



Annasaheb Dange College of Engineering and Technology
 Ashta - 416301, Dist. : Sangli, Maharashtra
 (An Empowered Autonomous Institute)



Curriculum Revision: Revision 02, with effect from the AY 2025- 26 to the students of UG Programme.

Department : Artificial Intelligence and Data Science
Programme : B.Tech.– AI&DS

Course Category	Acronym	I	II	III	IV	V	VI	VII	VIII	Total	% of Category
Basic Science Course	BS	7	8	0	0	0	0	0	0	15	9
Engineering Science Course	ES	9	9	0	0	0	0	0	0	18	10
Programme Core Course	PC	3	0	16	9	12	3	12	0	55	31
Programme Elective Course	PE	0	0	0	3	4	7	3	3	20	11
Open Elective (other than particular program)	OE	0	0	0	2	2	2	0	0	06	3
Multidisciplinary Minor	MDM	0	0	0	4	3	4	3	0	14	8
Vocational and Skill Enhancement Course	VSEC	0	2	2	0	0	1	1	0	06	3
Humanities Social Science and Management	HSSM	2	0	5	3	1	2	0	0	15	9
Indian Knowledge System	IKS	0	2	0	0	0	0	0	0		
Value Education Course(VAC)	VEC	0	0	0	0	0	0	0	0		
Research Methodology	RM	0	0	0	1	0	0	0	0	19	11
Experiential Learning (Internship, Project)	EL	0	0	0	1	1	0	4	12		
Community Engagement Activity / Field Project	CEA	0	0	0	0	0	2	0	0	02	1
Co-curricular & Extracurricular Activities	CCA	1	1	0	0	0	0	0	0	02	1
Self Study	SS	0	0	0	0	0	2	2	0	04	3
Total		22	22	23	23	22	23	25	15	176	100

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F.Y. B.Tech.–Artificial Intelligence and Data Science [Level 4.5, UG Certificate] Semester -I

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	BS	T1	2ADBS101	Applied Mathematics – I	3	1	-	4	4	40	20	40	-	-
02	BS	T1	2ADBS102	Biology for Engineers	2	1	-	3	3	40	20	40	-	-
03	ES	L2	2ADES103	Engineering Graphics with CAD	1	-	2	1	2	-	-	-	50	-
04	ES	T1	2ADES104	Introduction to Emerging Technologies	2	-	-	2	2	40	20	40	-	-
05	ES	L1	2ADES105	Programming for Problem Solving using C	2	-	4	2	4	-	-	-	50	50
06	ES	L2	2ADES106	Design Thinking	-	-	2	-	1	-	-	-	50	-
07	HS	L2	2ADHS107	Professional Communication Skills	-	-	4	-	2	-	-	-	50	-
08	PC	T1	2ADPC108	Computer organization and architecture	3	-	-	3	3	40	20	40	-	-
09	CC	L2	3BSCCXXX	Liberal Learning Course-I	-	-	2	-	1	-	-	-	50	-
Total					13	2	14	15	22					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria

TA (Theory) : $\geq 8/20$

MSE + ESE (Theory): $\geq 32/80$

TA (Theory) / CIA (Lab) : $\geq 20/50$

ESE (Lab) : $\geq 20/50$

CC Bouquet :

3BSCC121 - Introduction to Yoga and Mindfulness	3BSCC126 - Cultural Exploration & Heritage	3BSCC131- Introduction to Dance and Movement
3BSCC122 - Physical Fitness and Lifestyle Management	3BSCC127- Leadership and Team management	3BSCC132- Introduction to Music and Singing
3BSCC123 - Six-Sigma Happiness and Mind Mechanics	3BSCC128- Self Management and Purposeful Living	3BSCC133-Happiness and Well-Being
3BSCC124 - Creativity through Visual Arts	3BSCC129- Business Communication	3BSCC134- Financial Literacy & Investment Awareness
3BSCC125 - Community Engagement through NSS	3BSCC130- Mathematical Reasoning	3BSCC135-Cyber Awareness and Ethics

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F.Y. B.Tech.–Artificial Intelligence and Data Science

[Level 4.5, UG Certificate] Semester -II

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	BS	T1	2ADBS110	Applied Mathematics-II	3	1	-	4	4	40	20	40	-	-
02	BS	LIT2	2ADBS111	Engineering Physics and Chemistry	3	-	2	3	4	40	20	40	50	-
03	ES	LIT2	2ADES112	Basic Electrical and Electronics Engineering	2	-	2	2	3	40	20	40	50	-
04	ES	L1	2ADES113	Python Programming	2	-	2	2	3	-	-	-	50	50
05	ES	LIT2	2ADES114	Data Communication and Networking	2	-	2	2	3	40	20	40	50	-
06	IKS	T2	2ADHS115	Indian Knowledge system	2	-	-	2	2	-	50	-	-	-
07	VS	L2	2ADVS116	IDEA laboratory	1	-	2	1	2	-	-	-	50	-
08	CC	L2	3BSCCXXX	Liberal Learning Course-II	-	-	2	-	1	-	-	-	50	-
Total					15	1	12	16	22					

Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination

Minimum Passing Criteria	TA (Theory) : $\geq 8/20$	MSE + ESE(Theory): $\geq 32/80$	TA (Theory) / CIA (Lab) : $\geq 20/50$	ESE (Lab) : $\geq 20/50$
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CC Bouquet :

3BSCC121 - Introduction to Yoga and Mindfulness	3BSCC126 - Cultural Exploration & Heritage	3BSCC131- Introduction to Dance and Movement
3BSCC122 - Physical Fitness and Lifestyle Management	3BSCC127- Leadership and Team management	3BSCC132- Introduction to Music and Singing
3BSCC123 - Six-Sigma Happiness and Mind Mechanics	3BSCC128- Self Management and Purposeful Living	3BSCC133-Happiness and Well-Being
3BSCC124 - Creativity through Visual Arts	3BSCC129- Business Communication	3BSCC134- Financial Literacy & Investment Awareness
3BSCC125 - Community Engagement through NSS	3BSCC130- Mathematical Reasoning	3BSCC135-Cyber Awareness and Ethics

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Exit after F.Y.B.Tech. – Artificial Intelligence and Data Science

Additional Credits to qualify for UG Certificate

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
1	VSEC	L	2ADVS118	Internship in Computer Hardware & Networking	-	-	-	10	10	-	-	-	100	-
Total					-	-	-	10	10					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination														
Minimum Passing Criteria			TA (Theory) : ≥8/20		MSE + ESE(Theory): ≥32/80			TA (Theory) / CIA (Lab) : ≥20/50			ESE (Lab) : ≥20/50			


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S.Y. B. Tech. - Artificial Intelligence and Data Science [Level 4.5, UG Diploma] Semester - III

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	T1	2ADPC201	Statistical Analysis and Computing	3	1	-	4	4	40	20	40	-	-
02	PC	LIT1	2ADPC202	Data Structures and algorithms	3	-	2	3	4	40	20	40	50	50
03	PC	LIT2	2ADPC203	Operating Systems	3	-	2	3	4	40	20	40	50	-
04	PC	LIT1	2ADPC204	Foundation of AI with Ethics	3	-	2	3	4	40	20	40	50	50
05	VSEC	L2	2ADVS205	Object Oriented Programming using C++	-	-	2	-	1	-	-	-	50	-
06	VSEC	L2	2ADVS206	Data analysis using tools	-	-	2	-	1	-	-	-	50	-
07	HS	T2	2ADHS2XX	Foreign Language	2	-	-	2	2	-	50	-	-	-
08	HS	T2	2ADHS209	Psychology	1	-	-	1	1	-	50	-	-	-
09	HS	T2	2ADHS210	Universal Human Values	2	-	-	2	2	-	50	-	-	-
10	MA	T2	2ADCC211	Aptitude and Reasoning - I	2	-	-	2	-	-	50	-	-	-
Total					19	1	10	20	23					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination														
Minimum Passing Criteria			TA (Theory): ≥ 8 / 20		MSE + ESE (Theory): ≥ 32 / 80			TA (Theory) / CIA (Lab): ≥ 20 / 50			ESE (Lab): ≥ 20/50			

Foreign Language Bouquet:

2ADHS207 - Foreign Language-German	2ADHS208- Foreign Language-Japanese
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S.Y. B. Tech. - Artificial Intelligence and Data Science
[Level 4.5, UG Diploma] Semester -IV

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	T1	2ADPC212	Discrete Mathematics and Theory of Computations	2	1	-	3	3	40	20	40	-	-
02	PC	LIT1	2ADPC213	Database Management Systems	3	-	2	3	4	40	20	40	50	50
03	PE	T1	2ADPE21X	Professional Elective – I	3	-	-	3	3	40	20	40	-	-
04	MM	LIT2	2ADAI217	Multidisciplinary Minor - I	3	-	2	3	4	40	20	40	50	-
05	PC	L1	2ADPC218	Java Programming	1	-	2	1	2	-	-	-	50	50
06	OE	T1	3ILOE2XX	Open Elective – I	2	-	-	2	2	-	-	100	-	-
07	HS	T2	2ADHS219	Indian Constitution	1	-	-	1	1	-	50	-	-	-
08	HS	T2	2ADHS220	Environmental Studies	2	-	-	2	2	-	50	-	-	-
09	RM	L2	2ADRM221	Research Methodology	-	-	2	-	1	-	-	-	50	-
10	EL	L2	2ADEL222	Innovation and Product Development	-	-	2	-	1				50	
11	MA	T2	2ADCC223	Aptitude and Reasoning-II	2	-	-	2	-	-	50	-	-	-
Total					19	1	10	20	23					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination														
Summer Internship (in Industry, R&D organization, or Academic Institute) shall be undertaken after the IV Semester during the summer vacation. The evaluation of the internship will be conducted during the V Semester														
Minimum Passing Criteria			TA (Theory): ≥ 8 / 20		MSE + ESE (Theory): ≥ 32 / 80		TA (Theory) / CIA (Lab): ≥ 20 / 50		ESE (Lab): ≥ 20/50		ESE (Theory): ≥ 40 / 100			

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Exit Criteria after S. Y. B.Tech. – Artificial Intelligence and Data Science

(As per AICTE Guidelines)

Eligibility Criteria

- All conditions applicable to the Exit Option After First Year shall also apply. In addition, the following criteria must be met:
- Students will have the option to exit the Artificial Intelligence and Data Science Program after successfully completing the second year.
- To qualify this exit option students must complete Internship of minimum 8 weeks in Artificial Intelligence and Data Science related field, aimed at enhancing practical knowledge and industry exposure. Students must submit **internship** report in accordance with the schedule and guidelines provided.

Outcome:

- Upon exit, they will be awarded an **Undergraduate Diploma in Artificial Intelligence and Data Science**.


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T.Y. B. Tech. - Artificial Intelligence and Data Science
[Level 4.5, UG B.Voc.] Semester - V

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	LIT2	2ADPC301	Design and Analysis of Algorithms	3	-	2	3	4	40	20	40	50	-
02	PC	LIT1	2ADPC302	Machine Learning	3	-	2	3	4	40	20	40	50	50
03	PC	LIT1	2ADPC303	Data Exploration and Visualization	3	-	2	3	4	40	20	40	50	50
04	PE	LIT2	2ADPE30X	Professional Elective – II	3	-	2	3	4	40	20	40	50	-
05	MM	T1	2ADAI307	Multidisciplinary Minor - II	3	-	-	3	3	40	20	40	-	-
06	OE	T1	3ILOE3XX	Open Elective – II	2	-	-	2	2	-	-	100	-	-
07	HS	L2	2ADHS308	Entrepreneurship	-	-	2	-	1	-	-	-	50	-
08	EL	L2	2ADEL309	Summer Internship	-	-	-	-	1	-	-	-	50	-
09	MA	T2	2ADCC310	Aptitude and Reasoning - III	2		-	2	-	-	50	-	-	-
Total					19	-	10	19	23					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination														
Minimum Passing Criteria			TA (Theory): ≥ 8 / 20		MSE + ESE (Theory): ≥ 32 / 80		TA (Theory) / CIA (Lab): ≥ 20 / 50		ESE (Lab): ≥ 20/50		ESE (Theory): ≥ 40 / 100			

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T.Y. B. Tech. - Artificial Intelligence and Data Science
[Level 4.5, UG B.Voc.] Semester - VI

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	LIT1	2ADPC311	Deep Learning	2	-	2	2	3	40	20	40	50	50
02	PE	LIT1	2ADPE31X	Professional Elective – III	3	-	2	3	4	40	20	40	50	50
03	PE	T1	2ADPE31X	Professional Elective – IV	3	-	-	3	3	40	20	40	-	-
04	MM	LIT2	2ADMM318	Multidisciplinary Minor – III	3	-	2	3	4	40	20	40	50	-
05	HS	T2	2ADHS319	Project Management and Finance	2	-	-	2	2	-	50	-	-	-
06	OE	T1	3ILOE3XX	Open Elective – III	2	-	-	2	2	-	-	100	-	-
07	VSEC	L2	2ADVS320	R Programming	-	-	2	-	1		-	-	50	-
08	CEA	L2	2ADCE321	Mini Project	-	-	4	-	2	-	-	-	50	-
09	SS	T2	2ADSS322	Self-Study Course-I	-	-	-	2	2	-	-	100	-	-
10	MA	T2	2ADCC323	Aptitude and Reasoning-IV	2	-	-	2	-	-	50	-	-	-
Total					17	-	12	19	23					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination, CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination														
Minimum Passing Criteria			TA (Theory): ≥ 8 / 20		MSE + ESE (Theory): ≥ 32 / 80		TA (Theory) / CIA (Lab): ≥ 20 / 50		ESE (Lab): ≥ 20/50		ESE (Theory): ≥ 40 / 100			

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Exit Criteria after T.Y.B.Tech. – Artificial Intelligence and Data Science

(As per AICTE Guidelines)

Eligibility Criteria:

- Completion of all core courses in the first three years of the engineering curriculum.
- Demonstration of both theoretical understanding and practical application through:
 - Industry-Relevant Practical Training: Including internships or apprenticeships.
 - Advanced Skill-Based Course: Aligning with current industry needs.
 - Internship/Apprenticeship: At least 8 weeks in a relevant engineering field.
 - Community Engagement Project: Real-world problem-solving with societal benefit.
 - Capstone Project (Optional): Integration and application of learning outcomes across three years.

Outcome:

Students will be awarded a **B. Voc. Degree in Artificial Intelligence and Data Science**, signifying a strong foundation in engineering concepts, technical proficiency, and vocational readiness.


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ADCE

Final Year B. Tech.- Artificial Intelligence and Data Science
[Level 4.5, UG B.Tech] Semester - VII

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PC	LIT1	2ADPC401	High Performance Computing	3	-	2	3	4	40	20	40	50	50
02	PC	LIT1	2ADPC402	Generative AI	3	-	2	3	4	40	20	40	50	50
03	PC	LIT2	2ADPC403	Cloud Computing	3	-	2	3	4	40	20	40	50	-
04	PE	T1	2ADPE40X	Professional Elective - V	3	-	-	3	3	40	20	40	-	-
05	MM	T1	2ADMM407	Multidisciplinary Minor – IV	3	-	-	3	3	40	20	40	-	-
06	VSEC	L2	2ADVS408	Web and App Development	-	-	2	-	1	-	-	-	50	-
07	EL	L1	2ADEL409	Project	-	-	8	-	4	-	-	-	50	50
08	SS	T2	2ADSS410	Self-Study Course-II	-	-	-	2	2	-	-	100	-	-
Total					15	-	16	17	25					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination, CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination														
Minimum Passing Criteria			TA (Theory): ≥ 8 / 20		MSE + ESE (Theory): ≥ 32 / 80			TA (Theory) / CIA (Lab): ≥ 20 / 50		ESE (Lab): ≥ 20/50		ESE (Theory): ≥ 40 / 100		

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Final Year B. Tech.- Artificial Intelligence and Data Science
[Level 4.5, UG B.Tech] Semester - VIII

Sr. No.	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
										Theory			Laboratory	
										MSE	TA	ESE	CIA	ESE
01	PE	T1	2ADPE41X	Professional Elective – VI	3	-	-	3	3	40	20	40	-	-
02	EL	L2	2ADEL414	Internship	-	-	-	-	12	-	-	-	50	-
Total					3	-	-	3	15					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination														
Minimum Passing Criteria			TA (Theory): ≥ 8 / 20		MSE + ESE (Theory): ≥ 32 / 80			TA (Theory) / CIA (Lab): ≥ 20 / 50			ESE (Lab): ≥ 20/50			

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Professional Electives/ Honor's Track (20 Credits)

Track Name	Professional Elective-I (3-0-0)	Professional Elective-II (3-0-2)	Professional Elective-III (3-0-2)	Professional Elective-IV (3-0-0)	Professional Elective-V (3-0-0)	Professional Elective-VI (3-0-0)
Class	S.Y.B.Tech	T.Y.B.Tech	T.Y.B.Tech	T.Y.B.Tech	B.Tech	B.Tech
Semester	IV	V	VI	VI	VII	VIII
Artificial Intelligence and Learning Systems	2ADPE214 Responsible Artificial Intelligence	2ADPE304 Genetic Algorithms and Optimization Techniques	2ADPE312 Natural Language Processing	2ADPE315 Computer Vision	2ADPE404 Agentic AI & Autonomous Systems	2ADPE411 DevOps and ML Ops Engineering
Data Science and Engineering	2ADPE215 Data Analytics	2ADPE305 Advanced Database	2ADPE313 Data warehouse & Data mining	2ADPE316 Big Data Analytics	2ADPE405 Quantum Computing and Analytics	2ADPE412 DevOps and ML Ops Engineering
AI for Sustainable Development	2ADPE216 AI for Sustainable Development	2ADPE306 IoT for Smart and Sustainable Systems	2ADPE314 Intelligent Precision Agriculture	2ADPE317 Sustainable Data Science and Green AI	2ADPE406 AI for Health care	2ADPE413 Sustainable Smart Cities Analytics

- Students may choose Professional Elective courses from a single track or across multiple tracks, based on their academic interests and career aspirations.
- Only one Professional Elective course may be selected from a given column in a semester. Additional courses from the same column may be taken in subsequent semesters, but not concurrently.
- Students opting for the Honors Degree shall complete all Honors courses from a single track, which shall be different from the track chosen for their Professional Elective courses.


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Multidisciplinary Minor (14 Credits)

Minor Stream : Artificial Intelligence (AI)

Sr. No.	Course Category	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
									Theory			Laboratory	
									MSE	TE	ESE	ISE	ESE
01	MM	2ADAI217	Foundation of AI	3	-	2	3	4	40	20	40	50	-
02	MM	2ADAI307	Python for Data Science	3	-	-	3	3	40	20	40	-	-
03	MM	2ADAI318	Machine Learning	3	-	2	3	4	40	20	40	50	-
04	MM	2ADAI407	Deep Learning	3	-	-	3	3	40	20	40	-	-
Total				12	-	4	12	14					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment ESE-End-Semester Examination													
Minimum Passing Criteria		TA (Theory) : ≥8/20		MSE + ESE(Theory): ≥32/80		TA (Theory) / CIA (Lab) : ≥20/50			ESE (Lab) : ≥20/50				

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Ashta - 416301, Dist. : Sangli, Maharashtra
(An Empowered Autonomous Institute)

ADCE

Bridge Course for DSY - Lateral Entry Students

Sr. No.	Semester	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
											Theory			Laboratory	
											MSE	TA	ESE	CIA	ESE
1	III	BS	T1	2ADBS102	Biology for Engineers	2	1	-	3	3	-	-	100	-	-
2	IV	ES	T1	2ADES104	Introduction to Emerging Technologies	2	-	-	2	2	-	-	100	-	-
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination															
Minimum Passing Criteria													ESE : $\geq 40/100$		

*Note: All Direct Second Year students admitted to the B.Tech. Artificial Intelligence and Data Science programme shall compulsorily undergo the prescribed bridge courses. Students admitted from diploma programmes other than the parent discipline shall additionally complete bridge courses as prescribed by the designated committee.

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ADCE

Bridge Course – Change in Curriculum Revision (R1 to R2)

Sr. No.	Semester	Course Category	Course Type	Course Code	Course Name	L	T	P	S	Cr	Evaluation Scheme (Marks)				
											Theory			Laboratory	
											MSE	TA	ESE	CIA	ESE
01	I	ES	T1	2ADES104	Introduction to Emerging Technologies	2	-	-	2	2	-	-	100	-	-
02	I	PC	T1	2ADPC108	Computer Organization and Architecture	3	-	-	3	3	-	-	100	-	-
03	II	ES	L1	2ADES113	Python Programming	2	-	2	2	3	-	-	-	50	50
04	II	VS	L2	2ADVS116	IDEA Laboratory	1	-	2	1	2	-	-	-	50	-
Total						8	1	4	8	10					
Legends: L-Lecture, T-Tutorial, P-Practical, S-Self Study, Cr-Credits, MSE - Mid-Semester Examination. CIA-Continuous Internal Assessment, TA - Teachers Assessment, ESE-End-Semester Examination															
Minimum Passing Criteria						ESE (Theory): ≥ 40/100			CIA(Lab): ≥ 20 / 50				ESE (Lab): ≥ 20/50		

- Students shall complete the prescribed Semester I Bridge Courses during Semester III (Odd Semester) and the prescribed Semester II Bridge Courses during Semester IV (Even Semester).

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Annasaheb Dange College of Engineering and Technology, Ashta
Department of Artificial Intelligence and Data Science



AD CET

Structure and Curriculum Contents

B.Tech (First Year)

Revision - 2

SEM-I to SEM-II

(Academic Year 2025-26)

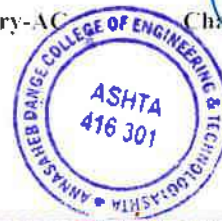
 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science								
Course Information:									
Class, Semester		FY. B.Tech, Semester – I					Category	BS	
Course Code, Course Title		2ADBS101, Applied Mathematics-I					Type	T1	
Prerequisites		-							
Teaching Scheme (per week)		Lecture	Tutorial		Practical		Self Study		Credits
		3	1		-		2		4
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE	
			40	20	40		-	-	
Course Outcomes (COs) :									
Upon successful completion of this course, the student will be able to:									
CO1		Determine the consistency of systems of linear equations using Echelon form of matrix							
CO2		Compute Eigen values, Eigen vectors, powers and inverse of a square matrix using characteristic equation							
CO3		Apply the concepts of complex number to solve the equations using De Moivre's theorem and hyperbolic identities							
CO4		Calculate partial derivatives, Jacobians, and extreme values of function of two variables using concept of partial differentiation							
CO5		Solve ordinary differential equation of order one and degree one using analytical method and numerical techniques.							
Syllabus:									
Module		Contents						Lecture Hours	
I		Solution of System of Linear Equations: Definition of system of linear equations, Classification of system of linear equations, Rank of matrix: Concept and computation using Echelon form and Normal form, Rouché–Capelli Theorem (Statements only), Solution of non-homogeneous system of linear equations, solution of Homogeneous system of linear equations, Applications in engineering.						7	
II		Eigen Values and Eigen Vectors: Definition of vectors in R^n , Linear Dependence and Independence of Vectors, Characteristic Equation of Matrix, Cayley-Hamilton theorem (statement only), Applications of Cayley-Hamilton theorem, Eigen Values and Properties, Eigen Vectors and Properties.						7	
III		Complex Number: Definition of complex number, Polar and exponential form of complex number, De Moivre's Theorem and Simple Applications, Power and Roots of complex numbers, Applications in solving equations. Hyperbolic Functions: Definitions, Identities of hyperbolic functions, Relation between Circular functions and hyperbolic functions, Inverse hyperbolic functions,						8	
IV		Partial Differentiation and Applications: Functions of several variables, partial derivatives of first order, Higher order partial derivatives, Homogeneous functions, Euler's Theorem on homogeneous function: statement and verification, Jacobians and Properties, Maxima and minima of functions of two variables.						8	
V		Ordinary Differential Equation of first order and first degree: Linear differential equation, exact differential equation, reducible to exact differential equation, reducible to linear differential equation, Applications of engineering (branch oriented)						8	

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VI	Numerical Solution of Ordinary differential equation of First Order & First Degree: Euler's method, Modified Euler's method, Runge-Kutta third order, Runge-Kutta Method of order four, Taylor Series method.	7
Total Lecture Hours		45
List of Tutorial with CO Mapping		
Sr.No	Title of Tutorial	CO Mapped
1	Rank of matrix and Solution of Homogeneous System of Linear Equations	1
2	Solution of Non-Homogeneous System of Linear Equations	1
3	Eigen Value, Eigen vectors and Properties	2
4	Cayley-Hamilton theorem and Applications	2
5	De Moivre's Theorem, Applications and Hyperbolic functions	3
6	Partial differentiations and Euler's theorem	4
7	Jacobians and Maxima-Minima of Two Variable Functions	4
8	Euler's and Modified Euler's Methods for Solving Initial Value Problems	5
9	Runge-Kutta Methods and Taylor series method	5
10	Ordinary differential equations of first order and first degree	5
Total Tutorial Hours		15
Text Books		
1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 8th Edition, Laxmi Publications ,2011.		
2. H. K. Das , Advanced Engineering Mathematics , 22th Edition, S. Chand ,2018.		
3. B. V. Ramana, Higher Engineering Mathematics, 6th Edition, Tata McGraw Hill Publ., 2010		
4. Dr. B. S. Grewal , Numerical Methods , 9th Edition, Khanna Publishers ., 2010		
References:		
1. Dr. B. S. Grewal , Higher Engineering Mathematics , 44th Edition, Khanna Publishers ,2018.		
2. N. P. Bali, Manish Goyal , Advanced Engineering Mathematics, 7th Edition, Infinity science press ,2010.		
3. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Vol-I, 9th Edition Pune Vidyarthi GrihaPrakashan,1984		
4. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Vol-II, 7th Edition Pune Vidyarthi Griha Prakashan,1988.		
Online Learning Resources		
1. NPTEL Course on Engineering Mathematics-I, by Prof. Jitendra Kumar, IIT Kharagpur https://nptel.ac.in/courses/111105121		
2. NPTEL Course on Numerical Methods. by Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar, IIT Roorkee https://nptel.ac.in/courses/111107105		
3. NPTEL Course on Matrix Analysis with Application, by Prof. S. K. Gupta , Prof. Sanjeev Kumar, IIT Roorkee https://nptel.ac.in/courses/111107112		
4. NPTEL Course on Mathematics-III, by Prof. Durga C Dalal, Dr. M. Guru Prem Prasad. IIT Guwahati https://nptel.ac.in/courses/122103012		

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Course Information:								
Class, Semester		FY. B. Tech, Semester – I				Category	BS	
Course Code, Course Title		2ADBS102, Biology for Engineers				Type	T1	
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self-Study	Credits		
		2	1	-	1	3		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-
Course Outcomes (COs): Upon successful completion of this course, the student will be able to:								
CO1	Define fundamental biological principles of Cellular structures, Genetics, Biochemistry and apply them in solving practical, real-world problems.							
CO2	Explain basic molecular processes, structure and function of DNA with emphasis on replication, transcription, and translation processes relevant to modern engineering practices.							
CO3	Integrate microbiology and biotechnology concepts to design and implement effective solutions in computational and systems engineering projects.							
CO4	Classify how biological systems inspire neural networks and biomimetic designs, drawing upon principles from biomimetics, systems biology, and proteomics							
CO5	Assess the environmental and health challenges, along with the ethical, legal, and social implications, of applying biological principles to develop sustainable engineering solutions from a biological perspective.							
CO6	Understand diseases and disorders, healthcare technologies, and correlate the role of Artificial Intelligence in developing effective engineering solutions in health care technology.							
Syllabus:								
Module	Contents							Lecture Hours
I	Introduction to Biology and Its Relevance for Engineers Course Overview & Importance of Biology in Engineering: Introduction to interdisciplinary approaches. Cell Theory & Structure: Overview of prokaryotic versus eukaryotic cells, Transport Across Cell Membrane, Cell Division. Fundamental Biochemistry: Macromolecules (carbohydrates, proteins, lipids, nucleic acids) and enzyme function. Biodiversity & Classification: The hierarchical organization of life and modern taxonomy, the 5-kingdom classification. Interdisciplinary Integration: How biological principles inform cutting-edge engineering designs.							5
II	Microbiology and Biotechnology Introduction to Microorganisms: Bacteria, viruses, fungi, and their characteristics. Microbial Genetics & Evolution: Gene transfer, mutations, and their impacts. Techniques in Microbiology: Isolation, culturing methods, and basic staining techniques. Biotechnology Applications: Role of bioinformatics, synthetic biology, and engineering innovations. Case Studies: Real-world examples of biotechnological solutions in engineering.							5
III	Systems Biology and Bioinformatics Principles of Systems Biology: Understanding networks, feedback loops, and complex systems. Introduction to Bioinformatics: Tools and techniques for computational biology. Genomics and Proteomics: Overview of genomic data and proteomic analysis. Biological Databases: Utilization of NCBI, BLAST and other key resources. Integrative Models: Merging biological systems with computational models for analysis.							5
IV	Genetics and Molecular Engineering Fundamentals of Genetics: Mendelian inheritance and classical genetics. DNA Structure and Function: Detailed exploration of replication, transcription, and translation. Genetic Engineering Techniques: Overview of CRISPR, recombinant DNA, and related							5


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	methodologies. Ethical, Legal & Social Aspects: Discussion on the implications of genetic modification. Genetic Disorders: Examples and their biological basis.	
V	Biomimetics and Neural Networks Introduction to Biomimetics: Nature-inspired designs in engineering. Anatomy of the Human Brain: Basic neurobiology and the organization of neural systems. From Biology to AI: Understanding how neural networks are modelled after natural systems. Applications in Robotics & Intelligent Systems: Case studies and real-world implementations. Comparative Analysis: Evaluating the similarities between biological neural networks and artificial intelligence systems.	5
VI	Diseases, Health, and Sustainable Engineering Diseases and Disorders: Infectious, chronic, cancer, Genetic and neurological, cardiovascular, auto immune and role of Artificial Intelligence. Public Health Fundamentals: Epidemiology, disease modelling, and statistics in biology. Engineering Solutions in Health: How biological insights contribute to healthcare technologies. Sustainable Engineering: Integrating biological principles with green technology. Course Integration & Future Directions: Discussion on emerging interdisciplinary trends in CSE and AI & DS.	5
Total Lecture Hours		30
List of Tutorials with CO Mapping		
Sr. No	Title / Topic of the Tutorial	CO Mapped
1	Study of simple, compound Microscope	1
2	Study of nervous system using specimen, models, etc.	4
3	Investigating the Effect of Light on Seed Germination	1
4	DNA Extraction from Strawberries	2
5	Mendelian Genetics Simulation Using Paper-Based Punnett Squares	1
6	Creating Lotus Leaf-Inspired Hydrophobic Surfaces	4
7	Building a Physical Model of an Artificial Neural Network	4
8	Demonstration of Antibiotic Effects on Bacterial Lawn Culture	3
9	Constructing a Simple Particulate Matter Sensor	5
10	Simple DNA Extraction from a Banana	2
11	Decomposition and Nutrient Recycling Simulation	5
12	Virtual Simulation of PCR (Polymerase Chain Reaction)	2
13	Analyzing Insect Eye Structures to Improve Camera Algorithms	4
14	Comparing Tree Branching Patterns with Neural Network Architectures	4
15	Designing a Simple pH Biosensor for Water Analysis	5
16	Observation of plant cell and Human Cheek Cells	1
Total Tutorial Hours		15
Text Books		
1. Biology for Engineers Anthony J. Young, Engineering Press, 1 st , 2015		
2. Fundamentals of Biology, Lisa M. Johnson, Academic Publishers, 3 rd , 2012		
3. Essential Cell Biology, Bruce Alberts et al. Garland Science 2 nd , 2014		
4. Microbiology: An Introduction, Gerard J. Tortora, Pearson, 11 th , 2017		
5. Genetics: From Genes to Genomes, Leland H. Hartwell, McGraw-Hill, 4 th , 2011		
References:		
1. Biotechnology for Engineering Kavita Kumar, Tech Books Publishing, 2 nd , 2018		
2. Systems Biology: A Textbook Edda Klipp, Wiley-VCH, 2 nd , 2016		
3. Introduction to Bioinformatics, Arthur M. Lesk, Oxford University Press, 2 nd , 2013		
4. Biomimetics in Engineering, Robert J. Fuller, Springer 1 st , 2019		
5. Sustainable Engineering: Principles and Practice Michael T. Solomon, CRC Press, 3 rd , 2020		
Online Learning Resources		
1. https://onlinecourses.nptel.ac.in/noc19_ge31		



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Course Information:								
Class, Semester		FY. B.Tech. Semester – I				Category	ES	
Course Code, Course Title		2ADES103, Engineering Graphics with CAD				Type	L2	
Prerequisites		--						
Teaching Scheme (per week)		Lecture	Tutorial		Practical	Self Study	Credits	
		I	-		2	1	2	
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	-
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Construct projections of straight lines in various positions with reference planes, by variation in inclination, grade, bearing, and initial conditions.							
CO2	Complete the projection of planes in various positions relative to reference planes, considering variations in initial conditions and inclination, to achieve an accurate shape in inclined positions.							
CO3	Draw the three orthographic views for a given three-dimensional pictorial view, concerning the direction of viewing in first-angle projection, explaining the sectional view, hidden object and dimensions.							
CO4	Develop a 3-dimensional isometric view converted from two or three orthogonal views to illuminate a 3D object.							
Syllabus:								
Module	Contents						Lecture Hours	
I	Fundamentals of Engineering Graphics and Projections of Lines Fundamentals of Engineering Graphics: Introduction to Drawing instruments and their uses. Different types of lines used in drawing practice, Dimensioning system as per BSI. Introduction to Computer Aided Drafting Introduction to CAD & Graphical user interface of the CAD software, Draw Commands, Drafting Aids (Limits, layer, Dimensioning, Object snap, Zoom).						3	
II	Projections of Lines and Projections of Planes Projections of Lines: Introduction to First angle and third angle methods of projection. Projections of points on regular and auxiliary reference planes. Projections of lines (horizontal, frontal, oblique and Profile lines) on regular and auxiliary reference planes. . True length of a line, Point View of a line, angles made by the line with reference planes. Projections of intersecting lines, Parallel lines, perpendicular lines, and skew lines. Grade and Bearing of a line Projections of Planes: Projections on regular and on auxiliary reference planes. Types of planes (horizontal, frontal, oblique and Profile planes), Edge view and True shape of a Plane. Angles made by the plane with the principal reference planes. Projections of plane figures inclined to both planes. (Only regular polygon).						4	
III	Orthographic Projections Lines used, selection of views, spacing of views, dimensioning, and sections. Drawing required views from given pictorial views (conversion of pictorial views into orthographic views), including sectional orthographic views.						4	
IV	Isometric Projections Introduction to isometric. Isometric scale. Isometric projections, and Isometric views/drawings. Circles in isometric view. Isometric views of simple solids and objects.						4	
Total Lecture Hours						15		

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Text Books

1. W. J. Luzadder, Fundamentals of Engineering drawing, Revised Edition, Prentice Hall of India, 1999.
2. N. D. Bhatt, Machine Drawing, 15th Edition, Charotar Publishing House Pvt. Ltd.-Anand, 2007.
3. Jhole, Dhananjay, Engineering Drawing, Revised Edition, Tata McGraw-Hill, 2011.
4. M.L. Mathur, Engineering Drawing & Graphics, Revised Edition, Jain brothers, 1999..

References:

1. K. Venugopal, Engineering Drawing and Graphics, 5th Edition, New Age Publication, 2004.
2. R. K. Dhawan, A textbook of Engineering Drawing, Revised Edition, S. Chand and Co, 2008.
3. N. B. Shaha and B. C. Rana, Engineering Drawing, 2nd Edition, Person Education, 2012.
4. K. L. Narayana, Machine Drawing, New Age Publication

Online Learning Resources

1. NPTEL Course on *Engineering Drawing*, by Prof. P. S. Robi, IIT Guwahati
<https://nptel.ac.in/courses/112103019>
2. NPTEL Course on *Engineering/ Architectural Graphics- Part I- Orthographic Projection*, by Prof. Avlokita Agarwal, IIT Roorkee
<https://nptel.ac.in/courses/124107157>
3. NPTEL Course on *Engineering Graphics and Design*, by Prof. NareshDatla, Prof. S. R. Kale, IIT Delhi
<https://nptel.ac.in/courses/112102304>
4. NPTEL Course on *Engineering Drawing and computer graphics*, by Prof. Rajaram Lakkaraju, IIT Kharagpur
https://onlinecourses.nptel.ac.in/noc21_me125/preview


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Course Information:							
Class, Semester		F.Y. B.Tech – Semester I				Category	ES
Course Code, Course Title		2ADES104, Introduction To Emerging Technologies				Type	T1
Prerequisites		-					
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits	
		2	-	-	1	2	
Examination Scheme (Marks)		Theory	MSE 40	TA 20	ESE 40	Practical	CIA - ESE -
Course Outcomes (COs) :							
Upon successful completion of this course, the student will be able to:							
CO1	Describe the key characteristics of emerging technologies such as AI, IoT, AR/VR, Quantum Computing, and Blockchain						
CO2	Apply the concepts of AI, IoT, CPS, and Blockchain to real-world case studies to identify their disruptive impact on digital transformation initiatives						
CO3	Explain the role of robotics, additive manufacturing, and green technologies in supporting sustainability and ethical technology deployment						
CO4	Implement innovative solutions using autonomous systems and green technologies to address sustainability challenges						
Syllabus:							
Module	Contents						Lecture Hours
I	Foundations of Emerging Technologies and Innovation Ecosystem Emerging technologies characteristics and disruptive impact, Indian innovation ecosystem: Digital India, Startup India, AIM, India Stack, National Education Policy and interdisciplinary learning, Case studies: Smart Cities, Aadhaar, UPI, Digital Health Mission.						5
II	Artificial Intelligence, Machine Learning & Data Science AI basics: history, goals, types of AI (Narrow, General, Super AI), Machine learning: supervised, unsupervised, reinforcement learning, Introduction to data science: lifecycle, Big Data (5Vs), visualization, Human-centered AI and ethical concerns: bias, privacy, responsible AI.						5
III	IoT, Cyber-Physical Systems, Edge Computing & Cybersecurity IoT: architecture, sensors, communication, cloud, Cyber-physical systems: smart grid, autonomous vehicles, industrial automation, Edge & fog computing: real-time applications and use cases, Cybersecurity basics: CIA triad, malware, phishing, digital hygiene.						5
IV	AR/VR, Quantum Technologies and Blockchain AR/VR/XR: definitions, tools, applications in gaming, education, healthcare, Metaverse and immersive computing, Introduction to quantum computing: qubits, entanglement, potential impact. Quantum AI, Blockchain, Smart Contracts, DApps, DeFi, NFTs.						5
V	Robotics, Autonomous Systems & Additive Manufacturing Robotics: types, sensors, actuators, applications in healthcare, defense, logistics, Autonomous systems: drones, driverless vehicles, swarm robotics, 3D/4D printing: additive manufacturing, materials, future directions, Design thinking for innovation in robotics & manufacturing.						5
VI	Green Technologies, Sustainability & Tech Ethics Emerging technologies for solving climate/environmental challenges, Smart grids, clean energy systems, climate tech, e-waste, Sustainable design and SDGs: tech for social good, Tech ethics: inclusivity, equity, digital divide, societal impact.						5
Total Lecture Hours						30	

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Course Information:								
Class, Semester	FY. B.Tech, Semester – I						Category	BS
Course Code, Course Title	2ADES105, Programming for Problem solving using C						Type	LI
Prerequisites	--							
Teaching Scheme (per week)	Lecture	Tutorial		Practical		Self Study	Credits	
	2	-		4		2	4	
Examination Scheme (Marks)	Theory	MSE	TA	ESE	Practical	CIA	ESE	
		-	-	-		50	50	
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Prepare an algorithm and draw a flowchart to accurately solve various mathematical problems by using structured approach.							
CO2	Apply the fundamental concepts like data types, operators, looping constructs to solve mathematical problems by using the decision and looping controls							
CO3	Develop a C program to demonstrate the modular approach by using the concept of function, structure and pointer							
CO4	Demonstrate a solution for various mathematical problems by using the fundamental concepts of C							
CO5	Write, Compile and debug a program for various problem statements by C language.							
Syllabus:								
Module	Contents							Lecture Hours
I	Basics of Programming The meaning of algorithms, Flowcharts, Pseudo codes, Writing algorithms and drawing flowcharts for simple exercises, Memory concepts, C Program development environment.							5
II	C Fundamentals Importance of 'C' Language, History, Structure of 'C' Program, Sample 'C' Program, Constants, variables and data types, Enumeration, Operators and expressions, Managing input / output operations, Control statements-Decision making, Case control & Looping Constructs.							7
III	Array The meaning of an array, one dimensional and two dimensional arrays, declaration and initialization of arrays, reading , writing and manipulation of above types of arrays, multidimensional arrays. Strings-Declaring and initialing character array, reading and writing string to/from terminal, arithmetic operations on characters, putting strings together, string handling functions.							4
IV	Functions Need of user defined functions, elements of User defined functions, defining functions, return values and their types, function calls, function declaration, methods of parameter passing, Scope rule of functions, user defined and library functions.							4
V	Structure & Pointers Need of Structure, defining a structure, declaring and accessing structure variables, structure initialization, copying and comparing structure variables, array of structures, structures and functions, Unions. Understanding pointers, accessing the address space of a variable, declaring and initialization pointer variables, accessing a variable through its pointer, pointer expressions, pointers and arrays, pointer and character strings, pointer and structure, Void pointer and generic pointer, null pointer, dangling pointer, pointer to a function. Calling A function through function pointer. Dynamic memory allocation malloc() ,calloc() ,realloc(), free(), Core dump ,Memory leak.							6

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VI	File Handling Defining and opening a file, closing a file, input/output operations on files, error handling during I/O operations, random access files, command line arguments, C preprocessor.	4
Total Lecture Hours		30
List of Experiments with CO Mapping		
S.No	Title / Topic of the Experiment	CO Mapped
1	Write an algorithm for given problem statement.	1
2	Draw a flowchart for given problem.	1
3	Program using different data types and operators in C.	2
4	Program using different operators and demonstration of operator precedence.	2
5	Program using if and if else construct.	2
6	Program using if else ladder and nested if else.	2
7	Program using switch case.	2
8	Program to demonstrate looping constructs(while and for loops)	2
9	Program to demonstrate looping constructs(do while and nested loops)	2
10	Program to demonstrate one dimensional array	3
11	Program to demonstrate two dimensional array	3
12	Implement a program to demonstrate String handling functions.	3
13	Implement a program to demonstrate user defined functions.	4
14	Program to demonstrate concept of recursion (factorial, Fibonacci)	4
15	Program to demonstrate concept of structures in c.	4
16	Program to demonstrate concept of array of structures in c.	5
17	Program to demonstrate pointers in c.	5
18	Program to demonstrate pointers arithmetic in c.	5
19	Program to demonstrate function pointer.	5
20	Implement a program to demonstrate file handling.	6
21	Program to demonstrate command line arguments.	6
Total Practical Sessions	30	Total Practical Hours
		60
Text Books		
1. ISRD Group , Programming And Problem Solving Using C Language , McGraw-Hill Publications ,2012.		
2. Yashwant Kanetkar, Let Us C, 3 rd edition, BPB , 2011		
3. Harvey M. Deitel , Paul J. Deitel, Abbey Deitel, C How to Program, 2 nd edition, Pearson, 2009		
4. E. Balguruswamy, Programming in ANSI C, 4 th edition, Tata Mc-Graw Hill, 2008		
References:		
1. D. M. Ritchie, The 'C' Programming Language, 2 nd edition, 1998		
2. Sidnal, C Programming Laboratory: Handbook for Beginners, 1 st edition, Wiley India Limited, 2012		
3. Yashwant Kanetkar, Understanding pointers in C, 4 th edition, BPB Publications, 2001		


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Course Information:								
Class, Semester		F.Y. B.Tech – Semester I					Category	ES
Course Code, Course Title		2ADES106 - Design Thinking					Type	L2
Prerequisites								
Teaching Scheme (per week)		Lecture	Tutorial		Practical	Self Study	Credits	
		-	-		2	1	1	
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	-
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1		Explain the principles and process of Design Thinking and its application in problem-solving.						
CO2		Identify and define real-world problems using user-centric observation and empathy techniques.						
CO3		Conduct user research through surveys, interviews, and persona building to derive user needs and insights.						
CO4		Apply ideation techniques to generate innovative and feasible solutions for identified problems.						
CO5		Develop and present prototypes and communicate their solutions effectively using charts, posters, and model presentations.						
Syllabus:								
Module		Contents						
I		Introduction to Design Thinking, Design Thinking Process						
II		Empathize Phase: Empathy and Ethics, User Perspective, Activities – Empathy Map, Planning, Persona building.						
III		Customer Journey Mapping, Observation of stakeholders, Defining and Conceptualization of problem						
IV		Ideation, Activities – 5 Whys & I How, Story boarding, Brainstorming.						
V		Prototype – Types, Mindsets, Tools.						
VI		Testing – Scenario, Methods, Refinements & Recommendations.						
List of Experiments with CO Mapping								
S.No		Title / Topic of the Experiment						CO Mapped
1		Introduction to Design Thinking Activity: Make a group of 2-4 students. Give each group a simple, relatable problem (e.g., "Long queues at the campus canteen" or "Difficulty in finding parking on campus"). Ask them to: Empathize: Identify users and their pain points. Define: Write a clear problem statement. Ideate: Brainstorm possible solutions. Sketch: Draw their proposed solution on chart paper. Present: Each group will present their idea briefly.						1,2
2		Identification of Problems Activity 1: Present case study (in group) how companies like Airbnb, Apple, IDEO, Netflix, Samsung, Toyota used Design Thinking to drive innovation. Activity 2: User Interviews – The student or group should walk around the campus or their locality to observe and identify at least three (per student)						1,2

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	real-life problems faced by users (students, faculty, staff, and community). Conduct interviews to gather qualitative insights. Steps: 1. Observation: Note down pain points using observation and informal interviews. 2. Listing: Write a list of problems identified. 3. Shortlisting: Apply criteria like relevance, feasibility, user impact, and alignment with SDGs to shortlist one problem to work on for further Design Thinking phases.	
3	Selection of Problems Activity: Students will present (PPT) their selected problem, why they chose it, who the users are, and the evidence collected.	1,2
4	Designing of Empathy Map Activity: Prepare Empathy Map – Visualize what users say, do, think, and feel.	1,3
5	Customer Survey and Analysis Activity: Students create a structured survey (MCQ, likert scale, open ended questions etc.) using google forms and prepare charts (bar, pie etc) and do the analysis.	1,3
6	Persona Building Activity: Based on findings from Observations and interviews, Customer Survey and Analysis from previous experiments, identify pattern i.e. common characteristics, behaviors, needs, pain points, and goals among users and create persona template.	1,3
7	Customer Journey Map Activity: Select the persona created in the previous experiment, define the Scenario, List Stages/Phases of the Journey, Map User Actions, Identify User Emotions, Identify Touchpoints, Identify Pain Points and opportunities for Improvement.	1,3
8	Defining the problem Activities: • Observation of Stakeholders – Note behaviors and pain points. • 5 Whys Method (Drill Down) – Uncover root causes behind a problem. • Root Cause Mapping – Visual diagram connecting symptoms to core issues. Refine Problem Statement – Create a focused, actionable problem definition.	1,3
9	Poster Presentation Activity: Use A2/A1 sheet and draw charts, diagrams, sketches. and minimal text to represent experiment no 1-8.	1,2,3
10	Ideation Activities: • SCAMPER Model – Modify existing ideas by Substituting, Combining, Adapting, etc. • Brainstorming (Crazy 8 Method) – Rapid sketching of 8 ideas in 8 minutes. • Mind Mapping – Visually connect ideas around a central problem/theme. Use the suitable and best one activity from above.	1,4
11	Prototype Building Activities:	1,5

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	• Storyboarding – Sketch out user scenarios and interactions. • Prototyping – Build a working model or prototype or model.	
12	Testing Activities: • Scenario-Based Testing – Test ideas in realistic user scenarios. Peer Testing – Get feedback from other participants or teams.	1,5
13	Refinement & Recommendation Activities: • Final Presentation – Showcase prototype or working model. • Documentation of Learnings – Reflect on the process, improvements, and impact (Make a report). Apply for IPR/Incubation/Research Grant/Paper Publication.	1,5
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1. E Balaguruswamy, Developing Thinking Skills (The way to Success), First Edition, Khanna Book Publishing Company, 2023		
2. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, First Edition, Harvard Business Review, 2008		
3. R T Krishnan & V Dabholkar, 8 steps to Innovation, First Edition, Collins Publishing, 2013		
References:		
1. Nigel Cross, Design Thinking, First Edition, Bloomsbury, 2011		
2. Idris Mootee, Design Thinking for Strategic Innovation, First Edition, Wiley, 2013		
Online Learning Resources		
1. <u>NPTEL Design Thinking - A Primer</u> https://youtu.be/AamBSYPJlcA?si=wJDNT4L9q1NB-6T9		
2. Design Thinking and Innovation https://www.coursera.org/learn/designthinkingandinnovation		


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Course Information:								
Class, Semester		FY. B.Tech, Semester – I					Category	HS
Course Code, Course Title		2ADHS107 Professional Communication Skills					Type	L2
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial		Practical	Self Study	Credits	
		-	-		4	1	2	
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	-
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1		Demonstrate the Listening, Speaking, Reading and Writing (LSRW) skills considering the frame of English language rules accurately for effective and sound communication in academic and profession contexts.						
CO2		Exhibit their portfolio and career choices confidently, considering corporate expectations by using digital tools convincingly.						
CO3		Write letters, reports, Emails and Blogs proficiently by following required techniques that help in getting acquainted with professional correspondence.						
CO4		Attain professional skill while convincingly presenting on allotted topics using MS PowerPoint and AI techniques.						
CO5		Justify own role in communicative events in well-organized manner with balanced zeal.						
List of Experiments with CO Mapping								
S.No		Title / Topic of the Experiment						CO Mapped
1		Self – Introduction						1
2		SWOT Analysis						1
3		Basics of English Pronunciation						1
4		Rapid Review of Grammar						1
5		Diagnosing Listening and Speaking Skills						1
6		Diagnosing Reading and Writing Skills						1
7		Introduction to MS Office (Word, Excel, PPT)						1,4
8		Presenting my career choices						1,2
9		Preparing Portfolio						1,2
10		Describing Technical Charts, Image, and Processes						1,4
11		Using Language Learning Apps and Tools						1,4
12		Presenting Portfolio						1,2
13		Effective Presentation Skills						1,4

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14	Delivering Power Point Presentation	1,4,5
15	Job Application and Resume Writing	1,3
16	Email Writing	1,3
17	Group Discussion	1,5
18	Public Speaking	1,5
19	Report Writing	1,3
20	Organizing an Event	1,5
21	Technical Writing	1,3
22	Blog Writing	1,3
23	Mock Interview	1,2,5
24	Achievement Test	1
Total Practical Sessions		30
Total Practical Hours		60
Text Books		
1. The Professional: Defining the New Standard of Excellence at Work Subroto Bagchi Penguin Books India Pvt. Ltd. Revised Edition, 2011.		
2. Cambridge Guide to IELTS. Pauline Cullen, Amanda French, Cambridge University Press, Reprint, 2017.		
3. A Practical Course in Effective English Speaking Skills. J. K. Gangal, PHI Learning Private Limited, New Delhi, Print, 2012		
4. English For Engineers. Dr. Shyamaji Dubey, Dr. Manish Kumar. Vikas Publication House Pvt. Ltd. New Delhi, Print, 2020.		
5. Personality Development and Soft Skills. Barun K. Mitra, Oxford University Press, New Delhi, 7 th impression, 2012.		
References:		
1. High-school English Grammar and Composition. Wren and Martin, S. Chand and Co., New Delhi, 1 st edition, 2015.		
2. The Ace of Soft Skills. Ajai Chowdry, Bala Balchandran, Pearson Publication, Delhi, 8 th edition, 2017.		
3. Effective Technical Communication. M. Ashraf Rizvi, McGraw Hill Education, Chennai, 2 nd edition, 2017.		
4. Business Communication. Hory Sankar Mukerjee, Oxford University Press, New Delhi, 2 nd edition, 2013.		
5. Communicative English for Engineers and Professionals. Nitin Bhatnagar, Mamta Bhatnagar, Pearson Publication, Delhi, 1 st edition, 2013.		
Online Learning Resources		
1. Software: Pronunciation apps (e.g., ELSA Speak, Speak English), grammar checkers (e.g., Grammarly).		
2. Online Platform Coursera (for basic English courses), Duolingo, BBC Learning English.		


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Established: 1999								
Course Information:								
Class, Semester		FY. B.Tech, Semester - I					Category	PC
Course Code, Course Title		2ADPC108 ,Computer Organization and Architecture					Type	TI
Prerequisites								
Teaching Scheme (per week)		Lecture	Tutorial		Practical	Self Study	Credits	
		3	-		-	1	3	
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-
Course Outcomes (COs):								
Upon successful completion of this course, the student will be able to:								
CO1		Describe the evolution, structure, and classification of computer systems.						
CO2		Explain the organization of a basic computer system and the instruction execution cycle.						
CO3		Apply the concepts of assembly language to create simple programs that perform arithmetic and logic operations						
CO4		Analyze algorithms used for computer arithmetic operations including addition, multiplication, and division						
CO5		Illustrate the structure and operation of various memory systems including cache and virtual memory.						
CO6		Understand the principles of pipelining, Flynn's taxonomy, and vector processing						
Syllabus:								
Module		Contents						Lecture Hours
I		Structure of Computers Generations Of A Computer, Computer Types: Classification by size, processors, word-length, users, Computer Data Representation: Basic computer data types, Complements, Fixed point representation, Floating Point Representation.						7
II		Basic Computer Organization and Design Instruction Codes, Basic Computer Instruction, Input/output instructions, Timing and Control, Instruction Cycle, I/O Operations, Stack Organization, Register Stack, Addressing Modes, Data Transfer & Manipulation						8
III		Programming Basic Computer Introduction, Machine Language, Assembly Language, assembler, Program loops, Programming Arithmetic and logic operations, subroutines.						8
IV		Computer Arithmetic Introduction, Addition and subtraction, Multiplication Algorithms(Booth Multiplication Algorithm), Division Algorithm						7
V		The Memory System CPU-Main Memory Connection, A block schematic: Random Access Memory, Cache Memory, Memory Interleaving, Virtual Memory, Internal Organization ofSemiconductor Memory Chips, Memory operation: read, Write, MOS Memorycell, Static Memories Vs Dynamic Memories, RAID (Redundant Array of Independent Disks), Direct Memory Access						8
VI		Pipeline and Vector Processing: Flynn's taxonomy. Parallel Processing, Pipelining, Arithmetic Pipeline. Instruction, Pipeline.						7
Total Lecture Hours							45	

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Text Books	
1. W. Stallings, Computer Organization and Architecture: Designing for performance, 12 th Edition, Pearson Education/ Prentice Hall of India, 2003	
2. Zaky, Computer Organization, 5 th Edition, 2001	
3. M. Morris Mano, Computer System Architecture, 3 rd Edition Pearson Education	
References:	
1. A. Tanenbaum, Structured Computer Organization, 9th Edition, John Wiley & Sons, 2006	
2. John P Hays, Computer Architecture and Organization, 3 rd Edition, McGraw-Hill Publication, 1998	



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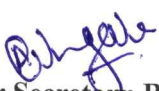
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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science							
Course Information:								
Class, Semester		F. Y. B.Tech, Semester - II					Category	BS
Course Code, Course Title		2ADBS110, Applied Mathematics -II					Type	T1
Prerequisites		2ADBS101						
Teaching Scheme (per week)		Lecture	Tutorial		Practical		Self Study	Credits
		3	1		-		2	4
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-
Course Outcomes (COs) : Upon successful completion of this course, the student will be able to:								
CO1		Determine equation of a curve and compute statistical measures to analyze data using statistical techniques						
CO2		Apply the concepts of vector spaces over real numbers to solve problems using linear algebra concepts						
CO3		Determine approximate root of algebraic and transcendental equations using numerical methods						
CO4		Determine unknown values from tabulated data using finite difference and interpolation techniques.						
CO5		Define and distinguish different types of graphs using basic definitions and examples from graph theory.						
Syllabus:								
Module	Contents							Lecture Hours
I	Curve fitting and Statistics: Method of Least Squares, Fitting of Straight Line, Fitting of Parabola, Fitting of exponential curves, Lines of Regression.							8
II	Vector Space: Introduction to Vector spaces, subspaces and characterization, linear combination and span basis and dimension, linear transformation, Row space, column space, null space and range of transformation.							7
III	Numerical Solution of algebraic and transcendental equation: Introduction, Bisection method, Regula Falsi method, Secant method, Newton Raphson method.							7
IV	Statistical Measures: Introduction, Arithmetic Mean, Geometric Mean, Harmonic Mean, Median, Mode, Partition values: Quartiles, Deciles and Percentiles, Concept of dispersion, Range, Quartile Deviation, Mean Deviation, Mean Square Deviation, Variance and Standard Deviation.							8
V	Finite Differences and Interpolation: Finite differences, Newton's Interpolation formulae, Stirling formula, Lagrange's interpolation formula, Divided Difference							8
VI	Graph Theory: Definition of graph, degree of vertex, types of graph, isomorphism, matrix representation of graph, subgraphs, complement of a graph, operation on graph, connected graph, shortest path algorithm.							7
Total Lecture Hours							45	
List of Tutorial with CO Mapping								
Sr.No	Title of Tutorial						CO Mapped	
1	Fitting of straight line and Second-degree parabola						1	
2	Fitting of exponential curves and lines of regression						1	
3	Subspace and Linear transformation						2	
4	Basis and Dimension						2	


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5	Solution of Algebraic and transcendental equation	3
6	Measures of Central tendency	1
7	Measures of dispersion	1
8	Interpolation with equal intervals	4
9	Interpolation for unequal intervals	4
10	Graph theory	5
Total Practical Sessions		15
Total Practical Hours		30

Text Books

1. H. K. Das, Advanced Engineering Mathematics, 22nd Edition, S. Chand, 2018.
2. B. V. Ramana, Higher Engineering Mathematics, 6th Edition, Tata McGraw Hill Publ., 2010
3. Dr. B. S. Grewal, Numerical Methods, 9th Edition, Khanna Publishers, 2010
4. J. P. Tremblay & R. Manohar, Discrete Mathematical Structures with application to Computer Science Ist-Tata MGH International, 2007.

References:

1. Dr. B. S. Grewal, Higher Engineering Mathematics, 44th Edition, Khanna Publishers, 2018
2. N. P. Bali, Manish Goyal, Advanced Engineering Mathematics, 7th Edition, Infinity science press, 2010.
3. S. C. Gupta, V. K. Kapoor, Fundamental of Mathematical Statistics, 10th Edition, Sultan Chand and Sons Publisher, 2000.
4. Seymour Lipschutz, Marc Lars Lipson, Linear Algebra, 4th Edition, McGraw Hill, 2009.

Online Learning Resources

1. NPTEL Course on Engineering Mathematics-I, by Prof. Jitendra Kumar, IIT Kharagpur
<https://nptel.ac.in/courses/111105121>
2. NPTEL Course on Numerical Methods, by Prof. Ameeya Kumar Nayak, Prof. Sanjeev Kumar, IIT Roorkee
<https://nptel.ac.in/courses/111107105>
3. NPTEL Course Business Statistics, by Prof. Mukesh Kumar Barua, IIT Roorkee
<https://nptel.ac.in/courses/110107114>
4. NPTEL Discrete Mathematics, by Dr. Sugata Gangopadhyay, Dr. Aditi Gangopadhyay, IIT Roorkee
<https://nptel.ac.in/courses/111107058>

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Course Information:								
Class, Semester		F.Y. B.Tech. Semester – II				Category	BS	
Course Code, Course Title		2ADBS111, Engineering Physics & Chemistry				Type	LIT2	
Prerequisites		1ADBS111						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits		
		3	-	2	2	4		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		50	-
Course Outcomes (COs) : Upon successful completion of this course, the student will be able to:								
CO1	Describe the basic principles of nanotechnology for nanomaterial production using appropriate synthesis methods and microscopy techniques							
CO2	Use optical principles and experimental techniques to study diffraction, polarization in engineering applications.							
CO3	Apply optics concepts to analyze lasers and fiber optic transmission in engineering contexts.							
CO4	Explain the properties and applications of engineering materials for industrial and societal use based on their chemical compositions.							
CO5	Compute the calorific values of fuels for domestic and industrial applications by considering environmental effects and principles of green chemistry.							
CO6	Solve the domestic and industrial problems related to water quality parameters using theoretical knowledge and laboratory experiments.							
Syllabus:								
Module	Contents						Lecture Hours	
I	Diffraction and Polarization : Diffraction - Diffraction grating, Plane diffraction grating- construction & theory, Determination of wavelength using plane diffraction grating, Resolving power of grating, Numericals. Polarization :-Polarization of light, Polarization by double refraction, Positive and Negative crystals, Optical activity, Laurent's half shade Polarimeter, Numericals.						8	
II	Laser and Fiber Optics: Laser: Introduction, Principle of laser, Pumping and Population inversion, Characteristics of laser, Ruby Laser, Applications of laser in Artificial Intelligence and data science field. Fiber Optics : Introduction, Total internal reflection, Structure of optical fibre, Propagation mechanism of optical fibre, Numerical aperture, Acceptance angle, Skip distance, Attenuation, Types of optical fibre, Applications of optical fiber in Artificial Intelligence and data science field.						8	
III	Nanophysics: Introduction- Nanotechnology. Nano-materials, Top-down and Bottom-up synthesis approach. Ball milling method, Sol-gel synthesis method, Carbon nanotubes, Properties and applications of carbon nanotubes, Scanning Electron Microscopy (SEM) and Atomic Force Microscopy (AFM), Properties and applications of nano-materials in Artificial Intelligence and data science field.						7	
IV	Water Technology and Management: Introduction, impurities in natural water and it's removal, Water Testing: Acidity, alkalinity, chlorides and hardness of water (definition, causes and significance), Disinfection of water, WHO Standards, Scales and sludges: Introduction, Formation in boilers and removal methods.						8	

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	Treatment of hard water by: Ion-exchange process, Zeolite process, Desalination of brackish water by Reverse Osmosis method, Numerical on temporary, permanent and total hardness of water.	
V	Energy Technology and Green Chemistry: A) Batteries: Introduction, Types of batteries, battery characteristics, Lithium- ion batteries (LIBs), Sodium- ion batteries (Instrumentation, advantages, disadvantages and applications). B) Fuels: Introduction, classification, characteristics of good fuels, types of calorific value (higher and lower), Bomb calorimeter and Boy's calorimeter. Numericals on Bomb and Boy's calorimeter. C) Environment and Green Chemistry: Definition, Twelve principles of green chemistry, Importance of green chemistry in research and industrial applications.	7
VI	Advanced Materials for Engineering Applications: A) Alloys: Introduction, classification, purposes of making alloys. Ferrous alloys: Plain carbon steels (mild, medium and high). Nonferrous alloys: Aluminum alloy (Duralumin and Alnico), Nickel alloy (Nichrome), Tin alloys (Solders). B) Polymers: Introduction, plastics, thermo-softening and thermosetting plastics, industrially important plastics like phenol-formaldehyde, urea-formaldehyde, Conducting polymers, Biodegradable polymers. C) Composites: Introduction, Constituents, Fibre-reinforced plastics (FRP) and Glass reinforced plastics (GRP).	7
Total Lecture Hours		45
List of Experiments with CO Mapping		
S. No.	Title / Topic of the Experiment	CO Mapped
1	Plane Diffraction Grating- Determine the wavelength of light using plane diffraction grating.	1
2	Laurent's Half shade Polarimeter - Determination of specific rotation of optically active material.	1
3	Laser - Determination of wavelength of He-Ne laser light using diffraction grating.	1
4	Laser - Determination of divergence of He-Ne laser light	1
5	Numerical aperture of optical fiber: To calculate NA of optical fiber by laser diode.	1
6	Inverse Square Law- Verify inverse square law.	1
7	Band gap energy: To determine band gap energy of given semiconductor.	1
8	Determination of alkalinity of water (Acid- Base Titration).	5
9	Determination of chloride content of water by Mohr's method. (Precipitation Titration).	5
10	Determination of total hardness of water by EDTA method (Complexometric Titration).	5
11	Estimation of copper in brass solution (Displacement Titration)	3
12	Preparation of urea formaldehyde.	3
13	Determination of pH of industrial waste water by pH-meter.	5
14	Demonstration of H ₂ -O ₂ fuel cell/ battery.	4
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1. G Vijayakumari, Engineering Physics, 3 rd Edition, Vikas Pub. House (P) Ltd, 2009		
2. M.N.Abadhanulu & P. G. Kshirsagar, A Text Book of Engineering Physics, 12 th Edition, S. Chand Publication., 2018		
3. K.K.Chattopadhyay and A.N. Banerjee, Introduction to Nano Science and Nanotechnology, 3 rd Edition, PHI Learning, 2009		
4. S. S. Dara, A Text Book of Engineering Chemistry, 11 th Edition, S. Chand & Co. Ltd., New Delhi, 2008.		
5. Shashi Chawala, A Text book of Engineering Chemistry, 3 rd Edition, Dhanpat Rai Publishing Co. New Delhi, 2007		
References:		
1. David Halliday, Robert Resnick & Jearl Walker, Fundamentals of Physics, 12 th Edition, John Wiley & Sons, 2021		
2. Resnick Halliday, Krane, Engineering Physics, 8 th Edition, John Wiley & Sons Pub., 2008		
3. Sulbha K. Kulkarni, Nanotechnology Principles and Practices, 4 th Edition, Springer, 2007		
4. Jain & Jain, Engineering Chemistry, 16 th Edition, Dhanpat Rai Publishing Co., New Delhi, 2016		
5. Wiley India, Engineering Chemistry, 1 st Edition, Wiley India Pvt. Ltd., New Delhi., 2012		

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Online Learning Resources

1. For optics- <https://nptel.ac.in/courses/122/107/122107035/>
2. For Quantum Physics -<https://nptel.ac.in/courses/122/106/122106034/>
3. For Ultrasonic -- <https://freevidelectures.com/course/3531/engineering-physics-i/8>
4. For Solid State Physics -- <https://nptel.ac.in/courses/115/105/115105099/>
5. Water Technology-- https://youtu.be/dKWJzp_rrIE
6. For lithium-ion batteries (LIBs): <https://www.youtube.com/watch?v=DBLHaLhyo2w>
7. Composite materials-Wikipedia -: https://en.wikipedia.org/wiki/Composite_material

Experiments that may be performed through virtual labs:

S. No.	Experiment Name	Experiments Links
1.	Water analysis-Determination of Chemical parameters	https://inoc-amrt.vlabs.ac.in/exp/water-analysis-chemical-parameters/index.html
2.	Demonstration of Photo-colorimeter	https://pcv-amrt.vlabs.ac.in/exp/spectrophotometry/index.html
3.	Photoelectric Effect	https://mp-amrt.vlabs.ac.in/exp/photoelectric-effect/index.html
4.	Numerical Aperture of Optical Fiber	https://lo-amrt.vlabs.ac.in/exp/numerical-aperture-optical-fiber/
5.	LASER Beam divergence and spot size	https://lo-amrt.vlabs.ac.in/exp/laser-beam-divergence/


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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science							
Course Information:								
Class, Semester		SY. B.Tech, Semester – II					Category	ES
Course Code, Course Title		2ADES112, Basic Electrical and Electronics Engineering					Type	LIT2
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial		Practical		Self Study	Credits
		2	-		2		2	3
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		50	-
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1		Explain fundamental electrical and electronic laws and components used in basic circuits and devices for solving elementary electrical problems.						
CO2		Analyze single-phase and three-phase AC circuits using phasor techniques and sinusoidal parameters for accurate calculation of voltage, current, and power.						
CO3		Describe electrical protection systems, wiring methods, AC machines, and transformers using understanding of basic power distribution and energy conversion.						
CO4		Distinguish between semiconductor devices, rectifiers, transistors along with their role in real-life electronic applications						
CO5		Solve number system conversions and classify logic gates to understand basic concepts of digital electronics.						
Syllabus:								
Module	Contents							Lecture Hours
I	DC Circuits: Ohm's Law, Equivalent Resistance, Kirchhoff current Law, Kirchhoff voltage laws, Mesh analysis, Nodal analysis, Superposition Theorem							5
II	AC Circuits: Representation of sinusoidal waveforms, peak, Average & RMS values. Real, Reactive and Apparent power, Power triangle, Analysis of single-phase ac circuits (R, L and C), Basics of three phase circuits.							5
III	Electrical Installation: Earthing – plate and pipe, Wiring circuits – Simple, Staircase and Godown wiring. Electrical Machine: Principle, Construction and Working of Single Phase AC machine and Single-phase transformer, EMF equation of Transformer.							5
IV	Semiconductor device and applications: Introduction to PN junction diode- Working and Characteristics, Conductors, Insulators, Semiconductors- Intrinsic and Extrinsic, Applications of Electronics in Real Life							5
V	Semiconductor Diode and applications: Zener Diode, LED, Photodiode, Half wave rectifier, Full Wave Rectifier, BJT, JFET (Construction, Working Principle, Characteristics)							6
VI	Digital Electronics Basics: Number Systems: Binary, Octal, Decimal and Hexadecimal number system, Conversion of Number System, Logic Gates- Basic, Universal and Exclusive gates							4
Total Lecture Hours							30	
List of Experiments with CO Mapping								
S.No	Title / Topic of the Experiment							CO Mapped
1	Study of Basic Electrical Components, Equipment and their symbols used in Electrical Engineering							1
2	Study of Safety Precautions and Earthing Systems							3
3	Experimental Verification of Kirchhoff's Laws.							1
4	Experimental Verification of Superposition Theorem.							1
5	Measurement of Power and Power Factor in a Single-phase Circuit.							2
6	Load Test on Single Phase Transformer.							3
7	Demonstration of wiring circuits.							3


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8	Experimental verification of Semiconductor Diode Characteristics	4
9	Experimental verification of Zener Diode Characteristics	4
10	Characteristics of Single-Phase Half-wave and Full-wave rectifiers.	4
11	Verification of logic gates	5
12	Verification of logic gates using universal gates	5
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1.	D. P. Kothari, I. J. Nagrath, Basic Electrical Engineering, 4 th , Tata McGraw Hill, 2019	
2.	D. C. Kulshreshtha, Basic Electrical Engineering, 2 nd , McGraw Hill, 2020	
3.	D. P. Kothari, Basic Electrical & Electronics Engineering, 2 nd , TMH New Delhi, 2020	
4.	D. Patranabi, Sensors and transducers, 2 nd , PHI learning Pvt. Ltd., 2003	
References:		
1.	Millman and Halkias, Integrated Electronics, 2 nd , McGraw Hill, 2010	
2.	A.K. Thereja and B.L. Thereja, Electrical Technology volume II, 2 nd , S. Chand & Co. Publications, 2007	
3.	L. Bakshi and A. Bakshi, Basic Electrical Engineering, 1 st , Technical Publications, Pune, 2005	
4.	Albert Malvin, David Bates, Electronic Principles, 7 th , McGraw Hill Education, 2017	
Online Learning Resources		
1.	Basic Electrical Circuits by Prof. Gajendranath Chowdary https://onlinecourses.nptel.ac.in/noc25_ee91/preview	
2.	Introduction to Semiconductor Devices by Prof. Naresh Kumar https://onlinecourses.nptel.ac.in/noc25_ee92/preview	
3.	Digital Circuits by Prof. Santanu Chattopadhyay https://onlinecourses.nptel.ac.in/noc25_ee125/preview	
Experiments that may be performed through virtual labs:		
S.No	Experiment Name	Experiments Links
1.	Experimental Verification of Kirchhoff's Laws.	https://bes-iitr.vlabs.ac.in/exp/kirchhoff-law/
2.	Load Test on Single Phase Transformer.	https://bes-iitr.vlabs.ac.in/exp/single-phase-transformer/
3.	Verification of logic gates	https://de-iitr.vlabs.ac.in/exp/truth-table-gates/

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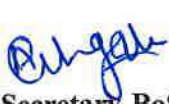
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 Established: 1999		Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence & Data Science						
Course Information:								
Class, Semester		FY. B.Tech, Semester – I					Category	ES
Course Code, Course Title		2ADES113, Python Programming					Type	L1
Prerequisites		2ADES105						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits		
		2	-	2	1	3		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	50
Course Outcomes (COs): Upon successful completion of this course, the student will be able to:								
CO1		Understand the history, features, and basic syntax of Python, including identifiers, variables, operators, and data types.						
CO2		Demonstrate the ability to set up the Python environment and use standard libraries like NumPy, Pandas, Matplotlib, and Scikit-learn for basic data processing and visualization.						
CO3		Apply conditional statements, loops, and loop control structures to solve computational problems.						
CO4		Manipulate and analyze string data using Python string operations, escape characters, formatting, and built-in string methods.						
CO5		Implement programs using Python collections (Lists, Tuples, Dictionaries) and develop modular code with functions, including user-defined and anonymous functions.						
CO6		Implement programs using Python collections (Lists, Tuples, Dictionaries) and develop modular code with functions, including user-defined and anonymous functions.						
Syllabus:								
Module		Contents						Lecture Hours
I		Introduction to Python: Introduction of Python and history of Python, Features of Python, Installation of Python Environment Setup, Python Identifiers, Keywords and Indentation, Comments, Variables, Variable Names, Variables - Assign Multiple Values, Python - Output Variables, Global Variables, Data Types, Operators. Libraries of Python: NumPy, Pandas, Matplotlib, Scikit-learn.						5
II		Control Statements & Strings: Sequence Control – Precedence of operators, Type conversion Conditional Statements: if, if-else, nested if-else, Looping- for, while, nested loops, loop control statements (break, continue, pass) a. Strings: declaration, manipulation, special operations, escape character, string formatting operator, Raw String, Unicode strings, Built-in String methods.						5
III		Lists and Functions: Python Lists: Concept, creating and accessing elements, updating & deleting lists, traversing a List, reverse Built-in List Operators, Concatenation, Repetition, In Operator, Built-in List functions and methods. Functions: Definitions and Uses, Function Calls, Type Conversion Functions, Math Functions, Composition, Adding New Functions, Flow of Execution, Parameters and Arguments, Variables and Parameters, Void Functions, Anonymous functions.						5
IV		Tuples & Dictionaries: Tuples, Accessing values in Tuples, Tuple Assignment, and Tuples as return values, Variable-length argument tuples, and Basic tuples operations, Concatenation, Repetition, in Operator, Iteration, Built-in tuple functions, indexing, slicing and matrices. Creating a Dictionary, Accessing Values in a dictionary, Updating Dictionary, Deleting Elements from Dictionary, Properties of Dictionary keys, Operations in Dictionary, Built-In Dictionary Functions, Built-in Dictionary Methods						5


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V	Object Oriented Concept: Object Oriented Programming Features, Classes and objects declaration, Constructor, Inheritance: Single Inheritance, Multiple Inheritance, Multilevel Inheritance, Regular Expressions, Principles of Object Orientation, Iterators, Polymorphism, Encapsulation and abstraction, Operator Overloading	5
VI	I/O and Error Handling In Python: Basics of Input/Output Operations, Python File Open, Python Read File, File Write, Python Delete File, Writing Binary Files Manually, Using Pickle to Write Binary Files, What is Exception?, Handling an exception, try....except...else. try-finally clause, Argument of an Exception.	5
Total Lecture Hours		30
List of Experiments with CO Mapping		
1	Python Environment Setup, First Program, and Installation of Core Libraries	1
2	Working with Variables, Data Types, and Operators in Python	1
3	Implementing Conditional Statements and Looping Constructs in Python	2
4	String Manipulation and Built-in String Functions	1
5	Creating and Manipulating Lists in Python	1,4
6	Defining and Using Functions, Including Anonymous Functions (Lambda)	4
7	Working with Tuples: Access, Slicing, and Operations	4
8	Creating and Manipulating Dictionaries in Python	4
9	Creating Classes and Objects, Implementing Constructors and Inheritance	3
10	Demonstrating Polymorphism, Encapsulation, and Operator Overloading	3
11	File Handling: Reading from and Writing to Text and Binary Files	5
12	Exception Handling Using try-except and Finally Blocks	5
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1. Introduction to computing and Problem Solving with Python Jeeva Jose and Sojan Lal Khanna Book Publishing Co. (P) Ltd 1 2016		
2. Python Data Science Handbook: Essential Tools for Working with Data Jake VanderPlas O'Reilly 2017		
References:		
1. Core Python Programming, Wesley J. Chun, Prentice Hall, 2006		
Online Learning Resources		
https://onlinecourses.swayam2.ac.in/ini25_cs04/announcements?force=true		

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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science							
Course Information:								
Class, Semester	FY. B.Tech, Semester – II					Category	ES	
Course Code, Course Title	2ADES114, Data Communication & Networking					Type	LIT 2	
Prerequisites	--							
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Self Study	Credits			
	2	-	2	1	3			
Examination Scheme (Marks)	Theory	MSE	TA	ESE	Practical	CIA	ESE	
		40	20	40		50	-	
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Analyze the functioning of data communication systems and computer networks with respect to their components, architectures, and services.							
CO2	Select and justify suitable transmission media and switching techniques based on application requirements, performance, and cost.							
CO3	Examine transmission errors with reference to IEEE standards, and apply appropriate error detection and correction techniques.							
CO4	Demonstrate different TCP/IP services such as IP addressing, DNS, DHCP, FTP, and remote access protocols.							
CO5	Implement relevant network topologies using appropriate networking devices such as switches, routers, and access points.							
Syllabus:								
Module	Contents							Lecture Hours
I	Fundamentals of Data Communication Process of data communication and its components: Transmitter, Receiver, Medium, Message, Protocol, Modes of Communication (Simplex, Half duplex, Full Duplex), Fundamental of Computer Network: Definition and Need of Computer Network, Applications, Network Benefits, Classification of Network: LAN, WAN, MAN							5
II	Network Topologies and Network Devices Network Computing Model: Peer To Peer, Client Server, Network Topologies: Introduction, Definition, Selection criteria, Types of Topologies- Star, Mesh, Tree, Hybrid, Network Connecting Devices: Switch, Router, Repeater, Bridge, Gateways and Modem							5
III	Transmission Media and Switching Communication Media: Guided Transmission Media Twisted-Pair Cable, Coaxial Cable, Fiber-Optic Cable, Unguided Transmission Media: Radio Waves, Microwaves, Infrared, Satellite, Line-of-Sight Transmission, Point-to-Point, Broadcast, Multiplexing: Frequency-Division Multiplexing, Time - Division Multiplexing, switching: Circuit-switched network, Packet switched network							5
IV	Error Detection and Correction Types of Errors, Forward Error Correction Versus Retransmission, Framing: Fixed Sized and Variable Sized Framing, Error Detection: Repetition codes, Parity bits, Checksums, CRC, Error Correction: Automatic Repeat Request (ARQ), Hamming Code							5
V	Network Communication Models THE OSI MODEL: Layered Architecture, Encapsulation, Layers in OSI Model (Functions of each layer)-Physical Layer, Data-Link Layer, Network Layer, Transport Layer, Session Layer, Presentation Layer, Application Layer, TCP/IP Layers and their functions: Host to Network Layer, Internet Layer, Transport Layer, Application Layer							5


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VI	Network Addressing Addressing: Physical Address, Logical Address, Port Address, IP Address-Concept, Notation, Address Space, IPv4 Addressing: Classful and Classless Addressing, subnet mask, supernetting, subnetting, IPV6 Addressing scheme and basic structure		5
Total Lecture Hours			30
List of Experiments with CO Mapping			
S.No	Title / Topic of the Experiment		CO Mapped
1	Create and Test standard straight network cable(Universal Color Code) using crimping tool		1
2	Generate a Time Division Multiplexing (TDM) signal using relevant simulation software		2
3	Locate the error bit in the given data string by applying checksum error detection method		3
4	Implement Wireless network		4
5	Write a program for parity check error detection		3
6	Write a program for Cyclic Redundancy Check (CRC) error detection		3
7	Write a program for error correction using Hamming code		3
8	Configure static IP address in operating system along with appropriate subnet mask for given problem		4
9	Implement Classful Address in a given network node i) Identify range of IP Address in various classes ii) Justify the reason to choose various IP address classes for creating given network		4
10	Execute TCP/IP network commands: ipconfig, ping, tracert		4
11	Visit your computer Centre - i)Identify the type of topology ii)Identify types of connecting devices with specifications iii)Identify types of cables with specifications iv)List the type of network applications commonly used in the laboratory iv)Draw the layout of installed network		5
12	Share folder and printer in a network		
Total Practical Sessions	15	Total Practical Hours	30
Text Books			
1. Behrouz A.Forouzan, Data Communication and Networking, 5 th , McGraw-Hill, 2017			
2. Behrouz A.Forouzan, TCP/IP Protocol Suit, 4 th , McGraw-Hill, 2009			
3. Godbole Achyut, Data Communication and Networks, 2 nd , McGraw-Hill, 2017			
Reference Books			
1.A.S. Tanenbaum, Computer Networks, 5 th , Pearson, 2010			
Experiments that may be performed through virtual labs:			
S.No	Experiment Name	Experiments Links	
1.	Design of multiplexer circuits using gates	https://dld-iitb.vlabs.ac.in/exp/multiplexer-using-basic-logic-gates/	

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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science							
Course Information:								
Class, Semester		FY. B. Tech, Semester – I / II					Category	HS
Course Code, Course Title		2ADHS115, Indian Knowledge System					Type	T2
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self-Study	Credits		
		2	-	-	-	2		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-
Course Outcomes (COs): Upon successful completion of this course, the student will be able to:								
CO1	Explain the historical context and evolution of the Indian Knowledge System (IKS) and its relevance to modern engineering.							
CO2	Analyze ancient Indian mathematical, astronomical, and technological methodologies and compare them with contemporary engineering practices.							
CO3	Apply concepts from Ayurveda and ancient biological sciences to modern problem-solving in healthcare and related fields.							
CO4	Evaluate traditional Indian architecture, materials, and construction principles as early forms of sustainable engineering design.							
CO5	Integrate philosophical and scientific logic from Indian thought into ethical decision-making and sustainable engineering practices.							
Syllabus:								
Module	Contents							Lecture Hours
I	Introduction & Historical Context 1. Overview of the Indian Knowledge System: Philosophy and Scope 2. Historical timelines and key epochs 3. Geographical and cultural influences on ancient Indian science 4. Interdisciplinary approaches in ancient India. 5. Comparative analysis with other ancient civilizations							5
II	Mathematics & Astronomy in Ancient India 1. Foundations of Vedic Mathematics and its modern applications 2. Concepts of zero, decimal system, and number theory 3. Astronomical instruments and observational techniques 4. Calendrical systems and time measurement in ancient India 5. Engineering parallels in algorithmic design and computational thinking							5
III	Ayurveda and Life Sciences • Introduction to Ayurveda: Philosophy, doctrines, and methodologies • Medicinal systems and their chemical/pharmacological principles • Human physiology and surgical techniques in ancient texts (e.g., Sushruta Samhita) • Integrating traditional knowledge with modern biomedical engineering • Innovations in material sciences: Natural polymers and biocompatible materials							5
IV	Architectural Knowledge & Engineering Innovations • Ancient Indian architecture: Principles, materials, and techniques • Urban planning and infrastructure in historical Indian kingdoms • Structural innovations: Temples, forts, and water management systems • Engineering analysis of construction techniques from a modern perspective							5

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	Case studies: Earthquake-resistant designs in ancient constructions	
V	Philosophy, Science & Ethics - Indian philosophical schools and their perspectives on science - The concept of Rta (cosmic order) and its engineering analogies - Early scientific inquiry and epistemology in classical texts - Ethics, sustainability, and social responsibility in engineering - Integration of moral values and technical rigor in project design	5
VI	Contemporary Relevance & Innovation - Bridging ancient wisdom with modern technology - Case studies: Reviving lost techniques to inspire modern engineering solutions - Workshops on innovation and design thinking using Indian Knowledge System principles - Integration of cultural heritage in sustainable product design	5
Total Lecture Hours		30
Text Books		
01. Indian Knowledge Systems: An Introduction by Dr. Vivek Ramaswamy, Oxford University Press, 2 nd , 2005. 02. Traditions of Indian Science: A Textbook by Dr. Shyam R. Jha, Cambridge University Press, 1 st , 2010. 03. Contemporary Perspectives on Ancient Indian Wisdom by Dr. Arvind Sharma, Routledge, 1 st , 2013. 04. Foundations of the Indian Knowledge System by Dr. Meera Nair, Sage Publications, 3 rd , 2015. 05. Indian Thought and Science: Bridging the Past and Present by Dr. Ram Prasad, Springer, 2 nd , 2008.		
References:		
01. Encyclopedia of Indian Intellectual Heritage by Dr. Anil Kumar, Oxford University Press, 1 st , 2012. 02. Indian Philosophy and Science: A Reference Guide by Dr. Lalit Singh, Cambridge University Press, 2 nd , 2014. 03. The Vedic and Post-Vedic Traditions: A Reference Book by Dr. Pradeep Kumar, Routledge, 1 st , 2003. 04. Handbook of Indian Knowledge Systems by Dr. Sunita Reddy, Sage Publications, 1 st , 2016. 05. Traditional Indian Sciences: An Annotated Bibliography by Dr. Kavita Menon, Springer, 1 st , 2020.		
Online Learning Resources		
1. https://onlinecourses.swayam2.ac.in/imb23_mg53/preview 		


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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science								
Course Information:									
Class, Semester		F.Y. B.Tech. Semester – II					Category	VS	
Course Code, Course Title		2ADVS116, IDEA Laboratory					Type	L2	
Prerequisites		--							
Teaching Scheme (per week)		Lecture	Tutorial		Practical	Self Study	Credits		
		1	-		2	1	2		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE	
		--	--	--	--		50	--	
Course Outcomes (COs) :									
Upon successful completion of this course, the student will be able to:									
CO 1		Operate basic workshop tools for material processing and assembly							
CO 2		Make simple 2D and 3D designs using CAD software and prepare them using 3D printing, laser cutting, or CNC machining							
CO 3		Build basic electronic circuits using sensors, LEDs, motors, and microcontrollers							
CO 4		Apply fundamental programming concepts in embedded C (Arduino IDE) for controlling hardware and automating simple tasks.							
CO 5		Integrate mechanical parts and electronics to design and build working models or prototypes.							
Syllabus:									
Module	Contents							Lecture Hours	
I	Overview of IDEA Lab Introduction to the IDEA Lab: Vision, objectives, National Innovation Ecosystem (IIC, Atal Innovation Mission, NISP), Importance of multi-disciplinary, project-based learning Inspirational case studies from IDEA Labs, Safety protocols, Do & Don'ts in IDEA Lab.							1	
II	Fundamentals of Design & Prototyping Design Thinking Basics: Problem identification, ideation, prototyping, testing, and iteration, Introduction to CAD Software: Concepts of 2D and 3D modeling for various applications, File Formats for Fabrication: Understanding STL, DXF, G-Code, SVG, and their uses, Tolerances, fits, and design constraints for manufacturing.							2	
III	Digital Fabrication Technologies 3D Printing: Principles, types of 3D printers, materials, slicing software, and applications. Laser Cutting & Engraving: Principles, types of lasers, materials, design considerations, and safety. CNC Router: Introduction to CNC Router and Mini Desktop Lathe cum Milling operations, G-code fundamentals, material removal processes. 3D Scanning: Principles of 3D scanning, applications in reverse engineering and quality control. PCB Fabrication: Introduction to PCB Milling Machine and PCB Prototype Machine for custom circuit boards.							3	
IV	Fundamentals of Embedded Systems & IoT Basic Electrical and Electronic Concepts: Voltage, current, resistance, Ohm's Law, and fundamental components (resistors, capacitors, diodes, LEDs, sensors, actuators), Measuring Instruments Overview of microcontrollers: Overview of Arduino, ESP32, NodeMCU, and their applications in controlling hardware. Circuit simulation using Tinker CAD or Proteus. IoT Basics: Basic networking (Bluetooth/Wi-Fi/Ethernet), cloud integration							3	
V	Programming for automation Arduino IDE and Embedded C Programming: Setup, basic syntax (setup(), loop()), digital and analog I/O control.							3	

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	Basic Control Systems: Concepts of open-loop and closed-loop control with simple examples. Introduction to Python.		
VI	Project Planning and IPR Innovation Process: From idea generation to concept validation Project Planning & Management: Defining scope, setting timelines, budgeting, and resource allocation. Documentation and Presentation: Writing a concept note, creating innovation posters, and effective pitching techniques. Intellectual Property Rights (IPR): Basics of Patents, Copyrights, and Trademarks relevant to innovation.		3
Total Lecture Hours			15
List of Experiments with CO Mapping			
S.No	Title / Topic of the Experiment		CO Mapped
1	Introduction, Lab Safety & Tool Familiarization		1
2	Hands on practice of Mechanical Workshop Tools		1
3	3D Printing of simple parts		2
4	Laser Cutting		2
5	CNC Routing/ Engraving		2
6	Basic Electronics circuit		3
7	PCB Design and Prototyping		3
8	Microcontroller Programming and Sensor Interfacing		4
9	Mini Project		5
Total Practical Sessions		15	Total Practical Hours
			30
Text Books			
4. Veeranna D.K., AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), 1st Edition, Khanna Book Publishing Company, 2022			
5. Saji T. Chacko, Susan S. Mathew, AICTE's Prescribed Textbook: Fundamentals of Electrical and Electronics Engineering (with Lab Manual), 1st Edition, Khanna Book Publishing Company, 2024			
6. Mehta S.D., Electronic Product Design Volume - I (Basics of PCB Design), 1st Edition, S Chand & Company, 2011			
7. Mehta-Gupta, Y.P.Mehta, Vishal Mehta, Workshop Calculation and Science, 1st Edition, Dhanpat Rai Publications, 2020			
References:			
1. A. K. Maini, Nakul Maini, All-in-One Electronics Simplified, 1st Edition, Khanna Book Publishing Company, 2021			
2. J.G. Joshi, Electronics Measurements & Instrumentation, 1st Edition, Khanna Book Publishing Company, 2025			
3. Dr. Sabrie Soloman, 3D Printing & Design, 1st Edition, Khanna Book Publishing Company, 2020			
4. Kaushik Kumar, Hridayjit Kalita, Workshop/Manufacturing Practices, 5th Edition, S Chand & Company, 2011			
Online Learning Resources			
1. NPTEL Course on 3D Printing and Design for Educators, By Dr. Sharad K. Pradhan, NITTTR Bhopal https://onlinecourses.swayam2.ac.in/ntr24_ed17/preview			
2. NPTEL Course on Electronic Systems Design: Hands-on Circuits and PCB Design with CAD Software, By Prof. Ankur Gupta, IIT Delhi https://onlinecourses.nptel.ac.in/noc24_ee127/preview			
Experiments that may be performed through virtual labs:			
S. No	Experiment Name	Experiments Links	
1.	3D Printing Virtual Simulation Lab	https://3dp-dei.vlabs.ac.in/	
2.	Digital Fabrication of Flexible Circuit board	https://fab-coep.vlabs.ac.in/exp/digital-fabrication/	
3.	Embedded System Design with 8051 and PIC Microcontroller	https://esd-coep.vlabs.ac.in/	

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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science								
Course Information:									
Class, Semester		FY. B.Tech, Semester – I					Category	CC	
Course Code, Course Title		3BSCC121,Introduction to Yoga and Mindfulness					Type	L2	
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits			
		-	-	2	-	1			
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE	
			-	-	-		50	-	
Course Outcomes (COs) :									
Upon successful completion of this course, the student will be able to:									
CO1	Describe the significance and practical applications of yoga for holistic well-being under guided classroom sessions, ensuring coverage of physical, mental, and spiritual aspects.								
CO2	Explain the role of subtle energy systems (chakras, nadis) in health enhancement using yogic practices, showing linkage to at least two health benefits.								
CO3	Compare different paths of yoga (Bhakti, Jnana, Karma, Raja) through readings and discussions, citing at least one key practice and outcome for each..								
CO4	Demonstrate the Eight Limbs of Yoga in practical sessions, reflecting personal integration of at least four limbs in daily habits or behavior.								
CO5	Apply yoga and mindfulness techniques in real-life stress situations to improve emotional resilience, showing measurable improvement in two or more psycho-somatic areas.								
Practice Session									
No	Contents							CO Mapped	
1	Introduction to Yoga Practice and Warming Up Exercises Overview of yoga philosophy and benefits. Practice basic stretching and warm-up routines. Introduction to breath awareness and mindfulness.							1,5	
2	Omkar ,Prathana and types of Asanas , Surya Namaskar. Practice of Chant Omkar and opening prayer for mental centering. Perform Surya Namaskar and learn its 10-step sequence. Explore basic asana types: standing, sitting, supine.							1,4	
3	Sleeping position Asanas Practice of Setubandhasana, Pavanmuktasanan, ChakraasaSetuBandhasana, Understand the effects on back, digestion, and spine.							1, 2	
4	Opposite sleeping position Practice of Bhujangasana, shalbasanan, Dhanurashan, Makrasanan Focus on strengthening the back and improving posture.							1, 2	
5	Seating Position Practice of Padmaasna , Vajrasana , Gaumukhasana , Vakrasana Learn their benefits for digestion and meditation readiness.							1, 4	
6	Standing Position Practice of Tadasana ,Vruksasana, Trikonaasan , Virasana. Emphasize balance, posture, and muscular endurance.							1, 4	
7	Meditation Guided practice of breath-based (Anapan) and insight (Vipassana) meditation. Focus on observation without judgment.							4, 5	
8	Mantra meditation Practice chanting and internal repetition of mantras. Use traditional mantras for focus and mental calm.							4, 5	
9	Yognidra Perform deep relaxation technique (guided Yoga Nidra). Experience body awareness and mental stillness.							4, 5	

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10	Pranayam 1 Practice Anulom Vilom (alternate nostril), Bhramari (humming bee), and Sheetal (cooling breath). Focus on breath control and emotional regulation.	2, 5
11	Pranayam 2 Practice Sitkari and Kapalbhata. Learn their effects on metabolism, energy, and clarity.	2, 5
12	Tratak Perform Tratak (candle gazing) for concentration. Understand through demonstration or video.	4, 5
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1. Yog Jeevan . Dr. Chakote Riya 1st Edition 2016		
2. Yog Parchichaya Mandlik Gururji Nashik Mandlik Gururji Second Edition 2020		
References:		
1. Yoga for Modern Age Vethathiri Edition 16th 2023		
2. Maharishi, Simplified Physical Exercises Vethathiri Edition I 2014		


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Course Information:								
Class, Semester		FY. B.Tech, Semester – I					Category	CC
Course Code, Course Title		3BSCC122, Physical Fitness and Lifestyle Management					Type	L2
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits		
		-	-	2	-	1		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	-
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Explain the fundamentals of physical education and its role in developing holistic well-being.							
CO2	Demonstrate appropriate fitness practices and techniques to improve cardiovascular endurance, strength, and flexibility.							
CO3	Apply principles of wellness, including nutrition, sleep, and stress management, to maintain a healthy lifestyle.							
CO4	Integrate yoga, mindfulness, and relaxation techniques to promote mental well-being and emotional balance.							
CO5	Design a personalized lifestyle management plan based on fitness assessment, health goals, and behaviour change strategies.							
Practice Session								
No	Contents							CO Mapped
1	Introduction to Physical Education Understand the meaning and objectives of physical education.Learn its role in promoting health, fitness, and overall well-being.Explore career options and importance in daily life.							1
2	General Warm up Practice dynamic warm-up routines before workouts. Increase heart rate and blood circulation to muscles. Prevent injuries and improve workout performance.							2
3	Limbering down exercises. Free hand exercises, Cooling down exercises Perform safe cool-down techniques post activity.Reduce muscle soreness and stiffness.Bring heart rate back to normal gradually.							2
4	Stretching exercises / Flexibility exercises Improve range of motion in joints. Reduce muscle tension and prevent injuries. Learn static and dynamic stretching methods.							2
5	Fitness Evaluation 1 mile run and walk, Push ups , seat ups ,Seat and reach and BMI . Assess personal fitness using 1-mile run, push-ups, sit-ups, etc.Calculate BMI to understand body composition.Set personalized fitness goals based on results.							5
6	Aerobic activities Perform rhythmic activities to improve cardiovascular health.Engage in exercises like jogging, skipping, or dance aerobics.Enhance lung capacity and endurance.							2
7	Sports and games (, Cricket, Volleyball , basketball, Kho-Kho , Kabaddi, Athletics) Play team games like Cricket, Volleyball, Kabaddi, etc.Develop teamwork, coordination, and sportsmanship.Improve motor skills and physical agility.							2
8	Sports and games(Badminton, Table Tennis, Chess) Participate in games like Table Tennis, Badminton, Chess. Improve reflexes, concentration, and decision-making. Promote mental sharpness and social interaction.							4
9	Circuit Training, Strength Activities Perform multiple exercises in a sequence (circuit). Focus on building muscular strength and stamina. Use minimal equipment for maximum benefit.							2
10	Agility and Coordinative activities Practice quick movement drills to improve reflexes. Enhance body coordination and balance. Develop speed and reaction time.							2

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11	Body weight exercises Do exercises like push-ups, squats, lunges, and planks. Improve strength using your own body resistance. No need for gym equipment.	2
12	Functional training Mimic real-life movement patterns (bending, lifting, reaching). Improve daily functional strength and flexibility. Prevent posture-related problems.	3
Total Practical Sessions		15
Total Practical Hours		30
Text		
Test, Measurement and Evaluation in Sports and Physical Education*. 5th ed., Friends Publications, 2023.		
Rules of Games and Sports Updated version, Khel Shaitya Kendra, 2023.		
References:		
1 Beashel, Paul, and John Taylor. <i>Physical Education: Essential Issues</i> . Hodder Stoughton, 1997.		
2 Sodhi, H. S., and S. K. Sidhu. <i>Physique and Selection of Sportsmen</i> . Punjab Publishing House, 1984.		


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Course Information:									
Class, Semester		FY. B.Tech, Semester – I					Category	CC	
Course Code, Course Title		3BSCC123, Six Sigma Happiness and Mind Mechanics					Type	L2	
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits			
		-	-	2	-	1			
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE	
			-	-	-		50	-	
Course Outcomes (COs) :									
Upon successful completion of this course, the student will be able to:									
CO1	Analyze personal life patterns and decision-making processes using visual tools like life maps and time audits to improve self-awareness and productivity.								
CO2	Identify and modify recurring behavioral or emotional challenges using root cause analysis and habit-tracking techniques								
CO3	Apply reflective and psychological tools such as the Gratitude Journal, PERMA Wheel, and mindfulness meditation to enhance emotional well-being.								
CO4	Utilize creative thinking and visualization techniques such as mind mapping, personal development canvas, and flow activities to enhance planning and motivation.								
CO5	Formulate and monitor measurable personal goals using SMART criteria and Six Sigma strategies to construct a structured self-improvement and lifestyle plan.								
Practice Session									
No	Contents							CO Mapped	
1	Life Process Mapping Understand personal daily patterns. Identify meaningful and unproductive activities. Improve decision-making awareness. Build a visual blueprint of life routines.							1	
2	Time Audit Diary Track hourly usage of time. Identify time-wasters and focus zones. Increase productivity through reflection. Learn prioritization techniques.							1,2	
3	Root Cause Analysis Find root causes behind repeated problems. Use cause-effect diagrams (Fishbone). Develop problem-solving skills. Prevent recurring emotional or behavioral setbacks.							1	
4	Habit Tracker Creation Monitor progress of personal habits. Encourage accountability and consistency. Recognize triggers and patterns. Reinforce good habits using visual tools.							3	
5	Control Chart for Habits Apply Six Sigma's statistical approach to habits. Track habit frequency over time. Identify variation in behavior patterns. Improve self-control and discipline.							3	
6	Gratitude Journal Practice daily reflection on positive moments. Enhance emotional well-being. Reduce stress and negativity. Cultivate a habit of appreciation.							4	
7	PERMA Wheel Self-Assessment. Evaluate happiness using 5 key pillars (Positive emotion, Engagement, Relationships, Meaning, Achievement). Identify strengths and gaps in life satisfaction. Build awareness of emotional and social well-being. Create a personalized improvement plan.							4	
8	Flow Activity Practice Engage in high-focus enjoyable activity. Understand the “flow” mental state. Boost intrinsic motivation. Reduce distractions and increase creativity.							4	
9	Mind Mapping the Brain Visually organize thoughts and plans. Stimulate right and left brain together. Enhance memory, planning, and clarity. Strengthen problem-solving and goal-setting.							1, 5	

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10	Guided Mindfulness Meditation Practice breath work and awareness techniques. Reduce anxiety and mental fatigue. Increase present-moment awareness. Build emotional balance.	4
11	Personal Development Canvas Create a visual profile of strengths, values, and aspirations. Encourage strategic self-improvement. Connect life areas (career, personal, social). Track personal growth visually.	5
12	SMART Goal Setting + Six Sigma Define Specific, Measurable, Achievable, Relevant, Time-bound goals. Integrate Six Sigma process for goal monitoring. Improve consistency in self-development. Align actions with purpose and metrics.	5
Total Practical Sessions		15
Total Practical Hours		30
References:		
1 S. Radhakrishnan, An Idealist View Of Life, 2015, HarperCollins.		
2. Yogi Kochhar, Six Sigma Happiness (English Edition).		
3 An idealist way of Life – S Radhakrishnan		


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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science								
Course Information:									
Class, Semester		FY. B.Tech, Semester – I					Category	CC	
Course Code, Course Title		3BSCC124, Creativity through Visual Arts					Type	LI2	
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits			
		-	-	2	-	1			
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE	
			-	-	-		50	-	
Course Outcomes (COs) :									
Upon successful completion of this course, the student will be able to:									
CO1	Identify and apply the elements of art—line, shape, color, texture, and space—through various drawing and painting techniques.								
CO2	Demonstrate creativity and technical skills in using different mediums such as pastels, pen & ink, and water-based paints.								
CO3	Create original prints using simplified printmaking techniques such as relief, intaglio, and monoprint methods.								
CO4	Design visually appealing digital artwork such as posters, icons, and layouts using basic digital tools.								
CO5	Analyze and reflect on personal artwork and peer creations to improve visual communication and aesthetic understanding.								
Practice Session									
No	Contents							CO Mapped	
1	Fundamentals of Visual arts Introduction to elements of art: line, shape, colour, texture, space. Practice drawing with pencil and charcoal using simple objects and shapes. Explore light and shade for 3D effects.							1	
2	Basic Graphic Design Learn principles of alignment, contrast, hierarchy, and balance. Create a basic visual composition using text and image elements. Use sketching or digital tools for layout planning.							2	
3	Typography & Font Design Study of typefaces: serif, sans-serif, script, decorative. Draw custom fonts and stylized letters. Create a short phrase using hand-drawn typography.							2	
4	Logo Design Understand logo types: symbolic, text-based, combination marks. Design a logo for a fictional company or cultural event. Focus on clarity, colour choice, and relevance.							4	
5	Poster Design Choose a theme: social message, event, awareness, culture. Develop layout and imagery using watercolour, pen & ink, or digital tools. Apply principles of visual hierarchy and focal point.							4	
6	Photography Task: Lines & Angles Capture photographs focusing on geometric lines, angles, and symmetry. Submit 3–5 original photographs with a short description of each. Discuss visual impact and framing.							1, 5	
7	Digital Infographic Design Choose a topic (e.g., Indian innovations, clean energy, internet safety). Create a digital infographic using free tools like Canva or PowerPoint. Combine icons, minimal text, and visuals to communicate clearly.							4	
8	Visual Metaphor Drawing Select a concept (e.g., freedom, growth, technology) and represent it visually. Use drawing techniques to convey metaphor without text. Encourage creativity and symbolic thinking.							3,5	
9	Calligraphic strokes of Devnagari Practice traditional and artistic Devanagari calligraphy. Use ink pens or brush pens to form characters. Create a short meaningful phrase in decorative calligraphy.							2	

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10	Collage on Innovation in India Use newspapers, magazines, or printed material. Prepare a collage on topics like ISRO, start-ups, or digital India. Emphasize arrangement, contrast, and theme clarity.	3,5
11	Modern Arts Introduction and fundamental of modern art, Study abstract and modern Indian Artists Create an abstract or modern art piece using acrylics, pastels, or digital tools. Focus on expression and experimentation.	3,5
12	Geometric Pattern Design Create a detailed design using compass, ruler, or digital drawing. Highlight symmetry, color, and repetition	1,2
Total Practical Sessions		15
Total Practical Hours		30
References:		
1. <i>The New Drawing on the Right Side of the Brain</i> . TarcherPerigee, 2012. 2. <i>Digital Illustration: A Master Class in Creative Image-making</i> . Rotovision, 2010. 3. <i>A History of Indian Painting: The Modern Period</i> . Abhinav Publications, 1994. 4. <i>Basics of Visual Art</i> . New Academic Publishing, 2015.		


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Course Information:									
Class, Semester		FY. B.Tech, Semester - I					Category	CC	
Course Code, Course Title		3BSCC125,Community Engagement through NSS					Type	L2	
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits			
		-	-	02	-	1			
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE	
			-	-	-		50		
Course Outcomes (COs) :									
Upon successful completion of this course, the student will be able to:									
CO1		Identify the structure and needs of the local community through direct engagement and observation.							
CO2		Analyze community issues and participate in collaborative problem-solving activities.							
CO3		Demonstrate social and civic responsibility by applying engineering knowledge in real-world social contexts.							
CO4		Develop teamwork, leadership, and democratic values through community mobilization and shared responsibility.							
CO5		Respond effectively to emergencies and promote national integration, unity, and social harmony through participation in relevant campaigns and awareness programs.							
Practice Session									
No		Contents						CO Mapped	
1		Cleanliness Drive (Swachh Bharat Abhiyan) Conduct campus and neighbourhood cleaning. Raise awareness about hygiene and waste segregation.						1,2,3	
2		Tree Plantation Plant saplings in college or public areas. Educate the community on environmental benefits.						1,3	
3		Road Safety Campaign Conduct rallies, skits, or poster campaigns. Spread awareness about traffic rules and safe driving.						2,3,5	
4		Health Check-up Camp Organize basic health screening with medical professionals. Promote hygiene, nutrition, and disease prevention.						1,2,5	
5		Literacy Drive Teach basic reading and writing to underprivileged children or adults. Distribute learning materials and encourage regular attendance.						1,3,5	
6		Voter Awareness Campaign (SVEEP) Inform citizens about voter rights and the election process. Promote ethical voting through posters and street plays.						2,3,5	
7		Plastic-Free Campus Initiative Educate peers on the harmful effects of plastic. Conduct collection drives and promote reusable alternatives.						2,3	
8		Cultural and Heritage Promotion Organize folk art, dance, and storytelling sessions. Engage the community in preserving local culture.						3,5	
9		Yoga and Wellness Sessions Conduct yoga and mindfulness sessions for students and locals. Promote physical and mental health through regular practice.						3,4	
10		Self-Defence Training for Girls Organize practical training on basic self-defence techniques. Empower girls with safety awareness and confidence.						4,5	

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11	Social Contribution Orphanage/ Old age home visit Hold discussions or exhibitions on gender, caste, and social equality. Encourage inclusive behavior and respect for diversity.	3,4,5
12	Digital Literacy Program Teach basic smartphone and internet use to the elderly or untrained groups. Promote safe and productive use of digital tools	2,3,5
Total Practical Sessions		15
Total Practical Hours		30
References:		
1. NSS Course Manual, Published by NSS Cell, VTU Belagavi.		
2. Government of Karnataka, NSS cell, activities reports and its manual.		
3. Government of India, nss cell, Activities reports and its manual.		


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Course Information:								
Class, Semester		FY. B.Tech, Semester – I				Category	CC	
Course Code, Course Title		3BSCC126,Cultural Exploration & Heritage				Type	L2	
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits		
		-	-	2	-	1		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	-
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Identify and describe key elements of cultural heritage including tangible, intangible, and natural heritage with real-life examples.							
CO2	Demonstrate understanding of regional and national cultural practices through participation in experiential activities.							
CO3	Analyze the significance of preserving cultural heritage in the context of globalization and modernization.							
CO4	Collaborate in group projects to creatively document and present cultural themes using various mediums.							
CO5	Reflect critically on personal and collective cultural identities through journals, discussions, and presentations.							
Practice Session								
No	Contents						CO Mapped	
1	Introduction to Cultural Exploration and Heritage Understand the meaning of tangible, intangible, and natural heritage, Discuss real-life examples of cultural elements. Reflect on how culture shapes identity.						1,5	
2	Heritage Mapping/ Case Study on a Heritage Site Choose a local region or community. Identify and locate key cultural sites (temples, festivals, crafts). Create a visual or digital heritage map. Present findings in written or visual format						1,3,4	
3	Vaidik Tal Vadya Songs and Music tradition Introduction to Vedic Music, Demonstration of Vaidik Tal Vadya, Listening Session of Vedic Chants &Samagana, Group Singing of a Vedic Verse or Traditional Bhajan						2, 5	
4	Folk Dance Watch or participate in folk dance. Discuss the significance, costumes, and music of each. Compare cultural roots and evolution.						2, 4	
5	Traditional Music Dholki ,Tabala, Dhol ,LezimListen to selected regional or classical music samples. Identify the instruments, lyrics, and cultural setting.						2, 4	
6	Traditional Instrumental Taal, Tritaal, Tabala Observe or perform simple rhythms or melodies. Explore the cultural and ceremonial use of instruments.						1, 2	
7	Singing Types of singing, Vocal Singing Introduction to music fundamentals						2, 4	
8	Drama Introduction, Types, Information about acting, Stage information , Present / performance on stage						4,5	
9	Classical dance, Western dance Introduction to classical, and western dance demonstrations. Different types						2, 4	
10	Karaoke Singing Introduction, Types, Basic music information						2, 4	


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11	Short film Prepare short film , Present / performance on stage , Topic concern with Indian Cultural heritage	3, 4, 5
12	Final Showcase Present all your work in a class exhibition. Explain the cultural significance of each project. Receive peer and teacher feedback.	4, 5
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1. Nrutasaubha Manjiri ShriramDev XII 2015		
2. Indian Art and Culture , NitinSinghanian McGraw Hill Education IV 2022		
3. The Wonder That Was India Picador India Second2004		
4. The National Culture of India National Book Trust (NBT), India Second2016		
References:		
1. Bhattacharyya, Haridas, editor. <i>The Cultural Heritage of India</i> . The Ramakrishna Mission Institute of Culture, multiple volumes, revised ed.		
2. Singhanian, Nitin. <i>Indian Art and Culture</i> . 4th ed., McGraw Hill Education, 2022.		
3. Basham, A. L. <i>The Wonder That Was India</i> . Picador India, 2004.		
4. Jokilehto, Jukka. <i>A History of Architectural Conservation</i> . 2nd ed., Routledge, 2017.		


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Annasaheb Dange College of Engineering and Technology, Ashta

Department of Artificial Intelligence and Data Science



AD CET

Structure and Curriculum Contents

B. Tech (Second Year)

Revision -2

SEM – III to SEM – IV

(Academic Year 2026-2027)

 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science														
Course Information:															
Class, Semester		S.Y. B.Tech, Semester - III					Category	PC							
Course Code, Course Title		2ADPC201, Statistical Analysis and Computing					Type	T1							
Prerequisites		2ADBS110													
Teaching Scheme (per week)		Lecture		Tutorial		Practical		Self-Study		Credits					
		3		1		-		4		4					
Examination Scheme (Marks)		Theory		MSE		TE		ESE		Practical		CIA		ESE	
				40		20		40				-		-	
Course Outcomes (COs):															
Upon successful completion of this course, the student will be able to:															
CO1		Solve real-world engineering problems by applying concepts of random variables and probability distributions, with appropriate interpretation of probabilistic results.													
CO2		Evaluate real-world engineering problems by applying appropriate hypothesis testing techniques, with accurate statistical analysis and interpretation of results.													
CO3		Determine optimal strategies for real-world decision-making problems using game theory principles and solution methods, with appropriate justification of results.													
CO4		Compute solutions to engineering and mathematical problems using fuzzy sets and fuzzy numbers, with accurate interpretation of results.													
CO5		Determine solutions to engineering problems by applying differential and vector calculus concepts, with accurate computation and interpretation of results.													
Syllabus:															
Module		Contents										Lecture Hours			
I		Univariate and Bivariate Random Variables: Basics of probability, Random variable, Types of random variables, Probability mass function, probability density function, Expectation, mean and variance of a random variable. Two-dimensional random variable, Joint Probability mass function, Marginal Probability mass function and conditional Probability function, Joint probability density function, Marginal probability density function, Independent random variable, Applied analysis of real datasets to study relationships between variable										7			
II		Probability Distributions: Discrete Probability Distribution: Binomial Distribution, Poisson Distribution, Hypergeometric Distribution. Continuous Probability Distribution: Exponential Distribution, Uniform Distribution, Normal Distribution										8			
III		Testing of Hypothesis : Introduction to Population and Sample, Parameters and Statistics, Concept of Hypothesis Testing, Advanced sampling methods for statistical inference Large Sample Tests: Tests for means: Tests for single population mean, Tests for equality of two population means. Small Sample Tests: t-tests, Chi-Square Test, Tests for single population variance, Test for goodness of fit of given probability distribution., Model validation and variable significance techniques										8			
IV		Game Theory Introduction, Two-Person Zero Sum Game, Maximin-Minimax Principle, Algebraic Method and Arithmetic Method, Dominance Principle, Sub-Game Method, Graphical Method										7			

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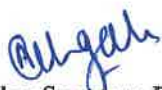
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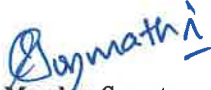
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V	Fuzzy Sets and Fuzzy Numbers. Basic concepts of Fuzzy Sets, Crisp Set and Fuzzy Set, Membership Functions, alpha and strong alpha cut of fuzzy sets and properties, Basic operations on fuzzy sets, Fuzzy Numbers, Fuzzy Cardinality.	7
VI	Differential and Vector Calculus Rolle's Theorem, Lagrange's Mean Value Theorem, Cauchy's Mean Value Theorem (without proof), applications and geometrical interpretations, vector functions, vector differential operator (∇ , del), gradient of scalar functions, directional derivative, divergence of vector fields, curl of vector fields, solenoidal vector fields, irrotational vector fields	8
Total Lecture Hours		45
List of Tutorials with CO Mapping		
S. No	Title / Topic of the Experiment	CO Mapped
1.	Expectation and Variance of Random Variables	1
2.	Joint, Marginal, and Conditional Probabilities	1
3.	Discrete Probability Distributions: Binomial, Poisson, Hypergeometric	1
4.	Continuous Probability Distributions: Exponential, Uniform, Normal	1
5.	Large Sample Tests for Means	2
6.	Small Sample Tests: t-Test, Chi-Square, Variance	2
7.	Two-Person Zero-Sum Games	3
8.	Graphical and Algebraic Methods	3
9.	Fuzzy Sets and Membership Functions	4
10.	Operations and Fuzzy Numbers	4
11.	Mean Value Theorems and Applications	5
12.	Gradient, Divergence, and Curl of Vector Fields	5
Total Tutorial Hours		15
Text Books		
1. Dr. B. S. Grewal, Higher Engineering Mathematics, 44 Edition, Khanna Publication, 2017		
2. Kanti Swarup, P. K. Gupta & Man Mohan, Operations Research, Sultan Chand & Sons, 20th Edition, 2022		
3. George J. Klir& Bo Yuan, Fuzzy Sets & Fuzzy Logic Theory and Applications, Pearson Education, 2nd Edition, 2015.		
4. H. K. Das, Advanced Engineering Mathematics, 22th Edition, S. Chand, 2018.		
5. B. V. Ramana, Higher Engineering Mathematics, 6th Edition, Tata McGraw Hill Publ., 2010		
References:		
1. S. C. Gupta & V. K. Kapoor, Fundamentals of Mathematical Statistics, Khanna Publishers, 12th Edition, 2020		
2. J.K. Sharma, Operation Research, Laxmi Publications, 6th Edition 2016		
3. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Publishers, 9th Edition, 2013		
Online Learning Resources		
Probability and Statistics	https://www.youtube.com/playlist?list=PLvuGwBYgypHZdTELi81ZStK_ScUk6Jqut	
Fuzzy Sets and Fuzzy Numbers.	https://www.youtube.com/playlist?list=PLbRMhDVUMngeASctgzKLElpgFNZmWwqRI	
Vector Calculus	https://www.youtube.com/playlist?list=PLbRMhDVUMngfIrZCNOvPZwHUUlpP66vQW	
Game Theory	https://www.youtube.com/playlist?list=PLOzRYVm0a65fY-Vh8Caiv3wAYmDd7SnrN	


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Course Information:							
Class, Semester	SY. B.Tech, Semester – III					Category	PC
Course Code, Course Title	2ADPC202, Data structures and algorithms					Type	LIT1
Prerequisites	2ADES105						
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Self Study	Credits		
	3	-	2	3	4		
Examination Scheme (Marks)	Theory	MSE	TA	ESE	Practical	CIA	ESE
		40	20	40		50	50
Course Outcomes (COs) :							
Upon successful completion of this course, the student will be able to:							
CO1	Explain the fundamental concepts of data structures, algorithms, and their time and space complexity for given computational problems using complexity measures, accurately.						
CO2	Implement linear data structures by performing insertion, deletion, searching, and traversal operations for given problem statements using appropriate programming techniques, efficiently.						
CO3	Demonstrate the representation and traversal techniques of non-linear data structures for given problem scenarios using appropriate traversal methods, accurately.						
CO4	Analyze sorting and searching algorithms for given computational problems and datasets using time and space complexity, appropriately.						
Syllabus:							
Module	Contents					Lecture Hours	
I	Introduction to Data Structures: Data, Data Object, Data types, Abstract Data Types (ADT), Data structures, Classification of Data Structure: primitive and non-primitive, Static and Dynamic, Direct and Indirect recursion, analysis of recursive functions e.g. Towers of Hanoi Introduction to Algorithms: Definition and Characteristics of an algorithm, Algorithm Specification, Introduction to algorithm design strategies Performance Analysis- Time and space complexity, Asymptotic notations, Best, Average and worst cases. Finding complexity using step count method, Analysis of programming Constructs-Linear, Quadratic, Cubic, Logarithmic, Case Study: Online Examination Result Processing System					8	
II	Linear Data Structures: Linked List Introduction to Static and Dynamic Memory Allocation, Linked List: Introduction, of Linked Lists, Realization of linked list using dynamic memory management, operations, Types of Linked List: singly linked, linear and Circular Linked Lists, Doubly Linked List, Primitive Operations on Linked List-Create, Traverse, Search, Insert, Delete, Sort, Case study: A music player application uses a doubly linked list to store songs in a playlist. Users can navigate forward and backward through the playlist. Each song node contains data about the song and references to both the previous and next songs.					8	
III	Linear Data Structures: Stack and Queue Stacks as ADT, operations, representation using static and dynamic structures, applications of stack Queue as ADT, operations, representation using static and dynamic structures, circular queue, priority queue, double ended queue. Case study: 1. Stack: Undo/Redo Feature in Text Editors. 2 Queue: In a network router, a queue is used to buffer packets for transmission. The packets arrive in order and are transmitted in the same order, ensuring smooth data flow through the network. In a real-time system, a deque could be used to handle urgent tasks at both ends of the queue					7	

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IV	Non Linear Data Structures: Tree Tree-Definitions and Concepts, Representation of binary tree, Binary tree traversal (Inorder, postorder, preorder), Threaded binary tree, Binary search trees, Conversion of General Trees To Binary Trees, Applications Of Trees Some balanced tree mechanism, eg. AVL trees, 2-3 trees, Height Balanced, Weight Balance, Red Black Trees Case study: 1 Student Record Management System using BST 2 Organization Structure of college	7
V	Non Linear Data Structures: Graphs Basic concept of graph theory, storage representation: adjacency matrix, adjacency list, adjacency multi-lists, graph traversal techniques- BFS and DFS. Graph-Matrix Representation Of Graphs, Elementary Graph operations,(Breadth First Search, Depth First Search) Case study :GPS/ navigation system that models a city map as weighted graph	7
VI	Searching and Sorting Techniques Linear search, binary search, Internal and External Sorts, bubble sort, selection sort, insertion sort, merge sort, quick sort, radix sort, heap sort. Hashing – Definition, hash functions, overflow, collision, Collision resolution techniques, Open addressing, Chaining. Case Study: Library Book Management and Retrieval System	8
Total Lecture Hours		45
S.No	Title / Topic of the Experiment	CO Mapped
1	Write a program to perform operations based on array, function, pointer, structures	1
2	Write a program to perform Implement Singly Linked List to perform following operations: Create, Insert, Delete, Display, Search, Reverse	2
3	Implement Doubly Linked List to perform following operations: Create, Insert, Delete, Display, Search	2
4	Implement Circular Linked List to perform following operations: Create, Insert, Delete, Display, Search, Reverse	2
5	Write a program to implement Stack ADT – Static and Dynamic	2
6	Write a program to implement Queue ADT – Static and Dynamic	2
7	Write a program to implement Binary Search Tree (BST) with insertion and deletion	3
8	Write a program to implement Graph using adjacency list and traversal	3
9	Write a program to implement Searching – Linear, Binary and Hashing algorithm	4
10	Write a program to perform Sorting using Bubble, Selection, Insertion sorting techniques	4
11	Write a program to perform Sorting – Merge and Quick	4
12	Micro project - Design and develop real-life application using data structure	1-4
Total Practical Sessions	15	Total Practical Hours
		30
Text Books		
1. Reema Thareja, "Data Structures Using C", 2nd Edition, Oxford University Press, 2019, ISBN 978-0-19-948285-0.		
2. R. Gillberg, B. Forouzn —Data Structures: A Pseudo code approach with C, Cenage Learning, ISBN: 9788131503140.		
3. Seymour Lipschutz, "Data Structures Using C (Schaum's Outline Series)", 1st Edition, McGraw-Hill Education, 1998, ISBN 978-0070378688.		
References:		
1. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson, 1997, ISBN 0-201-36121-3.		
2. Yedidyah Langsam, Moshe J. Augenstein, Aaron M. Tenenbaum, "Data Structures Using C", 2nd Edition, Pearson, 2006, ISBN 978-8177581144. Hill,2007		
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, "Introduction to Algorithms", 3rd Edition, MIT Press, 2009, ISBN 978-0262033848.		
4. Adam Drozdek, "Data Structures and Algorithms in C", 2nd Edition, Cengage Learning, 2012, ISBN 978-0534491827.5		
Online Learning Resources		

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Online Learning Resources

1. NPTEL, "Introduction to Data Structures", By Dr Gurpreet Singh Lehal Link:

https://onlinecourses.swayam2.ac.in/cec25_hs62/preview

2. NPTEL, "Data Structures" By Dr. M. Deivamani

Link: https://onlinecourses.swayam2.ac.in/cec25_ma15/preview

Experiments that may be performed through virtual labs:

S.No	Experiment Name	Experiments Links
1.	Linked List Experiment	IIIT Hyderabad – List of Data Structure Experiments https://ds1-iiith.vlabs.ac.in/exp/linked-list/overview.html? Virtual Laboratory : https://ds1-iiith.vlabs.ac.in/data-structures-1/ https://ds2-iiith.vlabs.ac.in/data-structures-2/ http://cse01-iiith.vlabs.ac.in/


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Course Information:								
Class, Semester	SY. B.Tech, Semester – III						Category	PC
Course Code, Course Title	2ADPC203, Operating Systems						Type	LIT2
Prerequisites	2ADPC108							
Teaching Scheme (per week)	Lecture	Tutorial		Practical		Self Study	Credits	
	3	-		2		3	4	
Examination Scheme (Marks)	Theory	MSE	TA	ESE	Practical	CIA	ESE	
		40	20	40		50	-	
Course Outcomes (COs) : Upon successful completion of this course, the student will be able to:								
CO1	Explain operating system concepts, inter-process communication, and multithreading using operating system principles, accurately.							
CO2	Apply process scheduling and synchronization techniques for process management using appropriate algorithms and mechanisms, effectively.							
CO3	Analyze deadlock, memory management, and virtual memory techniques using appropriate operating system strategies, efficiently.							
CO4	Analyze file systems, page replacement, disk scheduling, and I/O subsystem techniques using appropriate operating system algorithms, appropriately.							
Syllabus:								
Module	Contents						Lecture Hours	
I	Overview Introduction to Operating Systems, Operating System functions, Computer System organization, Operating System Architecture, Operating System Structure, Operating System operations, Types of Operating Systems, Operating System Services, User - Operating System interface, System calls, Types of system Calls, System programs, Kernel, Types of kernel.						7	
II	Process Management Process concept: Operations on processes, Inter-process communication, Multi-Threaded Models, Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms (First Come First Serve (FCFS), Shortest Job First (SJF), Shortest Remaining Time First (SRTF), Priority Scheduling, Round Robin (RR))						8	
III	Process Synchronization Background, the critical section problem, Peterson’s solution, synchronization hardware, semaphores, classic problems of Synchronization						7	
IV	Deadlock System model, deadlock characterization, methods for handling Deadlocks (deadlock preventions, deadlock avoidance, deadlock detection, deadlock recovery)						7	
V	Memory Management: Memory management strategies: Background; Contiguous memory allocation; Paging; Structure of page table; Segmentation. Swapping Virtual Memory Management: Background; Demand paging; Copy-on-write; Page replacement; Allocation of frames; Thrashing.						8	

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VI	Storage Management & I/O Subsystem File System: File concept, access methods, directory and disk structure, file-system mounting, file sharing, protection, Overview of I/O system, I/O hardware, Application I/O interface, Kernel I/O subsystem. Case study: UNIX/Linux file system and I/O subsystem		8
	Total Lecture Hours		45
S.No	Title / Topic of the Experiment		CO Mapped
1	Installation of Linux/Windows Operating Systems		1
2	Study and demonstration of basics of Linux/UNIX commands.		1
3	Program to implement Inter-Process Communication (IPC) using Pipes / Message Queues.		1
4	Program based on CPU Scheduling Algorithms.		2
5	Program to simulate producer-consumer problem using semaphores.		2
6	Program to demonstrate critical section and mutual exclusion.		2
7	Program based on Bankers algorithm for Deadlock Avoidance.		3
8	Program to convert Resource Allocation Graph (RAG) into Wait-For Graph (WFG) and detect deadlock using Wait-For Graph.		3
9	Program to simulate Paging technique of memory management.		3
10	Program based on Page Replacement Policies.		4
11	Program based on various I/O System calls of UNIX operating System.		4
12	Implementation of Disk Scheduling using FCFS, SCAN and C-SCAN algorithm		4
Total Practical Sessions		15	Total Practical Hours
			30
Text Books			
1. Silberschatz, Galvin, Operating System Concepts, 8th Edition, John Wiley, 2009			
2. Dhananjay Dhamdhare, Operating Systems: A Concept-Based Approach, McGraw-Hill Education, 16 February 2008			
References:			
1. Charles Crowley, Operating System A Design Oriented Approach, McGraw Hill Education, July 2017			
2. Achyut S.Godbole, Operating System with Case Studies in Unix, Netware and Windows NT,5th, Tata McGraw Hill,2007			
3. William Stallings, Operating Systems Internals and Design Principles,8 th , Pearson Education International,2014			
4. Mark G. Sobell, A practical Guide to Unix system V,2 nd , Benjamin cummings Pub.,2005			
Online Learning Resources			
1. NPTEL Course on Real Time Operating System ,by Prof. Rajib Mall, https://onlinecourses.nptel.ac.in/noc26_cs47/preview			
Experiments that may be performed through virtual labs:			
S.No	Experiment Name	Experiments Links	
1.	To Implement File Allocation Strategies	https://erpjietuniverse.in/virtual_lab/Operating_system/labs/exp9/index.html	

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Course Information:							
Class, Semester	SY. B.Tech, Semester - III					Category	PC
Course Code, Course Title	2ADPC204 , Foundations of AI with Ethics					Type	LIT1
Prerequisites	2ADES104						
Teaching Scheme (per week)	Lecture 3	Tutorial -	Practical 2	Self Study 3	Credits 4		
Examination Scheme (Marks)	Theory	MSE 40	TE 20	ESE 40	Practical	CIA 50	ESE 50
Course Outcomes (COs) :							
Upon successful completion of this course, the student will be able to:							
CO1	Explain the fundamentals of Artificial Intelligence, intelligent agents, and search techniques for given AI problem scenarios using AI concepts, intelligent agent models, and search algorithms, accurately.						
CO2	Solve AI problems for given problem scenarios using AI problem-solving methods, intelligent agents, and probabilistic reasoning techniques, effectively.						
CO3	Solve knowledge-based AI problems for given knowledge representation scenarios using first-order logic, unification, forward chaining, backward chaining, and resolution techniques, accurately.						
CO4	Evaluate AI planning solutions and responsible AI applications for given real-world AI scenarios using AI planning techniques and ethical principles, appropriately.						
Syllabus:							
Module	Contents					Lecture Hours	
I	AI Introduction Introduction – Definition – Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to AI problems.					8	
II	Problem Solving Methods Search Strategies- Uninformed - Informed - Heuristics & Meta Heuristics Algorithms Local Search Algorithms and Optimization Problems – Constraint Satisfaction Problems - Optimal Decisions in Games					7	
III	Software Agent Systems Introduction to Logical Agents, Uncertainty-Probability -Inference-Independence and Bayes' Rule- Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Multi Agent systems					8	
IV	Knowledge Representation First order logic, Syntax and semantics for first order logic, Knowledge engineering in first order logic, Inference in First order logic, prepositional versus first order logic– Unification and Lifting – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation					7	
V	Planning Classical Planning- algorithms for Classical Planning- Heuristics for planning- hierarchical planning- non deterministic domains- time, schedule and resources – analysis					8	
VI	Ethics Introduction to Ethics in AI – Privacy - Degrees of Privacy - Modern Privacy Risks - Algorithmic Fairness, Anonymity and Data Validity, Case Studies / Applications: Targeted Ads, Algorithms and Race, Self Driving Cars, Autonomous Weapons					7	
Total Lecture Hours						45	

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List of Experiments with CO Mapping			
S.No	Title / Topic of the Experiment		CO Mapped
1	Implement Search Strategies 8 Puzzle Problem		1
2.	Implement Search Strategies 8 Queens problem		2
3	Implement Crypt arithmetic.		2
4	Implement A* Algorithms		2
5	Implement Minimax Algorithm for game playing		2
6	Solve constraint satisfaction problems		2
7	Implement propositional model checking algorithms		3
8	Implement forward chaining, backward chaining		3
9	Implement resolution strategies		3
10	Micro Project		4
Total Practical Sessions		15	Total Practical Hours
			30
Text Books			
1. Artificial Intelligence –A Modern approach, Stuart J. Russell, Peter Norwig, Pearson Education 3rd 2016			
2. Artificial Intelligence Elaine Rich And Kevin Knight Tata McGraw Hill Publishing Company, New Delhi, 2014			
References:			
1. Prolog: Programming for Artificial Intelligence, I. Bratko Addison-Wesley Educational Publishers Inc. Fourth edition 2015			
2. The Quest for Artificial Intelligence Nils J. Nilsson Cambridge University Press 6th 2013			
3. Artificial Intelligence: Foundations of Computational Agents David L. Poole and Alan K. Mackworth Cambridge University Press 2012			
4. Multi Agent Systems Gerhard Weiss MIT Press Second Edition 2013			
Online Learning Resources			
1. https://onlinecourses.nptel.ac.in/noc25_cs88/preview			
2. https://nptel.ac.in/courses/112103280			
3. https://onlinecourses.nptel.ac.in/noc21_ge20/preview			

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Course Information:								
Class, Semester		SY. B.Tech , Semester - III				Category	VSEC	
Course Code, Course Title		2ADVS205, Object Oriented Programming using C++				Type	L2	
Prerequisites		2ADES105						
Teaching Scheme (per week)		Lecture	Tutorial		Practical	Self Study	Credits	
		-	-		2	-	1	
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			--	--	--		50	--
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Explain object-oriented programming concepts, including classes, objects, member functions, constructors, and function overloading, for modular software applications using object-oriented programming principles, accurately.							
CO2	Apply object-oriented design principles, including constructors, destructors, operator overloading, and encapsulation, for efficient and reusable software solutions using appropriate programming techniques, effectively.							
CO3	Demonstrate object-oriented programming principles, including friend functions, inheritance, and polymorphism, for flexible and maintainable software applications using object-oriented programming concepts, accurately.							
CO4	Develop software applications using file handling and exception handling techniques for efficient data management and runtime error handling, effectively.							
List of Experiments with CO Mapping								
S.No	Title / Topic of the Experiment						CO Mapped	
1	Write a C++ program to create a class Student with data members (roll no, name, marks) and member functions to read and display student details.						1	
2	Write a C++ program to demonstrate function overloading for the following prototypes. • add(int a, int b) • add(double a, double b)						1	
3	Write a C++ program to implement default arguments and returning value by reference using a class Calculator.						1	
4	Write a Program to Generate Fibonacci Series use Constructor to Initialize the Data Members.						2	
5	Write a C++ program that illustrates the order of execution of constructors and destructors when new class is derived from more than one base class.						2	
6	Write a Program to Demonstrate the i) Operator Overloading. ii) Function Overloading						2	
7	Write a Program to Demonstrate Friend Function and Friend Class.						3	
8	Write C++ programs that illustrate how the following forms of inheritance are supported: a) Single inheritance b) Multiple inheritance c) Multi level inheritance d) Hierarchical inheritance						3	
9	Write a Program to Invoking Derived Class Member Through Base Class Pointer						3	
10	Write a C++ program to create a text file, check file created or not, if created it will write some text into the file and then read the text from the file.						4	
11	Write a C++ program to write and read time in/from binary file using fstream						4	

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12	Write a function which throws a division by zero exception and catch it in catch block. Write a C++ program to demonstrate usage of try, catch and throw to handle exception.	4
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1. E. Balagurusamy, Object Oriented Programming with C++, McGraw-Hill Publication, 6th Edition, 2013.		
2. Dr. B. B. Meshram, Object Oriented Paradigms with C++ Beginners Guide for C and C++, SPD Publication, 1st Edition, 2016.		
3. Rajesh R. Shukla, Object-Oriented Programming in C++, Wiley India Publication, 1st Edition, 2008.		
References:		
1. Robert Lafore, Object Oriented Programming in C++, Sams Publishing, 4th Edition, 2001		
2. Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley Publication, 4th Edition, 2013.		
3. P. J. Deitel, H. M. Deitel, C++ How to Program, PHI Publication, 9th Edition, 2012.		
4. John Hubbard, Programming with C++, Schaum's Outlines, McGraw-Hill Publication, 2nd Edition, 2000.		
5. Nicolai M. Josuttis, Object-Oriented Programming in C++, Wiley Publication, 1st Edition, 2002.		
Online Learning Resources		
1. http://www.spoken-tutorial.org/NMEICT Project of Govt. Of India.		
Experiments that may be performed through virtual labs:		
S.No	Experiment Name	Experiments Links
1.	Understand subtype polymorphism in C++/Java	https://oop-amrt.vlabs.ac.in/exp/subtype-polymorphism/
2	Implement association relationship between classes using C++	https://oop-amrt.vlabs.ac.in/exp/association-relationship/


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Course Information:					
Class, Semester	SY. B.Tech, Semester - III			Category	VSEC
Course Code, Course Title	2ADVS206, Data Analysis using tools			Type	L2
Prerequisites	-				
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Self-Study	Credits
	-	-	2	-	1
Examination Scheme (Marks)	Theory	MSE	TE	ESE	Practical
		-	-	-	CIA 50
					ESE -
Course Outcomes (COs) :					
Upon successful completion of this course, the student will be able to:					
CO1	Explain the Preprocessing of datasets by applying appropriate data preparation techniques using business intelligence software tools, ensuring data quality and readiness for analysis.				
CO2	Analyze datasets using suitable analytical methods and software tools to derive accurate, meaningful, and interpretable insights.				
CO3	Develop visualizations, reports, and dashboards to communicate analytical findings for informed and evidence-based decision-making.				
CO4	Implement data-driven solutions for real-world applications using appropriate data analysis tools and techniques, meeting specified problem requirements and validating the results.				
List of Experiments with CO Mapping					
S.No	Title / Topic of the Experiment				CO Mapped
1	Study of Data Analysis and Business Intelligence Tools (Excel, Cognos, Power BI) and comparison of their features.				1
2	Perform Data Cleaning Operations in Excel: Removing duplicates, handling missing values, correcting inconsistencies.				1
3	Implement Text Functions in Excel (LEFT, RIGHT, MID, LEN, TRIM) for data preprocessing.				1
4	Apply Data Validation, Error Handling, and Date-Time Functions for business datasets.				1
5	Perform Data Sorting, Filtering, and Conditional Formatting for sales and customer datasets.				2
6	Implement Logical Functions (IF, AND, OR, Nested IF) for business decision-making scenarios.				2
7	Perform Data Lookup Operations using VLOOKUP, HLOOKUP, INDEX-MATCH, and XLOOKUP.				2
8	Create and Analyze Pivot Tables and Pivot Charts for business performance analysis.				2
9	Perform What-if Analysis using Goal Seek and Scenario Manager for financial forecasting.				2
10	Design Interactive Dashboards in Excel using charts, slicers, and KPI indicators.				3
11	Create Advanced Data Visualizations: Histogram, Scatter Plot, Sparklines, and Combo Charts.				3
12	Develop a Business Performance Dashboard using Excel for sales, finance, or student performance data.				3
13	Create Data Modules and Reports using IBM Cognos Analytics from multiple data sources.				3
14	Design Interactive Dashboards in Cognos using filters, drill-down, and drill-through features.				4

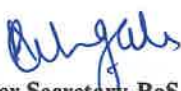

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15	Micro Project: Business Intelligence Solution Development (Sales Analysis / Financial Analysis / Student Performance Analysis) using Excel and Cognos/Power BI.	5
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1. Wayne Winston, Microsoft Excel Data Analysis and Business Modeling, Microsoft Press, 2016.		
2. Conrad Carlberg, Statistical Analysis with Excel, Pearson Education, 2018.		
3. IBM Corporation, IBM Cognos Analytics User Guide, IBM Documentation, Latest Edition.		
Reference Books		
1. Bill Jelen, Excel 2021 Inside Out, Microsoft Press, 2021.		
2. Stephen Few, Show Me the Numbers: Designing Tables and Graphs to Enlighten, Analytics Press, 2012.		
Online Learning Resources		
1. IBM Cognos & Excel Course: https://www.coursera.org/learn/data-visualization-dashboards-excel-cognos		
2. Microsoft Excel Support: https://support.microsoft.com/excel		
3. IBM Cognos Official: https://www.ibm.com/products/cognos-analytics		


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Course Information:								
Class, Semester		S.Y. B.Tech, Semester III					Category	HS
Course Code, Course Title		2ADHS207, Foreign Language - German					Type	T2
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self-Study	Credits		
		2	-	-	2	2		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-
Course Outcomes(COs):								
Upon successful completion of this course, the student will be able to:								
CO1	Explain basic German vocabulary, grammar, pronunciation, and common expressions used in everyday communication.							
CO2	Apply basic German language skills to communicate in familiar situations through listening, speaking, reading, and writing activities.							
CO3	Apply appropriate German vocabulary, sentence structures, and grammar to engage in simple conversations and respond to routine personal and social situations.							
CO4	Prepare simple written texts such as emails, messages, and short paragraphs in German using appropriate vocabulary and grammatical structures.							
Syllabus:								
Module	Contents							Lecture Hours
	PRE TERM SECTION							
1	Introduction to German Language • Introduction to German language and culture • German alphabets • Pronunciation and phonetics • Greetings and farewells • Classroom expressions • Basic vocabulary							10
2	Self-Introduction and Basic Communication • Personal pronouns • Verbs Haben and Sein • Verb conjugation • Introducing oneself and others • Numbers (0–1000) • Days of the week • Basic sentence structure • W-Fragen (Question Words)							10
3	Countries, Languages and Daily Communication • Countries and nationalities • Languages • Asking and answering simple questions • Yes/No questions • Articles (Definite and Indefinite) • Simple conversations							10
	IN TERM SECTION							
4	Friends, Family and Hobbies • Talking about friends and colleagues • Family members • Hobbies and interests							

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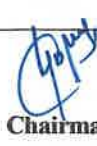


	• Daily routine • Possessive articles • Describing people	10
5	Time, Dates and Appointments • Days, months and seasons • Telling time • Dates and birthdays • Making appointments • Invitations • Apologizing • Modal verbs	10
6	Work and Workplace Communication • Occupations and professions • Workplace vocabulary • Talking about studies and work • Telephone conversations • Job advertisements • Expressing opinions about jobs	10
7	City, Transport and Directions • Places in a city • Means of transport • Asking for and giving directions • Enquiring information • Imperative forms • Negation • Definite and indefinite articles	10
SELF-STUDY SECTION		
8	Food, Shopping and Restaurants • Food and beverages • Shopping conversations • Ordering food • Paying bills • Akkusativ case • Verbs with Akkusativ • Restaurant communication	10
9	Home, Communication and Writing Skills • Describing home and surroundings • Understanding advertisements • Likes and dislikes • Letters and emails • Understanding texts • Dativ case • Dativ prepositions • Wechselpräpositionen	10
10	Social Life, Past Events and Fashion • Planning activities with friends • Event information and radio announcements • Separable verbs • Personal pronouns • Präteritum of Haben and Sein • Perfekt tense and Partizip II • Conjunctions (und, oder, aber) • Clothes and fashion • Demonstrative and interrogative articles • Verbs with Dativ	10
Total Lecture Hours		100


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Text Books:

1. Netzwerk neu A1 Kursbuch Goyal publishers & Distributors Pvt. Ltd. First Indian reprint 2020 Reprinted 2023
2. Netzwerk neu A1 Übungsbuch Goyal publishers & Distributors Pvt. Ltd. First Indian reprint 2020 Reprinted 2023

References:

1. Fit fürs Goethe -Zertifikat A1 Start Deutsch 1 Hübner


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Course Information:								
Class, Semester		S.Y. B.Tech, Semester III				Category	HS	
Course Code, Course Title		2ADHS208, Foreign Language - Japanese				Type	T2	
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self-Study	Credits		
		2	-	-	2	2		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-
Course Outcomes(COs):								
Upon successful completion of this course, the student will be able to:								
CO1	Explain basic Japanese vocabulary, grammar, pronunciation, and common expressions used in everyday communication.							
CO2	Apply basic Japanese language skills to communicate in familiar situations through listening, speaking, reading, and writing activities.							
CO3	Apply appropriate Japanese vocabulary, sentence structures, and grammar to engage in simple conversations and respond to routine personal and social situations.							
CO4	Apply appropriate Japanese vocabulary and grammatical structures to compose simple written texts such as emails, messages, and short paragraphs.							
Syllabus:								
Module	Contents						Lecture Hours	
MODULE 1 - PRE-TERM								
I	Introduction to Japanese Language and Culture - Overview of Japanese language and culture - Japanese writing systems: Hiragana, Katakana, Kanji - Basic pronunciation and phonetics - Greetings according to time of day - Classroom and workplace expressions - Asking for repetition and clarification - Basic etiquette and manners						10	
II	Self-Introduction and Personal Information - Introducing oneself and others - Name, nationality, occupation, and residence - Family members - Languages spoken - Basic sentence patterns - Introduction to Hiragana writing practice						10	
III	Hiragana and Katakana Mastery - Complete Hiragana characters - Complete Katakana characters - Reading and writing practice - Simple words and phrases - Listening and pronunciation exercises - Everyday vocabulary development						10	

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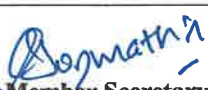
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IV	Food and Dining - Food and beverage vocabulary - Expressing likes and dislikes - Reading simple menus - Ordering food and drinks - Restaurant conversations - Japanese dining etiquette	10
V	Home, Family and Surroundings - Describing houses and rooms - Household objects and furniture - Family relationships - Location expressions - Counting objects and people - Describing surroundings	10
VI	Daily Life and Time Expressions - Telling time - Days, dates, and months - Daily routines - Operating hours and schedules - Borrowing and lending items - Making simple appointments	10
VII	Hobbies, Interests and Social Interaction - Hobbies and leisure activities - Sports, movies, music, manga, and anime - Inviting friends - Accepting and declining invitations - Expressing preferences and interests - Social conversations	10
MODULE 3 - SELF STUDY SECTION		
VIII	Transportation and Navigation - Public transportation vocabulary - Trains, buses, stations, and landmarks - Asking for directions - Giving simple directions - Understanding signs and notices - Travel-related conversations	10
IX	Shopping and Everyday Transactions - Shopping vocabulary - Asking for products and prices - Quantities and measurements - Locating items in stores - Purchasing goods - Customer-service interactions	10
X	Holidays, Experiences and Future Plans - Talking about past weekend activities - Introduction to simple past tense - Expressing wishes and desires - Travel plans and future intentions - Introduction to frequently used Kanji - Course review and consolidation - Speaking role-plays and presentations	10


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	• Speaking role-plays and presentations • Reading and writing assessment	
Total Lecture Hours		100
Text Books		
1. Irodori: Japanese for life in Japan (A1), The Japan Foundation, 2020		
Reference Books		
1. Marugoto Starter (A1) Katsudoo + Rikai (2 Books set) https://amzn.in/d/07fApBbW		
2. Genki: An Integrated Course in Elementary Japanese Vol. 1 [3rd Edition] https://amzn.in/d/0gXGM2Ef		
3. Minna no Nihongo 1-1&1-2 Main Textbook elementary +Translation & Grammatical with downloadable CDs. https://amzn.in/d/0dyQ9ips		


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Course Information:				
Class, Semester	S.Y. B.Tech, Semester III		Category	HS
Course Code, Course Title	2ADHS209, Psychology		Type	T2
Prerequisites	-			
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Credits
	1	-	-	1
Examination Scheme (Marks)	Theory	MSE	TA	ESE
		-	50	-
Course Outcomes(COs):				
Upon successful completion of this course, the student will be able to:				
CO1	Explain the fundamental concepts of decision making, emotional intelligence, emotional regulation, and procrastination in everyday personal, academic, and professional contexts.			
CO2	Differentiate between effective and ineffective thinking patterns, emotional responses, decision-making approaches, and behavioural strategies using psychological principles.			
CO3	Apply appropriate psychological principles and decision-making strategies to improve self-management, interpersonal effectiveness, and productivity in real-life situations.			
CO4	Evaluate the influence of cognitive biases, emotions, attention, and behavioural habits on decision making and personal effectiveness, and select appropriate corrective strategies.			
Syllabus:				
Module	Contents			Lecture Hours
I	Decision Making - Decision Making in Everyday Life - Why Smart People Make Poor Decisions - How Our Brain Makes Decisions (System 1 & System 2) - Cognitive Biases in Real Life - Decision-Making Frameworks - Thinking Tools			5
II	Understanding Emotional Intelligence - Understanding emotions and importance - EI vs IQ and 5 Domains of EI - Emotional Intelligence and Personality			3
III	Emotional Regulation & Interpersonal Skills - Impulse control (self-regulation) - Handling criticism (self-management) - Empathy and altruism (social awareness) - Assertiveness (relationship management)			3
IV	Procrastination - Introduction and definition of procrastination - Why do we procrastinate - Time management myths - Techniques to beat procrastination			4
Total Lecture Hours				15
Reference Books:				
1. "Thinking, Fast and Slow", Daniel Kahneman, Penguin Books, 2011				
2. Emotional Intelligence: Why It Can Matter More Than IQ", Daniel Goleman, Bantam Books, 1995				


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3. “Atomic Habits: An Easy & Proven Way to Build Good Habits & Break Bad Ones”, James Clear, Avery, 2018
4. “Deep Work: Rules for Focused Success in a Distracted World”, Cal Newport, Grand Central Publishing, 2016
5. “The Power of Habit: Why We Do What We Do in Life and Business”, Charles Duhigg, Random House, 2012
6. “Nudge: Improving Decisions About Health, Wealth, and Happiness”, Richard H. Thaler & Cass R. Sunstein, Penguin Books, 2008
7. “The 7 Habits of Highly Effective People”, Stephen R. Covey, Free Press, 1989
NPTEL and Online Resources
1. https://www.youtube.com/watch?v=O2y1QGCIzMw
2. https://www.youtube.com/watch?v=33d61cpRfog
3. https://www.youtube.com/watch?v=b6FpfGIENPo
4. https://www.youtube.com/watch?v=YLhGgef7SvA
5. https://www.youtube.com/watch?v=TOFjyi0tg5w


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Course Information:								
Class, Semester		S.Y. B.Tech, Semester III				Category	HS	
Course Code, Course Title		2ADHS210, Universal Human Values				Type	T2	
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self-Study	Credits		
		2	--	-	2	2		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-
Course Outcomes(COs):								
Upon successful completion of this course, the student will be able to:								
CO1	Explain the concept, significance, and need of Universal Human Values and their role in achieving harmony in personal, social, and professional life.							
CO2	Apply the principles of harmony, social responsibility, and environmental sustainability in day-to-day life and professional situations.							
CO3	Classify ethical issues in engineering, society, and emerging technologies using ethical principles and professional guidelines.							
CO4	Demonstrate value-based behaviour and ethical decision-making for personal growth and professional practice through self-reflection and case-based situations.							
Syllabus:								
Module	Contents						Lecture Hours	
I	Evolution and Need of Universal Human Values: Meaning and concept of Universal Human Values, Historical evolution of value systems, Impact of Industrial Revolution on society and lifestyle, Consequences of World War II and global conflicts, Emergence of global value frameworks, Role of United Nations and UNESCO, Introduction of UHV in Indian education system by AICTE, Present-day challenges: stress, lack of purpose, environmental issues						05	
II	Understanding the Human Being: Human being as a combination of self and body, Distinction between self (consciousness) and body (physical entity), Needs of self vs needs of body, Happiness vs physical pleasure, Harmony in the self (thoughts, feelings, actions), Self-exploration and self-awareness						05	
III	Harmony in Relationships: Meaning and importance of relationships, Values in relationships (Trust, Respect, Affection, Care, Guidance, Reverence, Love), Mutual fulfillment in relationships, Role of family in value development, Interpersonal conflicts and resolution, Relationship in professional environment						05	
IV	Harmony in Society and Nature: Individual → Family → Society → Nation → World, Concept of undivided society, Social harmony and responsibility, Coexistence in nature, Human-nature relationship, Environmental degradation and its causes, Sustainable living and resource utilization, Local and global environmental issues						05	
V	Universal Human Values in Engineering and Technology: Professional ethics in engineering, Role of engineers in society, Guidelines by IEEE, Ethical issues in modern technology, Role of institutions like OpenAI, Core Framework to Assess Values: Self-Reflection Model, Value-Action Gap Model, Emotional Intelligence (EQ) Framework (The Nine Values (Bhavas) Assessment Model)						05	

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VI	Application of UHV in Personal and Professional Life: Self-reflection and personal development, Value-based decision making, Goal setting with values, Fulfilling Basic Human Aspirations Application of UHV in career and workplace, Development of holistic and responsible lifestyle, Core Framework to Assess Values: Emotional Intelligence (EQ) Framework, (Human-AI Value Alignment) Ikigai Model	05
Total Lecture Hours		30
Text Books		
1. Human Values and Professional Ethics: R. R. Gaur, R. Sangal, G. P. Bagaria, Excel Books, New Delhi, 2010		
2. Engineering Ethics: Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2013		
3. Understanding Human Being, Nature and Existence Comprehensively: UHV Team, UHV, 2022.		
4. Life 3.0, Max Tegmark, Knopf, 2017		
References:		
1. AICTE Universal Human Values Course Material, 2017 onwards		
2. IEEE Code of Ethics		
3. Engineering Ethics: Charles E. Harris Jr., Michael S. Pritchard, Michael J. Rabins, Cengage Learning, 2013		
Online Learning Resources		
1. TED Talks on ethics, happiness, human behaviour		
2. NPTEL Courses on UHV and Engineering Ethics		
3. MIT: AI Ethics lectures (Open Courseware)		


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Course Information:								
Class, Semester		S.Y. B.Tech, Semester III				Category	MA	
Course Code, Course Title		2ADCC211, Aptitude and Reasoning- I				Type	T2	
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self-Study	Credits		
		2	--	-	2	-		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-
Course Outcomes(COs):								
Upon successful completion of this course, the student will be able to:								
CO1	Apply quantitative aptitude concepts such as HCF & LCM, Vedic Mathematics, Ages, Percentage, Profit & Loss to solve numerical and real-time problem-solving tasks efficiently.							
CO2	Analyze and solve logical reasoning problems based on Number Series, Alphabet Series, Coding-Decoding, Cubes & Dice by applying systematic analytical approaches.							
CO3	Develop professional and career readiness skills through SWOT Analysis, understanding of Engineering Ecosystem, effective email writing, and essay writing techniques.							
CO4	Demonstrate logical thinking, decision-making ability, and personality development skills to enhance employability and professional effectiveness.							
Syllabus:								
Module	Contents						Lecture Hours	
I	HCF & LCM Vedic Math						4	
II	Number Series, Alphabet Series (Quant) Percentage						4	
III	Profit & Loss Coding-Decoding						4	
IV	Cubes & Dice SWOT Analysis						4	
V	Introduction to Engineering Ecosystem Ages						4	
VI	Email writing, Essay writing Logical Thinking Basics						4	
Total Lecture Hours						24		
Text Books								
1. R.S. Agarwal ,S Chand ,Quantitative Aptitude,2019								
2. R.S. Agarwal ,S Chand ,Verbal & Non-verbal Reasoning,2010								
3. P.C. Wren ,S Chand,Wren & Martin (Verbal, Grammar) ,2017								
Reference Books								
1. Face Wiley ,APTIPEDIA (Quantitative, Logical, Verbal Aptitude) ,2017								
2. P.A. Anand ,Maestro ,Quantitative Aptitude,Wiley 2015								
3. Arun Sharma ,Meenakshi Upadhyay (Verbal Ability), McGraw Hill, 2020								


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Course Information:									
Class, Semester		SY. B.Tech, Semester – IV					Category	PC	
Course Code, Course Title		2ADPC212, Discrete Mathematics and Theory of Computation					Type	T1	
Prerequisites		2ADBS110							
Teaching Scheme (per week)		Lecture	Tutorial		Practical		Self Study		Credits
		2	1		-		3		3
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE	
			40	20	40		-	-	
Course Outcomes (COs) :									
Upon successful completion of this course, the student will be able to:									
CO1	Apply the concepts of discrete structures for mathematical and computational problems using appropriate mathematical techniques and representations, accurately.								
CO2	Apply the principles of abstract algebraic structures for theoretical computing problems using algebraic properties and operations, correctly.								
CO3	Use formal language techniques for language recognition problems using finite automata, regular expressions, and grammars, correctly.								
CO4	Analyze computational problems using appropriate models of computation and formal computational methods, accurately.								
Syllabus:									
Module	Contents							Lecture Hours	
I	Logic and Set theory: Logic- Proposition and Predicate Logic, Theory of Inference for Statement Calculus, Predicate Calculus, Proof of Techniques, Induction Set Theory: Basic concepts of set theory, operations on sets, ordered pairs, Cartesian Product, relation, properties of binary relations, matrix and graph representation, partition and covering of set.							6	
II	Relations and Functions: Relations and their Properties, n-ary relations and their applications, Representing relations, Closures of relations, Partial orderings, Partitions, Hasse diagram. Functions- Surjective, Injective and Bijective functions, Identity function, Partial function, Invertible function, Constant function, Inverse functions and Compositions of functions, The Pigeonhole Principle.							5	
III	Algebraic Systems: The structure of algebra, Algebraic Systems, Semi Groups, Monoids, Groups, Homomorphism and Normal Subgroups							4	
IV	Mathematical Induction, Regular Languages & Finite Automata : Regular expressions and corresponding regular languages, Finite automata-definition and representation, Minimization of DFA, Non-deterministic F.A.,NFA with epsilon to DFA conversion, Equivalence of FA's ..							5	
V	Grammar and Languages: Types of Languages, Derivation and ambiguity in CFL, Simplification of CFG, Conversion of CFG to CNF, Conversion of CFG to GNF, Pumping Lemma							5	
VI	Push Down Automata and Turing Machines PDA Definition, Deterministic PDA & types of acceptance, Equivalence of CFG's & PDA's.TM- Models of computation, definition of Turing Machine as Language acceptors, combining Turing Machines							5	
Total Lecture Hours							30		

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List of Tutorials with CO Mapping		
S. No	Title / Topic of the Experiment	CO Mapped
1	Logic and Propositional Calculus	1
2	Predicate Logic, Proof Techniques and Set Theory	1
3	Relations and Functions	1
4	Algebraic Structures	2
5	Regular Expressions and Finite Automata	3
6	DFA Minimization and NFA to DFA Conversion	3
7	Context-Free Grammar (CFG)	3
8	Pushdown Automata (PDA)	4
9	Turing Machines	4
10	Comprehensive Problem Solving	4
Total Tutorial Hours		15
Text Books		
1.	J. P. Tremblay & R. Manohar, Discrete Mathematical Structures with application to Computer Science, Tata MGH International, 2007	
2.	John C. Martin, Introduction to Languages & Theory of Computations, Tata McGraw-Hill Edition, 3 rd , 2007	
3.	John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Pearson Edition, 3 rd , 2006	
References:		
1.	Kenneth H. Rosen (AT&T Bell Labs), Discrete Mathematics and its Applications, Tata McGraw-Hill, 7 th 2012	
2.	Michael Sipser, Introduction to Theory of Computations, Cengage Learning, 3 rd , 2012	
3.	Kavi Mahesh, Theory of Computation – A Problem Solving Approach, Wiley India, 1 st , 2005	
Online Learning Resources		
1.	https://www.youtube.com/watch?v=WW7Y00b4QHs&list=PLEAYkSg4uSQ2Wfc_l4QEZUSRdx2ZcFziQ	


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Course Information:								
Class, Semester		SY. B.Tech, Semester - IV				Category	PC	
Course Code, Course Title		2ADPC213, Database Management Systems				Type	LIT1	
Prerequisites		2ADPC202						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits		
		3	-	2	3	4		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		50	50
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Explain database system concepts and architecture for effective data management with conceptual accuracy and appropriate technical understanding.							
CO2	Develop structured database solutions for real-world applications using appropriate database design and management techniques with correctness, efficiency, and compliance with database requirements.							
CO3	Analyze database performance and operations for effective optimization and improved database efficiency with accurate interpretation of performance factors.							
CO4	Evaluate database reliability and security mechanisms for ensuring integrity, availability, and data protection with justified decisions and adherence to database standards.							
Syllabus:								
Module	Contents						Lecture Hours	
I	Database Fundamentals & ER -Relational Model: Database Management Systems (DBMS), Database System Applications, Characteristics of the Database Approach, Advantages of DBMS, Disadvantages of DBMS, Database Architecture, File System vs DBMS, What is Data Independence, purpose of database system, Types of dataset, Entity-Relationship model, entities, attributes, relationships, constraints, ER diagrams, weak entities, mapping ER to relational model, E-R Diagrams, introduction to database design principles. Relational Model, Relational Model Concepts, Introduction to RDBMS : Working, Features and Difference, Introduction to vector database						8	
II	Relational Algebra & SQL: Relational algebra operations (selection, projection, join, division), introduction to SQL, DDL, DML, DCL, Embedded SQL, constraints: Concept of keys: primary, candidate, foreign, Set operations aggregate functions, nested queries, Subqueries, views, triggers, SQL join operations: Inner Join, Left Join, Right Join, Full Join, PL-SQL: Introduction, Basic Syntax, Data Types, Variables, Operators, Loops, Cursors, Procedures Funtions, Exceptions						8	
III	Functional Dependency & Normalization: Importance of good schema, Motivation of Normalization forms Functional dependencies, Multi-valued Dependencies, Join Dependencies, Closure of Set FDs, attribute closure, types of dependencies, normalization: - 1NF, 2NF, 3NF, BCNF, decomposition, design of good relational schemas.						7	
IV	Storage, Indexing & Query Processing: Data Storage & its Types, File organization, indexing primary, secondary, B+ tree, hashing techniques, introduction to query processing, query optimization basics.						8	
V	Transaction Management: Transaction concepts, ACID properties, Storage Structure, concurrency control locking, timestamp, serializability: Testing Serializability, Conflict serializability, deadlocks						8	

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VI	Recovery: Recovery techniques log-based recovery, checkpoints, Recovery Concepts, NO-UNDO/REDO recovery based on Deferred update, Recovery techniques based on immediate update, Shadow paging, Database backup and recovery from catastrophic failures, Crash Recovery	6
Total Lecture Hours		45
List of Experiments with CO Mapping		
S. No	Title / Topic of the Experiment	CO Mapped
1	Drawing an E-R Diagram for any organization and converting the E-R diagram into Relational Tables.	1
2	Design and create a database schema using SQL DDL commands	2
3	Construct tables with appropriate constraint, such as PRIMARY KEY, FOREIGN KEY, UNIQUE, and NOT NULL to ensure data integrity.	2
4	Execute SQL DML commands for data manipulation SQL DCL commands for access control	3
5	Perform SQL join operations to retrieve combined data like different types of joins (INNER JOIN, LEFT JOIN, RIGHT JOIN, FULL JOIN) to integrate data from multiple tables.	3
6	Apply aggregate functions for data analysis using functions like MAX, MIN, AVG, and COUNT to derive meaningful insights.	2
7	Construct complex queries, nested queries and subqueries using SELECT, WHERE, and FROM clauses.	4
8	Design and normalize a database schema & normalize up to 3NF/BCNF	4
9	Study and Implementation of Functions and Stored Procedures	4
10	Create and utilize views for data abstraction and security to simplify query complexity and enhance data security.	4
11	Design and implement database triggers to automate actions based on events such as INSERT, UPDATE, and DELETE.	4
12	Micro project: Implement a real-world database application.	1-4
Total Practical Sessions		15
Total Practical Hours		30
Text Books		
1. Database System Concepts, Abraham- Silberschatz, Henry F. Korth, S. Sudarshan, Publisher: McGraw-Hill, Edition: 7th Edition, Year: 2020 / 2021		
2. Fundamentals of Database Systems-Ramez Elmasri, Shamkant B. Navathe, Publisher: Pearson Education, Edition: 7th Edition, Year: 2016 / 2017		
References:		
1. Database Systems: A Practical Approach to Design, Implementation and Management, Thomas M. Connolly, Carolyn E. Begg, Pearson Education, 3rd Edition (or latest available in library), 2016 / 2017		
2. SQL, PL/SQL: The Programming Language of Oracle, Ivan Bayross, BPB Publications, 5th Edition, Year: 2023		
Online Learning Resources		
1. Database Management System – IIT Kharagpur, https://nptel.ac.in/courses/106105175		
2. Introduction to Database Systems – IIT Madras, https://nptel.ac.in/courses/106106220		
Experiments that may be performed through virtual labs:		
S.No	Experiment Name	Experiments Links
1.	ER Modeling from Problem Statement	https://se-iitkgp.vlabs.ac.in/exp/e-r-modeling/procedure.html
2.	Implementation and Analysis of User Authentication Mechanisms in Database Systems	https://ds-amrt.vlabs.ac.in/exp/user-authentication-mechanisms/


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Course Information:							
Class, Semester	SY. B.Tech, Semester -IV		Category	PE			
Course Code, Course Title	2ADPE214, Responsible Artificial Intelligence		Type	T1			
Prerequisites	2ADPC204						
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Self Study			
	3	-	-	3			
Examination Scheme (Marks)	Theory	MSE	TA	ESE			
		40	20	40			
Practical	CIA	ESE					
	-						
Course Outcomes (COs) :							
Upon successful completion of this course, the student will be able to:							
CO1	Describe the principles and lifecycle of Responsible AI for given AI systems, scenarios, and use cases with correct interpretation of ethical and Responsible AI principles and practices.						
CO2	Develop trustworthy AI systems for given AI applications and problem statements meeting fairness, explainability, privacy, security, and Responsible AI requirements.						
CO3	Analyze AI systems for given AI applications, ethical issues, and governance scenarios ensuring alignment with ethical, governance, and regulatory requirements for responsible and compliant AI deployment.						
CO4	Evaluate AI applications and case studies for given AI use cases and real-world scenarios with appropriate recommendations based on Responsible AI principles and evaluation frameworks.						
Syllabus:							
Module	Contents			Lecture Hours			
I	Introduction to Responsible AI : What is Responsible AI ?, Need and importance in modern AI systems, AI risks and societal impact, Key principles: fairness, accountability, transparency, privacy, Overview of AI lifecycle and ethical checkpoints.			7			
II	Bias, Fairness, and Explainability: Types of bias: data bias, algorithmic bias, Fairness metrics and evaluation, Bias mitigation techniques, Explainable AI (XAI) concepts, Tools: LIME, SHAP.			8			
III	Privacy, Security, and Safety : Data privacy concepts (PII, anonymization), Privacy-preserving techniques: differential privacy, federated learning, AI security risks: adversarial attacks, Safe AI system design, Robustness in AI models			8			
IV	AI Ethics and Governance: Ethical theories (utilitarianism, deontology), AI ethics principles by organizations like IEEE and OECD, AI governance frameworks, Responsible AI lifecycle management, Human-in-the-loop systems.			8			
V	Legal and Regulatory Frameworks : Overview of global AI regulations, GDPR, EU AI Act, Indian perspective on AI governance, Compliance and accountability.			7			
VI	Case Studies and Applications : AI failures (bias in hiring, facial recognition issues), Ethical issues in autonomous systems, AI in healthcare, finance, and surveillance, Case study discussions and analysis.			7			
Total Lecture Hours				45			
Text Books							
1. Artificial Intelligence: A Guide for Thinking Humans – Melanie Mitchell, Farrar, Straus and Giroux, 1st Edition 2019.							
2. Ethics of Artificial Intelligence – Nick Bostrom , Oxford University Press							

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Reference Books	
1.	Atlas of AI: Power, Politics, and the Planetary Costs of AI, Kate Crawford, Yale Univ. Press, 1st Edition 2021
2.	The Alignment Problem: Machine Learning and Human Values, Brian Christian, W. W. Norton & Company, 1st Edition, 2020.
3.	Human Compatible: Artificial Intelligence and the Problem of Control, Stuart Russell, Viking Press, 1st Edition 2019
Online Learning Resources	
1.	Google AI Responsible AI Practices
2.	Microsoft Responsible AI Guidelines
3.	UNESCO AI Ethics Recommendations


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Course Information:								
Class, Semester		SY. B.Tech, Semester -IV				Category	PE	
Course Code, Course Title		2ADPE215, Data Analytics				Type	T1	
Prerequisites		2ADPC202						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self Study	Credits		
		3	-	-	3	3		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Explain the concepts of data analytics, data analytics lifecycle, types of analytics, and the Python-based data analytics ecosystem using appropriate terminology with conceptual clarity.							
CO2	Implement preprocessing of datasets using appropriate data handling and transformation techniques with improved data quality for analysis.							
CO3	Analyze datasets by using appropriate exploratory data analysis techniques and suitable visualization methods to obtain meaningful insights.							
CO4	Implement predictive models using appropriate regression and classification techniques to evaluate model performance.							
CO5	Develop data analytics solutions using suitable analytics tools and techniques for real-world applications and informed decision-making.							
Syllabus:								
Module	Contents						Lecture Hours	
I	Introduction to Data Analytics Data, Information, Knowledge, Types of Analytics: Descriptive, Diagnostic, Predictive, Prescriptive, Data Analytics Lifecycle, Data sources and types, Python ecosystem for Data Analytics, Jupyter Notebook / Google Colab, NumPy fundamentals						7	
II	Data Handling and Preprocessing Introduction to NumPy, Data Collection and Loading Data, Data Cleaning Techniques, Handling Missing Values, Handling Outliers, Data Transformation and Scaling, Data Encoding Techniques Data Integration and Data Reduction, Introduction to Pandas						8	
III	Exploratory Data Analysis and Visualization Data Exploration using Pandas, Descriptive Statistics, Data Visualization Concepts, Histograms Bar Charts and Pie Charts, Box Plots, Scatter Plots, Correlation Analysis, Introduction to Feature Engineering						8	
IV	Predictive Analytics Introduction to Predictive Modeling, Simple Linear Regression, Multiple Linear Regression, Logistic Regression, Model Training and Testing, Overfitting and Underfitting, Cross-Validation Basics, Model Evaluation Metrics: Accuracy, Precision, Recall, F1-Score, R ² Score						8	
V	Data Analytics Tools and Techniques Advanced Data Manipulation using Pandas, Data Aggregation and Grouping, Data Filtering and Sorting, Merging and Joining Datasets, Data Visualization using Matplotlib, Data Visualization using Seaborn, Dashboard Concepts, Introduction to Power BI/Tableau						8	
VI	Applications of Data Analytics Time Series Analysis Basics, Introduction to Recommendation Systems, Web, Analytics Business Analytics, Healthcare Analytics, Financial Analytics-Commerce Analytics, Mini Case Studies and Project						6	
Total Lecture Hours						45		


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Text Books	
1.	Allen B. Downey, Think Stats: Exploratory Data Analysis in Python, 2nd Edition, O'Reilly Media, 2014
2.	Wes McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, O'Reilly Media, 2017
3.	Brian Caffo, Statistical Inference for Data Science, Leanpub / Johns Hopkins University, 2016
References:	
1.	Sheldon M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press, 5th Edition, 2014
2.	Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press, 1st Edition, 2020
3.	Field Cady, The Data Science Handbook, Wiley India, 1st, 2017
Online Learning Resources	
1.	https://www.youtube.com/@statquest/playlists
2.	https://www.youtube.com/@AlexTheAnalyst/videos


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Course Information:								
Class, Semester		SY. B.Tech, Semester - IV					Category	PE
Course Code, Course Title		2ADPE216, AI For Sustainable Development					Type	T1
Prerequisites		2ADHS208						
Teaching Scheme (per week)		Lecture	Tutorial		Practical	Self Study	Credits	
		3	-		-	3	3	
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			40	20	40		-	-
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1		Explain the fundamentals of AI and sustainability using AI concepts, sustainability principles, and Sustainable Development Goals (SDGs), accurately.						
CO2		Apply AI techniques and tools using appropriate datasets, software, and sustainability case studies for AI-based sustainability applications, effectively.						
CO3		Evaluate AI applications using ethical frameworks and real-world scenarios, appropriately.						
CO4		Analyze emerging trends in Sustainable AI using research literature and modern AI technologies, effectively.						
Syllabus:								
Module		Contents						Lecture Hours
I		Introduction to Sustainable AI Definition and Scope of Sustainable AI , Sustainability and AI, Key Trends in Sustainable AI, Sustainable Development Goals (SDGs), Ethical considerations in AI for society.						8
II		AI in Environmental Management Environmental Monitoring and Management, Geosciences and AI, Freshwater Management, Disaster Risk Reduction, Climate Change Assessments, Smart agriculture and precision farming, Renewable energy optimization, E-waste generation, Case studies of AI in environmental protection						8
III		AI Technologies and Tools Machine Learning fundamentals, Deep Learning and Neural Networks, Natural Language Processing (NLP), Computer Vision basics, Data collection, preprocessing, and visualization, AI tools and platforms (TensorFlow, Python libraries)						7
IV		AI for Social Sustainability Bias and fairness: Ensuring AI systems are fair. unbiased" and respectful of diversity, Job displacement: Mitigating the impact of AI-driven automation on employment and job markets., Social manipulation: Preventing AI-powered social manipulation and disinformation, Disaster prediction and management, Ethical AI and bias mitigation						7
V		Future Potential of AI in Scientific Research Advancements in AI Technologies, Quantum Computing, Data Quality and Management, IoT Enhancements, Ethical Frameworks for AI, AI and Public Trust, AI for Social Good, Future Challenges and Opportunities						7
VI		Research and Development Sustainable AI research: Encouraging research on sustainable AI development, deployment, and impact assessment. . AI for sustainability: Exploring AI applications that support sustainability. such as climate change mitigation and environmental monitoring. AI literacy and education: Promoting AI literacy, and education to ensure stakeholders understand AI's potential and limitations. Challenges in AI adoption for sustainability . Data privacy and security issues						8

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Text Books
1. Sætra, Henrik Skaug. "AI for the Sustainable Development Goals." CRC Press, February 2022.
2. Walker, Thomas, Stefan Wendt, Sherif Goubran, and Tyler Schwartz (Eds.). "Artificial Intelligence for Sustainability: Innovations in Business and Financial Services." Palgrave Macmillan Cham, DOI: https://doi.org/10.1007/978-3-031-49979-1
References:
1. Various academic papers and reports on Sustainable AI analyzing the intersection of artificial intelligence and sustainability, highlighting key challenges and opportunities from reputable sources such as IEEE, ACM, ScienceDirect, and governmental organizations.
2. The Quest for Artificial Intelligence Nils J. Nilsson Cambridge University Press 6th 2013
Online Learning Resources
1. https://onlinecourses.nptel.ac.in/noc25_cs88/preview

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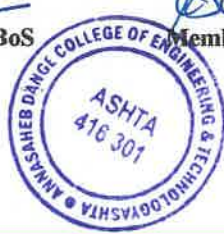
Course Information:							
Class, Semester	SY. B.Tech, Semester - IV					Category	MM
Course Code, Course Title	2ADAI217, Foundations of Artificial Intelligence					Type	LIT2
Prerequisites	2ADES104						
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Self Study		Credits	
	3	-	2	3		4	
Examination Scheme (Marks)	Theory	MSE	TA	ESE	Practical	CIA	ESE
		40	20	40		50	-
Course Outcomes (COs) :							
Upon successful completion of this course, the student will be able to:							
CO1	Explain the fundamentals of Artificial Intelligence and search techniques by using AI concepts, search algorithms, and illustrative examples with correct interpretation of AI principles.						
CO2	Solve AI problems by applying AI search methods, intelligent agents, and probabilistic reasoning with appropriate selection of AI techniques and reasoning methods.						
CO3	Solve knowledge-based AI problems by applying knowledge representation and logical reasoning using propositional and first-order logic with accurate logical inference.						
CO4	Evaluate real-world AI solutions by analyzing AI planning methods and AI applications with appropriate planning strategies and justified decision-making.						
Syllabus:							
Module	Contents						Lecture Hours
I	Introduction to Artificial Intelligence Definition and Scope of Artificial Intelligence, Evolution and Future Trends of AI, AI Paradigms and Interdisciplinary Nature, Intelligent Agents: Definition, Types, and Characteristics, Agent-Environment Interaction, Problem Formulation and Problem-Solving Approach in AI						7
II	Problem Solving and Search Techniques State Space Representation, Search Strategies:, Uninformed Search (BFS, DFS, Uniform Cost Search), Informed Search (Greedy Best First, A* Search), Heuristic Functions and Design Issues, Local Search Algorithms and Optimization Problems, Constraint Satisfaction Problems (CSP): Formulation and Backtracking.						8
III	Intelligent and Software Agent Systems Introduction to Logical Agents, Knowledge-Based Agents, Reasoning under Uncertainty Probability Theory and Basic Inference, Independence and Bayes' Rule, Architecture of Intelligent Agents, Multi-Agent Systems: Communication, Coordination, Negotiation and Bargaining among Agents						8
IV	Knowledge Representation and Reasoning Knowledge Representation Concepts, Propositional Logic: Syntax and Semantics, First, Order Logic (FOL): Syntax, Semantics, and Knowledge Engineering, Inference in First Order Logic, Unification and Lifting, Forward Chaining and Backward Chaining Resolution Principle, Comparison of Propositional Logic and First Order Logic						8
V	Planning and Decision Making Introduction to AI Planning, Classical Planning Problems, Algorithms for Classical Planning, Heuristic Planning Techniques, Hierarchical Planning, Planning in Non-Deterministic Domains, Time, Scheduling, and Resource-Constrained Planning, Analysis of Planning Systems						7

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VI	Applications of Artificial Intelligence Overview of AI Applications, Language Models and AI Assistants, Information Retrieval and Search Engines. Information Extraction Systems, Fundamentals of Natural Language Processing, Machine Translation Techniques, Basics of Speech Recognition Introduction to Robotics and Intelligent Robots		7
	Total Lecture Hours		45
	List of Experiments with CO Mapping		
S.No	Title / Topic of the Experiment		CO Mapped
1	Implement basic search strategies – 8-Puzzle, 8-Queens problem.		1
2.	Implement Crypt arithmetic		2
3	Implement A* algorithms		2
4	Implement memory bounded A* algorithms		2
5	Implement Minimax algorithm for game playing (Alpha-Beta pruning)		2
6	Solve constraint satisfaction problems		2
7	Implement propositional model checking algorithms		3
8	Implement forward chaining, backward chaining		3
9	Implement resolution strategies		3
10	Build naive Bayes models		2
11	Implement Bayesian networks and perform inferences		2
12	Implement AI Planning for a Robot Navigation Problem		4
Total Practical Sessions	15	Total Practical Hours	30
Text Books			
1. Artificial Intelligence –A Modern approach, Stuart J. Russell, Peter Norwig, Pearson Education 3rd 2016			
2. Artificial Intelligence Elaine Rich And Kevin Knight Tata McGraw Hill Publishing Company,New Delhi, 2014			
References:			
1. Prolog: Programming for Artificial Intelligence,I. Bratko Addison-Wesley Educational Publishers Inc. Fourth edition 2015			
2. The Quest for Artificial Intelligence Nils J. Nilsson Cambridge University Press 6th 2013			
3. Artificial Intelligence: Foundations of Computational Agents David L. Poole and Alan K. Mackworth Cambridge University Press 2012			
4. Multi Agent Systems Gerhard Weiss MIT Press Second Edition 2013			
Online Learning Resources			
1. https://onlinecourses.nptel.ac.in/noc25_cs88/preview			


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Course Information:								
Class, Semester		SY. B.Tech, Semester – IV					Category	PC
Course Code, Course Title		2ADPC218, Java Programming					Type	L1
Prerequisites		2ADVS205						
Teaching Scheme (per week)		Lecture	Tutorial		Practical	Self Study		Credits
		1	-		2	1		2
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	-	-		50	50
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1		Explain object-oriented programming concepts including classes, objects, inheritance, interfaces, packages, abstraction, encapsulation, and polymorphism using Java programming principles, accurately.						
CO2		Apply exception handling and file handling techniques for developing reliable and error-free Java applications using appropriate programming constructs, effectively.						
CO3		Develop graphical user interface (GUI) applications and implement multithreading and networking concepts using appropriate Java libraries and programming techniques, efficiently.						
CO4		Develop integrated Java applications using the Collections Framework, database connectivity (JDBC), and appropriate programming techniques to solve real-world problems, effectively.						
Syllabus:								
Module		Contents						Lecture Hours
I		Fundamental Programming in Java Object-Oriented Programming Concepts, JVM, JIT Compiler, Byte Code,, A Simple Java Program, Source File Declaration Rules, Comments, Data Types, Variables, Operators, Strings, Input and Output, Arrays- Jagged Array. Objects and Classes: Declaring Classes, Declaring Member Variables, Defining Methods, Constructor, Creating and using objects, Access Modifiers, Static Fields and Methods, this keyword.						3
II		Inheritance, Interface and Packaging Inheritance, Interface and Packaging Inheritance: Definition, Types of Inheritance, Polymorphism, Overriding and Hiding Methods, Super keyword, Final Classes and Methods, Abstract Classes and Methods, casting, finalization and garbage collection. Interfaces: Defining an Interface, Implementing an Interface Packages: Class importing, creating a Package, Naming a Package, Using Package Members.						2
III		Exception and I/O Streams Exception: Definition, Dealing with Errors, The Classification of Exceptions, Declaring Checked Exceptions, Throw an Exception, Creating Exception Classes, Catching Exceptions, finally clause,I/O Streams: Byte Stream – InputStream, OutputStream, FileInputStream, FileOutputStream, Character Streams.						2
IV		Graphical User Interfaces using Swing: Introduction to the Swing, Swing features, Swing Top Level Containers-Creating a Frame, Positioning a Frame, Displaying Information in a Panel, The Model-View-Controller Design Pattern, The JComponent Class – JLabel, JTextField, JButton etc. Layout Management: Border Layout, Flow Layout, Grid Layout Event Handling: Basics of Event Handling, The AWT Event Hierarchy, Key Events, Mouse Events						3

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V	Networking and Multithreading Multithreading: Processes and Threads, Runnable Interface and Thread Class, Defining and Starting a Thread, Thread States, Thread Properties, Networking: Overview of Networking, Networking Basics, Reading from and Writing to a URL Connection, Sockets, Reading from and Writing to a Socket.	3
VI	Collection and Database Programming Collections: Collection Interfaces, Concrete Collections- List, Queue, Set, Map, the Collections Framework. Database Programming: The Design of JDBC, The SQL, Basic JDBC Programming Concepts, Query Execution, Result Sets.	2
Total Lecture Hours		15

List of Experiments with CO Mapping

S.No	Title / Topic of the Experiment	CO Mapped
1	Implement a Java program to demonstrate the concept of Class and Object	1
2	Implement Java programs to demonstrate single, multilevel, and hierarchical inheritance	1
3	Implement multiple inheritance using Interface	1
4	Implement Java programs using Package and Sub-packages	2
5	Implement exception handling and user-defined exception in Java	2
6	Implement file read and write operations using Java I/O streams	2
7	Implement GUI-based application using Swing components	3
8	Implement GUI application using different Layout Managers	3
9	Implement multithreading using Thread class and Runnable interface	3
10	Implement client-server communication using Socket programming	4
11	Implement programs using Java Collections Framework	4
12	Implement Java application with Database Connectivity using JDBC	4
Total Practical Sessions		15
Total Practical Hours		30

Text Books

1. Cay Horstmann, Core Java- Volume I and II Fundamentals, 8th, Pearson ,2011.
2. Yashavant Kanetkar, Let Us Java ,3rd, BPB Publication ,2017.

References Books

1. Herbert Schildt, Java 2 Complete Reference, 9th, TMGH,2014.
2. Deitel Paul, JAVA HOW TO PROGRAM, Deitel Harvey,10th, PHI Learning ,2016.
3. Prentice Hall, Thinking in Java ,4th, Bruce Eckel ,2006.
4. Khaleed Mughal and Rolf W. Rasmussen, A Programmer's guide to JAVA SCJP Certification ,3rd, Addison Wesley,2008.

Online Learning Resources

1. NPTEL Course on Programming, Data Structures and Algorithms using Java, by Prof. Rajeev Kumar, IIT Kharagpur, <https://nptel.ac.in/courses/106105191>
2. Java Tutorials (Official Documentation), Oracle
<https://docs.oracle.com/javase/tutorial/>
3. Introduction to Java Programming, Geeks for Geeks
<https://www.geeksforgeeks.org/java/>
4. Java Programming Basics, Tutorials Point
<https://www.tutorialspoint.com/java/index.htm>

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5. Java Programming for Beginners, MIT Open Course Ware https://ocw.mit.edu/courses/6-092-introduction-to-programming-in-java-january-iap-2010/		
Experiments that may be performed through virtual labs:		
S.No	Experiment Name	Experiments Links
1.	Introduction to Java Programming Language	https://java-iitd.vlabs.ac.in/exp/introduction-java/


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	Course Information:						
Class, Semester	SY. B.Tech, Semester - IV			Category	HS		
Course Code, Course Title	2ADHS219, Indian Constitution			Type	T2		
Prerequisites	-						
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Self Study	Credits		
	1	-	-	1	1		
Examination Scheme (Marks)	Theory	MSE	TA	ESE	Practical	CIA	ESE
		-	50	-		-	-
Course Outcomes (COs) : Upon successful completion of this course, the student will be able to:							
CO1	Describe the evolution and salient features of the Indian Constitution using the Government of India Acts of 1935 and 1947.						
CO2	Illustrate the philosophy of the Indian Constitution using the Preamble, Fundamental Rights, Fundamental Duties, and Directive Principles of State Policy						
CO3	Explain the constitutional amendment process, principles of the Basic Structure, and emergency provisions under the Indian Constitution						
CO4	Summarize the structure and functioning of the Union and State Governments using the parliamentary and legislative systems.						
Syllabus:							
Module	Contents				Lecture Hours		
I	Constitution: Basic Structure & Making of Constitution Meaning of the constitution law and constitutionalism, Historical perspective of the constitution of India, Government of India Act of 1935 and Indian Independence Act of 1947, Enforcement of the Constitution, Meaning and importance of Constitution, Making of Indian Constitution – Sources, Salient features of Indian Constitution, Preamble.				04		
II	Fundamental Rights & Fundamental Duties Fundamental Rights – Features and characteristics, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles-Definition and Meaning, 42 nd Constitutional Amendment Act, List and Importance of Fundamental Duties.				06		
III	Amendments of Constitution and Emergency Provisions: Meaning and need of Constitutional Amendments, Procedure of Amendment under Article 368, Types of Amendments, Important Constitutional Amendments (42 nd , 44 th , 73 rd , 74 th , 86 th and 101 st Amendments), Basic Structure Doctrine. Emergency Provisions – Meaning and Objectives, National Emergency (Article 352), State Emergency/President's Rule (Article 356), Financial Emergency (Article 360), Effects of Emergency on Fundamental Rights and Centre-State Relations, Safeguards introduced by 44 th Constitutional Amendment.				03		
IV	Government of The Union and States: President of India – Election and Powers, Prime Minister of India - Election and Powers, Lok Sabha - Structure, Rajyasabha – Structure, Governor of State, Chief Minister and Council of Ministers in a state.				02		
Total Lecture Hours					15		
Text Books							
1. M. Laxmikanth, Indian Polity, 7th Edition, McGraw Hill Publications Delhi, 2023.							
2. P. M. Bakshi, The Constitution of India, 19th Edition, Lexis Nexis, 2023.							
3. Durga Das Basu, Introduction to the Constitution of India, 26th Edition, Lexis Nexis, 2022.							
4. M. Laxmikanth, Governance in India, 3rd Edition, McGraw Hill Publications Delhi, 2021.							

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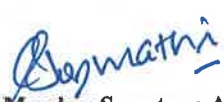
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5. J. N. Pandey, The Constitutional Law of India, 59th Edition, Allahabad: Central Law Agency, 2022.
References:
1. V. N. Shukla, Constitution of India, 14th Edition, EBC, 2022.
2. V. N. Tripathi, Constitution of India, 9th Edition, Premier Publishing Company, 2021.
3. M. V. Pylee, India's Constitution, 18th Edition, S. Chand Publications, New Delhi, 2020.
Online Learning Resources
1. https://legislative.gov.in/constitution-of-india/
2. nptel.ac.in/courses/129106003?utm


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Course Information:								
Class, Semester	SY. B.Tech, Semester - IV					Category	HS	
Course Code, Course Title	2ADHS220, Environmental Studies					Type	T2	
Prerequisites								
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Self Study		Credits		
	2	-	-	2		2		
Examination Scheme (Marks)	Theory	MSE	TA	ESE	Practical	CIA	ESE	
		-	50	-		-	-	
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Explain environmental systems, population dynamics, natural resources, and sustainability concepts.							
CO2	Explain the Sustainable Development Goals (SDGs) and their significance in engineering for sustainable development.							
CO3	Apply pollution concepts to identify sources, impacts, and suitable control measures for air, water, soil, and noise pollution.							
CO4	Apply principles of climate change mitigation and adaptation, renewable energy, waste management, and environmental governance to recommend sustainable engineering practices.							
Syllabus:								
Module	Contents						Lecture Hours	
I	Environmental Systems, Population, and Resource Use: Components of environment and earth systems, Population growth, urbanization, and industrial development, Natural resources: water, energy, land, minerals, Resource depletion, carrying capacity, and environmental stress, Human-environment interactions and sustainability challenges						5	
II	Sustainable Development Goals (SDGs) and Engineering Responsibility: Evolution of sustainable development concept, Overview of 17 Sustainable Development Goals and key targets, Interlinkages among SDGs (water-energy-food-climate nexus), SDGs relevant to engineering disciplines, Role of engineers in achieving SDGs						5	
III	Pollution Science and Environmental Quality: Air pollution: sources, types, impacts, and control overview, Water pollution: indicators, standards, reuse and recycling, Soil pollution: contamination sources and remediation concepts, Noise pollution: sources, measurement, impacts, and mitigation.						5	
IV	Climate Change – Science, Mitigation, and Adaptation: Greenhouse effect and climate change science, Evidence of climate change and observed impacts, Mitigation strategies: technology, energy transition, efficiency, Adaptation strategies: climate-resilient infrastructure and planning, Role of engineers in climate action.						5	
V	Renewable Energy and Sustainable Technologies: Overview of renewable energy technologies, Solar energy (PV and thermal systems), Wind energy systems, Hydropower, geothermal, ocean energy, Bioenergy and waste-to-energy, Comparative assessment of renewable technologies.						5	
VI	Waste Management, and Environmental Governance: Solid waste management and E-waste management, Life Cycle Assessment (LCA): concept and applications, Environmental policies and legislation (India and global overview), Environmental Impact Assessment (EIA), Ethics and professional responsibility of engineers						5	
Total Lecture Hours						30		

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Text Books:	
1.	Singh, J. S., Singh, S. P., Gupta, S. R., and Singh, R. Ecology, Environmental Science and Conservation. 2nd Edition. S. Chand Publishing, 2025.
2.	Bharucha, E. Environmental Studies for Undergraduate Courses. 4th Edition. Universities Press (India) Pvt. Ltd. 2025.
3.	Cunningham, W.P., & Cunningham, M.A., Environmental Science: A Global Concern, 15th Edition, McGraw-Hill Education, New Delhi, 2020.
4.	Rathoure, V.C., Fundamentals of Environmental Studies, 2nd Edition, Tata McGraw-Hill Education, New Delhi, 2019
5.	Singh, J.S., & Singh, S.P., Environmental Science: An Integrated Approach, 5th Edition, Jones & Bartlett Learning, 2019
6.	Kaushik, A., & Kaushik, C.P., Perspectives in Environmental Studies, 5th Edition, New Age International Publishers, New Delhi, 2018.
References:	
1.	Trivedi, R.K., & Goel, P.K., An Introduction to Environmental Biology, 1st Edition, University Book House, Jaipur, 2018.
2.	Odum, E.P., Fundamentals of Ecology, 5th Edition, Cengage Learning, 2017.
3.	Dash, M.C., Fundamentals of Ecology, 4th Edition, McGraw-Hill Education, New Delhi, 2016.
Online Learning Resources	
1.	https://www.youtube.com/watch?v=MtpxOdtS9KU&list=PL3qvHcrYGylu2egw2tipHWODV6elVC2Gg
2.	https://niti.gov.in/divisions/division/sustainable-development-goal


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Course Information:															
Class, Semester		SY. B.Tech, Semester - IV					Category	RM							
Course Code, Course Title		2ADRM221, Research Methodology					Type	L2							
Prerequisites		-													
Teaching Scheme (per week)		Lecture		Tutorial		Practical		Self Study		Credits					
		-		-		2		-		1					
Examination Scheme (Marks)		Theory		MSE		TA		ESE		Practical		CIA		ESE	
				-		-		-		50		-			
Course Outcomes (COs :															
Upon successful completion of this course, the student will be able to:															
CO1		Utilize fundamental concepts of research, research problems, literature sources, and research methodologies for engineering applications under given research scenarios.													
CO2		Apply appropriate research design, sampling techniques, and data collection methods to conduct systematic research studies under given problem statements.													
CO3		Analyze research data using qualitative, quantitative, statistical, and hypothesis testing techniques under given research scenarios.													
CO4		Develop a technical research article with ethical publication practices, appropriate referencing standards, and quality research guidelines.													
Syllabus:															
Module		Contents										Lecture Hours			
I		Research Fundamentals Meaning and objectives of research, Significance of research, Types of research, Research process, Criteria of Good Research, Importance of Research in Engineering										4			
II		Research Problem & Literature Review Meaning of Research Problem, Identification & Formulation of research Problem, Techniques for defining Research Problem, Literature Sources: Journals, Conferences, Patents, Use of Digital Libraries, Literature Review techniques and gap identification.										5			
III		Research Design & Methodology Need & Features of Good Research Design, Types of Research Design: Exploratory, Descriptive, Experimental, Sampling Techniques. Data Collection: Types of Data: Primary, Secondary, Methods of Data Collection: Survey, Questionnaire, Interview, Observation, Experimentation										6			
IV		Data Analysis & Testing of Hypothesis Types of data: Qualitative and Quantitative, Basic statistical tools: Mean, Median, Standard Deviation, Data representation: Tables, Graphs, Charts, Introduction to analysis tools, Interpretation of results, Hypothesis, Basic concepts concerning testing of hypothesis, Procedure for hypothesis testing, Flow diagram of hypothesis testing, Test of hypothesis, Hypothesis testing of Means, Hypothesis testing for differences between Means.										5			
V		Report Writing Introduction Technical Report Writing and tools (Latex), Significance of report writing, Steps in writing report, Types of reports, Layout and structure of reports, Documentation and Referencing Styles, Presentation Tools & Techniques: Zotero & Mendeley.										4			

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VI	Research Journals and Publication Ethics Research Journals, Types of Journals, Research Publication Process, Journal Indexing: Meaning and Importance of Journal Indexing, Benefits of Indexed Journals, Major Indexing Databases, (Scopus, Web of Science, Google Scholar, SCI, ESCI, and PubMed), Journal Metrics and Quality Indicators: Impact Factor, h-index, i10-index, CiteScore, SNIP and SJR, Types of Publications, Ethics in Research Publication: Plagiarism and Similarity Index (Turnitin Software), Copyright and Authorship, Duplicate Publication, Clone, Predatory, and Fake Journals, Researcher Profiles and Identifier (ORCID, Researcher ID)	6
Total Lecture Hours		30
Text Books		
1. Research Methodology–Methods and Techniques by C. R. Kothari, Second Edition, New Age International Publishers		
2. Dr. Santosh M Nejakar, Dr. Harish Bendigeri “Research Methodology and Intellectual Property Rights”, ISBN 978-93-5987-928-4, Edition: 2023-24		
Reference Books		
1. Research Methodology Concept and cases By Deepak Chawala and Neena Sondhi		
2. Research Methodology: Step by step guide for beginners, Ranjeet Kumar, 5 th Edition, SAGE Publications		
3. How to Write and Publish a Scientific Paper, Robert A. Day, Barbara Gastel, 8 th Edition: 8th Edition, Cambridge University Press		
NPTEL and Online Resources		
1. https://onlinecourses.swayam2.ac.in/e-learning/preview/ntr26_ed28		
2. https://onlinecourses.swayam2.ac.in/e-learning/course/nou26_ge46		

Note: For the smooth and effective execution of this course, the department shall allocate 02 lecture hours in the respective timetables in place of practical hours as per the resolution passed in STT meeting.

ISE Activities

1. Conduct a literature review in the selected domain, identify the research gap, and submit a Literature Review Report.
2. Prepare and submit a Technical Article on the chosen topic based on the literature review.

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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence and Data Science							
Course Information:								
Class, Semester	SY. B.Tech, Semester - IV			Category				
Course Code, Course Title	2ADEL222, Innovation and Product Development			EL				
Prerequisites	-			Type				
Teaching Scheme (per week)	Lecture	Tutorial	Practical	Credits				
	-	-	2	1				
Examination Scheme (Marks)	Theory	MSE	TA	ESE				
		-	-	-				
			Practical	CIA				
				50				
Course Outcomes (COs) :								
Upon successful completion of this course, the student will be able to:								
CO1	Identify innovative product ideas by observing real-world problems and user needs using creativity and design thinking tools.							
CO2	Apply design thinking techniques to generate and refine innovative solutions for identified engineering or societal problems based on user requirements.							
CO3	Construct functional prototypes and estimate preliminary production costs using appropriate materials, manufacturing methods, and engineering tools.							
CO4	Analyze prototype performance and production feasibility by interpreting testing results, cost data, and scalability requirements.							
CO5	Evaluate intellectual property opportunities, commercialization potential, and production planning based on technical feasibility, market requirements, and economic considerations.							
CO6	Develop a comprehensive entrepreneurial proposal integrating intellectual property protection, commercialization strategy, and production planning for an innovative product.							
Syllabus:								
The Innovation and Product Development course is designed to provide students with experiential learning in innovation, prototyping, product development, and commercialization. The course focuses on identifying real-world problems and transforming innovative ideas into functional prototypes/models/products through systematic design and development processes.								
Students will learn techniques for validating innovative concepts, assessing feasibility and utility, selecting suitable materials, along with a design-thinking approach and developing prototypes/models/products through iterative improvement and performance testing. The course also emphasizes expert reviews, prototype assessment, cost estimation, pricing strategies, and preliminary production planning for scalability.								
Further, students will gain exposure to Intellectual Property Rights (IPR), commercialization processes, and startup development, enabling them to prepare draft proposals for patenting, commercialization, or entrepreneurial ventures based on their innovative solutions.								


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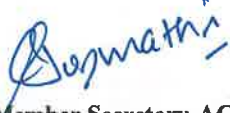

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INNOVATION AND PRODUCT DEVELOPMENT ACTIVITY PLAN

Sr. No	Innovation Prototype Course Activities	Planned Week
01	Introduction to Innovation and Prototyping	Week 1
02	Revising Design Thinking Approach	Week 2
03	Identifying Innovative Problems (Students & Faculty)	Week 3
04	Validating Innovation: Assessing Utility of a Proposed Concept	Week 4
05	Review No. 1 – by Guides - Innovativeness Assessment - (Final Idea Presentation)	Week 5
06	Planning and Designing the Prototype	Week 6
07	Choosing and Testing Materials for the Prototype	Week 7
08	Building the working Prototype / Model/ Product	Week 8
09	Improving working Prototype / Model/ Product	Week 9
10	Testing the Prototype / Model/ Product Performance	Week 10
11	Review No. 2 – by Expert Panel - Prototype/Model/Product Assessment along with poster	Week 11
12	Estimating Costs & Formulating a Pricing Strategy for Product	Week 12
13	Creating a Preliminary Production Plan for Scaling the Prototype	Week 13
14	Formulating IPR or Commercialization or Start up	Week 14
15	Review No. 3 – Submission of Draft Copy for IPR or Commercialization or Start up	Week 15


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 Established: 1999	Annasaheb Dange College of Engineering and Technology Ashta - 416301, Dist. : Sangli, Maharashtra (An Empowered Autonomous Institute) Department of Artificial Intelligence & Data Science							
Course Information:								
Class, Semester		S.Y. B.Tech, Semester IV				Category	MA	
Course Code, Course Title		2ADCC223, Aptitude and Reasoning-II				Type	T2	
Prerequisites		-						
Teaching Scheme (per week)		Lecture	Tutorial	Practical	Self-Study	Credits		
		2	-	-	2	-		
Examination Scheme (Marks)		Theory	MSE	TA	ESE	Practical	CIA	ESE
			-	50	-		-	-
Course Outcomes(COs):								
Upon successful completion of this course, the student will be able to:								
CO1		Apply quantitative aptitude concepts such as Partnership, Average, and Syllogism to solve numerical and logical problems effectively.						
CO2		Analyze and solve reasoning-based problems involving Seating Arrangements, Puzzles, and Direction Sense using systematic problem-solving approaches.						
CO3		Demonstrate professional communication and employability skills through presentation skills, grooming, body language, group discussions, and interview techniques for effective participation in hiring processes.						
CO4		Develop career readiness skills by preparing professional resumes, optimizing LinkedIn profiles, and applying networking strategies such as cold calling for internship and job opportunities.						
Syllabus:								
Module	Contents							Lecture Hours
I	Partnership Average							4
II	Seating Arrangements Puzzles							4
III	Syllogism Direction							4
IV	Presentation Skills Grooming & Body Language							4
V	Resume Writing LinkedIn Cold Calling							4
VI	Group Discussion Interview							4
Total Lecture Hours							24	
Text Books								
1. R.S. Agarwal ,S Chand ,Quantitative Aptitude ,2019								
2. R.S. Agarwal ,S Chand ,Verbal & Non-verbal Reasoning ,2010								
3. P.C. Wren , S Chand ,Wren & Martin (Verbal, Grammar) , 2017								
Reference Books								
1. Face ,Wiley ,APTIPEDIA (Quantitative, Logical, Verbal Aptitude), 2017								
2. P.A. Anand ,Maestro , Wiley (Quantitative Aptitude) ,2015								
3. Meenakshi Upadhyay ,Arun Sharma (Verbal Ability),McGraw Hill ,2020								

Member Secretary-BoS

Chairman -BoS

Member Secretary-AC

Chairman-AC

