIS**	**2**1AIM72.2	**8 Hours**

Word Counting in Corpora, Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

Text Book	Text Book 1: Ch 4,5,6. Text Book 2: Ch 6,8

MODULE-3	**SYNTACTIC ANALYSIS**	21AIM72.2, 21AIM72.3	**8 Hours**

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing: Ambiguity, Dynamic Programming parsing. Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures

Text Book	Text Book 1: Ch 12,13,14,15. Text Book 2: Ch 9,10

MODULE-4	**SEMANTICS AND PRAGMATICS**	21AIM 72.2,21AIM72.4, 21AIM72.5	**8 Hours**

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods

Text Book	Text Book 1; Ch 17, 18, 19, 20

MODULE-5	**DISCOURSE ANALYSIS AND LEXICAL**	21AIM72.5, 21AIM72.6	**8 Hours**

	RESOURCES AND NLP APPLICATIONS		

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, **Speech Recognition Tools:** Vosk, Kaldi. Future Trends in NLP**.**

Case Study	Using NLP for Healthcare summaries
Text Book	**Text Book 1: Ch 21 Text Book 2: Ch 15,16**

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test	Qualitative Assessment(s) *	MCQ
		25	**15**	**10**
L1	**Remember**	5	**-**	**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	10	10	**-**
L4	**Analyze**	5	5	**-**
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) Daniel Jurafsky and James H.Martin, "Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech Recognition" (Prentice Hall Series in Artificial Intelligence), 2017.ISBN: 0133252930, 9780133252934. https://web.stanford.edu/~jurafsky/slp3/
2) Jacob Eisenstein. "Natural Language Processing ", MIT Press, 2019.ISBN: 9780262042840 https://web.stanford.edu/~jurafsky/slp3/

Reference Books:

1. Samuel Burns "Natural Language Processing: A Quick Introduction to NLP with Python and NLTK, 2019. ISBN: 9781699028452, 1699028451
2. Christopher Manning, "Foundations of Statistical Natural Language Processing", MIT Press, 2009
3. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O'Reilly Media, 2009.ISBN: 9780596555719, 0596555717

Web links and Video Lectures (e-Resources):

- https://archive.nptel.ac.in/courses/106/106/106106211/
- https://www.nptelvideos.com/course.php?id=424
- https://www.youtube.com/watch?v=rmVRLeJRkl4

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

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

PROJECT WORK			
Course Code	**21AIM73**	**CIE Marks**	**100**
L:T:P:S	**0:0:12:0**	**SEE Marks**	**100**
Hrs / Week	**-**	**Total Marks**	**200**
Credits	**12**	**Exam Hours**	**03**

Course outcomes:

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

21AIM73.1	Apply the Domain knowledge, technical skill set and software engineering principles for solving industry/research problems
21AIM73.2	Analyse the required algorithms to define modules for solution
21AIM73.3	Design a new innovation method based on the real-world requirements.
21AIM73.4	Evaluate the modules using testing methodologies and tools to prove the performance of the implemented project.
21AIM73.5	Manage project schedules, resources and work assignments to ensure timely completion
21AIM73.6	Demonstrate the work with detailed project/technical report.

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
21AIM73.1	3		-	-	-	3		-	-	-	-	3	3	2
21AIM73.2		3	-	-	-	-	-	3	-	-	-	-	3	2
21AIM73.3	-	-	3	-	3	3	-	-	-	-	3	-	3	2
21AIM73.4	-	3	-		-	-	-	-	-	-	-	-	3	2
21AIM73.5		3	-		3				3	-	3	3	3	2
21AIM73.6	-	-	3	-	3	-	-	3	3	3	3	3	3	2

Objective

- Students to gain domain knowledge and technical skills to solve potential business problems, research problems, collect requirements, design suitable software solutions, and evaluate them.
- students work as a small team and understand the processes and practises in the industry.
- encourage independent learning and the innovative attitude of the students.
- Implement, test, and deploy solutions for target platforms.
- adhere to punctuality, setting and meeting deadlines.
- develop their interactive attitude, communication skills, organization, time management, and presentation skills.
- Preparing project reports and presentations

This course will be conducted largely as group of 2-4 student members under the direct supervision of a member of academic staff. The specific project topic undertaken will reflect the common interests and expertise of the student and supervisor.

Students will be required to:

1. Students form their own team, preferably combined with other departments (interdisciplinary team or Project).
2. Preparation of detailed design for the project.
3. Implementation of the sub-modules and their integration.
4. Testing and validation.
5. Publish the work carried out on the project in the referred journal.
6. Prepare and submit the major project report.

CIE Assessment Pattern (100 Marks)

RBT Level		Qualitative Assessment (s)
		100
L1	**Remember**	**-**
L2	**Understand**	**20**
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	20
L6	**Create**	**20**

SEE Assessment Pattern (100 Marks)

RBT Levels		Exam Marks Distribution (100)
L1	**Remember**	**-**
L2	**Understand**	**20**
L3	**Apply**	**20**
L4	**Analyze**	**20**
L5	**Evaluate**	**20**
L6	**Create**	**20**

SCIENTIFIC FOUNDATIONS OF HEALTH			
Course Code	**21AIK74**	**CIE Marks**	**50**
L:T:P:S	**1:0:0:0**	**SEE Marks**	**50**
Hrs / Week	**1**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**2**

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

21AIK74.1	Understand the concepts of Health and wellness and the importance of achieving balanced good health
21AIK74.2	Implement healthy lifestyle habits effectively to enhance overall well-being
21AIK74.3	Adopt the innovative & positive methods to avoid risks from harmful habits in their campus & outside the campus
21AIK74.4	Create the formulate strategies to fight against harmful diseases for good health through positive mindset

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

21AIK74.1	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
21AIK74.2	-	-	-	-	-	1	-	-	-	-	-	-
21AIK74.3	-	-	-	-	-	2	-	-	-	-	-	-
21AIK74.4	-	-	-	-	-	3	-	-	-	-	-	-

MODULE-1	**GOOD HEALTH AND IT'S BALANCE FOR POSITIVE MINDSET**	**21AIK74.1**	**3 Hours**

Health -Importance of Health, influencing factors of Health, Health beliefs, Advantages of good health, Health & Behavior, Health & Society, Health & family, Health & Personality, Psychological disorders-Methods to improve good psychological health, Changing health habits for good health.

Case Study	Factors Affecting Health and Mindset
Text Book	Text Book 1: Ch. 1

MODULE-2	**BUILDING OF HEALTHY LIFESTYLES FOR BETTER FUTURE**	**21AIK74.2**	**3 Hours**

Developing healthy diet for good health, Food & health, Nutritional guidelines for good health, Obesity & overweight disorders and its management, Eating disorders, Fitness components for health, Wellness and physical function, How to avoid exercise injuries.

Self-study	Benefits of mindfulness practices for stress reduction and mental clarity.
Text Book	Text Book 1: Ch. 2, Text Book 3: Ch. 7

MODULE-3	**CREATION OF HEALTHY AND CARING RELATIONSHIPS**	**21AIK74.1, 21AIK74.2**	**3 Hours**

Building communication skills (Listening and speaking), Friends and friendship - education, the value of relationships and communication, Relationships for Better or worsening of life,

understanding of basic instincts of life (more than a biology), Changing health behaviours through social engineering,			
Case Study	Guidance and support to colleagues facing challenges or seeking career advancement.		
Text Book	Text Book 1: Ch. 3		
MODULE-4	**AVOIDING RISKS AND HARMFUL HABITS**	**21AIK74.3**	**3 Hours**
Characteristics of health compromising behaviors, Recognizing and avoiding of addictions, How addiction develops and addictive behaviors, Types of addictions, influencing factors for addictions, Differences between addictive people and non-addictive people and their behavior with society, Effects and health hazards from addictions, how to recovery from addictions			
Self-study	Study the impact of excessive sugar, salt, and saturated fats on cardiovascular health, obesity, and chronic diseases.		
Text Book	Text Book 1: Ch. 4, Text Book 3: Ch. 5,6		
MODULE-5	**PREVENTING AND FIGHTING AGAINST DISEASES FOR GOOD HEALTH**	**21AIK74.4**	**3 Hours**
Process of infections and reasons for it, Management of chronic illness for Quality of life, Health and Wellness of youth , Measuring of health & wealth status.			
Self-study	Explore diagnostic tests and their role in detecting health conditions before symptoms appear.		
Text Book	Text Book 1: Ch. 5, Text Book 2: Ch. 5		

CIE Assessment Pattern (50 Marks – Theory)

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

SEE Assessment Pattern (50 Marks – Theory)

RBT Levels	**Exam Marks Distribution (50)**

L1	**Remember**	**10**
L2	**Understand**	**30**
L3	**Apply**	**10**
L4	**Analyze**	**-**
L5	**Evaluate**	**-**
L6	**Create**	**-**

Suggested Learning Resources:
Textbook:

1. "Scientific Foundations of Health" – Study Material Prepared by Dr. L Thimmesha, Published in VTU - University Website.

2. "Scientific Foundations of Health", (ISBN-978-81-955465-6-5) published by Infinite Learning Solutions, Bangalore – 2022.

3. Health Psychology - A Textbook, FOURTH EDITION by Jane Ogden McGraw Hill Education (India) Private Limited - Open University Press.

Reference Books:

1. Health Psychology (Second edition) by Charles Abraham, Mark Conner, Fiona Jones and Daryl O'Connor – Published by Routledge 711 Third Avenue, New York, NY 10017.

2. HEALTH PSYCHOLOGY (Ninth Edition) by SHELLEY E. TAYLOR - University of California, Los Angeles, McGraw Hill Education (India) Private Limited - Open University Press.

Web links and Video Lectures (e-Resources):

- **https://archive.nptel.ac.in/courses/109/103/109103182/**
- **https://www.youtube.com/watch?v=BYmQbtyNfCo**
- **https://www.youtube.com/watch?v=u9TFeiBc_SE**
- **https://archive.nptel.ac.in/courses/109/101/109101007/**

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

- Activities to improve health, fitness, mindfulness etc.
- Case studies on healthy habits, impact of good lifestyle

.

VIII Semester

RANDOMIZED ALGORITHMS			
Course Code	**21AIM811**	**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:

21AIM811.1	Understand the fundamental principles of randomized algorithms, including types of randomness and their applications.
21AIM811.2	Analyze the performance and properties of randomized data structures to evaluate their effectiveness in handling dynamic data and optimizing memory usage.
21AIM811.3	Evaluate the accuracy and efficiency of Monte Carlo methods for numerical integration and randomized matrix multiplication, measuring their applicability to solve complex numerical problems
21AIM811.4	Assess the convergence properties and sampling efficiency of Markov Chain Monte Carlo (MCMC) methods to critique their performance in generating representative samples and exploring complex state spaces.
21AIM811.5	Design heuristic optimization solutions using metaheuristic algorithms to address optimization problems in diverse domains
21AIM811.6	Synthesize knowledge from modules to answer real-world problems using randomized 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
21AIM811.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
21AIM811.2	-	3	-	-	-	-	-	-	-	-	-	-	-	-
21AIM811.3	-	3		-	-	-	-	-	-	-	-	3	3	2
21AIM811.4	-	3	-	-	3	-	-	-	-	-	-	3	3	2
21AIM811.5	-	-	3	-		-	-	-	-	--	-	3	3	2
21AIM811.6	-	-	3	-	3	-	-	-	-	-	-	3	3	2

MODULE-1	**Introduction to Randomized Algorithms**	21AIM811.1	**8 Hours**

Introduction to Randomized Algorithms: Definition and importance of randomized algorithms-Types of randomness: Las Vegas vs. Monte Carlo algorithms -Applications of randomized algorithms. **Data Structures with Randomization:** Skip Lists: structure, operations, and performance -Treaps: structure, operations, and balancing properties.

Text Book	Text Book 2: Ch 1, 8
Case study	Classification and its Applications

MODULE-2	**Randomized Data Structures and Graph Algorithms**	21AIM811.1 21AIM811.2	**8 Hours**

Hashing and Bloom Filters: Bloom Filters: structure, operations, and false positive probability-Cuckoo Hashing: algorithm, analysis, and practical applications. **Randomized Graph Algorithms:** Randomized Minimum Spanning Tree (MST): algorithms and applications -Randomized Graph Traversal: techniques and performance analysis.

Text Book	Text Book 2: Ch 10 Text Book 2: Ch 5, 10
Case Study	Graph Algorithm or database in healthcare (life Science).

MODULE-3	**Monte Carlo Method**	21AIM811.3 21AIM811.4	**8 Hours**

Monte Carlo Method- Randomized Matrix Multiplication. **Approximate Counting**: Randomized Approximation Schemes- The DNF Counting Problem: The Naïve Approach- A fully Polynomial Randomized Scheme for DNF Counting -Approximating the permanent -Volume Estimation.

Text Book	Text Book 1: Ch 10 ,11		
MODULE-4	**Marko Chain Monte Carlo Methods**	21AIM811.3,21AIM811.4	**8 Hours**
Markov Chain Monte Carlo (MCMC)- Introduction to MCMC: basic concepts -The Metropolis Algorithm – A 2-SAT Example- Marko Chains-Random Walks on Graphs: algorithms and applications in network analysis.			
Text Book	Text Book 2: Ch 6 Text Book 2:		
MODULE-5	**Advanced Algorithms**	21AIM811.5 ,21AIM811.6	**8 Hours**
Parallel and Distributed Algorithms: PRAM Model- Maximal Independent Sets- Perfect Matching-The Choice Coordination Problem- byzantine Agreement. Online Algorithms: The online paging Problem- Adversary Models- Paging against an Oblivious Adversary- The k-server Problem.			
Case Study	Packing items into a container in a way that minimize transportation cost.		
Text Book	Text Book 2: 12,13.		

CIE Assessment Pattern (50 Marks – Theory)

RBT Levels		Test(s)	Qualitative Assessment(s) *	MCQ
		25	**15**	**10**
L1	**Remember**	5	**-**	**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	10	10	
L4	**Analyze**	5	5	
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. Probability and Computing: Randomization and Probabilistic Techniques in Algorithms and Data Analysis by Eli Upfal and Michael Mitzenmacher, Cambridge University,2005 (ISBN: 0521 83540 2)
2. Randomized Algorithms" by Rajeev Motwani and Prabhakar Raghavan, Cambridge University Press,2000. ISBN: 0521 47465 5

Reference Books:

1. Algorithm Design By Jon Kleinberg, Éva Tardos , Pearson Education,2006.ISBN: 9788131703106

Web links and Video Lectures (e-Resources):

- https://www.kindsonthegenius.com/how-bloom-filters-work/
- https://archive.nptel.ac.in/courses/106/103/106103187/
- https://www.youtube.com/watch?v=0r2D32esF3Y
- https://brilliant.org/wiki/randomized-algorithms-overview/

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

- Group discussion on real-world problems.
- Contents-related activities (Activity-based discussions)
  Organizing Group discussions on real-world problems
  Seminars

ADVANCED JAVA PROGRAMMING			
Course Code	**21AIM812**	**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:

21AIM812.1	Understand basics of server-side and TCP/IP socket programing
21AIM812.2	Analyze the need for advanced Java concepts like enumerations and annotations in developing modules in projects.
21AIM812.3	Evaluate the functioning of graphical programming using AWT.
21AIM812.4	Design server-side scripts (servlets) and JSPs that fit into a Java-based web application architecture.
21AIM812.5	Examine how the JDBC API can be used to access databases and manage connections.
21AIM812.6	Justify the use of collection frameworks and graphics programming to increase performance.

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
21AIM812.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
21AIM812.2	-	3	-	-	-	-	-	-	-	-	-	2	3	2
21AIM812.3	-	3	-	-	-	-	-	-	-	-	-	2	2	2
21AIM812.4	-	-	3	-	3	-	-	-	-	-	-	3	2	2
21AIM812.5	-	3	-	-	-	-	-	-	-	-	-	3	3	3
21AIM812.6	-	3	-	-	3	-	-	-	-	-	-	2	3	-

MODULE-1	Java Networking	21AIM812.1	**8 Hours**

Network Basics and Socket overview, TCP/IP client sockets, URL, TCP/IP server sockets, Datagrams, java.net package Socket, ServerSocket, InetAddress, URL, URL Connection

Case Study	URL, URLConnection
Text Book	Text Book 1: chapter 22

MODULE-2	**Enumerations, Autoboxing and Annotations**	21AIM812.2	**8 Hours**

Enumerations, Enumeration fundamentals, the values() and valueOf() Methods, Java enumerations are class types, enumerations Inherits Enum, example, type wrappers, Autoboxing, Autoboxing and Methods, Autoboxing/Unboxing occurs in Expressions, Autoboxing/Unboxing, Boolean and character values, Autoboxing/Unboxing helps prevent errors, A word of Warning. Annotations, Annotation basics, specifying retention policy, Obtaining Annotations at run time by use of reflection, Annotated element Interface

Case Study	Autoboxing in expressions
Text Book	Text Book 1: chapter 12

MODULE-3	**The Collection framework and Graphics Programming**	21AIM812.3,21AIM812.6	**8 Hours**

The collections and Framework: Collections Overview, Recent Changes to Collections, The Collection Interfaces, The Collection Classes, accessing a collection via an Iterator, Storing User Defined Classes in Collections, The Random Access Interface, The Collection Algorithms, Graphics programming using AWT.

Text Book	Textbook 1 - chapter 18

MODULE-4	**Servlet Concepts**	21AIM812.4	**8 Hours**

Background; The Life Cycle of a Servlet; Using Tomcat for Servlet development; A simple Servlet; The Servlet API; The javax.servlet. package; Reading Servlet Parameter; The Javax. servlet. http package; Handling HTTP Requests and Responses; Using Cookies; Session Tracking. Java Server Pages (JSP): JSP, JSP Tags, Tomcat, Request String, User Sessions, Cookies, Session Objects			
Case Study	Session tracking using servlets		
Text Book	Textbook 1 - Ch 38 Textbook 3- Ch 37,38		
MODULE-5	**The Concept of JDBC**	21AIM812.5, 21AIM812.6	**8 Hours**
The Concept of JDBC; JDBC Driver Types; JDBC Packages; A Brief Overview of the JDBC process; Database Connection; Associating the JDBC/ODBC Bridge with the Database; Statement Objects; ResultSet; Transaction Processing; Metadata, Data types; Exceptions.			
Text Book	Textbook 2- Chapter 2		

CIE Assessment Pattern (50 Marks – Theory) –

RBT Levels		Test (s)	Qualitative Assessment (s)*	MCQ
		25	**15**	**10**
L1	**Remember**	5	**-**	**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	5	10	
L4	**Analyze**	5	5	
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. Herbert Schildt: JAVA the Complete Reference, 9th Edition, Tata McGraw Hill, 2014. ISBN: :9780071808552, 0071808558.
2. Jim Keogh: J2EE-TheCompleteReference, McGraw Hill, 2007.ISBN: 9780072224726, 007222472X

Reference Books:

1. Stephanie Bodoff , The J2EE Tutorial, 2nd Edition, Pearson Education,2004. ISBN: 9780321245755
2. Y. Daniel Liang: "Introduction to JAVA Programming", 10th Edition, Pearson Education, 2007.ISBN: 9780136012672, 0136012671

Web links and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2. https://www.codecademy.com/learn/learn-advanced-java

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

- Activity-Based Learning (Suggested Activities in Class)/ Practical Based learning
- Visit to software Development Company (IV)
- Contents related activities (Activity-based discussions)
- Organizing hands-on sessions on JSP and servlets and other advanced concepts.
- Seminars

REINFORCEMENT LEARNING			
Course Code	**21AIM813**	**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:

21AIM813.1	Understand the basic concepts of Reinforcement Learning
21AIM813.2	Apply multi-armed bandit algorithms to solve exploration-exploitation trade off and others
21AIM813.3	Analyze the Monte Carlo method's involvement in the learning process through experience as well as Temporal-Difference Learning.
21AIM813.4	Evaluate the performance of prediction problems through the principle of optimality
21AIM813.5	Develop reinforcement learning applications using Finite MDP
21AIM813.6	Improve the knowledge of reinforcement learning to optimise the solution.

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
21AIM813.1	2	-	-	-	-	-	-	-	-	-	-	2	-	-
21AIM813.2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
21AIM813.3	-	3	-	-	-	-	-	-	-	-	-	2	2	2
21AIM813.4	-	3		-	-	-	-	-	-	-	-	2	2	-
21AIM813.5	-	-	3	-	-	-	-	-	-	-	-	2	3	3
21AIM813.6	-	-	3	-	3	-	-	-	-	-	-	-	3	3

MODULE-1	**Introduction**	21AIM813.1	**8 Hours**
Reinforcement Learning-Examples, Early History of Reinforcement Learning Elements of Reinforcement Learning. Limitations and Scope - An Extended Example: Tic-Tac-Toe.			
Case Study			
Text Book	Text Book 1: Ch 1		
MODULE-2	**MULTI-ARMED BANDITS**	21AIM813.2	**8 Hours**
k-armed Bandit Problem- Action-value Methods -The 10-armed Testbed -Incremental Implementation -Tracking a Non stationary Problem- Optimistic Initial Values -Upper-Confidence-Bound Action Selection-Gradient Bandit Algorithms.			
Case Study	Display ad bidding system in advertising.		
Text Book	Text Book 1: Ch 2,		
MODULE-3	**FINITE MARKOV DECISION PEOCESSES & DYNAMIC PROGRAMMING**	21AIM813.5	**8 Hours**
The Agent–Environment Interface -Goals and Rewards -Returns and Episodes -Unified Notation for Episodic and Continuing Tasks -Policies and Value Functions -Optimal Policies and Optimal Value Functions- Optimality and Approximation. **DYNAMIC PROGRAMMING**: Policy Evaluation (Prediction) -Policy Improvement - Policy Iteration -Value Iteration -Asynchronous Dynamic Programming -Generalized Policy Iteration.			
Case Study	Reinforcement learning in new recommendation.		
Text Book	Text Book 1: Ch 3,4		
MODULE-4	**MONTE CARLO METHODS**	21AIM813.3	**8 Hours**

Monte Carlo Prediction - Monte Carlo Estimation of Action Values -Monte Carlo Control - Monte Carlo Control without Exploring Starts -Off-policy Prediction via Importance Sampling -Incremental Implementation - Off-policy Monte Carlo Control.
TEMPORAL-DIFFERENCE LEARNING: TD Prediction - Advantages of TD Prediction Methods - Optimality of TD (0)- Sarsa: On-policy TD Control -Q-learning: Off-policy TD Control.

Text Book	Text Book 1: Ch 5,6		
MODULE-5	**APPROXIMATE SOLUTION METHODS**	21AIM813.4 21AIM813.6	**8 Hours**

Policy Gradient-Policy Approximation and its Advantages - The Policy Gradient Theorem -REINFORCE: Monte Carlo Policy Gradient -REINFORCE with Baseline -Actor–Critic Methods - Policy Gradient for Continuing Problems - Policy Parameterization for Continuous Actions.

Case Study	Reinforcement learning in Robotics manipulation.
Text Book	Text Book 1: Ch 9, 13

CIE Assessment Pattern (50 Marks – Theory) –

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

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)Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, second edition The MIT Press Cambridge, Massachusetts London, England,2018. ISBN: 9780262352703, 0262352702

Reference Books:

1. Dimitri Bertsekas and John Tsitsiklis, "Neuro-dynamic programming", Athena Scientific, 1997. ISBN: 9781886529106
3. Csaba Szepesvari, "Algorithms for Reinforcement Learning", Morgan and Claypool, 2010. ISBN: 9781608454921, 1608454924

Web links and Video Lectures (e-Resources):

https://www.youtube.com/watch?v=Mut_u40Sqz4
https://www.youtube.com/watch?v=K5RVbXeDE5A
https://www.bing.com/videos/riverview/relatedvideo?&q=reinforcement+learning+videos&&mid=79FAB9FB4429257261CB79FAB9FB4429257261CB&&FORM=VRDGAR

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

- Group discussion on real-world problems.
- Contents-related activities (Activity-based discussions)
  - Organizing Group discussions on real-world problems.
  - Seminars

ETHICS FOR AI AND ML ENGINEERS			
Course Code	**21AIM814**	**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 out comes: At the end of the course, the student will be able to:

21AIM814.1	Understand the legal and ethical frameworks governing artificial intelligence.
21AIM814.2	Apply human rights-centered design, deliberation, and normative modes to mitigate ethics and address conflicts
21AIM814.3	Analyze the moral framework of justice in AI and accountability in computer systems
21AIM814.4	Evaluate the ethical implications of AI in health, public, legal, and other research fields.
21AIM814.5	Develop the ethical considerations of AI and its impact on society.
21AIM814.6	Synthesize interdisciplinary ideas on artificial intelligence ethics.

MappingofCourseOutcomestoProgramOutcomesandProgramSpecificOutcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO 2
21AIM814.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
21AIM814.2	3	-	-	-	-	-	-	-	-	-	-	-	2	-
21AIM814.3	-	3	-	-	-	-	-	-	-	-	-	2	2	-
21AIM814.4	-	3	-	-	-	-	-	-	-	-	-	2	2	-
21AIM814.5	-	-	3	-	-	-	-	3	-	-	-	2	2	2
21AIM814.6	-	-	3	-	3	-	-	3	-	-	-	2	2	3

MODULE-1	**Introduction and Overview**	21AIM814.1	**8Hours**

Introduction & Overview for Law and Regulation, Ethics of the Ethics of AI, Ethical Issues in Relationship with Artificial Entities.

Text Book	Text Book 1: Ch 1

MODULE-2	**Framework and Modes**	21AIM814.2	**8 Hours**

AI Governance by Human Rights- Centered Design, Deliberation and Oversight: End to Ethics Washing, The Incompatible Incentives of Private-Sector AI. Normative Modes: Codes and standards. The Role of Professional Norms in the Governance of Artificial Intelligence.

Text Book	Text Book 1: 4-7

MODULE-3	**Concepts and Issues**	21AIM814.3, 21AIM814.4	**8 Hours**

Moral Framework of Justice in AI: on the Limits, Failing and Ethics of Fairness, Accountability in Computer Systems-Responsibility and AI, The concept of Handoff as a Model for Ethical Analysis and Design.

Text Book	Text book 1: 8 – 21

MODULE-4	**Perspectives and Approaches**	21AIM814.4	**8 Hours**

Perspective on Ethics of AI - Computer Science, Social Failure Modes in Technology and the Ethics of AI: An Engineering Perspective, Automating Origination: Perspectives from the Humanities, Perspectives on Ethics of AI: Philosophy

Text Book	Text Book 1: Ch 22- 28

MODULE-5	**Cases and Application**	21AIM814.4, 21AIM814.5, 21AIM814.6	**8 Hours**

Ethics of AI in Transport - Ethics of AI in Biomedical Research, Patient Care and Public Health, Ethics of AI in Law: Basics Questions, Beyond Bias:" Ethical AI" in Criminal Law.

Case Study	Solar Lighting Example
Text Book	Text book 1: Ch 35-39.

CIE Assessment Pattern (50 Marks – Theory)

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

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

SEE Assessment Pattern (50Marks –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. The Oxford Handbook of Ethics of AI, by Markus D Dubber, Frank Pasquale, Sunit Das, Oxford Press,2020. ISBN: 978-0-19-006739-7.

Reference Books:

1. Artificial Intelligence: A Guide for Thinking Humans by Melanie Mitchell, 2019. ISBN: 9780374715236, 0374715238
2. Robot Ethics 2.0: From Autonomous Cars to Artificial Intelligence edited by Patrick Lin, Keith Abney, and Ryan Jenkins, Oxford Press, 2017. ISBN: 9780190652951

Weblinks and Video Lectures(e-Resources):

- https://ocw.mit.edu/courses/res-ec-001-exploring-fairness-in-machine-learning-for-international-development-spring-2020/pages/module-one-introduction/

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

- Group discussion on real-world problems.
- Contents-related activities (Activity-based discussions)
- Organizing Group discussions on real-world problems
- Seminars

ADVANCED MACHINE LEARNING			
Course Code	**21AIM815**	**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:

21AIM815.1	Understand the principles and applications of ensemble learning methods.
21AIM815.2	Apply kernel, Random Forest, GBM, XGBoost and Support Vector Machines (SVM) to classification problems.
21AIM815.3	Analyze high-dimensional data using techniques by evaluating their effectiveness in data visualization and feature extraction.
21AIM815.4	Evaluate probabilistic graphical models to assess their applicability and performance in modeling dependencies and time-series data.
21AIM815.5	Compare the effectiveness of Isolation Forest and One-Class SVM for anomaly detection, critiquing their performance in identifying outliers in various datasets.
21AIM815.6	Design a solution for anomaly detection solutions by integrating Isolation Forest and One-Class SVM, tailored to specific datasets and problem domains.

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
21AIM815.1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
21AIM815.2	3	-	-	-	-	-	-	-	-	-	-	-	3	3
21AIM815.3	-	3	-	-	-	-	-	-	-	-	-	3	3	3
21AIM815.4	-	3	-	-	-	-	-	-	-	-	-	3	2	3
21AIM815.5	-	3	-	-	3	-	-	-	-	-	-	-	3	-
21AIM815.6	-	-	3	-	3	-	-	-	-	-	-	3	3	3

MODULE-1	**Ensemble Learning**	21AIM815.1, 21AIM15.2	**8 Hours**

Ensemble Leaning-difficulties in ensemble learning-Bagging: Two ensemble paradigms-Bagging Algorithm-Theoretical Issues-Random Tree Ensembles. Fusion Methods: Benefit of Combination-Averaging-Voting-combining by learning-other combination methods- Relevant methods. Ensemble Pruning.

Case Study	Predicting Bitcoin prices
Text Book	Text Book 4: Ch 3, 4, 6 Text Book 1: Ch 7, Text Book 2: Ch 8

MODULE-2	**Boosting methods**	21AIM815.2	**8 Hours**

The general boosting procedure-AdaBoost Algorithm-Theoretical Issues-Multiclass Extension- Noise Tolerance. Gradient Boosting- XGBoost algorithm.

Case Study	Classifying Fraudulent Transactions
Text Book	Text Book 4: Ch 2 Text Book 1: Ch 7

MODULE-3	**Kernels and SVM**	21AIM815.2, 21AIM815.3	**8 Hours**

Introduction- Kernel Functions-Using kernels inside GLMs (Generalized Linear Models)-The kernel trick-kernels for building generative models- Support vector Machines.

Text Book	Text Book 3: Ch 14

MODULE-4	**Dimensionality Reduction Techniques**	21AIM815.5, 21AIM815.6	**8 Hours**

Main approaches for dimensionality reduction- Projection- manifold learning-kernel PCA-LLE-other dimensionality reduction techniques. Anomaly Detection Techniques: one class SVM- isolation forest.

Text Book	Text Book 1: Ch 8

MODULE-5	**Markov and hidden Markov Models**	21AIM815.4, 21AIM815.6	**8 Hours**

Introduction- Markov models: Transition Matrix- Applications. Hidden Markov Models- Inference in HMM: Types of inference problems for temporal models- the forwards algorithm- the forwards-backwards algorithm- the Viterbi algorithm- forwards filtering, backwards sampling.

Text Book	Text book 3: Ch 17
Case Study	Independent component analysis -applications

CIE Assessment Pattern (50 Marks – Theory)

		Test (s)	Qualitative Assessment (s)	MCQ
		25	**15**	**10**
L1	**Remember**	5	**-**	**5**
L2	**Understand**	5	**-**	**5**
L3	**Apply**	10	10	
L4	**Analyze**	5	**5**	
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) Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" by Aurélien Géron, 2019. ISBN: 9781492032618, 1492032611
2) Advanced Machine Learning with Python, John Hearty, Packt Publishing, 2016. ISBN: 9781784393830, 1784393835
3) Machine Learning: A Probabilistic Perspective by Kevin P. Murphy, MIT Press,2012. ISBN: 9780262304320, 0262304325
4) Ensemble Methods: Foundations and Algorithms by Zhi-Hua Zhou, CRC Press,2012. ISBN: 9781439830055, 1439830053

Reference Books:

1. Fundamentals of Machine Learning for Predictive Data Analytics, by John D. Kelleher, Brian Mac Namee, Aoife D' Arey, 2nd Edition, MIT Press, 2020. ISBN: 9780262044691, 0262044692
2. Hands-On Ensemble Learning with Python, George Kyriakides, Konstantinos G. Margaritis, Packt Publishing, 2019. ISBN: 9781789617887, 178961788X

Web links and Video Lectures (e-Resources):

- https://machinelearningmastery.com/support-vector-machines-for-machine-learning/
- https://data-flair.training/blogs/applications-of-svm/

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

- Group discussion on real-world problems.
- Contents-related activities (Activity-based discussions)
- Organizing Group discussions on real-world problems
- Seminars

TECHNICAL SEMINAR			
Course Code	**21AIM82**	**CIE Marks**	**50**
L:T:P:S	**0:0:1:0**	**SEE Marks**	**-**
Hrs / Week	**-**	**Total Marks**	**50**
Credits	**01**	**Exam Hours**	**03**

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

21AIM82.1	Apply ethical principles and professional standards in the preparation and presentation of technical seminars
21AIM82.2	Evaluate the technical feasibility of topics for interdisciplinary discussion and debate.
21AIM82.3	Analyse current trends and advancements in a specific technical field to do research and define an innovative solution to the problem.
21AIM82.4	Demonstrate communication skills through the delivery of technical presentations

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
21AIM82.1	3	-	-	-	-	-		3	3	-	-	-	-	2
21AIM82.2	-	3	-	-	3	-	-	-	3	-	-	3	-	2
21AIM82.3	-	3	-	-	-	-	-	-	-	-	-	3	2	2
21AIM82.4	3	-	-	-	-	-	-	-	-	3	-	3	2	2

Objectives:

1. Develop students' ability to research, analyze, and present advanced technical topics effectively.
2. Enhance students' communication skills through the preparation and delivery of clear and structured technical presentations.
3. Foster interdisciplinary learning and critical thinking by discussing current trends and ethical considerations in various technical fields.

Guidelines:

1. Research and select a topic that is relevant and of interest to both you and your audience.
2. Conduct thorough research using credible sources to gather comprehensive information on your chosen topic.
3. Organize your seminar content into a clear and logical structure, including an introduction, main points, and a conclusion.
4. Develop visual aids (such as slides or demonstrations) to enhance understanding and engagement during your presentation.
5. Practice your presentation multiple times to ensure smooth delivery and adherence to time limits.
6. Engage with your audience by encouraging questions and fostering discussion during and after your presentation.
7. Incorporate real-world examples or case studies to illustrate key concepts and applications related to your topic.
8. Demonstrate technical proficiency and depth of knowledge in your field through clear explanations and demonstrations.
9. Critically analyze and discuss both the benefits and potential challenges or ethical implications associated with your topic.
10. Reflect on feedback received from peers and instructors to continuously improve your presentation skills and content delivery.

Suggested Areas:

- Health Care Advancements using AI
- Financial /Marketing/ Digital Marketing
- Recent Advancement in Education using AI
- Manufacturing/ Production
- Generative AI

RBT Levels		Marks Distribution		
		Review 1 (15 Marks)	Review 2 (15 Marks)	Seminar Report (20 Marks)
L1	**Remember**	-	**-**	**-**
L2	**Understand**	5	5	5
L3	**Apply**	5	**5**	5
L4	**Analyze**	5	5	5
L5	**Evaluate**	-	-	5
L6	**Create**	-	**-**	-

RESEARCH INTERNSHIP/ INDUSTRY INTERNSHIP /RURAL INTERNSHIP / INNOVATION - INCUBATION CENTER INTERNSHIP / START-UP INTERNSHIP			
Course Code	**21AIM83**	**CIE Marks**	**100**
L:T:P:S	**0:0:12:0**	**SEE Marks**	**100**
Hrs / Week	**-**	**Total Marks**	**200**
Credits	**12**	**Exam Hours**	**03**

Objectives

1.Students will be competent to connect with reputable industry, laboratory, or research institutes to gain Practical knowledge on software development and design, product design and development, analytics, Business processes and insights, industry practices, and other related aspects, as well as develop Problem-solving skills.

2.Students acquire technical, interpersonal, and teamwork abilities to fulfil the demands of business, academia, and other organizations in the important areas of automation and digitalization

Course outcomes:

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

21AIM83.1	Apply domain knowledge for problem solving.
21AIM83.2	Analyse solutions to complex business problems.
21AIM83.3	Design solutions for the target platform.
21AIM83.4	Create an innovation method to solve the Real-World (Rural) issues
21AIM83.5	Make efficient use of time and accomplish the assigned work within the time frame
21AIM83.6	Develop a technical report based on the technical knowledge acquired from the industry during the internship.

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
21AIM83.1	3	-	-	-	-	-	-	-	3	-	-	3	3	2
21AIM83.2	-	3	-	-	-	-			3	-	-	3	3	2
21AIM83.3	-	-	3	3	3	-	-	-	-	-	3	3	3	2
21AIM83.4	-	-	3	3	3	-	-	-	-	-	-	3	3	2
21AIM83.5	-	-	-	-	-	-	-	-	-	-	3	3	3	2
21AIM83.6	-	-	3	-	3	-	-	-	3	3	2	3	3	2

Description:

Research/Industry Internship/ Rural Internship / Innovation - Incubation Center Internship / Start-up Internship shall be carried out at an Industry, NGO, MSME, Innovation center, Incubation center, Start-up, center of Excellence (CoE), Study Centre established in the parent institute and/or at reputed research organizations/institutes.

The mandatory Research internship /Industry internship / Rural Internship is for 24 weeks.

The internship shall be considered as a head of passing and shall be considered for the award of a degree. Those, who do not take up/complete the internship shall be declared to fail and shall have to complete it during the subsequent SEE examination after satisfying the internship requirements.

Research internship: A research internship is intended to offer the flavour of current research going on in the research field. It helps students get familiarized with the field and imparts the skill required for carrying out research.

Industry internship: Is an extended period of work experience undertaken by students to supplement their degree for professional development. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with contingencies helps students recognize, appreciate, and adapt to organizational realities by tempering their knowledge with practical constraints.

The faculty coordinator or mentor has to monitor the student's internship progress and interact with them to guide for the successful completion of the internship.

The students are permitted to carry out the internship anywhere in India or abroad. University shall not bear any expenses incurred in respect of the internship.
With the consent of the internal guide and Principal of the Institution, students shall be allowed to carry out the internship at their hometown (within or outside the state or abroad), provided favour able facilities are available for the internship and the student remains regularly in contact with the internal guide.

Evaluation Stages:

Activity	**Evaluation Attribute**
Review-I	1. A brief introduction about the company with an assigned domain, project or modules, and other necessary details. 2. Submit the offer letter received from the company.
Review-II	1. Show progress during the internship period using a PowerPoint presentation.
Review-III	1. Show a demo of the work carried out or completed with the necessary details. 2. Submit the final report in the prescribed format with an internship completion certificate.

CIE Assessment Pattern (100 Marks)

RBT Levels		**Qualitative Assessment (s)**
		100 Marks
L1	**Remember**	**-**
L2	**Understand**	20
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	20
L6	**Create**	20

SEE Assessment Pattern (100 Marks)

RBT Levels		**Exam Marks Distribution (100)**
L1	**Remember**	
L2	**Understand**	20
L3	**Apply**	20
L4	**Analyze**	20
L5	**Evaluate**	20
L6	**Create**	20

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. **Kho-Kho:**	Total 32 Hrs/ Semester 2 Hrs/week

	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

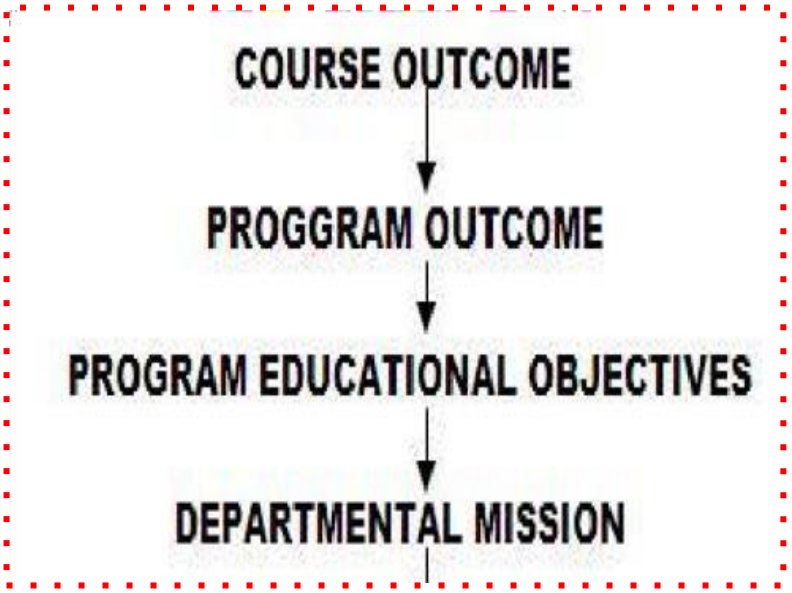
Outcome-based education (OBE) is an educational theory that bases each part of an educational system around goals (outcomes). By the end of the educational experience, each student should have achieved the goal. There is no specified style of teaching or assessment in OBE; instead, classes, opportunities,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

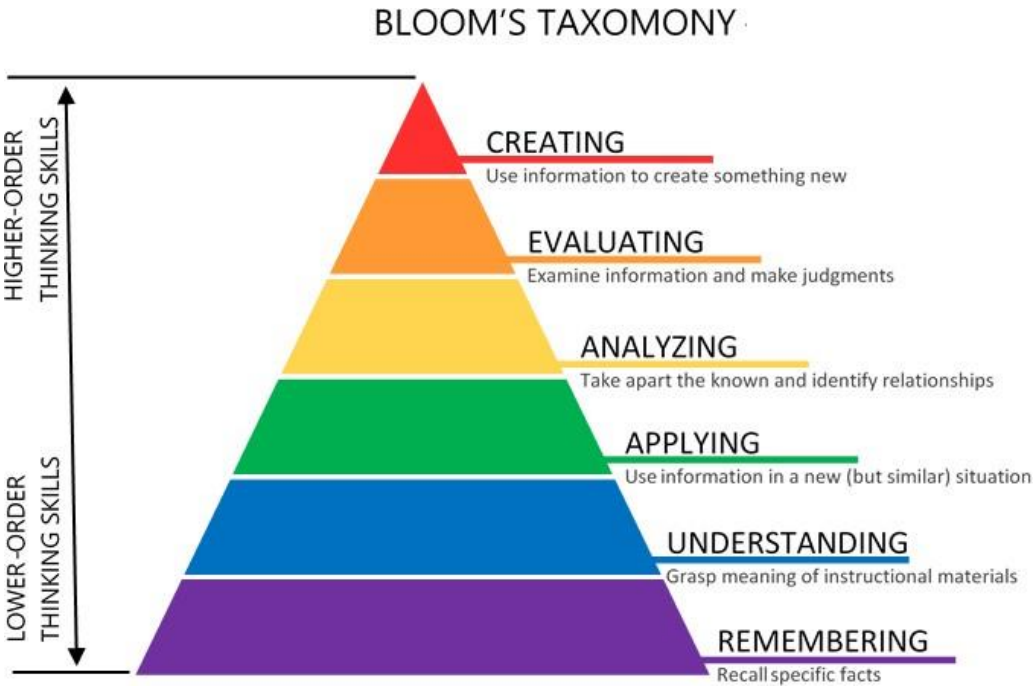
PO11 **Project Management and Finance:** Demonstrate knowledge and understanding of the Engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary Environments.

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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