

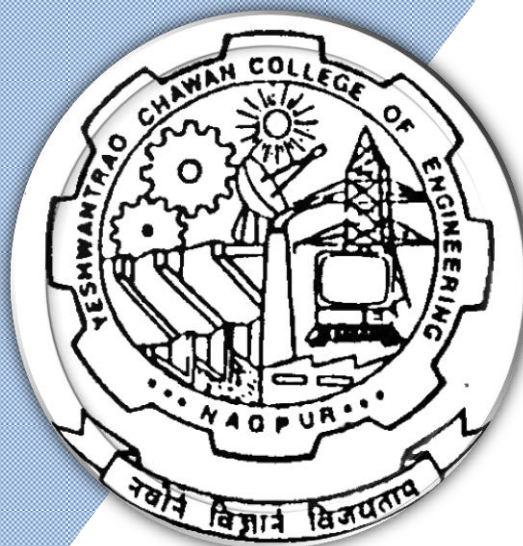
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology

SoE & Syllabus 2023

1st to 8th Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B.Tech. in Artificial Intelligence and Data Science

SoE No.
23ADS-101

SN	Sem	Type	BoS/Dept t	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-A)															
1	1	BS	GE	23GE1103	Differential Equations and Complex Analysis	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1110	Applied Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1111	Lab : Applied Physics	P	0	0	2	2	1		60	40	
4	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
5	1	BES	AIDS	23ADS1103	Foundations of Data Science	T	3	0	0	3	3	30	20	50	3
6	1	BES	AIDS	23ADS1104	Lab : Foundations of Data Science	P	0	0	2	2	1		60	40	
7	1	BES	AIDS	23ADS1101	C Programming	T	2	0	0	2	2	30	20	50	2
8	1	BES	AIDS	23ADS1102	Lab : C Programming	P	0	0	2	2	1		60	40	
9	1	VSEC1	GE	23GE1117	Get Set Go	...	...	...	...	...	2		60	40	
10	1	LLC1	GE		Liberal Learning Course (LLC1)	...	...	...	...	...	2		60	40	
TOTAL SECOND SEM							14	0	6	20	21				

MANDATORY LEARNING COURSES

1	2	HS		GE2131	Universal Human Values (UHV)	A	2	0	0	2	0				
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SECOND SEMESTER (GROUP-B)

1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1206	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1207	Lab : Engineering Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1213	Technical Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/AEC1	GE	23GE1214	Lab : Technical Communication	P	0	0	2	2	1		60	40	
6	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
7	2	BES	AIDS	23ADS1205	Computer Architecture and Organization	T	3	0	0	3	3	30	20	50	3
8	2	PC	AIDS	23ADS1206	Introduction to Object Oriented Concepts	T	3	0	0	3	3	30	20	50	3
9	2	PC	AIDS	23ADS1207	Lab : Introduction to Object Oriented Concepts	P	0	0	2	2	1		60	40	
10	2	VSEC2	GE	23GE1218	Functional English	...	...	...	...	...	2		60	40	
11	2	LLC2	GE		Liberal Learning Course (LLC2)	...	...	...	...	...	2		60	40	
TOTAL FIRST SEM							16	0	6	22	23				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activities decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		July, 2026	1.01	Applicable for AY 2026-27 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	



Yeshwantrao Chavan College of Engineering
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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B.Tech. in Artificial Intelligence and Data Science

SoE No.
23ADS-101

SN	Sem	Type	BoS/Dept	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS /Dept	Sub. Code	Subject
1	2	CC2	GE	LLC1201	Music (Vocal)
2	2	CC2	GE	LLC1202	Music (Instrumental)
3	2	CC2	GE	LLC1203	Indian Classical Dance
4	2	CC2	GE	LLC1204	Folk Dances
5	2	CC2	GE	LLC1205	Painting
6	2	CC2	GE	LLC1206	Theatre and acting
7	2	CC2	GE	LLC1207	Photography
8	2	CC2	GE	LLC1208	Yoga
9	2	CC2	GE	LLC1209	Chess
10	2	CC2	GE	LLC1210	Athletics
11	2	CC2	GE	LLC1211	Basket Ball
12	2	CC2	GE	LLC1212	Judo
13	2	CC2	GE	LLC1213	Elements of Japanese Language
14	2	CC2	GE	LLC1214	Elements of German Language
15	2	CC2	GE	LLC1215	Elements of French Language
16	2	CC2	GE	LLC1216	Elements of Spanish Language
17	2	CC2	GE	LLC1217	Basics of Vedic Maths
18	2	CC2	GE	LLC1218	Skilling in Microsoft Visio and Inkscape
19	2	CC2	GE	LLC1219	Art of Public Speaking

Liberal Learning Course

SN	Sem	Type	BoS /Dept	Sub. Code	Subject
1	1	CC1	GE	LLC1101	Music (Vocal)
2	1	CC1	GE	LLC1102	Music (Instrumental)
3	1	CC1	GE	LLC1103	Indian Classical Dance
4	1	CC1	GE	LLC1104	Folk Dances
5	1	CC1	GE	LLC1105	Painting
6	1	CC1	GE	LLC1106	Theatre and acting
7	1	CC1	GE	LLC1107	Photography
8	1	CC1	GE	LLC1108	Yoga
9	1	CC1	GE	LLC1109	Chess
10	1	CC1	GE	LLC1110	Athletics
11	1	CC1	GE	LLC1111	Basket Ball
12	1	CC1	GE	LLC1112	Judo
13	1	CC1	GE	LLC1113	Elements of Japanese Language
14	1	CC1	GE	LLC1114	Elements of German Language
15	1	CC1	GE	LLC1115	Elements of French Language
16	1	CC1	GE	LLC1116	Elements of Spanish Language
17	1	CC1	GE	LLC1117	Basics of Vedic Maths
18	1	CC1	GE	LLC1118	Skilling in Microsoft Visio and Inkscape
19	1	CC1	GE	LLC1119	Art of Public Speaking

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activities decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		July, 2026	1.01	Applicable for AY 2026-27 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	



Yeshwantrao Chavan College of Engineering
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SoE No.
23ADS-101

B.TECH SCHEME OF EXAMINATION 2023
(Scheme of Examination w.e.f. 2023-24 onward)
(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE	23GE1303	Linear Algebra	T	3	0	0	3	3	30	20	50	3
2	3	HSSM-1	GE	23GE1301	Fundamentals of Management & Economics	T	2	0	0	2	2	30	20	50	3
3	3	VEC-1	CV	23CV1311	Environmental Sustainability, Pollution and Management	T	2	0	0	2	2	30	20	50	3
4	3	PC	AIDS	23ADS1301	Statistics for Data Science	T	3	0	0	3	3	30	20	50	3
5	3	PC	AIDS	23ADS1302	Lab : Statistics for Data Science	P	0	0	2	2	1		60	40	
6	3	PC	AIDS	23ADS1303	Data Structures	T	3	0	0	3	3	30	20	50	3
7	3	PC	AIDS	23ADS1304	Lab : Data Structures	P	0	0	2	2	1		60	40	
8	3	CEP	AIDS	23ADS1305	Community Engagement Project	P	0	0	4	4	2		60	40	
9	3	OE-1	OE		Open Elective -I	T	2	0	0	2	2	30	20	50	3
10	3	MDM	CT		MD Minor Course-I	T	2	0	0	2	2	30	20	50	3
TOTAL							17	0	8	25	21				

List of Mandatory Learning Course (MLC)

1	3	HS	T&P	MLC2123	YCAP3 : YCCE Communication Aptitude Preparation	A	3	0	0	3	0				
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Open Elective - I

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chemistry and Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials and Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology and Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance and Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation and Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management and Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management
23	3	OE1	MGT	23OE1323	OE-I : Designated approved online NPTEL/KKSU Course
24	3	OE1	MGT	23OE1324	OE-I : Indian Archeology
25	3	OE1	MGT	23OE1325	OE-I : Social & Positive Psychology
26	3	OE1	MGT	23OE1326	OE-I : Seismology & Earthquake

		July, 2023	1.00	Applicable for AY 2023-24 Onwards
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SoE No.
23ADS-101

B.TECH SCHEME OF EXAMINATION 2023
(Scheme of Examination w.e.f. 2023-24 onward)
(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FOURTH SEMESTER															
1	4	HSSM-2	GE	23GE1401	Entrepreneurship Development	T	2	0	0	2	2	30	20	50	3
2	4	AEC-2	GE	23GE1405 23GE1406	Marathi Language Hindi Language	T	2	0	0	2	2	30	20	50	3
3	4	PC	AIDS	23ADS1401	Operating Systems	T	3	0	0	3	3	30	20	50	3
4	4	PC	AIDS	23ADS1402	Lab : Operating Systems	P	0	0	2	2	1		60	40	
5	4	PC	AIDS	23ADS1403	Advanced Data Structures	T	3	0	0	3	3	30	20	50	3
6	4	PC	AIDS	23ADS1404	Lab : Advanced Data Structures	P	0	0	2	2	1		60	40	
7	4	PC	AIDS	23ADS1405	Database Management Systems	T	3	0	0	3	3	30	20	50	3
8	4	PC	AIDS	23ADS1406	Lab : Database Management Systems	P	0	0	2	2	1		60	40	
9	4	PC	AIDS	23ADS1407	Lab : Java Full Stack	P	0	0	2	2	1		60	40	
10	4	VSEC-3	AIDS	23ADS1408	Lab : Python for Data Science	P	0	0	4	4	2		60	40	
11	4	VEC-2	AIDS	23ADS1409	Cyber Laws	T	2	0	0	2	2	30	20	50	3
12	4	OE-2	OE		Open Elective - II	T	2	0	0	2	2	30	20	50	3
13	4	MDM	AIDS		MD Minor Course - II	T	2	0	0	2	2	30	20	50	3
TOTAL							19	0	12	31	25				

List of Mandatory Learning Course (MLC)

1	4	HS	T&P	MLC2124	YCAP4 : YCCE Communication Aptitude Preparation	A	3	0	0	3	0				
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Open Elective - II

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management
23	4	OE2	MGT	23OE2423	OE-II : Designated approved online NPTEL/KKSU Course
24	4	OE2	MGT	23OE2424	OE-II : Indian Archeology
25	4	OE2	MGT	23OE2425	OE-II : Social & Positive Psychology
26	4	OE2	MGT	23OE2426	OE-II : Seismology & Earthquake

		July, 2023	1.00	Applicable for AY 2023-24 Onwards
Chairperson	Dean (Acad. Matters)	Date of Release	Version	



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**SoE No.
23ADS-101**

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	AIDS	23ADS1501	Artificial Intelligence	T	3	0	0	3	3	30	20	50	3
2	5	PC	AIDS	23ADS1502	Lab : Artificial Intelligence	P	0	0	2	2	1		60	40	
3	5	PC	AIDS	23ADS1503	Design and Analysis of Algorithms	T	3	0	0	3	3	30	20	50	3
4	5	PC	AIDS	23ADS1504	Lab : Design and Analysis of Algorithms	P	0	0	2	2	1		60	40	
5	5	PC	AIDS	23ADS1505	Therotical Foundation of Computer Science	T	3	0	0	3	3	30	20	50	3
6	5	PC	AIDS	23ADS1506	Fundamentals of Machine Learning	T	2	0	0	2	2	30	20	50	3
7	5	PE	AIDS		Professional Elective-I	T	3	0	0	3	3	30	20	50	3
8	5	PE	AIDS		Lab : Professional Elective-I	P	0	0	2	2	1		60	40	
9	5	OE-3	OE-3		Open Elective -III	T	3	0	0	3	3	30	20	50	3
10	5	MDM	AIDS		MD Minor Course-III	T	3	0	0	3	3	30	20	50	3
11	5	STR	AIDS	23ADS1507	Internship, Seminar and Report	P	0	0	2	2	1		60	40	
TOTAL							20	0	8	28	24				

List of Mandatory Learning Course (MLC)

1	5	HS	T&P	MLC2125	YCAPP5 : YCCE Communication Aptitude Preparation	A	3	0	0	3	0				
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Professional Elective - I

1	5	PE-I	AIDS	23ADS1521	PE-I : Computer Networks										
2	5	PE-I	AIDS	23ADS1522	PE-I : Lab : Computer Networks										
3	5	PE-I	AIDS	23ADS1523	PE-I : High Performance Computer Architecture										
4	5	PE-I	AIDS	23ADS1524	PE-I : Lab : High Performance Computer Architecture										
5	5	PE-I	AIDS	23ADS1525	PE-I : Financial Data Analytics										
6	5	PE-I	AIDS	23ADS1526	PE-I : Lab : Financial Data Analytics										
7	5	PE-I	AIDS	23ADS1527	PE-I : UI/UX Design										
8	5	PE-I	AIDS	23ADS1528	PE-I : Lab : UI/UX Design										
9	5	PE-I	AIDS	23ADS1529	PE-I : Advanced Probability and Statistics										
10	5	PE-I	AIDS	23ADS1530	PE-I : Lab : Advanced Probability and Statistics										

Open Elective - III

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	FACULTY
1	5	OE3	CSE	23OE3501	OE-III : Social Reformers in Modern Maharashtra	ARTS
2	5	OE3	CSE	23OE3502	OE-III : Independent India 1948-2010	ARTS
3	5	OE3	CT	23OE3503	OE-III : Introduction To Cognitive Psychology	ARTS
4	5	OE3	CT	23OE3504	OE-III : Introduction To Engineering Psychology	ARTS
5	5	OE3	CT	23OE3505	OE-III : Introduction To Behavioural Psychology	ARTS
6	5	OE3	CT	23OE3506	OE-III : Introduction To Emotional Psychology	ARTS
7	5	OE3	EL	23OE3507	OE-III : Elements of Public Administration	ARTS
8	5	OE3	ETC	23OE3508	OE-III : Ancient Indian History	ARTS
9	5	OE3	IT	23OE3509	OE-III : Consciousness Studies	ARTS
10	5	OE3	IT	23OE3510	OE-III : Psychology for Professionals	ARTS
11	5	OE3	IT	23OE3511	OE-III : Introduction to Sociology and Human Behavior	ARTS
12	5	OE3	GE	23OE3512	OE-III : Economics of Money and Banking	ARTS
13	5	OE3	GE	23OE3513	OE-III : Economics of Capital Market	ARTS
14	5	OE3	GE	23OE3514	OE-III : Digital Humanities	ARTS
15	5	OE3	GE	23OE3515	OE-III : Introduction to Political Science	ARTS
16	5	OE3	CT	23OE3516	OE-III : Bhagwat Geeta - An Engineer's Interpretation	ARTS - IKS
17	5	OE3	CT	23OE3517	OE-III : Artha shastra by Kautiliya	ARTS - IKS
18	5	OE3	CSD	23OE3518	OE-III : Glimpses of Ancient science and Technology	ARTS - IKS
19	5	OE3	CV	23OE3519	OE-III : Indian taxation system	COMMERCE
20	5	OE3	CV	23OE3520	OE-III : Elements of share trading	COMMERCE
21	5	OE3	EE	23OE3521	OE-III : Introduction to Fintech	COMMERCE
22	5	OE3	EE	23OE3522	OE-III : Financial Analytics	COMMERCE
23	5	OE3	ETC	23OE3523	OE-III : Fundamentals of Investments	COMMERCE
24	5	OE3	EE	23OE3524	OE-III : Lifestyle Diseases	HEALTHCARE & MEDICINE
25	5	OE3	EE	23OE3525	OE-III : Holistic Nutrition	HOME SCIENCE
26	5	OE3	EL	23OE3526	OE-III : Community Organization & Development	HOME SCIENCE
27	5	OE3	CSE	23OE3527	OE-III : Human Rights & International Laws	LAW
28	5	OE3	CSE	23OE3528	OE-III : Cyber Crime Administration	LAW
29	5	OE3	MATHS	23OE3529	OE-III : Finite Differences & Numerical Methods	SCIENCE
30	5	OE3	MATHS	23OE3530	OE-III : Business Statistics	SCIENCE
31	5	OE3	PHY	23OE3531	OE-III : Crystalline Solids: Properties and Applications.	SCIENCE
32	5	OE3	PHY	23OE3532	OE-III : Nanotechnology: Fundamental to Applications	SCIENCE
33	5	OE3	CHE	23OE3533	OE-III : Chemistry in daily life	SCIENCE
34	5	OE3	CHE	23OE3534	OE-III : Battery Systems and Management	SCIENCE
35	5	OE3	NPTEL	23OE3535	OE-III : Designated approved online NPTEL Course	NPTEL

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(Scheme of Examination w.e.f. 2023-24 onward)
(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	AIDS	23ADS1601	Computer Vision	T	2	0	0	2	2	30	20	50	3
2	6	PC	AIDS	23ADS1602	Lab : Computer Vision	P	0	0	2	2	1		60	40	
3	6	PC	AIDS	23ADS1603	Natural Language Processing	T	2	0	0	2	2	30	20	50	3
4	6	PC	AIDS	23ADS1604	Lab : Natural Language Processing	P	0	0	2	2	1		60	40	
5	6	PC	AIDS	23ADS1605	Design Thinking and Research Methodology	T	2	0	0	2	2	30	20	50	3
6		PE	AIDS		Professional Elective-II	T	3	0	0	3	3	30	20	50	3
7	6	PE	AIDS		Lab : Professional Elective-II	P	0	0	2	2	1		60	40	
8	6	PE	AIDS		Professional Elective-III	T	2	0	0	2	2	30	20	50	3
9	6	PE	AIDS		Lab : Professional Elective-III	P	0	0	2	2	1		60	40	
10	6	MDM	AIDS		MD Minor Course-IV	T	3	0	0	3	3	30	20	50	3
11	6	VSEC-4	AIDS	23ADS1606	Lab : Competitive Coding	P	0	0	4	4	2		60	40	
12	6	STR	AIDS	23ADS1607	Project Phase-I	P	0	0	4	4	2		60	40	
TOTAL							14	0	16	30	22				

List of Mandatory Learning Course (MLC)

1	6	HS		MLC126	YCAP6 :	A	3	0	0	3	0				
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Professional Elective - II

1	6	PE-II	AIDS	23ADS1621	PE-II : Business Intelligence
2	6	PE-II	AIDS	23ADS1622	PE-II : Lab : Business Intelligence
3	6	PE-II	AIDS	23ADS1623	PE-II : Web Analytics
4	6	PE-II	AIDS	23ADS1624	PE-II : Lab : Web Analytics
5	6	PE-II	AIDS	23ADS1625	PE-II : Sensor Data Analytics
6	6	PE-II	AIDS	23ADS1626	PE-II : Lab : Sensor Data Analytics
7	6	PE-II	AIDS	23ADS1627	PE-II : GeoSpatial Data Intelligence
8	6	PE-II	AIDS	23ADS1628	PE-II : Lab : GeoSpatial Data Intelligence
9	6	PE-II	AIDS	23ADS1629	PE-II : Visual Analytics
10	6	PE-II	AIDS	23ADS1630	PE-II : Lab : Visual Analytics
11	6	PE-II	AIDS	23ADS1631	PE-II : Dot Net Full Stack Development
12	6	PE-II	AIDS	23ADS1632	PE-II : Lab : Dot Net Full Stack Development

Professional Elective - III

1	6	PE-III	AIDS	23ADS1641	PE-III : Internet of Things
2	6	PE-III	AIDS	23ADS1642	PE-III : Lab : Internet of Things
3	6	PE-III	AIDS	23ADS1643	PE-III : Reinforcement Learning
4	6	PE-III	AIDS	23ADS1644	PE-III : Lab : Reinforcement Learning
5	6	PE-III	AIDS	23ADS1645	PE-III : Advance Unix Programmin
6	6	PE-III	AIDS	23ADS1646	PE-III : Lab : Lab Advance Unix Programmin
7	7	PE-III	AIDS	23ADS1647	PE-III : Introduction to Salesforce
8	8	PE-III	AIDS	23ADS1648	PE-III : Lab : Introduction to Salesforce

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Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

**SoE No.
23ADS-101**

B.TECH SCHEME OF EXAMINATION 2023
(Scheme of Examination w.e.f. 2026-27 onward)
(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours	
							L	T	P	Hrs		MSEs*	TA**	ESE		
SEVENTH SEMESTER																
1	7	PC	AIDS	23ADS1701	Big Data and Cloud Computing	T	3	0	0	3	3	30	20	50	3	
2	7	PC	AIDS	23ADS1702	Lab : Big Data and Cloud Computing	P	0	0	2	2	1		60	40		
3	7	PC	AIDS	23ADS1703	Neural Networks and Deep Learning	T	3	0	0	3	3	30	20	50	3	
4	7	PC	AIDS	23ADS1704	Lab : Neural Networks and Deep Learning	P	0	0	0	2	1		60	40		
5	7	PC	AIDS	23ADS1705	Generative AI	T	2	0	0	2	2	30	20	50	3	
6	7	PC	AIDS	23ADS1706	Lab : Generative AI	P	0	0	0	2	1		60	40		
7	7	PC	AIDS	23ADS1707	Optimization Techniques	T	2	0	0	2	2	30	20	50	3	
8	7	PE	AIDS	23ADS1708	Lab : Optimization Techniques	P	0	0	2	2	1		60	40		
9	7	PE	AIDS		Professional Elective-IV	T	3	0	0	3	3	30	20	50	3	
10	7	PE	AIDS		Professional Elective-V	T	3	0	0	3	3	30	20	50	3	
11	7	MDM	AIDS		MD Minor Course-V	T	2	0	0	2	2	30	20	50	3	
12	7	STR	AIDS	23ADS1709	Project Phase-II	P	0	0	8	8	4		60	40		
13	7	STR	AIDS	23ADS1710	Campus Recruitment Training (CRT)	P	0	0	0	0	2			100		
14	7	STR	AIDS	23ADS1711	Comprehensive Evaluation of Core Knowledge	P	0	0	2	2	1		60	40		
TOTAL							18	0	14	36	29					

Professional Elective - IV

1	7	PE-IV	AIDS	23ADS1721	PE-IV : Wireless Sensor Network
2	7	PE-IV	AIDS	23ADS1722	PE-IV : Data Mining and Warehousing
3	7	PE-IV	AIDS	23ADS1724	PE-IV : Ethical Hacking
4	7	PE-IV	AIDS	23ADS1725	PE-IV : Soft Computing
5	7	PE-IV	AIDS	23ADS1727	PE-IV : Data and Cyber Security
6	7	PE-IV	AIDS	23ADS1728	PE-IV : Advanced Probability and Statistics
7	7	PE-IV	AIDS	23ADS1729	PE-IV : Quantum Computing

Professional Elective - V

1	7	PE-V	AIDS	23ADS1741	PE-V : Blockchain Technology
2	7	PE-V	AIDS	23ADS1743	PE-V : Industrial and Social Applications of Digital Twins
3	7	PE-V	AIDS	23ADS1744	PE-V : Graph Analytics
4	7	PE-V	AIDS	23ADS1745	PE-V : Human Computer Interaction
5	7	PE-V	AIDS	23ADS1746	PE-V : Intelligent Systems
6	7	PE-V	AIDS	23ADS1747	PE-V : Edge AI & IoT Analytics
7	7	PE-V	AIDS	23ADS1748	PE-V : Software Testing

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(Scheme of Examination w.e.f. 2026-27 onward)
(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
EIGHTH SEMESTER															
1	8	PC	AIDS	23ADS1801	Software Engineering	T	2	0	0	2	2	30	20	50	3
3	8	MDM	AIDS		MD Minor Course-VI	T	2	0	0	2	2	30	20	50	3
2	8	STR	AIDS	23ADS1802	Internship / On Job training	P	0	0	18	18	7			100	
TOTAL							4	0	18	22	11				

Grand Total							106	0	82	192	153				
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Multidisciplinary Minor Courses															
		Track1								Track2					
Course	Sem	Data Science								Full Stack Development					
MDM-I	3	(MDM1ADS101) Basics of Data Science								(MDM1ADS201) Front-End Web Development					
MDM-II	4	(MDM2ADS102) Predictive Data Science								(MDM2ADS202) Back-End Web Development					
MDM-III	5	(MDM3ADS103) Multivariate Statistics								(MDM3ADS203) Flutter with Firebase Stack					
MDM-IV	6	(MDM4ADS104) Introduction to Big Data Analytics								(MDM4ADS204) Django Stack					
MDM-V	7	(MDM5ADS105) Data Modelling								(MDM5ADS205) Ruby on Rails Stack					
MDM-VI	8	(MDM6ADS106) Data Visualization								(MDM6ADS206) LAMP Stack					

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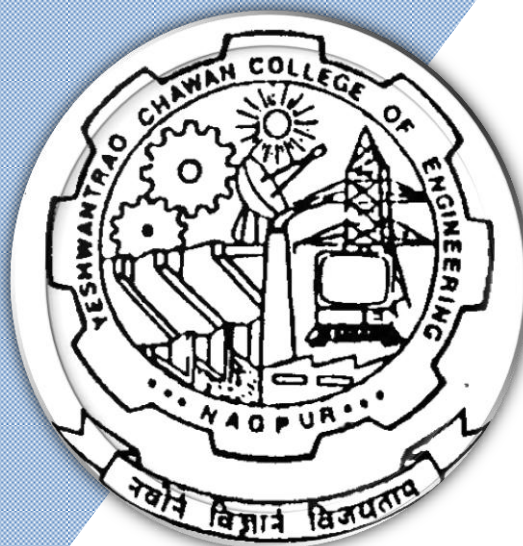
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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2023 1st Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



Yeshwantrao Chavan College of Engineering
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B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B.Tech. in Artificial Intelligence and Data Science

SoE No.
23ADS-101.1

SN	Sem	Type	BoS/Dept t	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-A)															
1	1	BS	GE	23GE1103	Differential Equations and Complex Analysis	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1110	Applied Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1111	Lab : Applied Physics	P	0	0	2	2	1		60	40	
4	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
5	1	BES	AIDS	23ADS1103	Foundations of Data Science	T	3	0	0	3	3	30	20	50	3
6	1	BES	AIDS	23ADS1104	Lab : Foundations of Data Science	P	0	0	2	2	1		60	40	
7	1	BES	AIDS	23ADS1101	C Programming	T	2	0	0	2	2	30	20	50	2
8	1	BES	AIDS	23ADS1102	Lab : C Programming	P	0	0	2	2	1		60	40	
9	1	VSEC1	GE	23GE1117	Get Set Go	...	...	...	...	...	2		60	40	
10	1	LLC1	GE		Liberal Learning Course (LLC1)	...	...	...	...	...	2		60	40	
TOTAL SECOND SEM							14	0	6	20	21				

MANDATORY LEARNING COURSES

1	2	HS		GE2131	Universal Human Values (UHV)	A	2	0	0	2	0				
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SECOND SEMESTER (GROUP-B)

1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1206	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1207	Lab : Engineering Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1213	Technical Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/AEC1	GE	23GE1214	Lab : Technical Communication	P	0	0	2	2	1		60	40	
6	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
7	2	BES	AIDS	23ADS1205	Computer Architecture and Organization	T	3	0	0	3	3	30	20	50	3
8	2	PC	AIDS	23ADS1206	Introduction to Object Oriented Concepts	T	3	0	0	3	3	30	20	50	3
9	2	PC	AIDS	23ADS1207	Lab : Introduction to Object Oriented Concepts	P	0	0	2	2	1		60	40	
10	2	VSEC2	GE	23GE1218	Functional English	...	...	...	...	...	2		60	40	
11	2	LLC2	GE		Liberal Learning Course (LLC2)	...	...	...	...	...	2		60	40	
TOTAL FIRST SEM							16	0	6	22	23				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activities decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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(Department of Computer Technology)

B.Tech. in Artificial Intelligence and Data Science

SoE No.
23ADS-101.1

SN	Sem	Type	BoS/Dept	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS /Dept	Sub. Code	Subject
1	2	CC2	GE	LLC1201	Music (Vocal)
2	2	CC2	GE	LLC1202	Music (Instrumental)
3	2	CC2	GE	LLC1203	Indian Classical Dance
4	2	CC2	GE	LLC1204	Folk Dances
5	2	CC2	GE	LLC1205	Painting
6	2	CC2	GE	LLC1206	Theatre and acting
7	2	CC2	GE	LLC1207	Photography
8	2	CC2	GE	LLC1208	Yoga
9	2	CC2	GE	LLC1209	Chess
10	2	CC2	GE	LLC1210	Athletics
11	2	CC2	GE	LLC1211	Basket Ball
12	2	CC2	GE	LLC1212	Judo
13	2	CC2	GE	LLC1213	Elements of Japanese Language
14	2	CC2	GE	LLC1214	Elements of German Language
15	2	CC2	GE	LLC1215	Elements of French Language
16	2	CC2	GE	LLC1216	Elements of Spanish Language
17	2	CC2	GE	LLC1217	Basics of Vedic Maths
18	2	CC2	GE	LLC1218	Skilling in Microsoft Visio and Inkscape
19	2	CC2	GE	LLC1219	Art of Public Speaking

Liberal Learning Course

SN	Sem	Type	BoS /Dept	Sub. Code	Subject
1	1	CC1	GE	LLC1101	Music (Vocal)
2	1	CC1	GE	LLC1102	Music (Instrumental)
3	1	CC1	GE	LLC1103	Indian Classical Dance
4	1	CC1	GE	LLC1104	Folk Dances
5	1	CC1	GE	LLC1105	Painting
6	1	CC1	GE	LLC1106	Theatre and acting
7	1	CC1	GE	LLC1107	Photography
8	1	CC1	GE	LLC1108	Yoga
9	1	CC1	GE	LLC1109	Chess
10	1	CC1	GE	LLC1110	Athletics
11	1	CC1	GE	LLC1111	Basket Ball
12	1	CC1	GE	LLC1112	Judo
13	1	CC1	GE	LLC1113	Elements of Japanese Language
14	1	CC1	GE	LLC1114	Elements of German Language
15	1	CC1	GE	LLC1115	Elements of French Language
16	1	CC1	GE	LLC1116	Elements of Spanish Language
17	1	CC1	GE	LLC1117	Basics of Vedic Maths
18	1	CC1	GE	LLC1118	Skilling in Microsoft Visio and Inkscape
19	1	CC1	GE	LLC1119	Art of Public Speaking

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activities decided by course teacher, TA3 - 3 marks on class attendance

TA** = for Practical : MSPA will be 15 marks each

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B.Tech in Artificial Intelligence and Data Science

I SEMESTER

23GE1103: Differential Equations and Complex Analysis

Course Outcomes

The students will be able to

1. Use appropriate Methods to solve first order and higher order differential equations and apply it to find solutions of engineering problems.
2. Use appropriate methods to solve partial differential equations.
3. Determine the various functions of complex numbers.
4. Evaluate the integration of function of complex variables.

Unit I: Differential Equations I

(7 Hrs.)

Linear differential equations of first order and first degree, Differential equation reducible to linear form, Exact differential equations (excluding the case of integrating factor) and their applications to various fields. (Contemporary Issues related to Topic)

Unit II: Differential Equations II

(7 Hrs.)

Higher order linear differential equations with constant coefficients, Complementary functions and Particular Integral for different cases, Method of variation of parameters, Examples on application to various fields. (Contemporary Issues related to Topic)

Unit III: Differential Equations III

(6 Hrs.)

Cauchy's homogeneous linear differential equations, Legendre's linear differential equations, Applications of differential equations to various fields (only up to second order). (Contemporary Issues related to Topic)

Unit IV: Partial Differential Equations

(6 Hrs.)

Partial Differential Equations of first order, first degree i.e. Lagrange's form, linear homogeneous equations of higher order with constant coefficient. Application of variable separable method to solve first and second order partial differential equations. (Contemporary Issues related to Topic)

Unit V: Complex Number

(7 Hrs.)

Basic concepts of complex numbers and its various forms. Separation of real and imaginary parts, De Moivre's theorem, Application of De Moivre's theorem, Exponential function of complex numbers, Circular function of complex numbers, Hyperbolic function and their inverse, Logarithm of a complex number. (Contemporary Issues related to Topic)

Unit VI: Complex Variables

(6 Hrs.)

Analytic function, Cauchy-Riemann conditions, Harmonic functions, Finding Harmonic conjugates, Taylor's and Laurent's Theorem (statement only), Examples on Taylor's and Laurent's Theorem, Evaluation integral by using Residue theorem. (Contemporary Issues related to Topic)

Total Lecture 39 Hours

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B.Tech in Artificial Intelligence and Data Science

Textbooks:

1. Erwin Kreyzig, Advance Engineering Mathematics, 6th Edition, John Wiley and Sons, INC.
2. H.K. Dass, Engineering Mathematics, 11th revised edition, S. Chand, Delhi.
3. H.K. Dass, Advanced Engineering Mathematics, 8th revised edition, S. Chand, Delhi.
4. Dr. B.S. Grewal, Higher Engineering Mathematics, 42th edition, Khanna Publishers.
5. P.N.Wartikar and J.N.Wartikar, Applied Mathematics, 4th Edition, Vidyarthi GrihaPrakashan.

Reference Books:

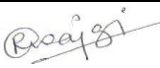
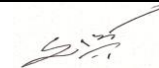
1. G B Thomas and R L Finney, Calculus and Analytical Geometry, 9th edition, Addison-Wesley, 1999.
2. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 10th edition, Laxmi Prakashan.

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- 1 <http://103.152.199.179/YCCE/Supported%20file/Supported%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/>

MOOCs Links and additional reading, learning, video material

1. <https://nptel.ac.in/courses/111103070>
2. https://onlinecourses.nptel.ac.in/noc19_ma28/preview
3. <https://nptel.ac.in/courses/111/106/111106100/>

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B.Tech in Artificial Intelligence and Data Science

I SEMESTER

23GE1110 : Applied Physics

Course Outcomes :

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

1. Correlate fundamentals of quantum mechanics to solve problems dealing with quantum particles.
2. Justify the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands.
3. Analyze the motion of charged particles in electric and magnetic field and its applications to electron optic devices.
4. Examine the intensity variation of light due to Laser and its application.
5. Illustrate working principles of optical fibers for their use in the field of industry.

Unit I: Quantum Physics

(6 Hrs.)

Wave particle duality, Davisson and Germer experiment, Wave packet, Heisenberg's uncertainty principle, thought experiment, Significance, Applications. **(Contemporary Issues related to Topic)**

Unit II: Introduction to Quantum Computing

(7 Hrs.)

Introduction of complex numbers, operators, Eigen values, Eigen functions. Wave function and its probability interpretation, Schrodinger Equation, Particle in infinite and finite potential well, quantum tunneling, Introduction to Bits and Qubits. **(Contemporary Issues related to Topic)**

Unit III: Band Theory of Solids

(7 Hrs.)

Formation of energy bands in solids; Classification of solids, Energy band diagram of Si and Ge, Intrinsic and extrinsic semiconductors, Conductivity, Law of mass action, Hall effect, Direct and Indirect band gap semiconductors. **(Contemporary Issues related to Topic)**

Unit IV: Electron Ballistics and Devices

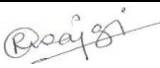
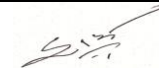
(7 Hrs.)

Motion of a charged particle in uniform electric and magnetic field, Cross field configuration; Electron refraction, Electron lens. Cathode ray oscilloscope and its application. **(Contemporary Issues related to Topic)**

Unit V: Lasers

(7 Hrs.)

Coherence and its types, Interaction of radiation with matter, Population Inversion, Pumping: methods and schemes, Optical resonant cavity, Ruby laser, He-Ne laser, diode laser, Properties and engineering applications of laser. **(Contemporary Issues related to Topic)**

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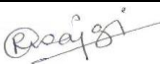
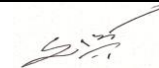
Unit VI: Optical Fibres	(6 Hrs.)
Principle, structure and classification, Acceptance angle, Numerical aperture, Losses in optical fibers, Applications as sensors. (Contemporary Issues related to Topic)	
Total Lecture	40 Hours

Textbooks	
1	M. N. Avadhanulu, P. G. Kshirsagar, A Textbook of Engg. Physics, S. Chand and Company.
2	Hitendra K Malik, A K Singh, Engineering Physics, 2nd Edition, Tata McGraw Hill Education Private Limited,

Reference Books	
1	David Halliday, Robert Resnick and Jerle Walker, John-Wiley India, Fundamentals of Physics, 10 th John Wiley & Sons Inc.
2	Brijlal and Subramanyam, Text Book of Optics, Revised edition, S. Chand and Company.
3	M.N. Avadhanulu, 2 nd Edition, Laser, S.Chand and Company.
4	A. Beiser, Concept of Modern Physics, 6 th Edition, Laser, Tata McGraw-Hill.
5	Thyagarajan K. and Ghatak A.K, LASERS: Theory and Applications, 2 nd Edition, Macmillan Publication
6	S. O. Pillai, Solid State Physics, 9 th Edition, New Edge International Publishers.
7	Palanisamy, Solid State Physics, 8 th Edition, New Edge International Publishers.
8	C. Kittel, Solid State Physics, 8 th Edition, Willey Publication.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	chrome-http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Physics/Eisberg%20&%20Resnick%20-%20Quantum%20Physics.pdf
2	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Physics/2016_Book_ThePhysicsOfSemiconductors.pdf

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/115106066 - Quantum Physics
2	https://archive.nptel.ac.in/courses/115/105/115105121/ -CRO
3	www.digimat.in/nptel/courses/video/115102124/L36.html - Laser

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(Department of Computer Technology)

**SoE No.
23ADS-101.1**

B.Tech in Artificial Intelligence and Data Science

I SEMESTER

23GE1111 : Lab. Applied Physics

Course Outcomes:

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

1. Correlate fundamentals of quantum mechanics to solve problems dealing with quantum particles.
2. Justify the characteristics of semiconductor materials in terms of crystal structures, charge carriers and energy bands.
3. Analyze the motion of charged particles in electric and magnetic field and its applications to electron optic devices.
4. Examine the intensity variation of light due to Laser and its application.
5. Illustrate working principle of optical fibers for their use in the field of industry.

List of Experiments :

Sr. No.	Experiments based on
1	Determination of Planck's Constant
2	Study of Tunnel Diode.
3	Determination of Hall coefficient and density of charge carriers using Hall effect.
4	Dependence of Hall coefficient on temperature.
5	The study of V-I characteristics of a semiconductor diode (Germanium and silicon) in forward and reverse bias mode.
6	Determination of Band gap in a semiconductor by four probe method.
7	Determination of Band gap in a semiconductor using reverse biased p-n junction diode.
8	Determination of wavelength of laser using diffraction grating.
9	Determination of divergence of laser beam.
10	Determination of Acceptance angle and numerical aperture of a given optical fiber.
11	To measure the phase shift introduced by a phase shift network using Dual beam CRO.
12	Determination of amplitude and frequency of sinusoidal signal using CRO.

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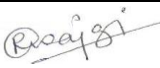
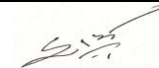
I SEMESTER

23EL1101 : Basic Electrical and Electronics Engineering

Course Outcomes:

1. Understand the fundamental concepts of Analog Electronic and Electrical Circuits
2. Apply the concepts of Electrical and Electronic Circuits to obtain the desired parameter
3. Analyze analog Electrical Circuits for given application.
4. Analyze analog Electronic Circuits for given application

Unit I: Circuit Elements and Energy Sources	(7 Hrs.)
Circuit Elements, Series and Parallel Combination of Resistances, Inductance and Capacitances, Energy Sources, Source Transformation, Sources with Periodic Waveforms, A.C. in Inductance and Capacitance, Star-Delta Connection. (Contemporary Issues related to Topic)	
Unit II: Analysis of Network	(7 Hrs.)
Kirchhoff's Laws, Current Division, Voltage Division, Nodal and Mesh Analysis of Electric Circuits, Thevenin's Theorem (Contemporary Issues related to Topic)	
Unit III: Generator and Motors	(7 Hrs.)
Introduction to Generator, Construction, working principle, Types of Generators, Introduction to DC Motor, Working Principle of DC Motor, Types of Motors. (Contemporary Issues related to Topic)	
Unit IV: Diode and Transistor	(6 Hrs.)
Introduction to Semiconductor, P-N junction diodes, Biasing & Characteristics of diodes. Diode Circuits - Half wave rectifier, full wave rectifier, bridge rectifier. Introduction to BJT- NPN and PNP, Modes of operation,. (Contemporary Issues related to Topic)	
Unit V: Operational Amplifier and Its Application	(7 Hrs.)
Introduction to Op-Amp, Inverting and Non-Inverting Amplifier, Linear Applications of OP-AMP like adder, Subtractor, integrator, differentiator and non-linear application using Comparator. (Contemporary Issues related to Topic)	
Unit VI: Electronics Measurement	(6 Hrs.)
Introduction to Measurement System, Generalized block diagram of Measurement System, Static & dynamic characteristics of measurement system, Types of errors & their sources, Statistical analysis. (Contemporary Issues related to Topic)	
Total Lecture	40 Hours

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Textbooks:

- | | |
|----|--|
| 1. | Basic Electrical Engineering, T. K. Nagsarkar and M. S. Sukhija, Oxford Higher Education, First Edition 2005 |
| 2. | Electronics Devices and circuits, Millman Jacob, McGraw Hill Education, Fourth Edition (2015) |
| 3. | Circuit Theory (Analysis and Synthesis) , by A. Chakrabarti, Dhanpat Rai & Co., Reprint Edition 2014 |

Reference Books:

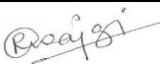
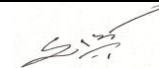
- | | |
|----|---|
| 1. | OP-AMP and Linear Integrated Circuit, by Ramakant A. Gayakwad, Prentice Hall India Learnin Private Limited, Published in 2002 |
| 2. | Electrical & Electronic measurement & Instrument, A. K. Sawhney, Dhanpat Rai & Co., 18th edition 2008 |

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

- | | |
|---|---|
| 1 | http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0 |
| 2 | https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042 |

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/noc22_ee113/preview |
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B.Tech in Artificial Intelligence and Data Science

I SEMESTER

23ADS1103 : Foundations of Data Science

Course Outcomes :

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

1. To interpret the data analysis task
2. To use the statistical techniques to prepare and present the data for analysis
3. To use the probability theory to handle uncertainty in the applications
4. To interpret the applications of data analysis.

Unit I:	(7 Hrs.)
Introduction to Data Science; role of data scientist, Types of Data, tool boxes for data scientists, introduction to R studio (Contemporary issues related to topic)	
Unit II:	(7 Hrs.)
Understanding different data sets Introduction to Data analysis, Types of Data analysis, Applications. Technologies involved in the data analysis (Contemporary issues related to topic)	
Unit III:	(7 Hrs.)
Preparing data for analysis: reading data from files, web, databases, Grouping and Displaying Data to Convey Meaning. Measure of central tendency, dispersion (Contemporary issues related to topic)	
Unit IV:	(7 Hrs.)
Probability theory: basic concepts, applications, types. Bayes theorem (Contemporary issues related to topic)	
Unit V:	(7 Hrs.)
Probability distribution, Binomial distribution, Poisson distribution, Normal distribution. random variable. (Contemporary issues related to topic)	
Unit VI:	(7 Hrs.)
Application domains of data analysis. Case studies in various application domains. (Contemporary issues related to topic)	
Total Lecture 42 Hours	

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Textbooks:

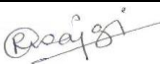
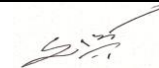
1. "Statistics for Management", Richard I. Levin & David S. Rubin, 7th Edition, Pearson Education.

Reference Books:

1. "Practical Statistics for Data Scientists, 50 Essential Concepts", Peter Bruce & Andrew Bruce, O'Reilly Media
2. "An Introduction to Statistical Learning with Applications in R", Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani, Springer Press

MOOCs Links and additional reading, learning, video material

1. <https://nptel.ac.in/courses/106106179>
2. <https://www.youtube.com/watch?v=wrIvuizi56oQ>

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B.Tech in Artificial Intelligence and Data Science

I SEMESTER

23ADS1104: Lab. Foundations of Data Science

Course Outcomes

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

1. To interpret the data analysis task
2. To use the statistical techniques to prepare and present the data for analysis
3. To use the probability theory to handle uncertainty in the applications
4. To interpret the applications of data analysis

Minimum Eight Practical's to be performed from the list as below

SN	Program based on
1	Introduction to R and excel
2	Extraction of data using R
3	Handling and understanding data using R
4	Implementations of conditional statements in R
5	Implementation of Loops in R
6	Introduction to data visualization in R
7	Implementing probability functions
8	Data Handling using Excel
9	Project activity on standard data set

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B.Tech in Artificial Intelligence and Data Science

I SEMESTER

23ADS1101 : C Programming

Course Outcomes :

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

1. Describe the basics of computer system components and operation, write algorithms and draw flowcharts.
2. Write programs using flow control statements.
3. Use functions to write modular programs.
4. Use linear data structures such as arrays and structures in programs.

Unit I:

6 Hrs.

Computer System Basics: Introduction to components of a computer system (disks, memory, processor), how program is executed, understanding of concepts such as compilers, source and object programs, etc. Introduction to algorithms and flowcharts, types of programming errors.
Basic building blocks of C: Character set, variables, identifiers & keywords, Data types, Operators: arithmetic, logical and relational operators, precedence of operators

Unit II:

6 Hrs.

Expressions, sizeof() operator, constants, typedef statement, basic input/output statements and functions (scanf, printf, getch, putch, gets, puts), Introduction to library functions, writing straight line programs. Decision control statements: if, if - else and nested if-else statements, else-if ladder statement, switch-case control statement.

Unit III:

6 Hrs.

Loop Structures: While, do while and for loops, break and continue statement, "goto" statement, bitwise operators

Unit IV:

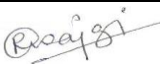
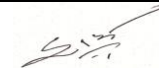
6 Hrs.

Modular programming: Concept of functions, user defined functions, function prototypes, formal parameters, actual parameters, return types, call by value, Recursive functions, comparing recursion against iteration, Concepts of a pointer, call by reference.

Unit V:

6 Hrs.

Arrays: One dimensional array, array manipulation, insertion, deletion of an element, searching techniques- Linear and binary search, sorting techniques – Bubble sort , and selection sort. Two-dimensional arrays: matrix representation, basic matrix operations such as addition, multiplication and transpose, Array as function arguments. Strings: string representation and string handling functions

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Unit VI:	6 Hrs.
Structure: Introduction, defining a structure, declaring structure variables, accessing structure members, structure initialization, array of structures.	
	Total Lecture 36 Hours

Textbooks:

1.	Computer Science: A Structured Programming Approach Using C, 3 rd , B.A.Forouzan and R.F. Gilberg, Cengage Learning
2.	The C Programming Language, 2 nd , Brian Kernighan and Dennis Ritchie, Prentice Hall

Reference Books:

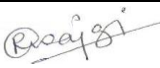
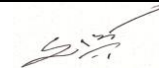
1.	Let Us C, 15th, Yashavant Kanetkar, BPB
2.	Computer Programming and Data Structures, 4th, E Balagurusamy, Tata McGraw Hill

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

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MOOCs Links and additional reading, learning, video material

1.	https://onlinecourses.nptel.ac.in/noc22_cs40/preview
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B.Tech in Artificial Intelligence and Data Science

I SEMESTER

23ADS1102 : Lab. C Programming

Course Outcomes :

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

1. Describe the basics of computer system components and operation, write algorithms and draw flowcharts.
2. Write programs using flow control statements.
3. Use functions to write modular programs.
4. Use linear data structures such as arrays and structures in programs.

Minimum Eight Practical's to be performed from the list as below

Sr.	Problem Statements																												
1 A	Introduction to Linux Operating system & it's different commands.																												
1 B	Introduction to Vi editor, Compilation and Execution of a program in Linux																												
2 A	1) Write a C program to display Your Name, Address and City in different lines. 2) Write a C program to convert centigrade into Fahrenheit. Formula: $C = (F-32)/1.8$.																												
2 B	1) Write program using conditional operators to evaluate the following function and print the value of y. $y = 2.4x + 3$, for $x \leq 2$ $y = 3x - 5$, for $x > 2$																												
3	Write a program to implement the following table, which tries to predict if a customer would buy a product. In particular, you need to ask for inputs Age, Gender and City, and print one of the three outputs Yes, No or Cannot Say. <table><tr><th>Age</th><th>Gender</th><th>City</th><th>Will Buy?</th></tr><tr><td>25-30</td><td>M</td><td>Chennai</td><td>Yes</td></tr><tr><td>33-45</td><td>F</td><td>Bangalore</td><td>Yes</td></tr><tr><td>57-80</td><td>F</td><td>Chennai</td><td>No</td></tr><tr><td>25-30</td><td>F</td><td>Hyderabad</td><td>No</td></tr><tr><td>13-19</td><td>M</td><td>Bangalore</td><td>Yes</td></tr><tr><td>16-20</td><td>M</td><td>Chennai</td><td>No</td></tr></table>	Age	Gender	City	Will Buy?	25-30	M	Chennai	Yes	33-45	F	Bangalore	Yes	57-80	F	Chennai	No	25-30	F	Hyderabad	No	13-19	M	Bangalore	Yes	16-20	M	Chennai	No
Age	Gender	City	Will Buy?																										
25-30	M	Chennai	Yes																										
33-45	F	Bangalore	Yes																										
57-80	F	Chennai	No																										
25-30	F	Hyderabad	No																										
13-19	M	Bangalore	Yes																										
16-20	M	Chennai	No																										
4	Write a menu driven program to perform following operations. 1) To display maximum number among inputted three number. 2) To display the final prize based on assumption that if total purchase price is above 2500 rs then discount is 25% and if total prize is above 5000 then discount is 30% else 40% discount. 3) To Display percentage of 2 nd number to 1 st number if two number is entered by the user. 4) Exit.																												
5	Write a program print whether entered number is Prime or not																												
6	Write a program to print the sum of exponential series $e(x) = 1 + x/1! + x^2 / 2! + x^3 / 3! + \dots$																												

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7	Write a program to print following pyramid <pre> 1 1 2 3 1 2 3 4 5 1 2 3 4 5 6 7 </pre>
8	i) Write a program in C that will scan a number N and then output the sum of the powers from 1 to N. thus, if the input is 4, the output should be 288. E.g. $(1)^1 + (2)^2 + (3)^3 + (4)^4 = 1 + 4 + 27 + 256 = 288$ [1,2,3,4] Use power function to calculate the power of number. ii) Write a recursive function to print Factorial of a entered number.
9	Write a program to sort an elements using bubble Sort.
10	Produce a multiplication table. Top left hand corner will show 1x1 and bottom right shows 12x12, as below. <pre> 1 2 3 4 5 6 7 8 9 10 11 12 2 4 6 8 10 12 14 16 18 20 22 24 3 6 9 12 15 18 21 24 27 30 33 36 4 8 12 16 20 24 28 32 36 40 44 48 5 10 15 20 25 30 35 40 45 50 55 60 6 12 18 24 30 36 42 48 54 60 66 72 7 14 21 28 35 42 49 56 63 70 77 84 8 16 24 32 40 48 56 64 72 80 88 96 9 18 27 36 45 54 63 72 81 90 99 108 10 20 30 40 50 60 70 80 90 100 110 120 11 22 33 44 55 66 77 88 99 110 121 132 12 24 36 48 60 72 84 96 108 120 132 144 </pre>
11	Write a program To copy one string to another string without using library function
12	Define a structure for a student having name, roll number and marks obtained in six, subjects. Write a program to input the details for 20 students and print the same.
13	Write a program that copies a file to another file. The names of two files should be sent as command line arguments.

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I SEMESTER

23GE1117-Get Set Go

Course Outcomes:

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

1. Students will understand the importance of building trust in communication and learn how to use the 3Vs of communication (Visual, Vocal, Verbal) to energize their interactions.
2. The course will focus on leadership principles and styles, emphasizing how effective communication can motivate others and gain willing cooperation. Students will participate in activities like skits and team presentations to demonstrate their leadership skills.
3. The course will equip students with team management and organization skills, enabling them to lead and participate in team-building activities effectively.

Unit:1	Build a foundation for success	6 Hours
Explain the Importance of Process of improvement, stating your Name with Impact, Recall and Use Names, Name Remembering Formula o LIRA o PACE – Individual Activity o BRAMMS o Chaining Method, Introduce “My Vision” Communication Fundamentals for Building Trust- Be a good listener, use conversation links, show genuine interest Hi-Five of Success ♣ Build on Memory Skills and Enhance Relationships ♣ PEG words ♣ Explain Permanent PEG Memory System, energize our Communications – Explain 3Vs of communication – Visual-Vocal-Verbal Activity – Practice Conversations, Pause-Part-Punch, Group Activity		
Unit:2	Increase Self Confidence	6 Hours
Use our experiences to communicate more confidently • Communicate with clarity and conciseness • Discover how past experiences influence behaviour ,Motivate Others and Enhance Relationships- • Learning Objectives • Explain Gain Willing Cooperation Principles • Group Presentation • Explain Demonstration of Leadership Principles • Explain “Evidence” critical in establishing credibility Individual Activity – Sharing of defining moment, Skit to demonstrate Leadership Principles, Stranded on Island .		
Unit:3	Fundamentals of Communication	6 Hours
Fundamentals of Communication (Earn the right – Excite -Eagerness) ♣ Elevator Pitch ♣ Develop more Flexibility, ♣ Recap and Summarize Activities - – Individual Presentation, Flexibility Drills, Individual Presentations – My Vision Assignment		
Unit:4	Team Management and Organization skills	5 Hours
Team Management and Organization skills, Leadership Styles, Effective Communication Activity- Team Presentation, Team building activities.		
EVALUATION	1 Hour	EVALUATION
WRITTEN TEST		
Total Lecture Hours		24 Hours

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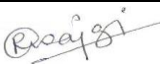
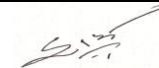
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Reference Books

- | | |
|---|---|
| 1 | Soft Skills - Enhancing Employability: Connecting Campus with Corporate. - M S Rao |
| 2 | Soft Skills Training: A Workbook to Develop Skills for Employment - Frederick H Wentz |
| 3 | Soft Skills: Know Yourself and Know the World - Alex |

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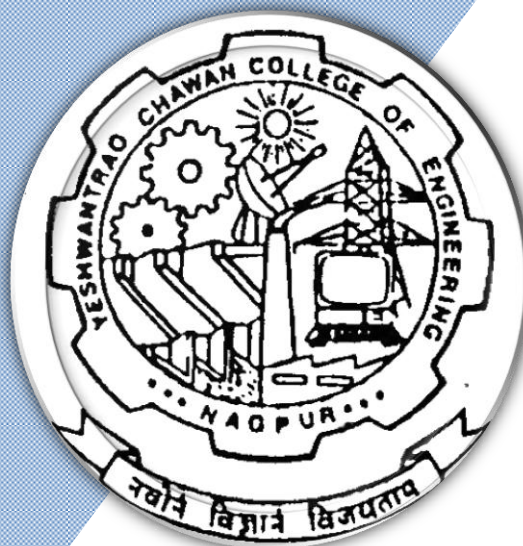
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(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2023 2nd Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B.Tech. in Artificial Intelligence and Data Science

SoE No.
23ADS-101.1

SN	Sem	Type	BoS/Dept t	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIRST SEMESTER (GROUP-A)															
1	1	BS	GE	23GE1103	Differential Equations and Complex Analysis	T	3	0	0	3	3	30	20	50	3
2	1	BS	GE	23GE1110	Applied Physics	T	3	0	0	3	3	30	20	50	3
3	1	BS	GE	23GE1111	Lab : Applied Physics	P	0	0	2	2	1		60	40	
4	1	BES	EL	23EL1101	Basic Electrical and Electronics Engineering	T	3	0	0	3	3	30	20	50	3
5	1	BES	AIDS	23ADS1103	Foundations of Data Science	T	3	0	0	3	3	30	20	50	3
6	1	BES	AIDS	23ADS1104	Lab : Foundations of Data Science	P	0	0	2	2	1		60	40	
7	1	BES	AIDS	23ADS1101	C Programming	T	2	0	0	2	2	30	20	50	2
8	1	BES	AIDS	23ADS1102	Lab : C Programming	P	0	0	2	2	1		60	40	
9	1	VSEC1	GE	23GE1117	Get Set Go	...	...	...	...	...	2		60	40	
10	1	LLC1	GE		Liberal Learning Course (LLC1)	...	...	...	...	...	2		60	40	
TOTAL SECOND SEM							14	0	6	20	21				

MANDATORY LEARNING COURSES

1	2	HS		GE2131	Universal Human Values (UHV)	A	2	0	0	2	0				
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SECOND SEMESTER (GROUP-B)

1	2	BS	GE	23GE1201	Calculus and Vector	T	3	0	0	3	3	30	20	50	3
2	2	BS	GE	23GE1206	Engineering Chemistry	T	3	0	0	3	3	30	20	50	3
3	2	BS	GE	23GE1207	Lab : Engineering Chemistry	P	0	0	2	2	1		60	40	
4	2	HS/AEC1	GE	23GE1213	Technical Communication	T	2	0	0	2	2	30	20	50	2
5	2	HS/AEC1	GE	23GE1214	Lab : Technical Communication	P	0	0	2	2	1		60	40	
6	2	HS/IKS	GE	23GE1215	Indian Knowledge System	T	2	0	0	2	2	30	20	50	2
7	2	BES	AIDS	23ADS1205	Computer Architecture and Organization	T	3	0	0	3	3	30	20	50	3
8	2	PC	AIDS	23ADS1206	Introduction to Object Oriented Concepts	T	3	0	0	3	3	30	20	50	3
9	2	PC	AIDS	23ADS1207	Lab : Introduction to Object Oriented Concepts	P	0	0	2	2	1		60	40	
10	2	VSEC2	GE	23GE1218	Functional English	...	...	...	...	...	2		60	40	
11	2	LLC2	GE		Liberal Learning Course (LLC2)	...	...	...	...	...	2		60	40	
TOTAL FIRST SEM							16	0	6	22	23				

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activities decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

		July, 2026	1.01	Applicable for AY 2026-27 Onwards
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SoE No.
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							L	T	P	Hrs		MSEs*	TA**	ESE	

Liberal Learning Course

SN	Sem	Type	BoS /Dept	Sub. Code	Subject
1	2	CC2	GE	LLC1201	Music (Vocal)
2	2	CC2	GE	LLC1202	Music (Instrumental)
3	2	CC2	GE	LLC1203	Indian Classical Dance
4	2	CC2	GE	LLC1204	Folk Dances
5	2	CC2	GE	LLC1205	Painting
6	2	CC2	GE	LLC1206	Theatre and acting
7	2	CC2	GE	LLC1207	Photography
8	2	CC2	GE	LLC1208	Yoga
9	2	CC2	GE	LLC1209	Chess
10	2	CC2	GE	LLC1210	Athletics
11	2	CC2	GE	LLC1211	Basket Ball
12	2	CC2	GE	LLC1212	Judo
13	2	CC2	GE	LLC1213	Elements of Japanese Language
14	2	CC2	GE	LLC1214	Elements of German Language
15	2	CC2	GE	LLC1215	Elements of French Language
16	2	CC2	GE	LLC1216	Elements of Spanish Language
17	2	CC2	GE	LLC1217	Basics of Vedic Maths
18	2	CC2	GE	LLC1218	Skilling in Microsoft Visio and Inkscape
19	2	CC2	GE	LLC1219	Art of Public Speaking

Liberal Learning Course

SN	Sem	Type	BoS /Dept	Sub. Code	Subject
1	1	CC1	GE	LLC1101	Music (Vocal)
2	1	CC1	GE	LLC1102	Music (Instrumental)
3	1	CC1	GE	LLC1103	Indian Classical Dance
4	1	CC1	GE	LLC1104	Folk Dances
5	1	CC1	GE	LLC1105	Painting
6	1	CC1	GE	LLC1106	Theatre and acting
7	1	CC1	GE	LLC1107	Photography
8	1	CC1	GE	LLC1108	Yoga
9	1	CC1	GE	LLC1109	Chess
10	1	CC1	GE	LLC1110	Athletics
11	1	CC1	GE	LLC1111	Basket Ball
12	1	CC1	GE	LLC1112	Judo
13	1	CC1	GE	LLC1113	Elements of Japanese Language
14	1	CC1	GE	LLC1114	Elements of German Language
15	1	CC1	GE	LLC1115	Elements of French Language
16	1	CC1	GE	LLC1116	Elements of Spanish Language
17	1	CC1	GE	LLC1117	Basics of Vedic Maths
18	1	CC1	GE	LLC1118	Skilling in Microsoft Visio and Inkscape
19	1	CC1	GE	LLC1119	Art of Public Speaking

MSEs* = Two MSEs of 15 Marks each will conducted and marks of these 2 MSEs will be considered for Continuous Assessment

TA ** = for Theory : TA1-5 marks on Proctored Online Exam, TA2-12 marks on activities decided by course teacher, TA3 - 3 marks on class attendance

TA = for Practical : MSPA will be 15 marks each**

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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

23GE1201: Calculus and Vector

Course Outcomes :

The students will be able to

1. Apply the knowledge of differentiation to solve the Engineering problems.
2. Determine the derivatives of functions of several variables and develop the relations among the derivatives of variables.
3. Apply the knowledge of Beta and Gamma functions to find area, volume and mass.
4. Discuss Calculus of Scalar and vector point function and use appropriate theorems to evaluate integrals of functions of single and multiple variables.

Unit I: Differential Calculus

(6 Hrs.)

Successive differentiation, n^{th} derivative of rational function, Trigonometrical transformations, n^{th} derivative of the product of two functions (Leibnitz's theorem), Taylor's theorem, Use of Maclaurin's theorem for one variable, standard expansions, Examples on Taylor's Theorem. **(Contemporary Issues related to Topic)**

Unit II: Partial Differentiation

(7 Hrs.)

Functions of several variables, First and higher order derivatives, Homogeneous functions, Euler's theorem on homogeneous function, Chain rule and total differential coefficient of composite functions. Jacobians. **(Contemporary Issues related to Topic)**

Unit III: Integral Calculus

(6 Hrs.)

Improper integrals: Gamma and Beta functions, applications of integral calculus in computing area, length, volumes, and surface of solids of revolutions. **(Contemporary Issues related to Topic)**

Unit IV: Multiple integrals

(6 Hrs.)

Double integral, change of order of integral, change of variables, triple integrals and its applications. **(Contemporary Issues related to Topic)**

Unit V: Vector Calculus

(7 Hrs.)

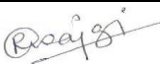
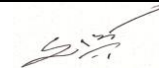
Vector fields, Vector differentiation, Gradient, Divergence and Curl, Directional derivatives with physical interpretation, Solenoidal and irrotational motions. **(Contemporary Issues related to Topic)**

Unit VI: Vector Integration & Applications

(7 Hrs.)

Vector integration: Line, surface and volume integrals, Statement of Stoke's theorem, Gauss divergence theorem and Green's theorem (without proof), Simple applications of these theorems. **(Contemporary Issues related to Topic)**

Total Lecture 39 Hours

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Textbooks:

- | | |
|----|--|
| 1. | Erwin Kreyzig, Advance Engineering Mathematics, 10 th Edition, John Wiley and Sons, INC. |
| 2. | H.K. Dass, Engineering Mathematics, 11 th revised edition, S. Chand, Delhi. |
| 3. | H.K. Dass, Advanced Engineering Mathematics, 8 th revised edition, S. Chand, Delhi. |
| 4. | Dr. B.S. Grewal, Higher Engineering Mathematics, 42 th edition, Khanna Publishers. |
| 5. | P.N.Wartikar and J.N.Wartikar, Applied Mathematics, 4 th Edition, Vidyarthi GrihaPrakashan. |

Reference Books:

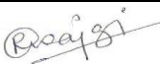
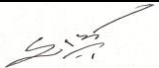
- | | |
|----|--|
| 1. | G B Thomas and R L Finney, Calculus and Analytical Geometry, 9th edition, Addison-Wesley, 1999. |
| 2. | Michael Spivak and Tom Apostol, Calculus, Vol I & Vol II 2 nd edition, Wiley. |
| 3. | N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, 10 th edition, Laxmi Prakashan. |

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

- | | |
|---|---|
| 1 | http://103.152.199.179/YCCE/Supported%20file/Supported%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/ |
|---|---|

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://nptel.ac.in/courses/111/106/111106146/ |
| 2. | https://nitkkr.ac.in/docs/5-Multiple%20Integrals%20and%20their%20Applications.pdf |

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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

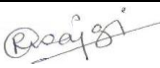
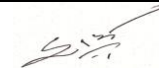
23GE1206 : Engineering Chemistry

Course Outcomes:

Upon successful completion of the course students will be able to

1. **Illustrate** qualitative and quantitative aspects of water for industrial and domestic applications. (L3)
2. **Apply** concepts of electrochemistry for energy storage devices and corrosion. (L3)
3. **Explain** basic principles of spectroscopy and its applications. (L3)
4. **Establish** insight into advanced engineering materials. (L3)

Unit:1	Water Chemistry Introduction, Potable water quality parameters. Hardness, Types of hardness. Sterilization. Desalination of water by R.O. Softening of water by Zeolite process and Ion Exchange Process (principle, advantages, and limitations). Numerical based on Hardness and Zeolite process. Boiler trouble (Scale and sludge). Contemporary issues related to the topic	7 Hours
Unit:2	Electrochemistry Introduction, metallic and electrolytic conductance. Electrode and electrode potential. Nernst Equation, numericals and applications. Faraday's laws and numericals. Industrial applications: Electroplating, Electrolytic refining, Corrosion- Definition, Causes, theories of corrosion- dry, wet and differential aeration. Contemporary issues related to the topic	7 Hours
Unit:3	Energy storage device Introduction, Characteristics, and general applications. Lithium-ion battery, Glass battery, H ₂ -O ₂ Fuel cell. Differences between battery and a fuel cell. Supercapacitors: Definition, types, characteristics, and application. H₂ as a green fuel: Introduction, production, storage, and utilization. Contemporary issues related to the topic	6 Hours
Unit:4	Drugs & Polymer chemistry Drugs: Introduction, types of drugs, synthesis of commonly used drug molecules such as aspirin and paracetamol. Polymer: Introduction, Classification of polymers, Use and disposal of polymers. Properties of polymers - Solubility, Molecular Weight, Crystallinity, Glass transition temperature. Contemporary issues related to the topic	6 Hours

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Unit:5	Spectroscopic Techniques and Applications Introduction, fundamentals, types, principles, and selection rules of spectroscopy. Basic principle and applications of UV- Visible, IR, NMR Spectroscopy and numericals. Contemporary issues related to the topic	6 Hours
Unit :6	Advanced Materials Nanomaterials: Definition, Carbon Nanotubes and types. Applications of Nanomaterials in electronics, environment and medicine. Chemical sensors: Types and application. Liquid Crystal Polymers: Introduction, General properties and applications. Polymers in electronic industries: Introduction, Piezo, Pyroelectric, Ferroelectric polymers. Smart materials: Introduction, Properties and applications of Chromoactive, Photoactive and Magneto rheological materials. Contemporary issues related to the topic	7 Hours
Total Lecture Hours		39 Hours

Text books

- 1 S S. Dara, A Textbook of Engineering Chemistry, S. Chand & Co New Delhi. Eleventh Edition.
- 2 P.C. Jain and Monica Jain, Engineering Chemistry, Dhanpat Rai & sons New Delhi, Sixteenth Edition.
- 3 P. W. Atkins, Physical Chemistry, Oxford Publications, Eighth edition.
- 4 Y.R. Sharma, Elementary organic spectroscopy, S. Chand and company private limited.

Reference Books

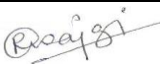
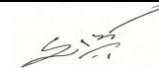
- 1 B.K.Sharma Krishna, Engineering Chemistry, Prakashan media private LTD. 1st Edition, 2014.
- 2 CNR Rao, Chemistry of Advanced Materials, Willey Publications, 1993.
- 3 Fred. Billmeyer Jr., A textbook of polymer science, Wiley India, 2nd Edition.
- 4 Robert B Leighou , Chemistry of Engineering Materials ,Hill Book Company, Inc New York
- 5 C.N. Banwell ,Fundamentals of Molecular Spectroscopy ,Mc Graw hill education , 4th Edition
- 6 William C. O'Mara, Robert B. Herring, Handbook of Semiconductor Silicon Technology ,Noyes Publications Park Ridge, NJ, USA.1st Edition.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

- 1 <http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/SERIES%20WISE%20BOOKS/CHEMISTRY/>

MOOCs Links and additional reading, learning, video material

- 1 <https://www.youtube.com/watch?v=XTt3gXB0a84>
- 2 <https://www.youtube.com/watch?v=i1hYXx79QiE>
- 3 <https://www.youtube.com/watch?v=JfJ7MIP9Dco>
- 4 <https://www.youtube.com/watch?v=L2VSOccUrSk>
- 5 <https://www.youtube.com/watch?v=p5pk4Um6lsk>
- 6 <https://www.youtube.com/watch?v=zVDMgoffmC0>

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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

23GE1207 : Lab. Engineering Chemistry

Course Outcomes:

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

1. **Illustrate** qualitative and quantitative aspects of water for industrial and domestic applications. (L3)
2. **Apply** concepts of electrochemistry for energy storage devices and corrosion. (L3)
3. **Explain** basic principles of spectroscopy and its applications. (L3)
4. **Establish** insight into advanced engineering materials. (L3)

Total 10 experiments are to be performed.

(4 each from Phase I and Phase II and two demonstration experiments)

SN	Experiments based on
	List of Experiments-Phase I
1	Determination of total hardness of water sample.
2	Determination of alkalinity present in the water sample.
3	Estimation of Fe^{2+} ions by redox titration
4	Determination of copper by iodometric titration
5	Estimation of Nickel.
6	To determine the strength of a given potassium dichromate solution with N/20 sodium thiosulphate solution
7	Determination of COD of water sample.
8	Synthesis of urea formaldehyde & phenol formaldehyde resin.
9	Determination of rate of the reaction of hydrolysis of ethyl acetate at room temperature and analysis of experimental data using Computational Software.
	List of Experiments-Phase II
1	Determination of viscosity of lubricating oil by Redwood Viscometer I or II
2	Determination of Cation exchange capacity of an ion exchange resin
3	Determination of molecular weight of a polymer.
4	Oil Testing for Flash Point / Cloud Point/Pour Point/Aniline Point
5	Proximate analysis of coal
6	Determination of surface tension of liquids using stalagmometer.
7	Determination of electrochemical equivalence of copper using Faradays Law
8	To determine the heat of solution of potassium nitrate calorimetrically.

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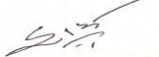
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9	Determination of strength of the given acid conductometrically.
10.	To verify Beer-Lambert law for KMnO_4 colorimetrically and determine the concentration of the given solution of KMnO_4 .
	List of Demonstration Experiments
1	Determination of pH of water sample by pH meter
2	Synthesis of polyaniline.

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II SEMESTER

23GE1213 : Technical Communication

Course Outcomes :

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

1. Apply different modes for effective communication
2. Produce competently the Phonology of English language
3. Apply nuances of LSRW skills
4. Practice Communication through different channels

Unit I: Basics of Communication	(6 Hrs.)
Process of Communication, Levels of Communication, Flow of Communication, Networks of Communication, Barriers to communication- Intrapersonal, Interpersonal, Organizational	
Unit II: English Phonetics	(7 Hrs.)
Speech Mechanism, Organs of speech, Consonant and Vowels sounds symbols, word stress rules	
Unit III: Presentation & Visual Communication , Reading & Listening Skills	(6 Hrs.)
Presentation-Purpose, Analysing Audience & Locale, Organizing Contents, Nuances of presentation- Kinesics, Proxemics, Chronemics, Vocalics, Modes of Presentation, Visual Communication –Introduction & importance, Role & Psychology of color in visual communication, Listening Skills -definition types and traits	
Unit IV: Research Paper & Technical Communication	(7 Hrs.)
Research Paper - Characteristics, components, Title, Abstract, Introductory Paragraph, Body of Presentation Conclusion, Acknowledgements , List of Symbols, References Memo- Objectives, Types, Structure and Layout Email-Etiquette s, acronyms	
Total Lecture 26 Hours	

Textbooks:

1.	Meenakshi Raman & Sangeeta Sharma, Technical Communication, Raman & Sharma, Oxford University Press Orford University Press
2.	T. Balasubramaniam, Textbook of English Phonetics for Indian Students, Macmillan India Ltd

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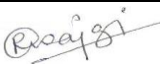
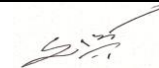
B.Tech in Artificial Intelligence and Data Science

Reference Books:

1.	Dale Carnegie ,How to Develop Self – Confidence & Influence People by Public Speaking
2.	AshaKaul, Communication Skills
3.	Allen Peas ,Body Language
4.	Gerson's Gerson, Technical Communication

MOOCs Links and additional reading, learning, video material

1.	https://dl.uswr.ac.ir/bitstream/Hannan/141245/1/9781138219120.pdf
2.	https://www.pdfdrive.com/word-power-made-easy-the-complete-handbook-for-building-a-superiorvocabulary-e157841139.html
3.	https://www.pdfdrive.com/improve-your-communication-skills-present-with-confidence-write-with-stylelearn-skills-of-persuasion-e156963640.html
4.	https://www.pdfdrive.com/21-days-of-effective-communication-everyday-habits-and-exercises-to-improveyour-communication-skills-and-social-intelligence-e158273760.html

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SoE No.
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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

23GE1214 : Lab. Technical Communication

Course Outcomes :

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

1. Apply different modes for effective communication
2. competently use the phonology of English language
3. Apply nuances of LSRW skills
4. Communicate through different channels

Lab I	(2 Hrs.)
Handson for Consonants and vowel sounds (Contemporary issues related to topic)	
Lab II	(2 Hrs.)
Identifying the pragmatic meaning of the text (Contemporary issues related to topic)	
Lab III	(2 Hrs.)
Sessions for Interview (Contemporary issues related to topic)	
Lab IV	(2 Hrs.)
Grooming session for effective use of body language (Contemporary issues related to topic)	
Lab V	(2 Hrs.)
Visual Media – preparing poster boards, advertising product (Contemporary issues related to topic)	
Lab VI	(2 Hrs.)
Group Discussion (Contemporary issues related to topic)	
Total Lecture	12 Hours

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Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

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B. Tech SoE and Syllabus 2023
(Scheme of Examination w.e.f. 2023-24 onward)
(Department of Computer Technology)

SoE No.
23ADS-101.1

B.Tech in Artificial Intelligence and Data Science

Textbooks:

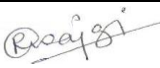
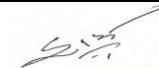
1.	Technical Communication, 3 rd Edition, Raman & Sharma, Oxford University Press
2.	Textbook of English Phonetics for Indian Students, 3 rd Edition, T. Balasubramaniam, Macmillan India Ltd

Reference Books:

1.	How to Develop Self – Confidence & Influence People by Public Speaking, 1st Edition, Dale Carnegie
2.	Communication Skills, 2nd Edition, Asha Kaul
3.	Body Language, 1st Edition, Allen Peas
4.	Technical Communication, January 2003, Gerson's Gerson

MOOCs Links and additional reading, learning, video material

1.	https://youtu.be/XoVLa6Dqd5I
2.	https://youtu.be/45uNWLmAZR8

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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

23GE1215 : Indian Knowledge System

Course Outcomes:

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

1. Apply primary requirements pertaining towards awareness of Indian Knowledge System.
2. Analyze various Indian society, culture and literature to enhance their traditions.
3. Evaluate structure of Indian art.
4. Understand Indian heritage and architectural skills.

Unit:1	Introduction to Indian Civilization	6 Hours
Development of Human Civilization with specific reference: Stone age: Tool Technology and Cultural Development, Indus Valley civilization, Vedic Civilization. (Contemporary Issues related to Topic)		
Unit:2	Indian Society, Culture and Literature	6 Hours
Society and its types, Culture and its Characteristics, Foundational Literature. (Contemporary Issues related to Topic)		
Unit:3	Tradition of Indian Art and Painting	7 Hours
Indian Traditional Painting, Art style folk, mural with Gandhara and Mathura school of art. (Contemporary Issues related to Topic)		
Unit:4	Indic Traditions of Architecture, Design and Planning	7 Hours
Monumental studies of architectural skill: Rock Cut Caves, Stupa and Temple Architecture, The Ancient cities of Indus Saraswati region. Town Planning and drainage system. (Contemporary Issues related to Topic)		
Total Lecture Hours		26 Hours

Textbooks

1	Reader's Digest: Vanished Civilizations, THE READER'S DIGEST ASSOCIATION LIMITED, LONDON,NEWYORK.
2	Qaiser Zoha Alam ; Language and Literature Divers Indian Experience
3	Bal Ram Singh (Author), Nath Girish (Author) ; Science and Technology in Ancient Indian Texts
4	NCERT Books

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Reference Books

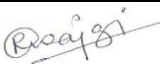
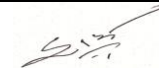
1	B S Harishankar; Art and Archaeology of India: Stone Age to the Present, 2003.
2	Gupte R S and Mahajan B D; Ajanta, Ellora and Aurangabad, 1962.
3	Dharampal, Some Aspects of Earlier Indian Society and Polity and Their Relevance Today, New Quest Publications, Pune, 1987.
4	Michel Lorblanchet, "Rock Art In The Old World" IGNCA series, in India
5	Percy Brown, "Indian Architecture" D. B. Taraporevala sons & co. Pvt. Ltd. Bombay(1959).

PPT's/Research papers

1	https://www.researchgate.net/publication/360889208_STONE_AGE_TOOL_TECHNOLOGY_and_CULTURAL_DEVELOPMENT
2	https://scholar.google.com/citations?view_op=view_citation&hl=en&user=iT1KSV8AAAAJ&sortby=pubdate&citation_for_view=iT1KSV8AAAAJ:UeHWp8X0CEIC

MOOCs Links and additional reading, learning, video material

1	https://prepp.in/news/e-492-indian-architecture-art-and-culture-notes
2	https://www.artzolo.com/blog/most-famous-indian-painting-styles
3	https://www.researchgate.net/publication/360889332_Stone_Age_Tool_Technology_Cultural_Development
4	https://testbook.com/ias-preparation/ancient-history-16-mahajanapadas

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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

23ADS1205 : Computer Architecture and Organization

Course Outcomes :

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

1. Relate & Identify the function and design of the various units of computers that process data and store the information.
2. Analyze and write control signal for executing machine instructions for different processors.
3. Explain & Design the organization of memory, memory hierarchy, other peripheral devices, and estimate the cost of computation.
4. Compare among different types of I/O operation

Unit I:

(7 Hrs.)

Binary Systems: Digital Systems, Binary Numbers, Binary Codes, Computer Arithmetic Number Base Conversions, Octal and Hexadecimal – conversions. Basic Logic Gates, Universal gates (NAND and NOR gates), other gates (XOR, XNOR gates). Boolean identities, De Morgan's Laws. k-map

Unit II:

(7 Hrs.)

Combinational and sequential circuits: (Simple block diagrams, truth tables and IC packages only required). Flip-flops: RS, clocked RS, JK, D and T flip flops, Master slave flip flops, Registers, latches and Tristate buffers. Basic Memory Organization

Unit III:

(7 Hrs.)

Von-Neuman architecture, Functional units, addressing methods, addressing modes, Execution of complete instructions, Bus organizations, sequencing of Control signals, Processor Design, hard wired control, Microprogrammed Control: Microinstructions, Grouping of control signals, Microprogram sequencing, Micro Instructions with next Address field, perfecting microinstruction.

Unit IV:

(7 Hrs.)

Arithmetic (Fixed and Floating point): Number Representation, Addition of Positive numbers, Logic Design for fast adders, Addition and Subtraction, Arithmetic and Branching conditions, Multiplications of positive numbers, Signed- Operand multiplication, fast Multiplication, Booth's Algorithm

Unit V:

(7 Hrs.)

Integer Division, Floating point numbers and operations. The Main Memory: Basic concepts, Memory Hierarchy, Speed Size and Cost, Cache Memory, Performance Considerations.

Unit VI:

(7 Hrs.)

Pipelining: Basic Concepts, Data Hazards, Instruction Hazards Computer Peripherals: I/O Devices, I/O transfers – program controlled, interrupt driven and DMA, Interrupt handling.

Total Lecture 42 Hours

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Textbooks:

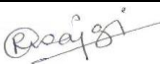
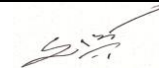
1.	Computer Organization , 5th edition, V.Carl Hamacher, Zvonko Vranesic, McGraw Hill Publications.
2.	Computer Architecture & Organization , 3rd edition , J.P. Hayes , McGraw Hill Publications
3.	Modern Digital Electronics,,3rd Edition, R. P. Jain, McGraw Hill

Reference Books:

1.	Computer Organization and Architecture , 6th edition , William Staling , Pearson Education
2.	Computer Architecture: A Quantitative approach , 6th edition, John L. Hennessy, David A. Patterson , MK series in computer architecture and design

MOOCs Links and additional reading, learning, video material

1.	https://onlinecourses.nptel.ac.in/noc23_cs67/preview
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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

23ADS1206 : Introduction to Object Oriented Concepts

Course Outcomes :

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

1. Understand the concept of object-oriented programming and modelling
2. Apply the knowledge of object-oriented programming to solve the given problem
3. Analyze the problem to provide the objectoriented solution using advanced programming concepts

Unit I: Introduction to C++

(6 Hrs.)

Difference between C and C++- Evolution of C++- The Object-Oriented Technology-Disadvantage of Conventional Programming- Key Concepts of Object-Oriented Programming, Advantage of OOP- Object Oriented Language.

Unit II: Classes and Objects & Constructors and Destructor

(7 Hrs.)

Classes in C++-Declaring Objects- Access Specifiers and their Scope- Defining Member Function-Overloading Member Function- Nested class, Constructors and Destructors, Introduction- Constructors and Destructor- Characteristics of Constructor and Destructor- Application with Constructor- Constructor with Arguments (parameterized Constructor-Destructors- Anonymous Objects

Unit III: Operator Overloading and Type Conversion & Inheritance

(7 Hrs.)

The Keyword Operator- Overloading Unary Operator- Operator Return Type- Overloading Assignment Operator (=)- Rules for Overloading Operators, Inheritance, Reusability- Types of Inheritance- Virtual Base Classes- Object as a Class Member- Abstract Classes- Advantages of Inheritance-Disadvantages of Inheritance.

Unit IV: Pointers & Binding Polymorphisms and Virtual Functions

(7 Hrs.)

Pointer, Features of Pointers- Pointer Declaration- Pointer to Class- Pointer Object- The this Pointer- Pointer to Derived Classes and Base Class, Binding Polymorphisms and Virtual Functions, Introduction- Binding in C++- Virtual Functions- Rules for Virtual Function- Virtual Destructor.

Unit V: Generic Programming with Templates & Exception Handling

(7 Hrs.)

Generic Programming with Templates, Need for Templates- Definition of class Templates- Normal Function Templates- Over Loading of Template Function-Bubble Sort Using Function Templates- Difference Between Templates and Macros- Linked Lists with Templates, Exception Handling- Principles of Exception Handling- The Keywords try to throw and catch- Multiple Catch Statements –Specifying Exceptions.

Unit VI: Overview of Standard Template Library

(6 Hrs.)

Overview of Standard Template Library- STL Programming Model- Containers- Sequence Containers- Associative Containers- Algorithms- Iterators- Vectors- Lists- Maps.

Total Lecture 40 Hours

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Textbooks:

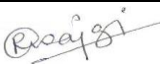
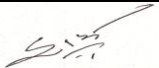
1.	Object Oriented Programming with C++, 5th edition , Bal Gurusamy, McGraw Hill Publications.
2.	Object Oriented Programming in C++ , 3rd edition , Lafore,R , Sams Publication

Reference Books:

1.	The C++ Programming Language, 6th edition , Stroustrup.B , Pearson Education
2.	C++ The Complete Reference , 6th edition , Schildt, H , McGraw Hill Publications

MOOCs Links and additional reading, learning, video material

1.	https://nptel.ac.in/courses/106105153
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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

23ADS1207: Lab. Introduction to Object Oriented Concepts

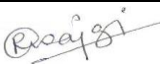
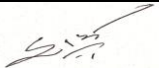
Course Outcomes

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

4. Understand the concept of object-oriented programming and modelling
5. Apply the knowledge of object-oriented programming to solve the given problem
1. Analyze the problem to provide the object oriented solution using advanced programming concepts

Minimum Eight Practical's to be performed from the list as below

SN	Program based on
1	Implement the concept of Class and its data members and member functions
2	Implement the concept of function overloading
3	Implement the concept of passing object as a function argument
4	Implement the concept of friend function
5	Implement the concept of constructor and its type.
6	Implement the concept of operator overloading
7	Implement the concept of single inheritance.
8	Implement the concept of multilevel Inheritance
9	Implement the concept of each access specifiers (Private, Public and Protected).
10	Implement the concept of run time polymorphism
11	Implement the concept of Files
12	Implement the concept of command line arguments
13	Implement the concept of function templates
14	Implement the concept of Class templates.
15	Implement the concept of exception.

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B.Tech in Artificial Intelligence and Data Science

II SEMESTER

23GE1218 : Functional English

Course Outcomes:

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

1. Understand the concept of FE (Functional English) and its application in various real-life scenarios.
2. Develop basic interactive communication skills, including greetings, asking for information, stating opinions, and providing feedback.
3. Acquire knowledge of social networking, texting, instant messaging, blogs, and discussion boards, along with the ethical considerations associated with online communication.
4. Successfully complete quizzes and assignments assessing knowledge in the covered topics of FE, social media, tenses, and effective communication.

Unit:1	Introduction to Functional English	6 Hours
What is FE? And Areas of application. Basic Interactive sentences - Greetings & Replies, Asking for information, Telling people what you do, Asking somebody's opinion, Giving your opinion, Saying someone is correct, Saying that someone is wrong, Apologizing, Praising someone's work, Saying goodbye. Introduction & Basics of Common Expressions – Offer, Request, Gratitude, Apology. Modal Verbs - Words used often: Can- could, Will – would, Shall – should, Ought to-Must, May-might. Practice exercises, Practice Conversations, Script Activity		
Unit:2	Internet & Social Media Communication	6 Hours
Introduction & Basics to Social Networking, Texting & Instant messaging, Blogs & Discussion Board- discussion with examples, Ethics of social media & communication Topic: Introduction to Creative Ads Why Ads, What's in it for me? Characteristics of ads. Assignment Quiz on the above Topics, Exercises for Evaluation		
Unit:3	TENSES	6 Hours
Introduction & Basics, Simple Tense (Past, Present, Future), Continuous Tense (Past, Present, Future) – discussion with examples. Introduction & Basics, Perfect Tense (Past, Present, Future), Perfect Continuous Tense (Past, Present, Future) – discussion with examples Introduction to Movie Magic, Learn English with films, Film Vocabulary, Describing a film, Types of Films Assessment – Letter and Email Writing, Tenses – Quiz		
Unit:4	Written Communication	5 Hours
Introduction & Basics of Writing, five methods of communication, Mind your grammar, Commonly confusing words Letters – Format, Parts of a business letter, When does communication fail?, Things to remember, Positive language not negative language, Active voice not passive voice Effective emailing -How to make an effective e-mail, Few common e-mail habits that cause problems, Parts of an e-mail, Some other important aspects.		

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B.Tech in Artificial Intelligence and Data Science

Assignment Presentation on Mad Ads, Quiz on Tenses and social media-Internet Communication
Topic: Activity Extempore

EVALUATION

1 Hour

WRITTEN TEST

TA=60

ESE=40

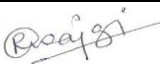
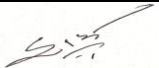
TOTAL=100

Total Lecture Hours

24 Hours

Reference Books

- 1 How to win friends & influence people – Dale Carnegie
2. Functional English for Communication - Ujjwala Kakarla
- 3 Functional English for Technical Students – Dr Prathibha Mahato & Dr Dora Thompson

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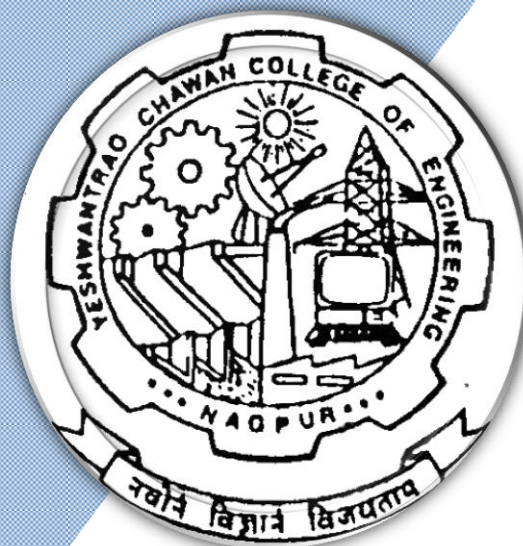
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(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2023 3rd Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

SoE No.
23ADS-101

B.TECH SCHEME OF EXAMINATION 2023
(Scheme of Examination w.e.f. 2023-24 onward)
(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
THIRD SEMESTER															
1	3	BS	GE	23GE1303	Linear Algebra	T	3	0	0	3	3	30	20	50	3
2	3	HSSM-1	GE	23GE1301	Fundamentals of Management & Economics	T	2	0	0	2	2	30	20	50	3
3	3	VEC-1	CV	23CV1311	Environmental Sustainability, Pollution and Management	T	2	0	0	2	2	30	20	50	3
4	3	PC	AIDS	23ADS1301	Statistics for Data Science	T	3	0	0	3	3	30	20	50	3
5	3	PC	AIDS	23ADS1302	Lab : Statistics for Data Science	P	0	0	2	2	1		60	40	
6	3	PC	AIDS	23ADS1303	Data Structures	T	3	0	0	3	3	30	20	50	3
7	3	PC	AIDS	23ADS1304	Lab : Data Structures	P	0	0	2	2	1		60	40	
8	3	CEP	AIDS	23ADS1305	Community Engagement Project	P	0	0	4	4	2		60	40	
9	3	OE-1	OE		Open Elective -I	T	2	0	0	2	2	30	20	50	3
10	3	MDM	CT		MD Minor Course-I	T	2	0	0	2	2	30	20	50	3
TOTAL							17	0	8	25	21				

List of Mandatory Learning Course (MLC)

1	3	HS	T&P	MLC2123	YCAP3 : YCCE Communication Aptitude Preparation	A	3	0	0	3	0				
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Open Elective - I

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chemistry and Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials and Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology and Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance and Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation and Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management and Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management
23	3	OE1	MGT	23OE1323	OE-I : Designated approved online NPTEL/KKSU Course
24	3	OE1	MGT	23OE1324	OE-I : Indian Archeology
25	3	OE1	MGT	23OE1325	OE-I : Social & Positive Psychology
26	3	OE1	MGT	23OE1326	OE-I : Seismology & Earthquake

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**SoE No.
23ADS-101**

B.Tech in Artificial Intelligence and Data Science

III /IV SEMESTER

23GE1303/ 23GE1403 : Linear Algebra

Course Outcomes:

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

- 1 Solve systems of linear equations using rank of matrix.
2. Determine eigen values and eigen vectors and solve eigen value problems.
3. Explain the concepts of vector space and subspace, span and basis.
4. Apply principles of matrix algebra to linear transformations and inner product.

Unit I:

8 Hrs.

Elementary matrix operations: Introduction to Matrices and Determinants, Solution of Linear Equations, Cramer's rule, Inverse of a Matrix.

Unit II:

7 Hrs.

Matrix Algebra: Rank of a matrix, Gaussian elimination, LU Decomposition (Crout's method), Solving Systems of Linear Equations using the tools of Matrices.

Unit III:

7 Hrs.

Diagonalization of Matrix: Eigen Values and Eigen vectors, Linear dependence and independence of Eigen Vectors, Orthogonal Eigen vector, Diagonalization of matrix, Cayley-Hamilton Theorem and Sylvester's Theorem.

Unit IV:

8 Hrs.

Vector Space: Vector Space, Subspace, Sum of Sub space, linear combination, Linear dependence and independence, Span and basis, Spanning sets, Generators.

Unit V:

7 Hrs.

Linear Transformation: Linear transformation, Ranges and Kernel (null space) of linear transformation, Inverse of linear transformation, Algebra of linear transformation, Singular and nonsingular linear transformation.

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Unit VI:	8 Hrs.
Inner product Spaces: Inner product space and Norms, orthogonal vector, the Gram Schamidt orthogonalization Process, orthogonal compliment, Adjoint of Linear operator, Normal and self-adjoint operator, Unitary and orthogonal operator, Bilinear and Quadratic form.	
	Total Lecture 45 Hours

Textbooks:	
1	Erwin Kreyzig, Advance Engineering Mathematics, 9 th Edition, John Wiley and Sons, INC.
2	Dr. B. S. Grewal, Higher Engineering Mathematics, 40 th edition, Khanna Publisher.
3	H.K. Dass, Advanced Engineering Mathematics, 8 th revised edition, S. Chand, Delhi.
4	Hoffman and Kunze, Linear Algebra, prentice Hall of India, New Delhi
5	Gilbert Strang, Linear Algebra and its Applications, Nelson Engineering (2007)

Reference Books:	
1	Chandrika Prasad, Mathematics for Engineers (19th edition), , John Wiley & Sons.
2	L.A. Pipes and Harville, Applied Mathematics for Engineers (3rd edition), McGraw Hill.
3	K.B.Datta, Matrix and Linear Algebra, , Prentice Hall of India.
4	Linear Algebra, Schaum's Solved Problem Series, Seymour Lipschutz, McGraw-Hill Book Company.

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]	
1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Applied%20Sciences%20&%20Humanities/Mathematics%20and%20Humanities/

MOOCs Links and additional reading, learning, video material	
1	https://nptel.ac.in/courses/111106051
2	https://archive.nptel.ac.in/courses/111/104/111104137/
3	https://archive.nptel.ac.in/courses/111/106/111106135/

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III SEMESTER

23GE1301: Fundamentals of Management & Economics

Course Outcomes:

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

1. Develop the Managerial Perspective and perform the various functions of management for optimum utilization of Engineering Resources
2. Identify and Analyze the role of Financial Accountancy and Marketing Management in the Organization
3. Develop perspective about economy based on logical reasoning and estimate the economic outcomes.
4. Interprets comparative advantage of resources.

Unit I:

7 Hrs.

Principles of Management: Evolution of Management Thought: Scientific and Administrative Theory of Management, Definition and Concept of Management, Functions of Management: Planning, Organizing, Directing, Staffing and Controlling, Motivational Theories, Concept of Leadership.

Unit II:

8 Hrs.

Marketing and Financial Management: Marketing and Financial Management –Marketing Theories and Concept-Marketing Mix, Market Segmentation, Targeting and Positioning and Functions Financial Management and Accountancy- Accountancy Rules and Capital, Preparation of Books of Account- Journal posting of Transaction into ledger and preparation of trial Balance, Introduction of Trading Account, Profit and loss account and balance sheet.

Unit III:

7 Hrs.

Introduction to Microeconomics: Nature and Scope of Microeconomics, Demand Analysis: Meaning and determinants of demand, law of demand, Elasticity of Demand - types and degrees, Utility analysis, Law of diminishing marginal utility, supply- law of supply, Law of Variable proportions and Return to Scale, Classification of market structure.

Unit IV:

8 Hrs.

Introduction to Macroeconomics: Nature and Scope of Macroeconomics, Concept of GDP, GNP, NDP, NNP, Measurement of GDP; Economic Growth and development, Money – definition, types and function of money, Inflation – meaning, types, causes and measure to control, concept of deflation, functions of central and commercial bank, Sources of public revenue - direct and indirect taxes.

Total Lecture 30 Hours

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Textbooks:

1	Principle of Management, 9 th edition, Harold Koontz Ramchandra, Tata McGraw hills
2	Marketing Management: Planning, Implementation and Control, 3 rd Edition, Ramaswamy V.S. and Namakumari S, Macmillian
3	Fundamentals of Accounting Gupta R.L. & Radhaswamy ;
4	Modern Economics, 13 th Edition, H. L. Ahuja, S. Chand Publisher, 2009
5	Modern Economic Theory, 3 rd edition, K. K. Devett, S. Chand Publisher, 2007
6	Principle of Economics, 7 th edition, Mankiw N. Gregory, Thomson, 2013

Reference Books:

1	Foundations of Financial Markets and Institutions, 3 rd Edition, Fabozzi, Prentice Hall
2	Fundamentals of Financial Instruments, 2 nd Edition, Parameshwaran, Wiley India
3	Marketing Management, 3 rd Edition, Rajan Saxena, Tata McGraw Hill
4	Advance Economic Theory, 17 th Edition, H. L. Ahuja, S. Chand Publisher, 2009
5	International Trade, 12 th edition, M. L. Zingan, Vindra Publication, 2007
6	Macro Economics, 11 th edition, M. L. Zingan, Vindra Publication, 2007
7	Monitory Economics, 1 st Edition, M. L. Sheth, Himayalaya Publisher, 1995

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

1	http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0
2	https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042

MOOCs Links and additional reading, learning, video material

1	https://onlinecourses.nptel.ac.in/noc22_mg104/preview
2	https://archive.nptel.ac.in/courses/110/101/110101131/
3	https://onlinecourses.nptel.ac.in/noc23_mg122/preview
4	https://onlinecourses.nptel.ac.in/noc21_hs52/preview
5	https://onlinecourses.nptel.ac.in/noc22_hs67/preview

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B.Tech in Artificial Intelligence and Data Science

III/IV SEMESTER

23CV1311/23CV1411

Environmental Sustainability, Pollution and Management

Course Outcomes :

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

The student will be able to

1. Gain insights into the efforts to safeguard the Earth's environment and resources.
2. Develop a critical understanding of the contemporary environmental issues of concern
3. Have an overview of pollution, climate change and national and global efforts to address adaptation and mitigation to changing environment through environmental management.
4. Learn about the major international treaties and our country's stand on and responses to the major international agreements.

Unit:1	Environment and Sustainable Development	8 Hours
The man-environment interaction; Overview of natural resources: renewable, and non-renewable energy resources; Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs; Environmental issues: Global change, Climate Change and Mitigation.		
Unit:2	Environmental Pollution and Health	7 Hours
Understanding pollution: Production processes and generation of wastes, Air pollution, Water pollution, Soil pollution and solid waste, Noise pollution, Thermal and Radioactive pollution. Impact on biotic and abiotic things.		
Unit:3	Environmental Management	8 Hours
Environmental management system: ISO 14001, Concept of Circular Economy, Life cycle analysis; Cost-benefit analysis, Environmental audit and impact assessment; Waste Management and sustainability; Ecolabeling /Eco mark scheme		
Unit:4	Environmental Treaties and Legislation	7 Hours
Introduction to environmental laws and regulation, An overview of instruments of international cooperation, Major International Environmental Agreements, Major Indian Environmental Legislations, Major International organizations, and initiatives		
Total Lecture		30 Hours

Text books

1	Chiras, D. D and Reganold, J. P. (2010). Natural Resource Conservation: Management for a Sustainable Future. 10th edition, Upper Saddle River, N. J. Benjamin/Cummins/Pearson
2	Rajagopalan, R. (2011). Environmental Studies: From Crisis to Cure. India: Oxford University Press
3	Krishnamurthy, K.V. (2003) Textbook of Biodiversity, Science Publishers, Plymouth, UK
4	Jackson, A. R., & Jackson, J. M. (2000). Environmental Science: The Natural Environment and Human Impact. Pearson Education
5	Pittock, Barrie (2009) Climate Change: The Science, Impacts and Solutions. 2nd Edition. Routledge.
6	Theodore, M. K. and Theodore, Louis (2021) Introduction to Environmental Management, 2nd Edition. CRC Press
7	Kanchi Kohli and Manju Menon (2021) Development of Environment Laws in India, Cambridge University Press

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Reference Books

1	Headrick, Daniel R. (2020) Humans versus Nature- A Global Environmental History, Oxford University Press
2	Gilbert M. Masters and W. P. (2008). An Introduction to Environmental Engineering and Science, Ela Publisher (Pearson)
3	William P. Cunningham and Mary A. (2015). Cunningham Environmental Science: A global concern, Publisher (Mc-Graw Hill, USA)
4	Varghese, Anita, Oommen, Meera Anna, Paul, Mridula Mary, Nath, Snehlata (Editors) (2022) Conservation through Sustainable Use: Lessons from India. Routledge.
5	Central Pollution Control Board Web page for various pollution standards. https://cpcb.nic.in/standards
6	Barnett, J. & S. O'Neill (2010). Maladaptation. Global Environmental Change—Human and Policy Dimensions 20: 211–213
7	Richard A. Marcantonio, Marc Lame (2022). Environmental Management: Concepts and Practical Skills. Cambridge University Press
8	Ministry of Environment, Forest and Climate Change (2019) A Handbook on International Environment Conventions & Programmes. https://moef.gov.in/wp-content/uploads/2020/02/convention-V-16-CURVE-web.pdf

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

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MOOCs Links and additional reading, learning, video material

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III SEMESTER

23ADS1301: Statistics for Data Science

Course Outcomes :

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

1. Apply different visualization and summarizing technique to given data for its interpretation.
2. Solve given problem using the probability theory and linear algebra
3. Perform sampling distribution to estimate the given data and predict the solution using regression
4. Analyse the data using hypotheses and other testing methods
5. Implement various statistics methods on a given dataset using modern tool and write a report

Unit I:	8 Hrs.
Probability and Probability distribution: Basic terminology in probability and rules, Probabilities under conditions of statistical independence and dependence, Bayes Theorem. Random variables, expected values, variance, probability distributions, model given data.	
Unit II:	8 Hrs.
Sampling and Sampling Distributions and: Sampling Distributions: Introduction to sampling, random sampling, non-random sampling, Introduction to sampling distributions, design of experiments	
Unit III:	8 Hrs.
Estimation and Testing Hypotheses: Introduction, point estimates, interval estimates and confidence interval, determining the sample size in estimations Introduction, Basic to the Hypotheses-testing Procedure, Testing Hypotheses, One sample test: Hypotheses Testing of Means when the population standard deviation is Known, Hypotheses Testing of Means when the population standard deviation is not known, Hypotheses Testing of proportions, Limitations of the tests of hypotheses	
Unit IV:	7 Hrs.
Testing Hypothesis II, Quality and quality control: Testing Hypotheses, Two sample test, Statistical process control, Control charts for process mean, Process variability, Charts for attribute, Total quality management.	
Unit V:	7 Hrs.
Simple Regression and Correlation: Introduction, Estimation Using the Regression Line, Correlation Analysis Making Inferences about Population Parameters Using Regression and Correlation Analyses.	
Unit VI:	7 Hrs.
Parametric and Non-Parametric Testing: Introduction to parametric and non-parametric tests, ANNOVA, Chi-square test, sign test, rank sum test.	
Total Lecture	45 Hours

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Textbooks:

- | | | | | |
|----|---|-----------------------------------|--------------|-----------------------------|
| 1. | Statistics for Management | Richard I. Levin & David S. Rubin | 7 th Edition | Pearson Education |
| 2. | Introduction to Linear Algebra | Gilbert Strang | 5 th Edition | Wellesley - Cambridge Press |
| 3. | Introduction to probability and statistics for engineers and scientist, | Sheldon M. Ross, | 3 rd Edi | Elsevier |

Reference Books:

- | | | |
|----|--|---|
| 1. | Practical Statistics for Data Scientists 50 Essential Concepts | Peter Bruce & Andrew Bruce |
| 2. | An Introduction to Statistical Learning with Applications in R | Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani |
| 3. | Mathematical foundations for data analysis | Jeff m. Phillips |

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

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|---|---|
| 1 | http://103.152.199.179/YCCE/Supported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Technology/ |
|---|---|

MOOCs Links and additional reading, learning, video material

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|----|---|
| 1. | https://www.youtube.com/watch?v=V5fqShLVp0I |
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III SEMESTER

23ADS1302 : Lab: Statistics for Data Science

Course Outcomes

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

1. Able to analyze and find the hidden meaning from the given data and visualize the results
2. Able to solve the real-life problem using the probability theory and use it for decision making
3. Able to analyze the samples from the population and solve the problem to get predictive solution using the estimation theory
4. Able to analyze the sample data and use it to test the assumptions made for the population parameter

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Implement basic functionality of R
2	Implement data import and export functionality in R
3	Implement R functions to calculate basic statistics of data source
4	Apply the basic visualization techniques in R to understand data
5	Apply some advanced visualization techniques in R to analyze the data
6	Solve the problems using probability distributions in R
7	Using a case study compare various probability distributions
8	Analyze the data using sampling technique
9	Analyze the data to find out estimated value

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III SEMESTER

23ADS1303 : Data Structures

Course Outcomes:

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

1. Apply the concepts of structures, unions, enums, pointers, and file handling in designing data-centric applications.
2. Analyze and implement various hashing techniques and collision handling strategies for efficient data retrieval.
3. Use dynamic memory allocation to implement stacks and queues, and apply them in expression evaluation and conversion problems.
4. Implement linked list-based data structures and apply them in solving real-life

Unit I:	8 Hrs.
Introduction to Structures, Array of Structures, Pointer to Structures, Union, Enum, File Handling	
Unit II:	8 Hrs.
Hashing – General Idea, Hash Function, Separate Chaining, Hash Tables without linked lists: Linear Probing, Quadratic Probing, Double Hashing, Rehashing, Hash Tables in the Standard Library, Universal Hashing, Extendible Hashing.	
Unit III:	8 Hrs.
Arrays, Dynamic Memory Allocation for Arrays, Stacks, Multiple Stack using Same Array, Stack using STL, Applications of Stacks: Expression Conversion, Expression Evaluation, Parenthesis Matching etc.	
Unit IV:	7 Hrs.
Queue types: Priority Queue, De-Queue, Circular Queue, Applications of Queue, Implementation of Stack using Queue, Implementation of Queue using Stack, Queue using STL	
Unit V:	7 Hrs.
Linked List, Self-Referential Structure, Types of Linked Lists: Singly Linked List, Doubly Linked List, Operations on Singly and Doubly Linked List, Applications of Linked List: Polynomial Evaluation etc.	
Unit VI:	7 Hrs.
Stack Implementation using Linked List, Queue implementation using linked list, Skip List. Circular Linked List	
	Total Lecture 45 Hours

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Textbooks:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4 th Edition, 2014, Pearson.
2. Introduction to Algorithms, Thomas H Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, 3rd Edition, 2009, The MIT Press.

Reference Books:

1. Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahani and Rajasekharam, 2nd Edition, 2009, University Press Pvt. Ltd.
2. Advanced Data Structures, Reema Thareja, S. Rama Sree, Oxford University Press, 2018

MOOCs Links and additional reading, learning, video material

1. <https://nptel.ac.in/courses/106102064>
2. https://www.youtube.com/watch?v=I_314LpT6X8
3. <https://nptel.ac.in/courses/106106133>

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III SEMESTER

23ADS1304 : Lab: Data Structures

Course Outcomes

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

1. Apply concepts of structures, arrays, pointers, unions, and enums.
2. Implement and analyze different types of queues and stacks, including their applications.
3. Utilize dynamic memory allocation and stack-based approaches to solve algorithmic problems.
4. Design, implement, and apply various types of linked lists and skip lists for complex data processing and problem-solving scenarios.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	program using structure arrays
2	program that demonstrates file handling operations
3	Program to implement a stack
4	Program to implement a queue
5	Program to implement one data structures using another
6	Program to implement stack and use it for infix to postfix conversion
7	Program to implement a singly linked list
8	Program to implement a doubly linked lists
9	Program to implement stack using singly linked lists
10	Program to implement queue using singly linked lists
11	program to implement a circular linked list
12	Program on Skip list

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III SEMESTER

23ADS1305 : Community Engagement Project

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III SEMESTER Open Elective -I : Basket

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	3	OE1	GE	23OE1301	OE-I : Combinatorics
2	3	OE1	GE	23OE1302	OE-I : Fuzzy Set Theory, Arithmetic And Logic
3	3	OE1	GE	23OE1303	OE-I : Green Chem. & Sustainability
4	3	OE1	GE	23OE1304	OE-I : Hydrogen Fuel
5	3	OE1	GE	23OE1305	OE-I : Electronic Materials And Applications
6	3	OE1	GE	23OE1306	OE-I : Laser Technology And Applications
7	3	OE1	MGT	23OE1307	OE-I : Finance And Cost Management
8	3	OE1	MGT	23OE1308	OE-I : Operation Research Techniques
9	3	OE1	MGT	23OE1309	OE-I : Project Evaluation & Management
10	3	OE1	MGT	23OE1310	OE-I : Total Quality Management
11	3	OE1	MGT	23OE1311	OE-I : Value Engineering
12	3	OE1	MGT	23OE1312	OE-I : Maintenance Management
13	3	OE1	MGT	23OE1313	OE-I : Industrial Safety
14	3	OE1	MGT	23OE1314	OE-I : Industry 4.0
15	3	OE1	MGT	23OE1315	OE-I : Operation Management
16	3	OE1	MGT	23OE1316	OE-I : Material Management
17	3	OE1	MGT	23OE1317	OE-I : Hospitality Management
18	3	OE1	MGT	23OE1318	OE-I : Human Resource Management & Organizational Behaviour
19	3	OE1	MGT	23OE1319	OE-I : Agri-Business Management
20	3	OE1	MGT	23OE1320	OE-I : Rural Marketing
21	3	OE1	MGT	23OE1321	OE-I : Marketing Management
22	3	OE1	MGT	23OE1322	OE-I : Health Care Management

Link for Open Electives syllabus: <https://ycce.edu/syllabus/>

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III SEMESTER

MDM1ADS101 : Basics of Data Science

Course Outcomes :

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

1. To interpret the data analysis task
2. To use the statistical techniques to prepare and present the data for analysis
3. To use the probability theory to handle uncertainty in the applications
4. To interpret the applications of data analysis

Unit I:	7Hrs.
Introduction to Data Science; role of data scientist, Types of Data, tool boxes for data scientists, introduction to R studio	
Unit II:	7Hrs.
Understanding different data sets Introduction to Data analysis, Types of Data analysis, Applications. Technologies involved in the data analysis	
Unit III:	8 Hrs.
Preparing data for analysis: Grouping and Displaying Data to Convey Meaning. Measure of central tendency, dispersion	
Unit IV:	8 Hrs.
Probability and Probability distribution: Basic terminology in probability and rules, Probabilities under conditions of statistical independence and dependence, Bayes Theorem. Random variables, expected values, variance, probability distributions, model given data.	
	Total Lecture 30 Hours

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Textbooks:

1.	Statistics for Management	Richard I. Levin & David S. Rubin	7 th Edition	Pearson Education
2.	Introduction to Linear Algebra	Gilbert Strang	5 th Edition	Wellesley - Cambridge Press
3.	Introduction to probability and statistics for engineers and scientist,	Sheldon M. Ross,	3 rd Edi	Elsevier

Reference Books:

1.	Practical Statistics for Data Scientists 50 Essential Concepts	Peter Bruce & Andrew Bruce
2.	An Introduction to Statistical Learning with Applications in R	Gareth James, Daniela Witten, Trevor Hastie & Robert Tibshirani

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

1	http://103.152.199.179/YCCE/Suported%20file/Supprted%20file/e-copies%20of%20books/Computer%20Technology/
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MOOCs Links and additional reading, learning, video material

1.	https://www.youtube.com/watch?v=V5fqShLVpoI
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B.Tech in Artificial Intelligence and Data Science

III SEMESTER

MDM1ADS201 : Front-End Web Development

Course Outcomes :

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

1. Apply foundational web technologies including HTML5 and CSS3 to create responsive and structured web pages using modern layout techniques like Flexbox and Grid.
2. Implement interactivity on web pages using JavaScript ES6+ features, DOM manipulation, event handling, and browser local storage.
3. Develop dynamic and modular front-end applications using React, including state management, component lifecycle, and routing.
4. Integrate front-end applications with deployment tools, apply UI best practices, manage forms with validation, and utilize version control systems for project management.

Unit I:	6 Hrs.
Web Foundations – HTML, CSS & Layouts: Role of front-end in web development, HTML5: tags, semantic structure, forms, media, CSS basics: selectors, colors, fonts, box model, CSS Layouts: Flexbox, Grid, responsiveness, DevTools, structure validation	
Unit II:	6 Hrs.
JavaScript Essentials + DOM Manipulation : JavaScript Syntax & ES6+ (let, const, arrow functions), Data types, conditionals, loops, arrays, objects, Functions, events, and DOM manipulation, Event listeners, querySelector, innerHTML, Introduction to local storage and basic debugging	
Unit III:	7 Hrs.
React Basics + State & Routing: Introduction to React, JSX, component structure, Props and state, useState, useEffect, component lifecycle, React Router for navigation, Handling forms and controlled components	
Unit IV:	7 Hrs.
Front-End Integration & Deployment: UI Enhancement & Best Practices, Styling in Modern React, Forms and Validation, Hosting & Deployment, Version Control Basics	
	Total Lecture 26 Hours

Textbooks:

1.	HTML and CSS: Design and Build Websites by Jon Duckett, Publisher: Wiley UNIT-1
2.	Learning JavaScript: JavaScript Essentials for Modern Application Development by Ethan Brown, Publisher: O'Reilly Media UNIT-2
3.	Learning React: Modern Patterns for Developing React Apps by Alex Banks & Eve Porcello, Publisher: O'Reilly Media UNIT-3&4

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III SEMESTER

Mandatory Learning Course (MLC)

MLC2123 : YCAP3

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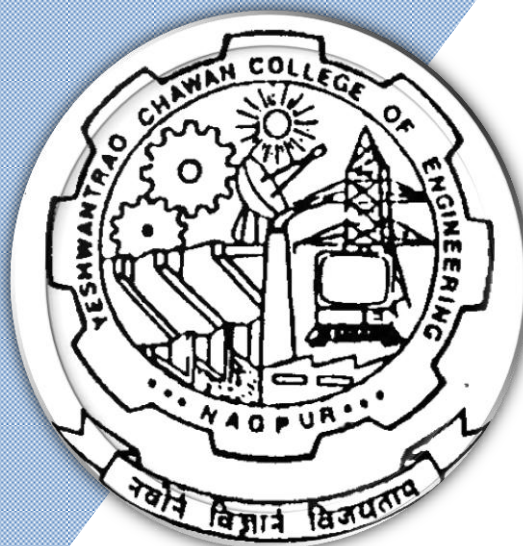
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Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2023 4th Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



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B.TECH SCHEME OF EXAMINATION 2023
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(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FOURTH SEMESTER															
1	4	HSSM-2	GE	23GE1401	Entrepreneurship Development	T	2	0	0	2	2	30	20	50	3
2	4	AEC-2	GE	23GE1405 23GE1406	Marathi Language Hindi Language	T	2	0	0	2	2	30	20	50	3
3	4	PC	AIDS	23ADS1401	Operating Systems	T	3	0	0	3	3	30	20	50	3
4	4	PC	AIDS	23ADS1402	Lab : Operating Systems	P	0	0	2	2	1		60	40	
5	4	PC	AIDS	23ADS1403	Advanced Data Structures	T	3	0	0	3	3	30	20	50	3
6	4	PC	AIDS	23ADS1404	Lab : Advanced Data Structures	P	0	0	2	2	1		60	40	
7	4	PC	AIDS	23ADS1405	Database Management Systems	T	3	0	0	3	3	30	20	50	3
8	4	PC	AIDS	23ADS1406	Lab : Database Management Systems	P	0	0	2	2	1		60	40	
9	4	PC	AIDS	23ADS1407	Lab : Java Full Stack	P	0	0	2	2	1		60	40	
10	4	VSEC-3	AIDS	23ADS1408	Lab : Python for Data Science	P	0	0	4	4	2		60	40	
11	4	VEC-2	AIDS	23ADS1409	Cyber Laws	T	2	0	0	2	2	30	20	50	3
12	4	OE-2	OE		Open Elective - II	T	2	0	0	2	2	30	20	50	3
13	4	MDM	AIDS		MD Minor Course - II	T	2	0	0	2	2	30	20	50	3
TOTAL							19	0	12	31	25				

List of Mandatory Learning Course (MLC)

1	4	HS	T&P	MLC2124	YCAP4 : YCCE Communication Aptitude Preparation	A	3	0	0	3	0				
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Open Elective - II

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management
23	4	OE2	MGT	23OE2423	OE-II : Designated approved online NPTEL/KKSU Course
24	4	OE2	MGT	23OE2424	OE-II : Indian Archeology
25	4	OE2	MGT	23OE2425	OE-II : Social & Positive Psychology
26	4	OE2	MGT	23OE2426	OE-II : Seismology & Earthquake

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B.Tech in Artificial Intelligence and Data Science

IV SEMESTER

23GE1401 : Entrepreneurship Development

Course Outcomes:

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

1. Appreciate role of entrepreneurs in society and develop entrepreneurial abilities by providing information about skill sets.
2. Develop an understanding of how and what form of business organization to choose for start up.
3. Stimulate to innovate, develop prototypes or ideas by applying theory into practice.
4. Identify the Support rendered by various Government Agencies.

Unit I:

7 Hrs.

Entrepreneur & Entrepreneurship: Meaning of Entrepreneur, Evolution of the concept – Theories and Models, Types of Entrepreneur, Stages in entrepreneurial process- Idea Generation, Screening, Selection and Managing Resources.

Unit II:

8 Hrs.

Legal Compliances for Incorporating Start up: Fundamentals of choosing the Business Organization form for startup, Incorporation of Partnership, LL.P & Co – operative, Incorporation of One Person Company, Pvt. Ltd., Pub. Ltd. and not for profit company, Financing the legal Venture and Legal Compliances.

Unit III:

7 Hrs.

Entrepreneurship and IP Strategy: Intellectual Property : Definition and Concept of Trade Mark, Patent, Copyright, Industrial Design, IP Strategy and Entrepreneurship.

Unit IV:

8 Hrs.

Support to Entrepreneurs: Financing new ventures, Business Incubators – Government Policy for Small Scale Enterprises, Growth Strategies in small industry – Expansion, Diversification, Joint Venture, Merger and Subcontracting.

Total Lecture

30 Hours

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Student activities:

1. Interview at least four entrepreneurs or businessman and identify Traits of successful entrepreneurs.
2. Analyse case studies of any two successful entrepreneurs.
3. Download product development and innovative films from internet.
4. Identify your hobbies and interests and convert them into business idea

Textbooks

1. Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, "Entrepreneurship – Theory, Process and Practice", 9th Edition, Cengage Learning 2014.
3. Corporate Law, 33rd ed. 2016, Taxman New Delhi.
4. Narayanan, V. K., Managing technology and innovation for competitive advantage, first edition, Pearson education, New Delhi, (2006)
5. Idris, K. (2003), Intellectual property: a power tool for economic growth, second edition, WIPO publication no. 888, Switzerland
6. Khanka. S.S., "Entrepreneurial Development" S.Chand & Co. Ltd., Ram Nagar, New Delhi, 2013.
7. Ramaiya's Guide to the Companies Act, 18th ed. 2014, Lexis Nexis New Delhi.

Reference Books

1. Mehta, Monica- The Entrepreneurial Instinct : How everyone has the innate ability to start a successful small business – McGraw – Hill Education, New Delhi 2012, ISBN 978-0-07-179742-9
2. Prasanna Chandra "Protect Preparation, Appraisal, Implementation" Tata McGraw Hill. New Delhi
3. S Anil Kumar "Entrepreneurship Development" New Age International Publishers
4. Nishith Dubey "Entrepreneurship Development" PHI Learning

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

- 1 <http://link.springer.com/openurl?genre=book&isbn=978-1-4613-6193-0>
- 2 <https://onlinelibrary.wiley.com/doi/book/10.1002/9780470168042>

MOOCs Links and additional reading, learning, video material

- 1 https://onlinecourses.swayam2.ac.in/cec23_mg24/course- entrepreneurship development
- 2 https://onlinecourses.nptel.ac.in/noc23_mg74/announcements?force=true-entrepreneur
- 3 https://onlinecourses.nptel.ac.in/noc23_mg126/announcements?force=true-Business fundamentals for entrepreneurship

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B.Tech in Artificial Intelligence and Data Science

IV SEMESTER

23GE1405 : Marathi Language

Course Objectives		
- मराठी भाषेच्या समृद्धीची जाणीव करून देणे. - विद्यार्थ्यांमध्ये भाषा कौशल्याचा विकास करणे आणि त्यातून रोजगाराच्या संधींचा शोध घेणे.		
Course Outcomes		
- भाषेचा जीवन व्यवहारात योग्य पद्धतीने वापर करण्याचा प्रयत्न करणे. - संत साहित्याच्या शिकवणुकीमुळे मानवता आणि मानवी व्यवहाराची सांगड घालणे, नैतिक मूल्ये रुजविणे. - विद्यार्थ्यांना रोजगाराभिमुख बनविणे.		
Unit:1	गद्य विभाग	8 Hours
- भारतीय लोकशाहीचे भवितव्य काय? - डॉ. बाबासाहेब आंबेडकर - काळी आई - व्यंकटेश माडगूळकर - संत तुकारामांचे अभंग - निर्मलकुमार फडकुले - माझी शाळा - प्रकाश खरात - समतेचे वारकरी संत गाडगेबाबा - अशोक राणा - लोककल्याणकारी राजा : आणि राष्ट्रसंत तुकडोजी महाराज - शरयू तायवाडे		
Unit:2	पद्य विभाग	8 Hours
- ज्ञानेश्वरांचे अभंग - संत ज्ञानेश्वर - वनसुधा - वामन पंडित - नवा शिपाई - केशवसुत - मेंढरं - विठ्ठल वाघ - पोरी - अनुराधा पाटील - गाव - हेमंतकुमार कांबळे		

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Unit:3	व्यावहारिक मराठी	7 Hours
१. म्हणी २. मुलाखतलेखन - डॉ. वैशाली धनविजय ३. वाक्प्रचार ४. जाहिरातलेखन - डॉ. अजय देशपांडे		
Unit:4	रोजगाराभिमुख मराठी व्यावहारिक कौशल्ये	7 Hours
१. प्रत्यक्ष मुलाखत कौशल्य २. वाचन कौशल्य - (अ) बातमी वाचन (ब) कथा वाचन ३. ऑनलाईन कौशल्य - (अ) ग्राहक सेवा केंद्राशी संवाद, (ब) ऑनलाईन अर्ज करणे		

Reference Books

- पाठ्यपुस्तक : शब्दसाधना - भाग १
- रोजगाराभिमुख मराठी व्यावहारिक कौशल्ये

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B.Tech in Artificial Intelligence and Data Science

IV SEMESTER

23GE1406 : Hindi Language

Course Objectives

- विद्यार्थियों में देशभक्तिपरक एवं पारिवारिक मूल्यों का विकास।
- विद्यार्थियों पर्यावरण-संरक्षण के प्रति सजग करना।
- एकांकी, कहानी, निबंध आदि विधाओं के मध्य का अंतर अवगत कराना।
- हिंदी के प्रयोजनमूलक स्वरूप से परिचित कराना।
- विद्यार्थियों को आधुनिक प्रौद्योगिकी (तकनीक) का प्रयोग करने में सक्षम बनाना।

Course Outcomes

- पौराणिक अथवा ऐतिहासिक घटनाओं को तार्किक आधार पर स्वीकार करेंगे। अपने परिवेश के उचित और अनुचित व्यवहारों के प्रति आकलन शक्ति बढ़ेगी।
- एकांकी, कहानी, निबंध आदि विधाओं के मध्य का अंतर बताने में सक्षम होंगे।
- कविता का रसास्वादन करने में समर्थ होंगे।
- 'अनुवाद' के स्वरूप एवं प्रक्रिया से अवगत होंगे।
- 'मार्गिक नक्शे' का दैनिक जीवन में उपयोग करने में सक्षम होंगे।

Unit:1	गद्य विभाग	8 Hours
१. भाईसाहब (कहानी)	- प्रेमचंद	
२. स्मृति (निबंध)	- श्रीराम शर्मा	
३. गिल्लू (रेखाचित्र)	- महादेवी वर्मा	
४. अभाव (कहानी)	- विष्णु प्रभाकर	
५. महाभारत की साँझ (एकांकी)	- भारतभूषण	
६. उखड़े खंबे (व्यंग्य)	- हरिशंकर परसाई	

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Unit:2	पद्य विभाग	8 Hours
१. कबीर के दोहे	- कबीरदास	
२. ले चल यहाँ भुलावा देकर	- जयशंकर प्रसाद	
३. स्नेह-निर्झर बह गया	- हैसूर्यकांत त्रिपाठी "निराला"	
४. प्रथम रश्मि	- सुमित्रानंदन पंत	
५. जीवन का झरना	- आरसीप्रसाद सिंह	
६. कविता के साथ	- दामोदर खड़से	
Unit:3	अन्य पाठ्य सामग्री	7 Hours
१. मुहावरे और लोकोक्तियाँ: पाठ्यपुस्तक में मुहावरे और लोकोक्तियाँ का अर्थ एवं वाक्य प्रयोग		
२. विज्ञापन कला : अर्थ, परिभाषा, प्रकार, शीर्षक का महत्त्व, विज्ञापन के प्रयोजन, सत्य, लक्ष्य, विज्ञापन की भाषा, अच्छे विज्ञापन के गुण इत्यादि।		
Unit:4	कौशल्य आधारित घटक	7 Hours
१. वाचन कौशल्य (समाचार-वाचन, कहानी-वाचन)		
२. सोशल मीडिया के शिष्टाचार		
३. ऑनलाइन आवेदन, ग्राहक-सेवा केंद्र से संवाद		

Reference Books

३. पाठ्यपुस्तक : "पलाश"

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**SoE No.
23ADS-101**

B.Tech in Artificial Intelligence and Data Science

IV Semester

23ADS1401: Operating Systems

Course Outcomes :

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

1. Describe the different services provided by Operating System at different level.
2. Apply knowledge of different operating system algorithms to solve a given problem.
3. Analyze various approaches used to improve system performance.
4. Differentiate various disk scheduling algorithms based on their performances..

Unit I:	(8 Hrs.)
Introduction, services provided by OS, functions of OS, system calls. Process management-introduction, process control block, process states, process context switch, threads: user level and kernel level.	
Unit II:	(8 Hrs.)
CPU scheduling, goals of scheduling, CPU scheduling algorithms: FCFS, SJF, SRTF, RR, Priority based.	
Unit III:	(7 Hrs.)
Inter-process communication: process cooperation and synchronization, race condition, critical section, mutual exclusion and implementation, semaphores, classical inter-process communication problems.	
Unit IV:	(8 Hrs.)
Deadlocks: System Model, deadlock characterization-necessary conditions, resource allocation graph (RAG), methods for handling deadlock-deadlock avoidance, deadlock detection, deadlock prevention, recovery from deadlock.	
Unit V:	(7 Hrs.)
Memory management techniques-contiguous and non-contiguous, paging and segmentation, translation look aside buffer (TLB) and overheads. Virtual memory and demand paging, page faults, page replacement algorithms, thrashing and working set model	
Unit VI:	(7 Hrs.)
File systems-introduction, disk space management and space allocation strategies, directory structures, disk caching, disk arm scheduling strategies: FCFS, SSTF, SCAN, CSACN, LOOK, CLOOK, File Organization: Sequential, Index, Index Sequential	
Total Lecture 45 Hours	

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Textbooks:

Operating system concepts, A. Silberchatz and P.Galvin , Addison Wesley Longman Inc

Reference Books:

1. Modern operating systems, 1st , A.S. Tanenbaum , Prentice Hall of India publication
2. Operating Systems, Crowley , Tata McGraw Hill

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

- 1 <http://103.152.199.179/YCCE/Supported%20file/Supported%20file/e-copies%20of%20books/Computer%20Technology/>

MOOCs Links and additional reading, learning, video material

1. <https://nptel.ac.in/courses/106102132>
2. <https://www.youtube.com/watch?v=kqGhEJRdu8>
3. https://www.youtube.com/watch?v=ucVm_arB-fw

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23ADS-101**

B.Tech in Artificial Intelligence and Data Science

IV SEMESTER

23ADS1402: Lab. Operating Systems

Course Outcomes

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

1. Describe the different services provided by Operating System at different level.
2. Apply knowledge of different operating system algorithms to solve a given problem.
3. Analyze various approaches used to improve system performance.
4. Differentiate various disk scheduling algorithms based on their performances.

Minimum Eight Practical's to be performed from the list as below

SN	Program based on
1	Basics of Linux commands and its use.
2	Write a shell script using control structure (i) Write a shell script to find maximum of 3 numbers. (ii) Write a shell script to check whether entered number even or odd
3	Write a shell script using loops (i) Write a shell script to find factorial of a number (ii) Write a shell script to reverse of a number
4	Write a program to create a process using fork() system call.
5	Write a program to implement Shortest Job First CPU scheduling algorithm.
6	Write a program to implement Non-Preemptive Priority CPU scheduling algorithm
7	Write a program to implement FIFO page replacement algorithm.
8	Write a program to implement Best-Fit/Worst-Fit strategies
9	Program based on threads
10	Case study on Android Operating System

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B.Tech in Artificial Intelligence and Data Science

IV Semester

23ADS1403: Advanced Data Structures

Course Outcomes :

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

1. Acquire the basic concepts of data structures and select appropriate data structures for solving real life problems
2. Demonstrate various operations on linked list, skip list, hashing based on the requirements of real life problems
3. Implement different types of trees and graph data structures and use them to solve problems dealing with non-linear data

Unit I:	(8 Hrs.)
Trees, terminologies, binary, binary search tree, complete, full, threaded, operations, traversals, BFS, DFS	
Unit II:	(8 Hrs.)
Heap Sort, Balanced trees: Height-balanced (AVL) trees, Red-black trees, implementation	
Unit III:	(9 Hrs.)
Multi-way trees-B and B+ and applications, Splay tree, Multidimensional tree: Tries and Pattern matching algorithms	
Unit IV:	(8 Hrs.)
Graphs: Representation, terminologies, & traversals. Spanning trees, topological sort and its implementation, articulation point, shortest path algorithm, all-pairs shortest paths	
Unit V:	(8 Hrs.)
Disjoint sets, hash table, Equivalence relation, Basic Data Structure, Simple Union and Find algorithms, Smart Union and Path compression algorithm	
Unit VI:	(8 Hrs.)
String Matching – The naive string-matching algorithm, The Rabin-Karp algorithm, The Knuth-Morris-Pratt algorithm.	
Total Lecture	45 Hours

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Textbooks:

1.	Data Structures with C Seymour Lipschutz Latest TMH
2.	Data structures using C Reema Thareja Latest Oxford

Reference Books:

1.	Introduction to Algorithms Thomas Cormen, Charles Leiserson, Ronal Rivest, Clifford Stein 3rd 2015 PHI
2.	Fundamentals of Data Structures in C++ Ellis Horowitz, Sartaj Sahani, Dinesh Mehta 2nd, 2009 University Press
3.	Data Structures and Program Design in C Robert Kruse, Cl Tondo 2nd, 2009 Pearson Education

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IV Semester

23ADS1404: Lab Advanced Data Structures

Course Outcomes

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

1. Implement different types of linked list with various operations on them
2. Implement various operations on skip list, disjoint set and hash table.
3. Identify and Implement various operations on different types of trees
4. Write program for finding shortest path between pair of entities

Minimum Eight Practical's to be performed from the list as below

SN	Program based on
1	Program based on Linked list
2	Program based on implementing one data structure using another data structure
3	Program to Print the Alternate Nodes in a Linked List using Recursion
4	Program based on Binary tree
5	Program based on Binary search tree
6	Program for Heap sort
7	Program based on Tries
8	Program based on graph
9	Program for detecting presence of cycle in given graph G
10	Program for printing topological sort of given graph

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IV SEMESTER

23ADS1405 : Database Management Systems

Course Outcomes :

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

1. **Understand** database management system, through modeling and designing concepts.
2. **Apply** the knowledge of relational algebra, query language, transaction management to perform the operations on database.
3. **Analyze** database schemas to identify design issues and recommend suitable normalization and transaction management techniques for improved efficiency and integrity
4. **Design** database schema using the entity relation diagrams and relational database aspects.

Unit I:

8 Hrs.

Introduction to Database Management System: Database system Concepts and Architecture, Data Models, Schemas and Instances, Abstraction & Different Levels of Data Abstraction, Data Independence: Logical & Physical Independence.

Entity-Relationship Model: Entities and Entity Sets, Relationships and Relationship Sets, Attributes, Mapping Constraints, Keys, Entity Relationship Diagram, Generalization, Aggregation, Reducing E-R Diagrams to Tables

Unit II:

7 Hrs.

Relational Data Model: Structure of Relational Databases

Relational Algebra: Structure of relational databases, Fundamental Relational-Algebra Operations, Additional relational algebra operations, extended relational algebra operations, modification of the databases.

Unit III:

8 Hrs.

SQL: Data definition language (DDL), Data Manipulation Language (DML), Basic structure of SQL Queries, Set operations, Null Values, Nested sub-queries, views, modification of database, transaction, Joins.

PLSQL Constructs: SQL data types & schemas, Integrity Constraints, Domain Constraints, Assertions, triggers, Stored Procedures

Unit IV:

8 Hrs.

Relational Database Design AND Normalization: Pitfalls in Relational Database Design, Functional Dependencies, Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decomposition, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Other Dependencies and Normal Forms

Unit V:

7 Hrs.

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Transaction Management: ACID Properties, Implementation of ACID Properties, Database processes to support ACID Properties, Schedules, and Testing of Serializability

Unit VI: **7 Hrs.**

Concurrency Control: Lock-based Protocols, Timestamp Based Protocols, Validation Techniques.

Crash Recovery: Failure Classification, Log Based Recovery, Buffer Management, Checkpoints.

Total Lecture 45 Hours

Textbooks:

1. Database System Concepts, Korth, Silberschatz McGraw-Hill publication.
2. Fundamentals of Database Systems, Elmasri, Navathe & Gupta, Pearson Education.

Reference Books:

1. Database System Concepts, Henry Korth and Others, McGraw Hill
2. Database Systems, Connolly, Pearson Publications
3. Database Systems, S. K. Singh, Pearson Education
4. Principles of Database Systems Ullman Golgotia Publications 1998

MOOCs Links and additional reading, learning, video material

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview

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IV SEMESTER

23ADS1406 : Lab: Database Management Systems

Course Outcomes

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

1. Apply the concepts of database query language to extract, process and manage the data
2. Design the conceptual and physical database schema using database query language

SN	Experiments based on
1	Implementation of DDL commands of SQL with suitable examples
2	Implementation of DML commands of SQL with suitable examples
3	Implementation of different types of function with suitable examples
4	Implementation of different types of operators in SQL
5	Implementation of different types of Joins
6	Study and Implementation of • Group By & having clause • Order by clause • Indexing
7	Study & Implementation of • Sub queries • Views
8	Study & Implementation of different types of constraints
9	Study & Implementation of Database Backup & Recovery commands. Study & Implementation of Rollback, Commit, Savepoint
10	Creating Database /Table Space • Managing Users: Create User, Delete User • Managing roles:-Grant, Revoke.
11	Study & Implementation of PL/SQL
12.	Study & Implementation of SQL Triggers.

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IV SEMESTER 23ADS1407 : Lab : Java Full Stack

Course Outcomes :

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

1. Apply the concepts related to advance Java features, database connectivity
2. Apply the techniques to create the user interface for application
3. Understand the process of deployment of application on cloud
4. Apply the different tools to develop the software solution

Unit I:	(5 Hrs.)
OOP Concepts, Data Structures, Collection Framework, File handling, JDBC, Introduction to JUnit.	
Unit II:	(5 Hrs.)
Introduction to Java 8 Features, Interface Enhancements, Functional Interfaces, Lambda Expression, ForEach, Method References, Streams API, JavaDocs	
Unit III:	(5 Hrs.)
Building Responsive Web Pages HTML5, CSS3 and JavaScript, Basic Single Page Applications Using Angular OR React.	
Unit IV:	(5 Hrs.)
Working with Spring Core, Dependency Injection, Spring MVC, Spring Boot, Introduction to Hibernate and Spring Microservices	
Unit V:	(5 Hrs.)
Virtualization Basics, Introduction to Cloud, RDB Cloud Fundamentals (SaaS, Paas, IaaS), Introduction to AWS (S3 Buckets, RDS), AWS Cloudfront.	
Unit VI:	(5 Hrs.)
Introduction to Maven, Jacoco, SonarLint, Jira, Swagger, Mockito, Docker, Gitrunner.	
Total Lecture	30 Hours

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IV SEMESTER

22ADS408: Lab: Python for Data Science

Course Outcomes :

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

1. Write a python program to apply various data structures concept
2. Apply the concept of file handling and object-oriented programming in python
3. Select the required framework and appropriate libraries to write a program in python
4. Develop web-based application using functionalities provided under various packages

Minimum Eight Practical's to be performed from the list as below

SN	Program based on
1.	Revision to Python language: Lists, Dictionary, Sets, Tuples, Numpy. write a Python program using: Lists comprehension, Dictionary comprehension
2.	Write a program using: File handling
3.	Write a program using: Exception Handling
4.	Write a program using: Enumeration, Lambda Function
5.	Write program using: Decorators
6.	Write a program using object-oriented concept
7.	Module reference: statistics, Random, Math
8.	Study of Pandas data frames and implement data frames related operations
9.	Program using: Matplotlib
10.	Project work: GUI creation in Python (Flask framework)

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IV SEMESTER

23ADS1409 : Cyber Laws

Course Outcomes :

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

1. Identify and explain international and national legal frameworks governing cyberspace.
2. Demonstrate familiarity with legal terminology commonly used in cyber law and technology-related legal discussions.
3. Identify different types of cybercrime and understand relevant laws and regulations for investigating and prosecuting cyber offenses

Unit I: Introduction

7 Hrs.

Introduction: Cyber Crime: Meaning and Definition, Classification of Cyber Crimes, Causes of Cyber Crime, Impact and Effects of Cyber Crimes,

Unit II: Information Technology Law:

6 Hrs.

Information Technology Law: Need of Legal Protection in Cyber World, Information Technology Act 2000 – Objectives, Scope, Applicability, Information Technology (Amendment) Act 2008, Recompense of Information Technology Law, Limitation of Information Technology Law

Unit III: Legal Protection against Cyber Crimes

7 Hrs.

Legal Protection against Cyber Crimes: Criminal Liabilities under Information Technology Act 2000, Common Cyber Crimes and Applicable Legal Provisions, Civil Liabilities under Information Technology Act 2000, Civil Liability for Corporate, Cyber Crimes under IPC and Special Laws

Unit IV: Case studies

6 Hrs.

Case studies: Cyber Crime-Some Landmark Occurrence, Recent Trends in Cyber Laws

Total Lecture 26 Hours

Textbooks:

1. Cyber Crim Elaw and Practice, The Institute of Company Secretaries of India - New Delhi
2. Information Security & Cyber Laws, by Gaurav Gupta, Sarika Gupta, Khanna Publishing House

Reference Books:

1. Understanding Cybersecurity Law and Digital Privacy, Melissa Lukings, Arash Habibi Lashkari, Springer Cham

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IV SEMESTER

MDM2ADS102 : Predictive Data Science

Course Outcomes :

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

1. Apply different visualization and summarizing technique to given data for its interpretation.
2. Solve given problem using the probability theory and linear algebra
3. Perform sampling distribution to estimate the given data and predict the solution using regression
4. Analyse the data using hypotheses and other testing methods

Implement various statistics methods on a given dataset using modern tool and write a report

Unit I:	7Hrs.
Sampling and Sampling Distributions and: Sampling Distributions: Introduction to sampling, random sampling, non-random sampling, Introduction to sampling distributions	
Unit II:	7Hrs.
Estimation and Testing Hypotheses: Introduction, point estimates, interval estimates and confidence interval, determining the sample size in estimations Introduction, Basic to the Hypotheses-testing Procedure, Testing Hypotheses, One sample test: Hypotheses Testing of Means when the population standard deviation is Known, Hypotheses Testing of Means when the population standard deviation is not known	
Unit III:	8 Hrs.
Testing Hypothesis II, Quality and quality control: Testing Hypotheses, Two sample test, Statistical process control, Control charts for process mean, Process variability, Charts for attribute, Total quality management.	
Unit IV:	8 Hrs.
Simple Regression and Correlation: Introduction, Estimation Using the Regression Line, Correlation Analysis Making Inferences about Population Parameters Using Regression and Correlation Analyses.	
	Total Lecture 30 Hours

Textbooks:

1.	Statistics for Management	Richard I. Levin & David S. Rubin	7 th Edition
		Pearson Education	
2.	Introduction to Linear Algebra	Gilbert Strang	5 th Edition Wellesley - Cambridge Press
3.	Introduction to probability and statistics for engineers and scientist,	Sheldon M. Ross,	3 rd Edi Elsevier

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Reference Books:

1.	Practical Statistics for Data Scientists 50 Essential Concepts	Peter Bruce & Andrew Bruce
2.	An Introduction to Statistical Learning with Applications in R Witten, Trevor Hastie & Robert Tibshirani	Gareth James, Daniela
3.	Mathematical foundations for data analysis	Jeff m. Phillips

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IV SEMESTER

MDM2ADS202 : Back-End Web Development

Course Outcomes :

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

1. Develop server-side applications using Node.js and Express.js with an understanding of modular architecture, HTTP handling, middleware, and JSON responses.
2. Design and implement RESTful APIs with secure user authentication using bcrypt and JWT, and apply best practices for error handling and environment configuration.
3. Integrate MongoDB with Express applications using Mongoose for schema modeling, perform CRUD operations, and handle asynchronous database interactions.
4. Apply best practices in structuring backend applications, test APIs using Postman, use version control with Git, and understand deployment workflows for backend services.

Unit I:

6 Hrs.

Node.js Fundamentals & Express.js Basics: Introduction to Node.js: event-driven architecture, modules, Setting up Node.js project with npm, Express.js framework basics, Creating HTTP servers & RESTful routing, Middleware usage, Serving static files, JSON response

Unit II:

6 Hrs.

RESTful API Development & Authentication: REST API design principles, Implementing CRUD operations (Create, Read, Update, Delete), Route parameters, error handling, User Authentication: Password hashing using bcrypt, Login with JSON Web Tokens (JWT), Securing routes, Environment variables with dotenv

Unit III:

6 Hrs.

MongoDB & Mongoose Integration: Introduction to NoSQL and MongoDB (Atlas + Compass), MongoDB collections, documents, and CRUD, Mongoose: Schema and Model definitions, Validations, Connecting to MongoDB from Express, Async/await and error handling in DB context

Unit IV:

6 Hrs.

API Integration, Testing & Deployment: Express App Structure & Best Practices, API Testing with Postman, Error Handling & Logging, Version Control with Git, Deployment Overview

Total Lecture

24 Hours

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Textbooks:

1.	Web Development with Node and Express (2nd Edition) by Ethan Brown, Publisher: O'Reilly Media, UNIT- 1, 2 & 4
2.	Node.js, MongoDB, and Angular Web Development by Brad Dayley, Brendan Dayley, Caleb Dayley, Publisher: Addison-Wesley, UNIT- 2 & 3

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IV SEMESTER Open Elective -II: Basket

SN	Sem	Type	BoS/ Deptt	Sub. Code	Subject
1	4	OE2	GE	23OE2401	OE-II : Combinatorics
2	4	OE2	GE	23OE2402	OE-II : Fuzzy Set Theory, Arithmetic And Logic
3	4	OE2	GE	23OE2403	OE-II : Green Chem. & Sustainability
4	4	OE2	GE	23OE2404	OE-II : Hydrogen Fuel
5	4	OE2	GE	23OE2405	OE-II : Electronic Materials And Applications
6	4	OE2	GE	23OE2406	OE-II : Laser Technology And Applications
7	4	OE2	MGT	23OE2407	OE-II : Finance And Cost Management
8	4	OE2	MGT	23OE2408	OE-II : Operation Research Techniques
9	4	OE2	MGT	23OE2409	OE-II : Project Evaluation & Management
10	4	OE2	MGT	23OE2410	OE-II : Total Quality Management
11	4	OE2	MGT	23OE2411	OE-II : Value Engineering
12	4	OE2	MGT	23OE2412	OE-II : Maintenance Management
13	4	OE2	MGT	23OE2413	OE-II : Industrial Safety
14	4	OE2	MGT	23OE2414	OE-II : Industry 4.0
15	4	OE2	MGT	23OE2415	OE-II : Operation Management
16	4	OE2	MGT	23OE2416	OE-II : Material Management
17	4	OE2	MGT	23OE2417	OE-II : Hospitality Management
18	4	OE2	MGT	23OE2418	OE-II : Human Resource Management & Organizational Behaviour
19	4	OE2	MGT	23OE2419	OE-II : Agri-Business Management
20	4	OE2	MGT	23OE2420	OE-II : Rural Marketing
21	4	OE2	MGT	23OE2421	OE-II : Marketing Management
22	4	OE2	MGT	23OE2422	OE-II : Health Care Management

Link for Open Electives syllabus: <https://ycce.edu/syllabus/>

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(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

**SoE No.
23ADS-101**

B.Tech in Artificial Intelligence and Data Science

IV SEMESTER

Mandatory Learning Course (MLC)

MLC2124 : YCAP4

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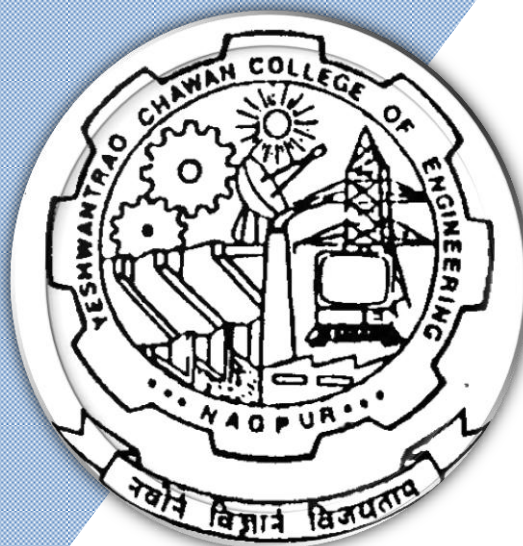
Nagar Yuwak Shikshan Sanstha's

Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2023 5th Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



Yeshwantrao Chavan College of Engineering
(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

**SoE No.
23ADS-101**

B.TECH SCHEME OF EXAMINATION 2023

(Scheme of Examination w.e.f. 2023-24 onward)

(Department of Computer Technology)

B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
FIFTH SEMESTER															
1	5	PC	AIDS	23ADS1501	Artificial Intelligence	T	3	0	0	3	3	30	20	50	3
2	5	PC	AIDS	23ADS1502	Lab : Artificial Intelligence	P	0	0	2	2	1		60	40	
3	5	PC	AIDS	23ADS1503	Design and Analysis of Algorithms	T	3	0	0	3	3	30	20	50	3
4	5	PC	AIDS	23ADS1504	Lab : Design and Analysis of Algorithms	P	0	0	2	2	1		60	40	
5	5	PC	AIDS	23ADS1505	Therotical Foundation of Computer Science	T	3	0	0	3	3	30	20	50	3
6	5	PC	AIDS	23ADS1506	Fundamentals of Machine Learning	T	2	0	0	2	2	30	20	50	3
7	5	PE	AIDS		Professional Elective-I	T	3	0	0	3	3	30	20	50	3
8	5	PE	AIDS		Lab : Professional Elective-I	P	0	0	2	2	1		60	40	
9	5	OE-3	OE-3		Open Elective -III	T	3	0	0	3	3	30	20	50	3
10	5	MDM	AIDS		MD Minor Course-III	T	3	0	0	3	3	30	20	50	3
11	5	STR	AIDS	23ADS1507	Internship, Seminar and Report	P	0	0	2	2	1		60	40	
TOTAL							20	0	8	28	24				

List of Mandatory Learning Course (MLC)

1	5	HS	T&P	MLC2125	YCAPP5 : YCCE Communication Aptitude Preparation	A	3	0	0	3	0				
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Professional Elective - I

1	5	PE-I	AIDS	23ADS1521	PE-I : Computer Networks										
2	5	PE-I	AIDS	23ADS1522	PE-I : Lab : Computer Networks										
3	5	PE-I	AIDS	23ADS1523	PE-I : High Performance Computer Architecture										
4	5	PE-I	AIDS	23ADS1524	PE-I : Lab : High Performance Computer Architecture										
5	5	PE-I	AIDS	23ADS1525	PE-I : Financial Data Analytics										
6	5	PE-I	AIDS	23ADS1526	PE-I : Lab : Financial Data Analytics										
7	5	PE-I	AIDS	23ADS1527	PE-I : UI/UX Design										
8	5	PE-I	AIDS	23ADS1528	PE-I : Lab : UI/UX Design										
9	5	PE-I	AIDS	23ADS1529	PE-I : Advanced Probability and Statistics										
10	5	PE-I	AIDS	23ADS1530	PE-I : Lab : Advanced Probability and Statistics										

Open Elective - III

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	FACULTY
1	5	OE3	CSE	23OE3501	OE-III : Social Reformers in Modern Maharashtra	ARTS
2	5	OE3	CSE	23OE3502	OE-III : Independent India 1948-2010	ARTS
3	5	OE3	CT	23OE3503	OE-III : Introduction To Cognitive Psychology	ARTS
4	5	OE3	CT	23OE3504	OE-III : Introduction To Engineering Psychology	ARTS
5	5	OE3	CT	23OE3505	OE-III : Introduction To Behavioural Psychology	ARTS
6	5	OE3	CT	23OE3506	OE-III : Introduction To Emotional Psychology	ARTS
7	5	OE3	EL	23OE3507	OE-III : Elements of Public Administration	ARTS
8	5	OE3	ETC	23OE3508	OE-III : Ancient Indian History	ARTS
9	5	OE3	IT	23OE3509	OE-III : Consciousness Studies	ARTS
10	5	OE3	IT	23OE3510	OE-III : Psychology for Professionals	ARTS
11	5	OE3	IT	23OE3511	OE-III : Introduction to Sociology and Human Behavior	ARTS
12	5	OE3	GE	23OE3512	OE-III : Economics of Money and Banking	ARTS
13	5	OE3	GE	23OE3513	OE-III : Economics of Capital Market	ARTS
14	5	OE3	GE	23OE3514	OE-III : Digital Humanities	ARTS
15	5	OE3	GE	23OE3515	OE-III : Introduction to Political Science	ARTS
16	5	OE3	CT	23OE3516	OE-III : Bhagwat Geeta - An Engineer's Interpretation	ARTS - IKS
17	5	OE3	CT	23OE3517	OE-III : Artha shastra by Kautiliya	ARTS - IKS
18	5	OE3	CSD	23OE3518	OE-III : Glimpses of Ancient science and Technology	ARTS - IKS
19	5	OE3	CV	23OE3519	OE-III : Indian taxation system	COMMERCE
20	5	OE3	CV	23OE3520	OE-III : Elements of share trading	COMMERCE
21	5	OE3	EE	23OE3521	OE-III : Introduction to Fintech	COMMERCE
22	5	OE3	EE	23OE3522	OE-III : Financial Analytics	COMMERCE
23	5	OE3	ETC	23OE3523	OE-III : Fundamentals of Investments	COMMERCE
24	5	OE3	EE	23OE3524	OE-III : Lifestyle Diseases	HEALTHCARE & MEDICINE
25	5	OE3	EE	23OE3525	OE-III : Holistic Nutrition	HOME SCIENCE
26	5	OE3	EL	23OE3526	OE-III : Community Organization & Development	HOME SCIENCE
27	5	OE3	CSE	23OE3527	OE-III : Human Rights & International Laws	LAW
28	5	OE3	CSE	23OE3528	OE-III : Cyber Crime Administration	LAW
29	5	OE3	MATHS	23OE3529	OE-III : Finite Differences & Numerical Methods	SCIENCE
30	5	OE3	MATHS	23OE3530	OE-III : Business Statistics	SCIENCE
31	5	OE3	PHY	23OE3531	OE-III : Crystalline Solids: Properties and Applications.	SCIENCE
32	5	OE3	PHY	23OE3532	OE-III : Nanotechnology: Fundamental to Applications	SCIENCE
33	5	OE3	CHE	23OE3533	OE-III : Chemistry in daily life	SCIENCE
34	5	OE3	CHE	23OE3534	OE-III : Battery Systems and Management	SCIENCE
35	5	OE3	NPTEL	23OE3535	OE-III : Designated approved online NPTEL Course	NPTEL

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Yeshwantrao Chavan College of Engineering

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B. Tech SoE and Syllabus 2023
(Scheme of Examination w.e.f. 2023-24 onward)
(Department of Computer Technology)

**SoE No.
23ADS-101**

B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1501 : Artificial Intelligence

Course Outcomes :

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

1. Develop an Understanding to identify performance measures for a given intelligent agent.
2. Apply searching techniques for problem-solving and planning
3. Apply different knowledge representation techniques on given facts
4. Solve AI problems using the techniques of uncertainty

Unit I:	8 Hrs.
Introduction: AI , History, Overview, Intelligent Agents, Performance Measure, Rationality, Structure of Agents, Problem-solving agents, Problem Formulation, Uninformed Search Strategies	
Unit II:	8 Hrs.
Informed (Heuristic) Search and Exploration, Greedy best first search, A* search, Memory bounded heuristic search, Heuristic functions, inventing admissible Heuristic functions, Local Search algorithms, Hill-climbing, Simulated Annealing	
Unit III:	7 Hrs.
Constraint Satisfaction Problems, Backtracking Search, variable and value ordering, constraint propagation, intelligent backtracking, local search for CSPs, Adversarial Search, Games, The minimax algorithm, Alpha-Beta pruning, Imperfect Real-Time Decisions	
Unit IV:	8 Hrs.
Knowledge Based Agents, Logic, Propositional Logic: Inference, Equivalence, Validity and Satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Models for first order logic, Symbols and Interpretations, Atomic sentences, complex sentences, Quantifiers, Inference in FOL, Unification, Forward Chaining, Backward Chaining, Resolution	
Unit V:	7 Hrs.
Planning, Language of planning problems, planning with state-space search, forward and backward state-space search, Heuristics for state-space search, partial order planning, planning graphs, planning with propositional logic	
Unit VI:	7 Hrs.
Uncertainty, Handling uncertain knowledge, rational decisions, basics of probability, axioms of probability, inference using full joint distributions, independence, Baye's Rule and conditional independence, Bayesian networks, Semantics of Bayesian networks, Exact inference in Bayesian Networks.	
Total Lecture 45 Hours	

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SoE No.
23ADS-101

B.Tech in Artificial Intelligence and Data Science

Textbooks:

- | | |
|----|--|
| 1. | Artificial Intelligence A Modern Approach, S. Russell and P. Norvig. Pearson Education |
| 2. | First course in AI, Deepak Khemani, McGraw Hill |
| 3. | Artificial Intelligence, E. Rich and K. Knight and Shivashankar B. Nair, McGraw Hill |

Reference Books:

- | | |
|----|---|
| 1. | Introduction to Artificial Intelligence and Expert System, D. W. Patterson, PHI |
| 2. | Artificial Intelligence, George F. Luger, Pearson Education |

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23ADS-101

B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1502: Lab. Artificial Intelligence

Course Outcomes

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

1. Apply different searching techniques to solve the given problem.
2. Apply different knowledge representation techniques on given facts
3. Implement the concept of uncertainty to solve a given problem

SN	Experiments based on
1	Write a program in prolog for implementation of predicate and rule.
2	Write a program using an Uninformed Searching Technique
3	Write a program using Heuristic Searching Technique
4	Write a program using Heuristic Searching Technique
5	Write a program using Adversarial Searching Technique
6	Implement any cryptarithmic puzzle
7	Implement Rule-Based Agent
8	Implement the Resolution theorem (Negation) using Prolog
9	Implement Bayes rule with probabilistic inference for reasoning under uncertainty.

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23ADS-101**

B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1503 : Design & Analysis of Algorithm

Course Outcomes :

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

1. Analyze different types of asymptotic notations and find the time complexity in terms of asymptotic notations
2. Solve recurrences using various techniques.
3. Implement divide and conquer strategy, greedy strategy, dynamic programming algorithms and backtracking strategy.
4. Identify and differentiate between various types of complexity classes.

Unit I:

8 Hrs.

Mathematical foundations, summation of arithmetic and geometric series, n , n^2 , bound summations using integration, Analysis of algorithms, analyzing control structures, worst case and average case analysis, Asymptotic notations, Analysis of sorting algorithms such as selection sort, insertion sort, bubble sort, heap sort, external Sorting, lower bound proof.

Unit II:

7 Hrs.

Recursive functions and recurrence relations, solutions of recurrence relations using technique of characteristic equation and generating functions, elementary and advanced data structures with operations on them and their time complexity, Amortized analysis

Unit III:

7 Hrs.

Divide and conquer basic strategy, binary search, quick sort, merge sort, Fast Fourier Transform etc. Greedy method –basic strategy, application to job sequencing with deadlines problem, minimum cost spanning trees, single source shortest path etc.

Unit IV:

8 Hrs.

Dynamic Programming basic strategy, multistage graphs, all pair shortest path, single source shortest paths, optimal binary search trees, traveling salesman problem.

Unit V:

8 Hrs.

Basic Traversal and Search Techniques, breadth first search, connected components, Backtracking basic strategy, 8 – Queen's problem, graph colouring, Hamiltonian cycles etc

Unit VI:

7 Hrs

NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NPcomplete, Cook's Theorem, decision and optimization problems, polynomial reduction.

Total Lecture 45 Hours

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(Department of Computer Technology)

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B.Tech in Artificial Intelligence and Data Science

Textbooks:

- | | |
|----|---|
| 1. | Computer Algorithms Third Horowitz, Sahani, Rajsekharan Galgotia Publications Pvt. Ltd. |
| 2. | Introduction to Algorithms Third Thomas H. Cormen Prentice Hall of India |

Reference Books:

- | | |
|----|--|
| 1. | Fundamentals of Algorithms Second Brassard and Bratley Prentice Hall |
|----|--|

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

- | | |
|---|---|
| 1 | http://103.152.199.179/YCCE/E%20-%20books-Wiley-Blackwell-/New%20Microsoft%20Office%20Word%20Document%20(2).htm |
|---|---|

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://archive.nptel.ac.in/courses/106/101/106101060/ |
| 2. | https://www.digimat.in/nptel/courses/video/106101060/L27.html |

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B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1504 : Lab: Design & Analysis of Algorithm

Course Outcomes

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

1. Students should be able to design some algorithms
2. Analyze their performance with respect to selected evaluation parameters

SN	Experiments based on
1	Write a program for insertion sort and display its time complexity for different number of inputs.
2	Write a program for heap sort and compare its time complexity with insertion sort for different number of inputs.
3	Write a program for merge sort and display its time complexity for different number of inputs.
4	Write a program for quick sort and compare its time complexity with merge sort for different number of inputs.
5	Write a program for fractional knapsack problem using greedy strategy and analyse its time complexity for different number of inputs.
6	Write a program for job sequencing with deadline problem using greedy strategy and analyse its time complexity for different number of inputs.
7	Write a program for travelling salesman problem using dynamic programming and analyse its time complexity for different number of inputs.
8	Write a program for all pair shortest path using dynamic programming and analyse its time complexity for different number of inputs.
9	Write a program for 8 queen's problem using backtracking
10	Write a program for graph colouring problem using backtracking

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B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1505 : Theoretical Foundation of Computer System

Course Outcomes :

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

1. Construct automata, regular expression for any pattern.
2. Construct context free grammar for various languages..
3. Construct push down automata and Turing Machine for a language.
4. Evaluate and justify whether a problem is decidable or not.

Unit I	7 Hrs.
Alphabet, Symbols, Sets, Strings, Language, Operations, Relations, Finite Automata, Acceptance of strings and languages, Non Deterministic Finite Automation , Deterministic Finite Automation Equivalence between NFA and DFA ,NFA with ϵ -transition, Minimization of FA.	
Unit II	8 Hrs.
Regular sets, Regular expressions, Manipulation of regular expressions, Equivalence between RE and FA. Pumping Lemma, closure properties of regular sets with proofs, Regular grammars, Right linear and left linear regular grammars, inter-conversion, Equivalence between regular grammar and FA, Inter-conversion between RE and RG	
Unit III	7 Hrs.
Context free grammar, Derivation trees (Syntax tree and Parse tree), Ambiguous Grammar, Context Free Language (CFL), Normal Form of grammar: Chomsky Normal Form, Greibach Normal Form, CYK algorithm.	
Unit IV	7 Hrs.
Push down automata, definition, and model, acceptance of CFL by empty Stack and by final state, equivalence CFL and PDA, Interconversion, Closure of properties of CFL with proofs, DPDA & NDPDA.	
Unit V:	8 Hrs.
Turing machine, Definition, Model of TM, Design of Turing Machine, Computable functions, Recursive enumerable language, Recursive Language, Properties of Recursive enumerable language, Church's hypothesis, Chomsky hierarchy of language , Linear bounded automata and context sensitive language, Universal Turing Machine	
Unit VI	8 Hrs.
Undecidable Problems related to Recursive enumerable language and Turing Machine, post correspondence problem, Recursive function Theory –Basis functions and operations on them. Bounded minimization preemptive μ recursive function –unbounded minimization and recursive function. Introduction to formal verification.	
Total Lecture	45 Hours

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B.Tech in Artificial Intelligence and Data Science

Textbooks:

- | | |
|----|---|
| 1. | Introduction to Automata Theory, Languages and Computation, Hopcroft H.E., Ullman and Motwani, Addison Wesley 2nd Edition, 2000 |
| 2. | Introduction to Languages and the theory of Automata, John C. Martin, McGraw-Hill 3rd Edition, 2003. |

Reference Books:

- | | |
|----|---|
| 1. | Introduction to the Theory of Computation, Michael Sipser, Course Technology, 2nd Edition, 2005 |
| 2. | Theory of Computation, O.G.Kakde, USP 2008 |

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B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1506 : Fundamentals of Machine Learning

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

1. Understand core machine learning concepts, including learning types, challenges, and theoretical foundations that guide model development.
2. Apply similarity-based and parametric classification models effectively to address practical machine learning problems, selecting appropriate methods based on problem context
3. Evaluate model performance using metrics, tuning strategies, and optimization techniques to identify factors influencing accuracy and generalization

Unit I	Introduction to Machine Learning:	7 Hours
Need for Machine Learning, meaning of learning, Types of Machine Learning, Challenges of Machine Learning, Machine Learning Process, Understanding Data		
Unit II	Basics of Learning Theory:	8 Hours
Introduction to learning types, Computational Learning Theory, Design of Learning System, Concept Learning, Induction Biases		
Unit III	Model Generalization and Learning Dynamics:	7 Hours
Model Performance Issues; Underfitting, Overfitting, Bias-Variance Tradeoff, Classification Metrics; Confusion Matrix, Accuracy, Precision, Recall (Sensitivity or True Positive Rate), F1 Score, ROC-AUC, Model Selection Techniques; Cross-Validation, Model Selection Strategies; Cross-Validation, Grid Search / Random Search, Variational Inference, Model Optimization Techniques; Regularization, Early Stopping, Dropout, Hyperparameter Tuning		
Unit IV	Similarity-Based Learning and Parametric Classifiers:	8 Hours
Introduction to similarity-based learning, Nearest Neighbor Learning, Weighted k-Nearest Neighbor Learning, Nearest Centroid Classifier, Parametric classifiers		
Total		30 Hours

Textbooks:

1.	S Sridhar and M Vijayalakshmi, "Machine Learning", Oxford University Press, 2021.
2.	Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, Mathematics for Machine Learning, Cambridge University Press (23 April 2020)
3.	Tom M. Mitchell- Machine Learning - McGraw Hill Education, International Edition
4.	Trevor Hastie, Robert Tibshirani, and Jerome Friedman -The Elements of Statistical Learning
5.	Zhi-Hua Zhou -Ensemble Methods: Foundations and Algorithms

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B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1521 : PE-1: Computer Networks

Course Outcomes :

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

1. Understand design issues of layers and network reference model
2. Solve the given problems related to networking domain.
3. Analyze different networking protocol at various layers.
4. Evaluate the performance of network using different tools.

Unit I:	8 Hrs.
Introduction: The uses of computer networks, LAN's, MAN's, WAN's., protocol hierarchies, design issues for layers, interfaces and services, connection oriented and connectionless services, service primitives relationship of services to protocols. The OSI reference model. TCP/IP reference model, Comparison of OSI & TCP/IP reference models, Critique of OSI model & protocols, critique of TCP/IP reference mode	
Unit II:	7 Hrs.
Transmission Impairments, Transmission Media: Guided, unguided, Architecture of the Internet, , The Public Switched Telephone Network Switching: circuit, packet and message switching, Modems	
Unit III:	8 Hrs.
The Data Link Layer: Data link layer design issues- Framing, Error Control, Flow Control, Link Management, Error detection and Correction-Error-Correcting Codes, error-detecting codes, Elementary data link protocols-An Unrestricted simplex Protocol, A simplex stop and wait protocol, A simplex protocol for a noisy channel, Sliding window protocols- A one bit sliding window protocol, Go Back N protocol, Selective Repeat Protocol.	
Unit IV:	7 Hrs.
The Medium Access Sublayer: Static and Dynamic Channel allocation in LAN's and MAN's, Access Protocols ALOHA, Persistent and Non Persistent CSMA, CSMA/CD, Collision free protocols, Binary countdown, Limited connection protocol: The adaptive tree walk protocol.	
Unit V:	8 Hrs.
The Network Layer: Network Layer design issues-services provided to the transport layer, Logical Addressing: Classbase and classless, Subnetting and Supernetting, Routing and Routing Algorithm, Distance Vector, Link State, Hierarchical. Congestion Control algorithms- Preallocation of buffers, Packet discarding, Choke packets, Load shedding, Jitter control. Leaky bucket algorithm, token bucket algorithm, IP header format (IPv4, IPv6)	
Unit VI:	7 Hrs.
The Transport Layer: Transport layer design issues-services provided to the session layer, Quality of service, transport service primitives, Elements of transport protocols-Addressing, Establishing and Releasing a connection, Flow control and Buffering, Multiplexing, Crash Recovery. Transmission Control Protocol (TCP). The Application Layer: HTTP DNS, SMTP, FTP, TFTP.	
Total Lecture	
	45 Hours

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B.Tech in Artificial Intelligence and Data Science

Textbooks:

1.	Computer Networks, A.S. Tanenbaum , Pearson Publication
2.	Computer Networking , Behrouz A. Forouzan , McGraw-Hill Publication.

Reference Books:

1.	Data communications and networking, Behrouz A. Forouzan , McGraw-Hill
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MOOCs Links and additional reading, learning, video material

<https://archive.nptel.ac.in/courses/106/105/106105183/>

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SoE No.
23ADS-101

B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1522 : PE-1: Computer Networks

Course Outcomes

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

- 1 To understand design issues of layers and network reference model
- 2.To Solve the given problems related to networking domain.
- 3.To analyze different networking protocol at various layers.
4. To evaluate the performance of network using different tools.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Use Network Utility Command like ping, ipconfig, netstat, tracert to observe the network details.
2	To implement Hamming Code using C and C++.
3	To implement Dijkstra's Routing algorithm using backtracking approach.
4	Use traffic monitoring tool Wireshark to observe network traffic with packet details.
5	To implement Go_back_n sliding window protocol
6	Configure router. Configure network using Cisco Packet Tracer software and show packet transmission from source to destination.
7	Use Openssl command to perform Asymmetric key encryption(RSA) and also implement RSA algorithm.
8	Client server communication using socket programming
9	Simulating IoT environment using Cisco Packet Tracer.

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23ADS-101**

B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1523 : PE-I: High Performance Computer Architecture

Course Outcomes :

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

1. Identify the dependency in computation.
2. Analyze and decompose the computation into parts for parallel computation.
3. Apply OpenMP, MPI and GPU programming for the development of parallel programs.
1. Simulate on parallel computing architectures and do performance evaluation amongst the parallel algorithms.

Unit I:	7 Hrs.
Parallel Computers and architectures, Dependency analysis, loop transformation techniques	
Unit II:	7 Hrs.
Programming with Shared Memory: OpenMP and Message-Passing Computing	
Unit III:	8 Hrs.
Embarrassingly Parallel Computations, Partitioning and Divide-and-Conquer Strategies, Pipelined Computations	
Unit IV:	8 Hrs.
Synchronous Computations, Load Balancing and Termination Detection, Introduction to GPU	
Unit V:	8 Hrs
Sorting Algorithms, Numerical Algorithms, Image Processing algorithms, Searching and Optimization	
Unit VI:	7 Hrs
Performance metrics: Speedup, efficiency, scalability, Case studies in scientific computing, machine learning, and big data	
Total Lecture	
	45Hours

Textbooks:

1. "Introduction to Parallel Computing", Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, 2nd edition, Addison-Wesley, 2003.
2. "Parallel Programming in C with MPI and OpenMP", Michael J. Quinn, McGraw Hill, 2003
3. "CUDA by Example: An Introduction to General-Purpose GPU Programming", Jason Sanders, Edward Kandrot, 1st edition, Addison-Wesley Professional, 2010.

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B.Tech in Artificial Intelligence and Data Science

Reference Books:

- | | |
|----|--|
| 1. | "Designing and Building Parallel Programs", Ian Foster, 1st edition, Pearson, 2019. |
| 2. | "An Introduction to Parallel Computing: Design and Analysis of Algorithms", Ananth Grama, 2nd edition, Pearson, 2004. |
| 3. | "Parallel Programming – Techniques and applications Using Networked Workstations and Parallel Computers", Barry Wilkinson and Michael Allen, 2nd edition, Pearson, 2004. |
| 4. | "Multi-Core Programming - Increasing Performance through Software Multi-Threading", Shameem Akhter and Jason Roberts, Intel Press, 2006. |

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23ADS-101

B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1524 : PE-I: High Performance Computer Architecture

Course Outcomes :

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

1. Apply OpenMP, MPI and GPU programming for the development of parallel programs.
2. Analyze and decompose the computation into parts for parallel computation.

SN	Experiments based on
1	Write OpenMP programs for parallelizing for loops with different scheduling strategies.
2	Write a basic MPI program for point-to-point communication.
3	Implement a parallel divide-and-conquer algorithm
4	Simulate pipelined computation using threads or message queues.
5	Write a basic CUDA program (e.g., vector addition or image thresholding).
6	Implement parallel sorting (Bitonic sort or parallel merge sort) using OpenMP.
7	Implement matrix multiplication in parallel using OpenMP or CUDA.
8	Implement an image filter (e.g., Gaussian blur) using parallel programming.
9	Analyze speedup and efficiency for a parallel matrix operation using different thread counts.
10	Mini-project: Parallelize a real-world problem (e.g., data aggregation, image processing, ML task) and measure performance.

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1527 :PE-1: UI/UX Design

Course Outcomes :

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

1. Understand design thinking concept
2. Apply user requirements and the design tools to design the UI
3. Analyze the various visual designs to select appropriate one

Unit I:	7 Hrs.
Design Thinking Fundamentals: Introduction to Design thinking – Concept, Purpose, 5 stages of design thinking – Empathize, Define, Ideate, Prototype, Test, Introduction to User Interface / User Experience (UI/UX) – Definition of Design with respect to digital media, User Interface, User experience, Difference between UI and UX. History of UX. Need of UI and UX	
Unit II:	7 Hrs.
User Requirements and its Analysis: Introduction to research and analysis tool (freeware) such as FigJam, User requirements – Definition, Types of user research - Qualitative research, Quantitative research. Tools to collect user requirements – personal observation, interviews, questionnaire, User/ Expert reviews, User requirement analysis - Understanding target audience and client requirements, Competitive analysis, Affinity mapping, Defining User Persona	
Unit III:	8 Hrs.
Information Architecture and Wireframing: Site maps and user flows, Content organization and navigation design, Low-fidelity wireframes: sketching interfaces, Layout design principles, Usability heuristics and accessibility basics	
Unit IV:	8 Hrs.
User Interface Design: Storyboarding, User journey mapping, Gestalt principles of design - Aesthetics in UI design - Using Light, Color and Contrast Effectively in UI Design, Introduction to any freeware design tool such as Figma, Visual Communication Design - effective visual communication for graphical user interface	
Unit V:	7 Hrs.
User Experience Design Tool: Introduction to User Experience design, UX design open source tool such as - Figma features – Navigations, interactions, Buttons Creating library, Gamification, micro-animation, Creating visual identity of the project – design system, design theme	
Unit VI:	8 Hrs.
Prototyping and Testing: Introduction to Wireframing - Purpose of wireframing, Types – low fidelity, medium fidelity, high fidelity, Basics of sketching, Creating low fidelity wireframes, medium fidelity and high fidelity in Figma, Basic considerations in wireframing – device, size, behavior, interaction 5.4 Elements used in wireframing – visual design, high fidelity elements, Prototyping and Testing	
	Total Lecture 45 Hours

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Textbooks:

1.	The Elements of User Experience: User-Centered Design for the Web and Beyond, Jesse James Garrett, New Riders Publishing
2.	Design Thinking: The Handbook, Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, World Scientific Publishing Co Pte Ltd
3.	Designing and Prototyping Interfaces with Figma, Fabio Staiano, Packt Publishing Ltd, Grosvenor House

Reference Books:

1.	https://aim.gov.in/pdf/Design_Thinking.pdf
2.	https://youtu.be/-wzNTPXVIyM?si=zET5z3GpIPI-cAry
3.	https://youtu.be/XT152i5asdQ?si=jPdLFFExnaZO8NRs
4.	https://usabilitypost.com/2008/08/14/using-light-color-and-c

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B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1528 : PE-1: Lab UI/UX Design

Course Outcomes

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

1. Create interactions using design tool
2. Create innovative design prototype for given applications

SN	Experiments based on
1	Use Design tool for user requirement collection and analysis
2	Recreate a given user interface using any open source design tool
3	Create grid system for the given screen using any design tool
4	Design given user interface using various components such as auto-layouts in the design tool
5	Recreate given website for UI design, color, images, interactions, menu
6	Create any two gamification effects for given user interface in given scenario
7	Design a quiz for given user interface
8	Create navigations for the given website/ App
9	Create gamification for task completion in website such as LMS/ retail website/ banking website
10	Convert created prototype in HTML page

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V SEMESTER

23ADS1529 : PE-I: Advanced Probability and Statistics

Course Outcomes :

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

1. Understand the characteristics of financial data and basic time series models used in financial analysis.
2. Apply statistical and econometric methods to address practical problems in financial data analysis.
3. Analyze financial datasets to identify patterns and relationships using advanced regression techniques
4. Design advanced models for financial data to support strategic decision-making.

Unit I:

8 Hrs.

Introduction to Random variables: discrete & continuous Random variables Discrete random variables - Uniform, Bernoulli, Binomial, Geometric, Poisson Distributions, Hyper-geometric, Negative Binomial Continuous Random variables: Uniform, Normal, Exponential, Gamma, Cauchy, Beta1 and Beta2

Unit II:

7Hrs.

Multivariate Statistics: Samples and Populations, Orthogonality, Data appropriate for multivariate Statistics, Degree of relationship among variables, Significance of Group differences.

Unit III:

8 Hrs.

Prediction of Group membership, bi-variate statistics: correlation and regression, data screening and Transformation, multiple regressions, multiway frequency analysis, analysis of co-variance.

Unit IV:

8 Hrs.

Discriminant function analysis, limitations, fundamental equations, types of discriminant function analysis, Principal components, factor analysis.

Unit V:

7 Hrs.

Markov Chain, Stochastic processes, Setting up Markov chains, Balance equations, Non-parametric interference, Empirical Distribution Function (or eCDF), Kernel Density Estimation (KDE), Statistical Functionals, Plug-in estimator, confidential interval, Percentiles, quantiles, Normal-based confidence intervals, DKW inequality, Parametric Interference, Consistency, Asymptotic Normality, Basics of parametric inference, Method of Moments Estimator (MME)

Unit VI:

7 Hrs.

Properties of Method of Moments Estimator (MME), Basics of MLE, Maximum Likelihood Estimator (MLE), Properties of MLE, Basics of hypothesis testing, The Wald test, t-test, Kolmogorov-Smirnov test (KS test), p-values, Permutation test

Total Lecture

45 Hours

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23ADS-101

B.Tech in Artificial Intelligence and Data Science

Textbooks:

- | | |
|----|--|
| 1. | An Introduction to Probability and Statistics. Vijay K Rohatgi and A.K.Md. Ehsanes Saleh, 2 nd edition, Wiley |
| 2. | Using Multivariate Statistics, 7/e by Linda S. Fidell, Barbara G. Tabachnick. |
| 3. | Probability and Statistics for Data Science: Math + R + Data (Chapman & Hall/CRC Data Science Series) |

Reference Books:

- | | |
|----|--|
| 1. | "Probability & Statistics", K.V. Iyengar & B. Krishna Gandhi, S.Chand. |
| 2. | "Probability & Statistics", William Mendenhall & Others, Cengage Publications. |
| 3. | "An introduction to probability theory and its applications", W. Feller, John Wiley and Sons |

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/noc20_ma18/preview |
|----|---|

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B.Tech in Artificial Intelligence and Data Science

V SEMESTER

23ADS1530 : Lab Advanced Probability and Statistics

Course Outcomes

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

1. Apply the concepts of probability and advance probability concepts
2. Apply the concept of Bivariate and Multivariate Regression and Correlation Analysis, for prediction and forecasting.

SN	Experiments based on
1	The concept of random variable
2	The concept of continuous random variable
3	The concept of multivariate statistics
4	The concept of bivariate statistics
5	The concept of principal component
6	The concept of factor analysis
7	The concept of Markov Chain
8	The nonparametric methods

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V SEMESTER

MDM3ADS103 : Multivariate Statistics

Course Outcomes :

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

1. Explain the structure and types of multivariate data and their measurement scales.
2. Describe the purpose, assumptions, and interpretation of key multivariate techniques.
3. Theoretically evaluate the appropriateness of a multivariate technique for a given research scenario.

Unit I:	8 Hrs.
Fundamentals of Multivariate Data: Definition and scope of multivariate data analysis, types of variables: quantitative vs. categorical, levels of measurement: nominal, ordinal, interval, ratio, importance and application areas of multivariate analysis, introduction to multivariate datasets and structure, concept of variates and multivariate measurement error.	
Unit II:	7 Hrs.
Descriptive Multivariate Statistics: Measures of central tendency and dispersion in multivariate context, covariance and correlation matrices, statistical distance: Mahalanobis distance, concept of multivariate normal distribution and its properties, outlier detection and assumptions in multivariate data.	
Unit III:	7 Hrs.
Core Multivariate Techniques: Concepts and Interpretation: Principal Component Analysis (PCA): objectives, variance explanation, dimensionality reduction; cluster analysis: basic concepts of similarity, dissimilarity, types of clustering (hierarchical, k-means)	
Unit IV:	8 Hrs.
Discriminant analysis: Definition, Importance and applications, Comparison with regression and classification methods, concepts of classification: Binary classification, Multi-class classification linear discriminants: Fisher's Linear Discriminant, Linear combination of predictor variables, assumptions, goals, and basic steps of each technique.	
Unit V:	(8 Hrs.)
Overview of Advanced Methods and Applications: Factor analysis: objective, concept of latent variables, factor loadings, rotation; multiple linear regression (MLR): objective, assumptions, model structure, interpretation	
Unit VI:	(8 Hrs.)
Multivariate Analysis of Variance (MANOVA): Motivation: Limitations of ANOVA for multiple dependent variables, Interrelationship between dependent variables, Controlling Type I Error in multiple comparisons, Multivariate hypothesis testing needs, Understanding group differences on a combination of outcomes, basic idea of comparing multivariate means; case-based discussions on applications in marketing, social sciences, and healthcare	
Total Lecture	45 Hours

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B.Tech in Artificial Intelligence and Data Science

Textbooks:

1	Johnson R.A. and Wichern D.W., Applied Multivariate Statistical Analysis, Pearson
2.	Hair J.F. et al., Multivariate Data Analysis, Prentice Hall

Reference Books:

1.	Anderson T.W., An Introduction to Multivariate Statistical Analysis, Wiley
2.	Mardia K.V. et al., Multivariate Analysis, Academic Press.

MOOCs Links and additional reading, learning, video material

1.	https://archive.nptel.ac.in/courses/111/104/111104024/
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V SEMESTER

Open Elective -III : Basket

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject
1	5	OE3	CSE	23OE3501	OE-III : Social Reformers in Modern Maharashtra
2	5	OE3	CSE	23OE3502	OE-III : Independent India 1948-2010
3	5	OE3	CT	23OE3503	OE-III : Introduction To Cognitive Psychology
4	5	OE3	CT	23OE3504	OE-III : Introduction To Engineering Psychology
5	5	OE3	CT	23OE3505	OE-III : Introduction To Behavioural Psychology
6	5	OE3	CT	23OE3506	OE-III : Introduction To Emotional Psychology
7	5	OE3	EL	23OE3507	OE-III : Elements of Public Administration
8	5	OE3	ETC	23OE3508	OE-III : Ancient Indian History
9	5	OE3	IT	23OE3509	OE-III : Consciousness Studies
10	5	OE3	IT	23OE3510	OE-III : Psychology for Professionals
11	5	OE3	IT	23OE3511	OE-III : Introduction to Sociology and Human Behavior
12	5	OE3	GE	23OE3512	OE-III : Economics of Money and Banking
13	5	OE3	GE	23OE3513	OE-III : Economics of Capital Market
14	5	OE3	GE	23OE3514	OE-III : Digital Humanities
15	5	OE3	GE	23OE3515	OE-III : Introduction to Political Science
16	5	OE3	CT	23OE3516	OE-III : Bhagwat Geeta - An Engineer's Interpretation
17	5	OE3	CT	23OE3517	OE-III : Artha shastra by Kautiliya
18	5	OE3	CSD	23OE3518	OE-III : Glimpses of Ancient science and Technology
19	5	OE3	CV	23OE3519	OE-III : Indian taxation system
20	5	OE3	CV	23OE3520	OE-III : Elements of share trading
21	5	OE3	EE	23OE3521	OE-III : Introduction to Fintech
22	5	OE3	EE	23OE3522	OE-III : Financial Analytics
23	5	OE3	ETC	23OE3523	OE-III : Fundamentals of Investments
24	5	OE3	EE	23OE3524	OE-III : Lifestyle Diseases
25	5	OE3	EE	23OE3525	OE-III : Holistic Nutrition
26	5	OE3	EL	23OE3526	OE-III : Community Organization & Development
27	5	OE3	CSE	23OE3527	OE-III : Human Rights & International Laws
28	5	OE3	CSE	23OE3528	OE-III : Cyber Crime Administration
29	5	OE3	MATHS	23OE3529	OE-III : Finite Differences & Numerical Methods
30	5	OE3	MATHS	23OE3530	OE-III : Business Statistics
31	5	OE3	PHY	23OE3531	OE-III : Crystalline Solids: Properties and Applications.
32	5	OE3	PHY	23OE3532	OE-III : Nanotechnology: Fundamental to Applications
33	5	OE3	CHE	23OE3533	OE-III : Chemistry in daily life
34	5	OE3	CHE	23OE3534	OE-III : Battery Systems and Management
35	5	OE3	NPTEL	23OE3535	OE-III : Designated approved online NPTEL Course

Link for Open Electives syllabus: <https://ycce.edu/syllabus/>

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B.Tech in Artificial Intelligence and Data Science

V SEMESTER

Mandatory Learning Course (Audit Course)

MLC2125 : YCAP5

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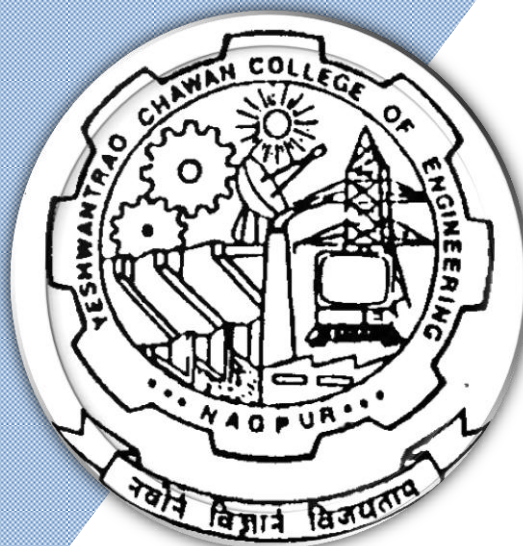
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Yeshwantrao Chavan College of Engineering

(An Autonomous Institution affiliated to Rashtrasant Tukadoji Maharaj Nagpur University)

(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2023 6th Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



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B.TECH SCHEME OF EXAMINATION 2023
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SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
SIXTH SEMESTER															
1	6	PC	AIDS	23ADS1601	Computer Vision	T	2	0	0	2	2	30	20	50	3
2	6	PC	AIDS	23ADS1602	Lab : Computer Vision	P	0	0	2	2	1		60	40	
3	6	PC	AIDS	23ADS1603	Natural Language Processing	T	2	0	0	2	2	30	20	50	3
4	6	PC	AIDS	23ADS1604	Lab : Natural Language Processing	P	0	0	2	2	1		60	40	
5	6	PC	AIDS	23ADS1605	Design Thinking and Research Methodology	T	2	0	0	2	2	30	20	50	3
6		PE	AIDS		Professional Elective-II	T	3	0	0	3	3	30	20	50	3
7	6	PE	AIDS		Lab : Professional Elective-II	P	0	0	2	2	1		60	40	
8	6	PE	AIDS		Professional Elective-III	T	2	0	0	2	2	30	20	50	3
9	6	PE	AIDS		Lab : Professional Elective-III	P	0	0	2	2	1		60	40	
10	6	MDM	AIDS		MD Minor Course-IV	T	3	0	0	3	3	30	20	50	3
11	6	VSEC-4	AIDS	23ADS1606	Lab : Competitive Coding	P	0	0	4	4	2		60	40	
12	6	STR	AIDS	23ADS1607	Project Phase-I	P	0	0	4	4	2		60	40	
TOTAL							14	0	16	30	22				

List of Mandatory Learning Course (MLC)

1	6	HS		MLC126	YCAP6 :	A	3	0	0	3	0				
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Professional Elective - II

1	6	PE-II	AIDS	23ADS1621	PE-II : Business Intelligence
2	6	PE-II	AIDS	23ADS1622	PE-II : Lab : Business Intelligence
3	6	PE-II	AIDS	23ADS1623	PE-II : Web Analytics
4	6	PE-II	AIDS	23ADS1624	PE-II : Lab : Web Analytics
5	6	PE-II	AIDS	23ADS1625	PE-II : Sensor Data Analytics
6	6	PE-II	AIDS	23ADS1626	PE-II : Lab : Sensor Data Analytics
7	6	PE-II	AIDS	23ADS1627	PE-II : GeoSpatial Data Intelligence
8	6	PE-II	AIDS	23ADS1628	PE-II : Lab : GeoSpatial Data Intelligence
9	6	PE-II	AIDS	23ADS1629	PE-II : Visual Analytics
10	6	PE-II	AIDS	23ADS1630	PE-II : Lab : Visual Analytics
11	6	PE-II	AIDS	23ADS1631	PE-II : Dot Net Full Stack Development
12	6	PE-II	AIDS	23ADS1632	PE-II : Lab : Dot Net Full Stack Development

Professional Elective - III

1	6	PE-III	AIDS	23ADS1641	PE-III : Internet of Things
2	6	PE-III	AIDS	23ADS1642	PE-III : Lab : Internet of Things
3	6	PE-III	AIDS	23ADS1643	PE-III : Reinforcement Learning
4	6	PE-III	AIDS	23ADS1644	PE-III : Lab : Reinforcement Learning
5	6	PE-III	AIDS	23ADS1645	PE-III : Advance Unix Programmin
6	6	PE-III	AIDS	23ADS1646	PE-III : Lab : Lab Advance Unix Programmin
7	7	PE-III	AIDS	23ADS1647	PE-III : Introduction to Salesforce
8	8	PE-III	AIDS	23ADS1648	PE-III : Lab : Introduction to Salesforce

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(Department of Computer Technology)

SoE No.
23ADS-101

B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1601 : Computer Vision

Course Outcomes :

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

1. Understand the basic concepts of image formation, camera geometry, and image representation in computer vision.
2. Apply fundamental image processing techniques like filtering, edge detection, and feature extraction.
3. Analyze 3D vision methods such as stereo vision and optical flow for motion and depth understanding.
4. Implement basic machine learning techniques for tasks like face detection and object classification in vision applications.

Unit I:	(7 Hrs.)
Introduction and applications of computer vision: Image formation, Image transformations, Basics of camera geometry and calibration, Understanding pixel values and image types (grayscale, color)	
Unit II:	(7 Hrs.)
Image Processing and Feature detection: Image filters, Edge detection, Corner detection, Feature Detection and Matching, Image Stitching/Mosaicing.	
Unit III:	(8 Hrs.)
3D Vision and Object Tracking: Stereo Vision, Optical Flow, Basic object tracking and recognition, Introduction to simple segmentation techniques.	
Unit IV:	(8 Hrs.)
Learning-Based Vision and Applications: Basics of machine learning in vision, Face detection using Adaboost, Object classification using SVMs and Neural Networks, Real-life applications: face recognition, motion detection	
Total Lecture	30 Hours

Textbooks:

1. Computer Vision: A Modern Approach, Forsyth and PonceH, 4th edition, Pearson Education.
2. Introductory Techniques for 3D Computer Vision", Emanuele Trucco and Alessandro Verr, Prentice Hall
3. Computer Vision Algorithms and Applications, Richard Szeliski
4. OpenCV Documentation & Tutorials (online)

Reference Books:

1. Robot Vision, B. K. P. Horn, MIT Press (Cambridge)
2. Trucco and Verri, Introductory Techniques for 3D Computer Vision, 1998

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1602 : Lab Computer Vision

Course Outcomes

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

1. Apply image enhancement and smoothing techniques to improve image quality for further analysis.
2. Extract meaningful features from images using descriptors such as HOG and SIFT.
3. Implement and evaluate modern object detection methods including YOLO and R-CNN.
4. Analyze and develop solutions for motion estimation, object recognition, and facial expression recognition using classical and learning-based methods.

Sr. No	Aim of Practical
1	Implement various grey level transformations for Image Enhancement
2	Write a Program to apply convolution processes on an input image for image smoothing.
3	Implement Histogram of Oriented Gradient (HOG) for Feature extraction
4	Write a Program to apply Scale Invariant Feature Transform on input image.
5	Implement object detection algorithm YOLO
6	Implement R-CNN algorithms for object detection
7	Implement motion estimation using optical flow technique.
8	Implement Object recognition.
9	Implement Facial Expression Recognition.

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1603: Natural Language Processing

Course Outcomes :

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

1. Model linguistic phenomena with formal grammars.
2. Design, implement and test algorithms for NLP problems
3. Apply NLP techniques to design real world NLP applications

Unit I: Foundations of NLP

7 Hrs.

Introduction to NLP: History, levels, ambiguity, knowledge in language processing, stages, challenges, Applications of NLP, Morphology Fundamentals: Morphological diversity, morphology paradigms (English & Indian languages), Lexicon-free approaches, Regular expressions, finite automata, FSTs, morphological parsing.

Unit II: Language Modelling & Parsing Techniques

8 Hrs.

N-gram models: Language modeling, spelling correction, Parsing: Theories and algorithms of parsing, Robust & scalable parsing (e.g., web text), Rule-based and probabilistic parsing, Scope and attachment ambiguity resolution

Unit III: Semantics and Word Sense Disambiguation

8 Hrs.

Lexical semantics: WordNet, Indian language WordNets, semantic roles, Multilingual dictionaries. Word Sense Disambiguation (WSD): Homonymy, Polysemy, Synonymy, Hyponymy, Dictionary-based and robust WSD techniques, Semantic analysis of sentence structures (noun, verb, and repositional phrases).

Unit IV:

7 Hrs.

Pragmatics and discourse: Co-reference and reference resolution, Syntactic & semantic constraints on references □ NLP Applications (focus on Indian languages): Sentiment analysis, Text entailment, Machine translation, Question answering in multilingual setting, Cross-lingual Information Retrieval (CLIR)

Total Lecture 30 Hours

Textbooks:

1. Speech and Language Processing: An Introduction to Natural Language Processing, Speech Recognition, and Computational Linguistics, Jurafsky, Daniel, and James, H. Martin, Prentice Hall, 2000
2. Foundations of Statistical Natural Language Processing 1999 Christopher D. Manning and Hinrich Schütze, Cambridge, MIT Press,.

Reference Books:

1. Natural Language Understanding 2nd, 1995. James Allen Benjamin/Cummings
2. Statistical Language Learning 1996 Eugene Charniak MIT Press
3. Harald Clahsen, Andrew Redford, Linguistics 1999 Martin Atkinson, David Britain, Cambridge University Press

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VI SEMESTER

23ADS1604: Lab Natural Language Processing

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1605 : Design Thinking in Artificial Intelligence and Data Science and Research Methodology

Course Outcomes :

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

1. Comprehend the foundational concepts of research methodology
2. Identify and formulate research problems and conduct effective literature reviews and adhere to ethical research practices
3. Collect and analyze data using appropriate methods.
4. Interpret research findings and write scientific reports.

Unit:1	Foundations of Design Thinking in AI and Data Science	8 Hours
Introduction to Design Thinking: Definition, Evolution & Relevance in AI and Data Science, Key Principles: Empathy, Ideation, Prototyping, Testing; The Five Stages of Design Thinking (Stanford d.school Model): Empathize, Define, Ideate, Prototype, Test – contextualized to AI/DS; Empathy in AI Design: Understanding the user and the dataset, Bias, fairness, and inclusivity in AI models; Problem Framing in Data Science: Moving from data availability to real problem statements, “How Might We...” questions for AI use-cases; Case Study Workshop: Example: Reframing a biased loan prediction algorithm, Activity: Empathy mapping for AI users (e.g., patients, customers)		
Unit:2	Applying Design Thinking to AI & Data Science Projects	7 Hours
Ideation for AI & Data Science Solutions: Brainstorming AI applications that solve real-world problems, Tools: SCAMPER, mind maps, etc.; Rapid Prototyping for Data Science: Designing user flows and interface mockups for AI-powered tools, Low-code/No-code AI prototypes (e.g., using tools like Teachable Machine); Testing and Feedback Loops: Interpretable AI: Making models explainable for non-tech users, Gathering feedback from users and stakeholders; Ethical & Human-Centric AI Design: Privacy, consent, transparency, Data biases and mitigation strategies; Capstone Mini Project: Group activity: Choose a domain (healthcare, retail, education, etc.), Apply all 5 stages of design thinking to an AI/DS problem, Present a concept prototype or solution proposal.		
Unit:3	Research Fundamentals, Research Problem and Design, Literature Review	8 Hours
Research Fundamentals: Definition, objectives, and significance of research, Types of research: Basic, Applied, Descriptive, Analytical, Quantitative, and Qualitative. Research Problem and Design: Criteria of good research, Techniques for defining and identifying a research problem, features of good research problem/design, Necessity of defining the problem, Meaning of research design, Types of research design – Exploratory, Descriptive, Diagnostic, and Experimental Literature Review: Importance and methods of conducting a literature review, Sources of information: Journals, conferences, patents, etc., technical reading strategies. Contemporary Issues related to Topic		

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Unit:4	Sampling and Data Collection, Data Analysis and Interpretation, Technical Writing, Research Ethics	7 Hours
Sampling and Data Collection: Sampling techniques: Probability and Non-probability sampling, Characteristics of a good sample, Sample size determination, Data types: Primary and Secondary, Methods of primary data collection: Observation, Interview, Questionnaire, Schedule, Secondary data sources Data Analysis and Interpretation: Processing and analyzing data, Statistical tools: Measures of central tendency, Dispersion, Correlation, Regression, Hypothesis testing: Null and alternative hypothesis, Type I and II errors, Use of software tools (e.g., Excel/SPSS/MATLAB for analysis), Interpretation of results Technical Writing, Research Ethics: Publication ethics and responsibilities of researchers, Structure and components of research report, Types of technical reports and papers, writing thesis and dissertations, Referencing and citation styles (APA, IEEE, etc.), Ethical considerations in engineering research., Plagiarism and research ethics Contemporary Issues related to Topic		
Total Lecture Hours		30 Hours
Textbooks		
1	Idris Mootee - Design Thinking for Strategic Innovation	
2	Ben Shneiderman- Human-Centered AI	
3	Foster Provost and Tom Fawcett- Data Science for Business	
4	Don Norman - <i>The Design of Everyday Things</i>	
5	Jake Knapp- <i>Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days</i>	
6	C.R. Kothari – <i>Research Methodology: Methods and Techniques</i> , New Age International	
7	Ranjit Kumar – <i>Research Methodology: A Step-by-Step Guide for Beginners</i> , Sage Publications.	
Reference Books		
1	R. Panneerselvam – <i>Research Methodology</i> , PHI Learning.	
2	Dawson, C. – <i>Practical Research Methods</i> , UBS Publishers.	
3	Trochim, W.M.K. – <i>Research Methods: The Concise Knowledge Base</i> .	
YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]		
1		
MOOCs Links and additional reading, learning, video material		
1	Stanford d.school resources (free) https://dschool.stanford.edu/resources	
2	IDEO Design Thinking Toolkit (free): https://designkit.org/	

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VI SEMESTER

23ADS1606: Lab : Competitive Coding

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VI SEMESTER

23ADS1607: Project Phase-I

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1621 : PE-II: Business Intelligence

Course Outcomes :

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

- Understand the basic concepts of Business Intelligence, digital data types, multidimensional modelling and its applications in different technology domain.
- Apply the ETL process to absorb the data in MDDM and statistical technique to understand data.
- Analyze the data to identify digital data types, multidimensional schema and hidden pattern from data.
- Design the MDDM and reports using the business concepts.

Unit I:

7 Hrs.

Introduction to Business Intelligence: Introduction to digital data and its types – structured, semi-structured and unstructured, BI Definitions & Concepts, BI Framework, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI best practices.

Unit II:

7 Hrs.

Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP) Introduction to Multi Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi-dimensional modeling, cubes, Identifying Dimension tables and fact table, attribute, hierarchies, star and snowflake schema, Data Warehousing concepts and its role in BI

Unit III:

8 Hrs.

Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration, needs and advantages of using data integration, introduction to common data integration approaches, Meta data – types and sources, Introduction to data quality, data profiling concepts and applications

Unit IV:

8 Hrs.

Decision Making and Analytics: An Overview of Business Intelligence, Analytics, and Decision Support
Descriptive Analytics: Introduction to Business Reporting, Visual Analytics, and Business Performance Management,
Predictive Analytics: Introduction to Techniques for Predictive Modeling
Prescriptive Analytics: Automated Decision Systems and Expert Systems, case study .

Unit V:

8 Hrs.

Introduction to business metrics and KPIs, creating cubes using Microsoft Excel, Basics of Enterprise Reporting: A typical enterprise, Malcolm Baldrige - quality performance framework, balanced scorecard, enterprise dashboard, balanced scorecard vs. enterprise dashboard.

Unit VI

7 Hrs.

Case study: Overview and use of products from open software. BI road Ahead: BI and mobility, BI and cloud computing, BI for ERP systems, Social CRM and BI.

Total

45 Hrs.

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Textbooks:

1.	R. N. Prasad, Seema Acharya, Fundamentals of Business Analytics, Wiley India
2.	Sam Anahory, Dennis Murray, Data Warehousing in the real world A practical guide for building Decision Support System, PEARSON

Reference Books:

1.	Business Intelligence by David Loshin, Business Intelligence by David Loshin, Business Intelligence by David Loshin.
2.	Business intelligence for the enterprise by Mike Biere, Business intelligence for the enterprise by Mike Biere, Business intelligence for the enterprise by Mike Biere.

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1622 : PE-II: Lab: Business Intelligence

Course Outcomes

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

1. Apply the ETL process to absorb the data in MDDM and statistical technique to understand data.
2. Design the MDDM and reports using the business concepts.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	By using excel, create a chart report, by considering module names on the X-axis, Various Modules on Y-axis. (Bar chart, pivot chart, pie chart, line chart, combo chart) Perform the Slice, Roll-up, Drill Down operations.
2	Perform Extract Transform Load (ETL) extracts data from data-sources, transforms it, cleans it in preparation for reports and analysis and loads it into a data warehouse.
3	Integration of SQL and Tableau.
4	To develop a dashboard that helps understand the factors impacting profit and loss, focusing on sales trends over the past five years and regional variations , you can structure the dashboard to include the following key elements:(Use Marketing and sales data, build insights from which decisions can be acted upon)
5	Develop Tableau Dashboard to analyze Netflix with OLAP system.
6	Identification of Dimension and Fact table and build star/snowflake model in Power BI by addressing the correct relationship 1:1,1:* , * : 1 and * : * etc.
7	Develop Power BI Dashboard : To provide real-time data on customer behavior and actions.

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1623 : PE-II Web Analytics

Course Outcomes :

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

1. Understand how website visitors view and interact with website pages and features.
2. Analyze data on customer purchasing patterns and demographics leading to business intelligence.
3. Understand demanding trends to make effective strategic decisions.
4. Perform web and text analytics.

Unit I:	8 Hrs.
An Overview of Business Intelligence, Analytics, and Decision Support, Changing Business Environments and Computerized Decision Support, Information Systems Support for Decision Making, The Concept of Decision Support Systems (DSS), Business Analytics Overview, Brief Introduction to Big Data Analytics.	
Unit II:	7 Hrs.
Text Analytics and Text Mining: Watson, Concepts and Definitions, Introduction to Natural Language Processing, Text Mining Applications, Text Mining Process, Text Mining Tools.	
Unit III:	7 Hrs.
Web Analytic fundamentals: Capturing data: Web logs or JavaScripts tags, Separate data serving and data capture, Type and size of data, Innovation, Integration, Selecting optimal web analytic tool, Understanding clickstream data quality, Identifying unique page definition, Using cookies, Link coding issues.	
Unit IV:	8 Hrs.
Web Metrics: Common metrics: Hits, Page views, Visits, Unique visitors, Unique page views, Bounce, Bounce rate, Page/visit, Average time on site, New visits; Optimization (e-commerce, non-e-commerce sites): Improving bounce rates, Optimizing adwords campaigns; Real time report, Audience report, Traffic source report, Custom campaigns, Content report, Introduction to Google analytics, Introduction to KPI, characteristics, Need for KPI, Perspective of KPI, Uses of KPI.	
Unit V:	7 Hrs.
Web analytics 2.0: Web analytics 1.0, Limitations of web analytics 1.0, Introduction to analytic 2.0, Competitive intelligence analysis : CI data sources, Toolbar data, Panel data ,ISP data, Search engine data, Hybrid data, Website traffic analysis: Comparing long term traffic trends, Analyzing competitive site overlap and opportunities.	
Unit VI:	8 Hrs.
Google Analytics: Brief introduction and working, Adwords, Benchmarking, Categories of traffic: Organic traffic, Paid traffic; Google website optimizer, Implementation technology, Limitations, Performance concerns, Privacy issues.	
Total Lecture	45 Hours

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Textbooks:

- | | |
|----|---|
| 1. | Clifton B., Advanced Web Metrics with Google Analytics, Wiley Publishing, Inc. (2010), 2nd ed. |
| 2. | Ramesh Sharda, Dursun Delen, Efraim Turban, Business Intelligence and Analytics: Systems for decision support, Pearson Education. |

Reference Books:

- | | |
|----|---|
| 1. | Rajiv Sabherwal, Irma Becerra-Fernandez, "Business Intelligence – Practice, Technologies and Management", John Wiley 2011. |
| 2. | Lariss T. Moss, ShakuAtre, "Business Intelligence Roadmap", Addison-Wesley It Service. |
| 3. | Kaushik A., Web Analytics 2.0 The Art of Online Accountability and Science of Customer Centricity, Wiley Publishing, Inc. (2010), 1st ed. |

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/noc22_cs40/preview |
|----|---|

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1624: PE-II Lab Web Analytics

Course Outcomes

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

1. Understand the fundamentals of Business Intelligence, Decision Support Systems, and Big Data Analytics.
2. Apply text mining techniques and tools to extract insights from unstructured data.
3. Analyze website traffic data and evaluate web metrics for performance optimization.
4. Evaluate web analytics tools and competitive intelligence data to support digital strategy decisions.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Create a Business Intelligence Dashboard using Excel/Power BI Objective: Understand how BI dashboards help in decision-making. Tasks: Import sample business data (e.g., sales, customer data), create visual reports using charts and slicers. Tools: Microsoft Power BI / Excel
2	Case Study Analysis of Decision Support System (DSS) Objective: Explore how organizations use DSS in real scenarios. Tasks: Select a company (e.g., Amazon, Uber), research their DSS implementation, and prepare a report. Tools: Internet research + documentation tools (Word/PPT)
3	Perform Basic Text Mining with Python (NLTK or spaCy) Objective: Extract insights from textual data. Tasks: Use Python to analyze sentiment, frequency of words from product reviews or tweets. Tools: Python, Jupyter Notebook, NLTK/spaCy
4	Use IBM Watson Natural Language Understanding (NLU) Objective: Analyze text using Watson's API. Tasks: Input a paragraph of news or blog content and extract keywords, sentiment, and emotion. Tools: IBM Cloud, Watson NLU
5	Capture and Analyze Web Log Data Objective: Understand how raw server logs track user behavior. Tasks: Use sample Apache or Nginx web logs, parse and visualize hit counts, IPs, pages accessed. Tools: Excel / Python (Pandas), WebLog Expert (optional)
6	Create a JavaScript Tag for Data Capture Objective: Learn how tracking scripts work on websites. Tasks: Insert a basic JavaScript snippet on a webpage to log page views and clicks. Tools: HTML, JavaScript, browser console

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7	Analyze Website Metrics using Google Analytics Objective: Explore GA interface and key reports. Tasks: Use a Google Analytics demo account or personal website to analyze metrics like bounce rate, time on site, pageviews. Tools: Google Analytics
8	Define KPIs for a Website Objective: Design key performance indicators based on website goals. Tasks: Choose a website (e-commerce or blog), define 5 KPIs (e.g., conversion rate, bounce rate), and explain their significance. Tools: Documentation (Google Docs/Word), GA demo account
9	Perform Competitive Analysis using SimilarWeb or SEMrush Objective: Compare two websites based on traffic sources and user behavior. Tasks: Use SimilarWeb/SEMrush to compare analytics of two competitors (e.g., Flipkart vs. Amazon). Tools: SimilarWeb, SEMrush (free version or trial)
10	Analyze Long-Term Traffic Trends Objective: Identify patterns in traffic over time. Tasks: Use Google Trends or GA to compare seasonal/annual traffic for keywords or sites. Tools: Google Trends, Google Analytics
11	Set Up Google Analytics on a Test Website Objective: Understand how to implement and configure GA. Tasks: Create a test website or use Blogger/WordPress, insert GA tracking code, and verify data capture. Tools: Google Analytics, HTML editor
12.	Analyze Traffic Categories (Organic vs Paid) Objective: Understand traffic segmentation in GA. Tasks: Use Google Analytics demo account to view and compare organic, paid, and referral traffic. Tools: Google Analytics

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**SoE No.
23ADS-101**

B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1627 : PE-II: GeoSpatial Data Intelligence

Course Outcomes :

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

1. Understand the core concepts and foundational principles of GIS analytics.
2. Apply spatial analysis techniques using vector and raster data for geospatial problem-solving.
3. Conduct spatial queries and perform statistical analyses on geographic data.
4. Interpret and visualize spatial patterns, relationships, and trends using geospatial tools.
5. Utilize GIS analytics in practical applications related to urban planning, environmental management, and transportation.

Unit I: Introduction to GIS Analytics	7 Hrs.
GIS analytics, Differences between mapping and spatial analysis, Types of spatial data: vector and raster, Applications of GIS analytics in the real world	
Unit II: Data Preparation and Management	8 Hrs.
Importing and cleaning spatial data, Attribute tables and data types, Spatial and attribute joins Coordinate systems and projections	
Unit III: Spatial Queries and Selections	7 Hrs.
Attribute-based queries: SQL in GIS, Location-based queries, Feature selection and extraction, Using queries for problem-solving	
Unit IV: Vector and Raster Analysis	8 Hrs.
Buffering and proximity analysis, Overlay analysis: union, intersect, Raster calculations and map algebra, Suitability analysis using raster layers	
Unit V: Spatial Statistics and Pattern Analysis	7 Hrs.
Basic spatial statistics: mean center, standard distance, Hotspot and cluster analysis, Visualizing spatial trends and distributions, Introduction to interpolation techniques: IDW, Kriging	
Unit VI: Applications	8 Hrs.
Case studies in urban planning, environment, and public health, Ethics and limitations in GIS analytics, Project: identify a problem, analyze spatial data, and present findings	
Total Lecture	45 Hours

Reference Books:

1.	Geospatial Intelligence: Concepts, Methodologies, Tools, and Applications, IGI Global, First Edition (2019), ISBN: 978-1-5225-8054-6
2.	The Esri Guide to GIS Analysis, Volume 2: Spatial Measurements and Statistics, Esri Press, Second Edition (2021), ISBN: 978-1-58948-608-9
3.	Applied GIS and Spatial Analysis, Wiley, First Edition (2003), ISBN: 978-0-470-84409-0

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VI SEMESTER

23ADS1628: PE-II : Lab : GeoSpatial Data Intelligence

Course Outcomes

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

1. Prepare and manage geospatial data for analysis.
2. Extract information using spatial and attribute queries.
3. Perform key analytical operations with vector and raster data.
4. Analyze and interpret spatial patterns statistically.
5. Apply learned techniques in a real-world context through a mini-project.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	To become familiar with the GIS software interface and load different types of spatial data.
2	Learn how to view, edit, and clean attribute data.
3	Join external tabular data to spatial features.
4	Perform queries to filter spatial features.
5	Conduct proximity analysis using buffer tools.
6	Learn overlay techniques to analyze spatial relationships.
7	Analyze and visualize spatial patterns using statistical tools.
8	Apply GIS analytics skills in a real-world scenario.

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VI SEMESTER

23ADS1629 : Visual Analytics

Course Outcomes :

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

1. Identify data and visualization types to derive insight.
2. Correlate data characteristics with appropriate visualization techniques.
3. Design and develop dashboards for informed decision-making.

Unit I:

7 Hrs.

Foundations of Data Visualization: Overview of data visualization concepts, history, and types of data. Data Abstraction and Task Abstraction models. Understanding the Four Levels of Validation. Scalar and point visualization: color maps, contouring, height plots. Vector visualization: properties, glyphs, and color coding. Visual variables and perception-based design.

Unit II:

8 Hrs.

Visual Analytics & Geo-Spatial Visualization: Designing and analyzing Networks and Trees. Effective representation using tables and layout design. Color and channel manipulations in maps. Geospatial visualization techniques: Choropleth, Hexbin, Dot, Cluster, Cartogram maps. Using geospatial tools and interpreting results for location-based insights.

Unit III:

7 Hrs.

Visualization Tools & Techniques: Introduction to R for visualization using ggplot2, plotly with datasets. Python tools: matplotlib, seaborn, altair, bokeh – comparisons and use cases. Introduction to Tableau: loading data, chart types, interactivity. Creating dashboards using Tableau and best practices.

Unit IV:

8 Hrs.

Visualization of Complex Data Types: Time-series visualization techniques, trends, and forecasts. Text data visualizations: word clouds, keyword maps, and sentiment analysis. Matrix visualizations: adjacency and incidence matrices. Heat maps for density and correlation visualization. Multivariate data representation with parallel coordinates and radar charts.

Unit V:

7Hrs.

Streaming Data Visualization: Introduction to streaming data concepts and use-cases. Architecture for streaming: Kafka, Flume, Spark Streaming. Tools and dashboards for real-time data. Challenges of latency and consistency. Visual analysis of dynamic datasets in finance and social media.

Unit VI:

8 Hrs.

Dashboards & Emerging Trends: Principles and components of dashboard design. Use cases across finance, healthcare, insurance, and marketing. KPIs, filters, interactivity, and storytelling. Emerging trends: AR/VR visualizations, AI-assisted analysis, and ethical implications. Hands-on mini project and use of open-source platforms.

Total Lecture

45Hours

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Textbooks:

- | | |
|----|---|
| 1. | Tamara Munzer, Visualization Analysis and Design, CRC Press 2014. |
| 2. | Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O'Reilly Media, Inc., 2018 |

Reference Books:

- | | |
|----|--|
| 1. | Chun-hauh Chen, W.K.Hardle, A.Unwin, Hand book of Data Visualization, Springer publication, 2016. |
| 2. | Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication,2020 |
| 3. | Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014. |

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/noc21_ge21/preview |
| 2. | https://www.my-mooc.com/en/categorie/data-visualization |

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VI SEMESTER 23ADS1630 : Lab: Visual Analytics

Course Outcomes

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

1. Effectively apply diverse visualization techniques to analyze and interpret various data types.
2. Create interactive dashboards and real-time visualizations to aid decision-making across domains.
3. Execute end-to-end data visualization projects from data cleaning to insightful storytelling using multiple tools.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Visualizing Different Data Types and Basic Charts: Problem Statement: Given a mixed dataset containing numerical, categorical, and ordinal variables (e.g., sales data with product categories, quantities, and ratings), create appropriate visualizations (bar charts, histograms, box plots) to summarize and interpret the data distribution and key trends.
2	Scalar and Vector Visualization Techniques Problem Statement: You have a dataset containing wind speed and direction measurements at various locations. Use scalar and vector visualization techniques such as contour plots, color maps, and vector glyphs to represent wind patterns and intensity effectively.
3	Visual Analytics with Networks, Trees, and Tables: Problem Statement: Analyze a social network dataset representing connections between users. Visualize the network graph, highlight important nodes, and present hierarchical relationships using tree diagrams and summary tables to explore the structure and influence of users.
4	Geo-Spatial Data Visualization using Choropleth and Cluster Maps: Problem Statement: Using a dataset of COVID-19 cases by region, create a choropleth map to visualize infection density, a cluster map to identify hotspots, and other geo-spatial visualizations that help in understanding the spatial spread of the disease.
5	Time-Series and Heatmap Visualizations: Problem Statement : Given temperature readings collected hourly over a year, generate time-series visualizations (line graphs, area charts) and heatmaps to identify seasonal trends, anomalies, and patterns in the data.

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6	Interactive Dashboard Creation: Problem Statement: Build an interactive dashboard for a retail company that includes sales, inventory, and customer feedback data. The dashboard should allow filtering by product categories, time periods, and geographic locations to support management's decision-making process.
7	Streaming Data Visualization: Problem Statement : Implement a live data visualization dashboard that displays streaming data such as stock prices or sensor readings. The dashboard should update in real-time and provide meaningful visual insights like trend lines and alerts.
8	Case Study: End-to-End Visualization Project: Problem Statement: Select a publicly available dataset (e.g., from Kaggle or government portals) related to environment, health, or finance. Perform data cleaning, exploratory analysis, and create multiple visualizations including dashboards to convey insights that support informed decisions.

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VI SEMESTER

23ADS1631 : DOT NET Full Stack Development

Course Outcomes :

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

1. Understand the fundamentals of the .NET Framework and develop basic C# console applications using control flow and error handling constructs.
2. Apply Object-Oriented Programming concepts in C# to create modular, reusable, and maintainable applications.
3. Develop dynamic web applications using ASP.NET Core MVC and RESTful APIs with proper routing, views, and controllers.
4. Integrate relational databases using Entity Framework Core to perform CRUD operations, manage data models, and ensure secure data access.
5. Design responsive web interfaces using HTML5, CSS, and JavaScript and integrate them with .NET Core backend applications.

Unit I:

7 Hrs.

Introduction to .NET and C#: Understanding the .NET Framework, Overview of C# Programming Language, Installing Visual Studio IDE, Writing Your First C# Program, Variables, Data Types, and Operators, Control Flow (if statements, loops), Methods and Functions, Debugging and Error Handling

Unit II:

7 Hrs.

Object-Oriented Programming (OOP) with C#: Introduction to Object-Oriented Programming (OOP), Classes and Objects, Encapsulation and Access Modifiers, Inheritance and Polymorphism, Interfaces and Abstract Classes, Exception Handling and Custom Exceptions, Working with Collections (Lists, Arrays), Design Patterns in C#

Unit III:

8 Hrs.

.NET Core and ASP.NET Core: Introduction to .NET Core and ASP.NET Core, Setting Up .NET Core Development Environment, Building Web Applications with ASP.NET Core MVC, Routing and Controllers, Views and Razor Syntax, Model Binding and Validation, Middleware and Configuration, Building RESTful APIs with ASP.NET Core

Unit IV:

8 Hrs.

Entity Framework and Database Integration: Introduction to Entity Framework Core, Creating Database Models, CRUD Operations with Entity Framework, Data Annotations and Fluent API, Working with Migrations, Advanced Querying and LINQ, Using Repository Pattern, Securing APIs and Data Access

Unit V:

7Hrs.

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Frontend Development with HTML, CSS, and JavaScript: Introduction to Frontend Development, HTML5 Markup and Elements, CSS Styling and Layout, JavaScript Fundamentals, DOM Manipulation and Events, Frontend Libraries (e.g., Bootstrap), Building Responsive Web UIs, Integrating Frontend with .NET Core

Unit VI: **8 Hrs.**

Single-Page Applications (SPA) with Angular/React/Vue: Introduction to SPAs and Frontend Frameworks, Setting Up Angular/React/Vue, Components and Routing, State Management, Services and API Integration, Form Handling and Validation, Building SPAs with Authentication, Optimizing SPA Performance

Total Lecture **45 Hours**

Textbooks:

- "C# 10 and .NET 6 – Modern Cross-Platform Development"** Mark J. Price, Packt Publishing Latest (6th or 7th Edition preferred) *Coverage:* Unit I, II, III (C#, OOP, .NET Core basics)
- "Entity Framework Core in Action"** Jon P Smith, Publisher: Manning Publications Edition: Second Edition, *Coverage:* Unit IV (EF Core, Database Integration, Migrations, LINQ)
- "Web Design with HTML, CSS, JavaScript and jQuery Set"** Jon Duckett, Publisher: Wiley, *Coverage:* Unit V (Frontend Development)
- "Pro Angular"** Adam Freeman, *Publisher:* Apress, *Edition:* Latest, *Coverage:* Unit VI (Angular SPA development) **OR** **"Learning React"** Alex Banks & Eve Porcello, *Publisher:* O'Reilly Media, *Coverage:* Unit VI (React SPA development)

Reference Books:

- "The C# Programming Yellow Book"** Rob Miles, *Publisher:* Self-published, *Free PDF Available* *Coverage:* Unit I, II (Beginner to Intermediate C#)
- "ASP.NET Core in Action"** Andrew Lock, *Publisher:* Manning Publications, *Edition:* Second Edition, *Coverage:* Unit III (ASP.NET Core in depth)
- "Front-End Development Projects with HTML, CSS, and JavaScript"** Peter Smith *Publisher:* Packt Publishing, *Coverage:* Unit V (Hands-on frontend projects)
- "Vue.js Up and Running"** Callum Macrae, *Publisher:* O'Reilly Media, *Coverage:* Unit VI (Vue.js for SPA)

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

- https://onlinecourses.nptel.ac.in/noc22_cs40/preview

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VI SEMESTER

23ADS1632 : LAB DOT NET Full Stack Development

Course Outcomes

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

1. Apply C# programming constructs including data types, control flow, functions, and exception handling to develop console-based applications.
2. Implement Object-Oriented Programming concepts in C# using classes, inheritance, polymorphism, interfaces, and collections.
3. Develop ASP.NET Core MVC applications using routing, controllers, views, and RESTful APIs with model binding and validation.
4. Integrate and manage databases using Entity Framework Core, including data modeling, CRUD operations, LINQ queries, and validation.
5. Design responsive front-end interfaces using HTML, CSS, JavaScript, and Bootstrap, and integrate them with .NET Core backend services.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Implement a program using different data types, variables, and arithmetic operators.
2	Create a C# program demonstrating control flow using if-else , switch , and loops (for , while).
3	Write a program using user-defined methods and function overloading.
4	Develop a program to demonstrate exception handling using try-catch-finally .
5	Implement a program demonstrating classes, objects, and access modifiers.
6	Create a C# program that demonstrates inheritance and polymorphism.
7	Build a program using interfaces and abstract classes.
8	Write a program that creates and manages a collection using List<T> and Array .
9	Implement a simple design pattern (e.g., Singleton or Factory) in C#.
10	Create an ASP.NET Core MVC application with routing, controller, and views.
11	Develop a simple RESTful API using ASP.NET Core with GET and POST endpoints.
12	Implement form input with model binding and server-side validation.
13	Use middleware for logging or error handling in an ASP.NET Core project.
14	Create a code-first Entity Framework Core model and generate a database using migrations.

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15	Implement CRUD operations using Entity Framework Core in an ASP.NET Core application.
16	Apply data annotations and Fluent API for model validation and relationships.
17	Perform advanced LINQ queries on a sample database.
18	Create a responsive web page using HTML5 and CSS3.
19	Implement JavaScript functions for DOM manipulation and handling events.
20	Use Bootstrap to design a responsive form and integrate it with a .NET Core backend.
21	Develop a simple frontend UI with user input that connects to an ASP.NET Core API.

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VI SEMESTER

23ADS1641 : Internet of Things

Course Outcomes :

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

Understand IOT architecture and its enabling technologies.

1. Analyze IOT environments using various communication technologies.
2. Apply various IOT enabling technologies for creation of IOT environments.

Unit I:	8 Hrs.
Introduction : Concepts behind the Internet of Things, Characteristics of IoT, IoT enabling technologies, IoT Communication Model, IoT architecture, Applications of IoT, Transducers, Sensors, Sensor classes, Sensor types, Actuators and its types, IOT Protocols. Application layer: MQTT, COAP, XMPP, AMQP, Communication protocols: IEEE802.15.4, ZigBee, Wireless HART, Zwave, Bluetooth, NFC, RFID	
Unit II:	7 Hrs.
Wireless Sensor networks: Components of sensor nodes, Node Behavior in WSNs, Applications, WSN Coverage, OGDC algorithm, Stationary and Mobile Wireless Sensor Networks.	
Unit III:	7 Hrs.
Cloud Computing: Recent Trends in Computing, Characteristics, Components of Cloud Computing, Service Models, Deployment Models, Service Management, Cloud Security, IoT Data analytics, Case studies, Middleware for IoT	
Unit IV:	8 Hrs.
Machine to Machine Communication: Node types, IP and Non IP based M2M network, Interoperability in Internet of Things: Current Challenges in IoT, Interoperability, Types of Interoperability, Software-Defined Networking SDN Architecture, OpenFlow Protocol, APIs in SDN, Controller Placement.	
	Total Lecture 30 Hours

Textbooks:

1. **Internet of Things (A Hands-on-Approach)** by Vijay Madisetti and Arshdeep Bahga
2. **Rethinking the Internet of Things: A Scalable Approach to Connecting Everything** by Francis daCosta

Reference Books:

1. **From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence** by Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle.

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VI SEMESTER

23ADS1642 : Internet of Things Lab

Course Outcomes

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

1. Demonstrate IOT architecture and its enabling technologies.
2. Develop various IOT environments

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	To study IoT Kit
2	Design a sketch for running of LED's
3	Design a sketch to monitor state of switch by establishing serial communication between Arduino and computer.
4	Design a sketch to read analog value of potentiometer by establishing serial communication between Arduino and computer.
5	Design a sketch for blinking LED's without using delay
6	Design a sketch to develop switch based binary LED counter. Also observe output on serial monitor.
7	Design a sketch to create a simple digital clock using LCD display.
8	Design a sketch to make use of EEPROM to control devices(LED)
9	To log data of temperature sensor over internet and monitor it from anywhere in the world

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VI SEMESTER

23ADS1643 : PE-III Reinforcement Learning

Course Outcomes :

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

1. Demonstrate various Components of Reinforcement Learning.
2. Make use of various exploration and exploitation strategies.
3. Apply Model based and Model Free Prediction techniques.
4. Make use of different value based Reinforcement Learning Algorithms.
5. Demonstrate various Policy based Reinforcement Learning Algorithms.

Unit I:

6 Hrs.

Introduction: Deep Reinforcement Learning, Suitability of RL, Components of Reinforcement Learning -Agent, Environment, Observations, Actions, Example-The Bandit Walk Environment, Agent-Environment interaction cycle, MDP (Markov Decision Process): The engine of the Environment-States, Actions, Transition Function, Reward Signal.

Unit II:

6 Hrs.

Planning: Objective of a decision making agent-environment, Plan, Optimal policy, Comparison of Policies, Bellman Equation/State-Value Function, Action-Value Function
Exploitation and Exploration of Reinforcement Learning: Bandits- Single-state decision problem(Multi-Armed Bandit(MAB) problem), Greedy Strategy, Random Strategy, Epsilon-Greedy Strategy, Decaying Epsilon-Greedy Strategy.

Unit III:

6 Hrs.

Model Free Reinforcement Learning: Monte Carlo Prediction (MC), First-Visit MC (FVMC), Every-Visit MC (EVMC), Temporal Difference Learning (TD), Learning to estimate from multiple steps, N-step TD learning,

Unit IV:

6 Hrs.

Monte Carlo control, SARSA: On-Policy TD control, **Q-learning:** Off-Policy TD control, Double Q-learning, **Model Based Reinforcement Learning:** Dyna-Q, Trajectory sampling.

Unit V:

6 Hrs.

Value Based Reinforcement Learning: Deep reinforcement learning agents with sequential feedback, evaluative feedback, sampled feedback, Function Approximation for Reinforcement Learning- high-dimensional state and action spaces, , Neural Fitted Q (NFQ).

Unit VI:

6 Hrs.

Policy Based Reinforcement Learning: Policy Gradient and Actor-Critic Methods—REINFORCE Algorithm and Stochastic Policy Search ,Asynchronous Advantage Actor-Critic (A3C), Generalized Advantage Estimation (GAE), Advantage Actor-Critic(A2C), Deep Deterministic Policy Gradient (DDPG), Twin-Delayed DDPG (TD3).

Total Lecture

36 Hours

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Textbooks:

1. Miguel Morales, Grokking Deep Reinforcement Learning, Manning Publications, 2020

Reference Books:

1. Richard S. Sutton and Andrew G. Barto, Reinforcement learning: An Introduction, Second Edition, MIT Press, 2019.
2. Marco Wiering, Martijn van Otterlo(Ed), Reinforcement Learning, State-of-the-Art, Adaptation, Learning, and Optimization book series, ALO, volume 12, Springer, 2012
3. . Keng, Wah Loon, Graesser, Laura, Foundations of Deep Reinforcement Learning: Theory and Practice in Python, Addison Wesley Data & Analytics Series, 2020.
4. Francois Chollet, Deep Learning with Python, Manning Publications, 2018.

MOOCs Links and additional reading, learning, video material

1. http://cse.iitkgp.ac.in/~adas/courses/rl_aut2021/syllabus.html

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**SoE No.
23ADS-101**

B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1644 : PE-III- Lab Reinforcement Learning

Course Outcomes

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

CO1: Apply reinforcement learning algorithms to solve control problems in simulated environments.

CO2: Evaluate and compare value-based and policy-based learning methods for agent performance

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Multi-Armed Bandit with Epsilon-Greedy Strategy Implement a simple Multi-Armed Bandit problem and solve it using the epsilon-greedy exploration strategy. Plot the average reward and understand how exploration helps in better decision-making.
2	Monte Carlo Value Estimation on FrozenLake Use Monte Carlo First-Visit method to estimate the value function of different states in the FrozenLake environment. Compare it with the Every-Visit method.
3	Temporal Difference (TD(0)) Learning on FrozenLake Apply TD(0) to learn the value of states from episodes without waiting for the episode to finish. Compare the value estimates with Monte Carlo methods.
4	SARSA vs Q-learning on FrozenLake Implement both SARSA (On-Policy) and Q-learning (Off-Policy) algorithms. Train agents and compare their performance on the FrozenLake environment
5	Dyna-Q – Model-Based Learning in GridWorld Introduce a simple grid environment and apply the Dyna-Q algorithm which combines learning from experience and simulated planning steps.
6	Deep Q-Learning (DQN) on CartPole Build a simple DQN using a neural network to play the CartPole game. Use experience replay and target network for stable training.
7	Policy Gradient using REINFORCE Algorithm Implement the REINFORCE algorithm on CartPole using a simple neural network policy to learn directly from rewards and gradients.
8	Advantage Actor-Critic (A2C) on CartPole Apply & implement A2C to train an agent on the CartPole environment using a separate actor and critic network for better learning performance.

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1647: PE-III: Introduction to Salesforce

Course Outcomes :

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

1. Apply the knowledge of customer-centered organization and implement the integral processes within an organization that are automated and how does the automation create predictability and efficiencies.
2. Analyze business intelligence, cross selling/up selling, customer loyalty, continuous improvement and quality programs that have been the direct and ongoing result of implementing CRM applications. Solve queries based on relational algebra & SQL.
3. Design and customize a CRM application for organization to suit their business needs

Unit I:

7 Hrs.

Introduction to Salesforce CRM: Salesforce, Types of Salesforce Clouds and their features, Industry Clouds in salesforce.

CRM Administration and Data Model Design: Lightning and classic UI and differences, Object Manager, App Manager, Setup, App creation, tabs, Types of Objects, Data Types, Sandboxes, Understanding Relationships and its limitations, Types of Relationship and their differences, Junction Object, formulas, Dependency picklist fields, Validation Rules.

Unit II:

8 Hrs.

Data Management with CRM Tool: Record details, List Views, Filters, Actions Page layouts, Compact Layouts, Introduction to Lightning flows (Auto triggered and Screen flow), email templates, approval processes, Community Creation, Reports and Dashboards.

Security Model: Introduction to Profiles and Permission Set, Permission Set Group, Overview of Data Security, Control access to org, object, field, record, OWD, Role and Roles Hierarchy, Sharing Rule, Sharing sObjects, Apex Sharing.

Unit III:

7 Hrs.

CRM Tool Development: Introduction to Apex, Collections, SOQL and SOSL, DML Operations, Controllers In APEX, Email Service Using Apex Class and Triggers, Asynchronous APEX, Batch APEX, Apex Test Classes. Some Important Governor Limits (like SOQL limit, DML limit etc).

Introduction to use of AI in Salesforce: Agentforce for developers, Agents, Prompt and Data Cloud.

Unit IV:

8 Hrs.

Lightning Web Component:

Introduction to Aura and LWC and difference between them. Decorators in LWC like wire, api and track. Lightning Data Service, Imperative Apex call from LWC, Parent child LWC component communication using custom events. Use of LMS (Lightning Message Service) for communicating between unrelated components, Navigation Mixin

Total

30 Hrs.

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

23ADS1648: PE-III: Lab Introduction to Salesforce

Course Outcomes

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

1. Explain the value of relationship management strategy.
2. Implement cloud-based solutions for customers using Salesforce CRM tool
3. Help teams articulate their CRM goals and identify key milestone in the relationship management process.
4. Demonstrate the use of Lightning Component Framework.

SN	Experiments based on
1	A] Introduction Cloud Computing and its Services. B] Introduction to Salesforce CRM.
2	A] Creation of Custom Objects in salesforce Lightning and apply validations on different fields. B] To create Look-up and Master Details Relationship with objects.
3	A] To implement formula field. B] To form dependencies among fields.
4	To create a domain specific schema builder.
5	A] To create clone user and assigned permissions B] To perform OWD operations.
6	Create lightning flow in salesforce: A] Auto triggered flow B] Screen flow
7	To create Email templates in salesforce Lightning. Send Email using flows.
8	A] Write an Apex code to perform the DML Operations on Standard or the Custom objects created by the user. B] Write Test class to cover the same C] Use of Agentforce for developers to document, explain and create test classes
9	Write Async Apex (Batch class)
10	A] Create Resource Resource, Connected App and test with workbench/postman B] Write a Apex class to do Basic Http Request Callout and related configuration like Named Credentials or Remote Site Settings
11	A] Create a Hello LWC Component B] Create a Hello Aura Component. Understand difference with respect to syntax
12.	A] LWC Component showing use of LDS. B] LWC Component showing use of wire to fetch the backend data C] LWC Component to do imperative call
13	A] Use of events in LWC to communicate between Parent and Child component B] Use of LMS for communication between unrelated components
14.	Group Mini Project

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

MDM4ADS104 : Introduction to Big Data Analytics

Course Outcomes :

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

1. Understand the characteristics of big data and concepts of Hadoop ecosystem.
2. Understand the concepts of Scala programming.
3. Apply Mapreduce programming model to process big data.

Unit I:	6 Hrs.
Introduction to Big data: Introduction – Big Data- Characteristics of Big Data – Big data management architecture- Examining Big Data Types – Big Data Technology Components -- Big data analytics – Big data analytics examples - Web Data Overview – Web Data in Action.	
Unit II:	6 Hrs.
Hadoop : Introduction – History of Hadoop - Hadoop Ecosystem- Analyzing data with Hadoop - Hadoop Distributed File System- Design - HDFS concepts - Hadoop filesystem –Data flow – Hadoop I/ O - Data integrity – Serialization - Setting up a Hadoop cluster - Cluster specification - cluster setup and installation	
Unit III:	6 Hrs.
MapReduce: Introduction – Understanding Map, Reduce functions - Scaling out - Anatomy of a MapReduce Job Run - Failures – Shuffle and sort - Mapreduce types and formats - features – counters - sorting - Mapreduce Applications – Configuring and setting the environment - Unit test with MR unitlocal test	
Unit IV:	6 Hrs.
Spark: – Installing spark – Spark applications, Jobs, Stages and Tasks –Resilient Distributed databasesAnatomy of a Spark Job Run – Spark on YARN- SCALA: Introduction- Classes and objects- Basic types and operators- built-in control structures- functions and closures- inheritance	
Total Lecture	36 Hours

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Textbooks:

- | | |
|----|--|
| 1. | "Hadoop: The Definitive Guide "Third Edit on Tom White O'reily Media, 2012 |
| 2. | "Big Data Analytics" First Edition Seema Acharya, Subhasini Chellappan " Wiley 2015. |

Reference Books:

- | | |
|----|---|
| 1. | "Taming the Big Data Tidal wave "Bill Franks (2012). John Wiley & Sons |
| 2. | "Programming in Scala", Second Edition, Martin Odersky, Lex Spoon, Bill Venners (2010)
Artima Press, California. |
| 3. | "Professional NoSQL"Shashank Tiwari (2011). John Wiley & Sons |
| | |

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/noc20_cs92/preview |
| 2. | https://onlinecourses.swayam2.ac.in/arp19_ap60/preview |

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B.Tech in Artificial Intelligence and Data Science

VI SEMESTER

Mandatory Learning Course (Audit Course)

MLC2126 : YCAP6

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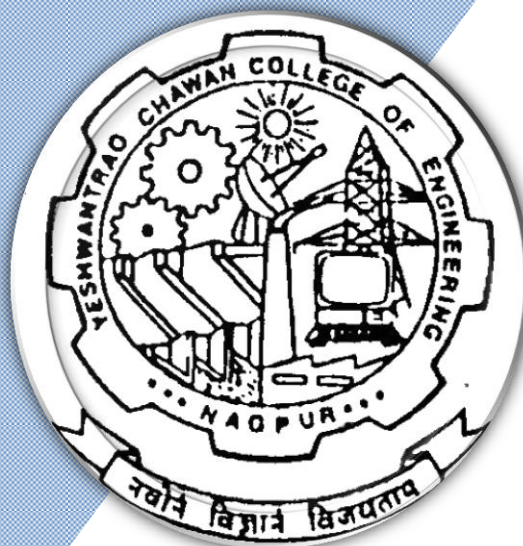
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Bachelor of Technology SoE & Syllabus 2023 7th Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



Yeshwantrao Chavan College of Engineering
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B.TECH SCHEME OF EXAMINATION 2023
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(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours	
							L	T	P	Hrs		MSEs*	TA**	ESE		
SEVENTH SEMESTER																
1	7	PC	AIDS	23ADS1701	Big Data and Cloud Computing	T	3	0	0	3	3	30	20	50	3	
2	7	PC	AIDS	23ADS1702	Lab : Big Data and Cloud Computing	P	0	0	2	2	1		60	40		
3	7	PC	AIDS	23ADS1703	Neural Networks and Deep Learning	T	3	0	0	3	3	30	20	50	3	
4	7	PC	AIDS	23ADS1704	Lab : Neural Networks and Deep Learning	P	0	0	0	2	1		60	40		
5	7	PC	AIDS	23ADS1705	Generative AI	T	2	0	0	2	2	30	20	50	3	
6	7	PC	AIDS	23ADS1706	Lab : Generative AI	P	0	0	0	2	1		60	40		
7	7	PC	AIDS	23ADS1707	Optimization Techniques	T	2	0	0	2	2	30	20	50	3	
8	7	PE	AIDS	23ADS1708	Lab : Optimization Techniques	P	0	0	2	2	1		60	40		
9	7	PE	AIDS		Professional Elective-IV	T	3	0	0	3	3	30	20	50	3	
10	7	PE	AIDS		Professional Elective-V	T	3	0	0	3	3	30	20	50	3	
11	7	MDM	AIDS		MD Minor Course-V	T	2	0	0	2	2	30	20	50	3	
12	7	STR	AIDS	23ADS1709	Project Phase-II	P	0	0	8	8	4		60	40		
13	7	STR	AIDS	23ADS1710	Campus Recruitment Training (CRT)	P	0	0	0	0	2			100		
14	7	STR	AIDS	23ADS1711	Comprehensive Evaluation of Core Knowledge	P	0	0	2	2	1		60	40		
TOTAL							18	0	14	36	29					

Professional Elective - IV

1	7	PE-IV	AIDS	23ADS1721	PE-IV : Wireless Sensor Network
2	7	PE-IV	AIDS	23ADS1722	PE-IV : Data Mining and Warehousing
3	7	PE-IV	AIDS	23ADS1724	PE-IV : Ethical Hacking
4	7	PE-IV	AIDS	23ADS1725	PE-IV : Soft Computing
5	7	PE-IV	AIDS	23ADS1727	PE-IV : Data and Cyber Security
6	7	PE-IV	AIDS	23ADS1728	PE-IV : Advanced Probability and Statistics
7	7	PE-IV	AIDS	23ADS1729	PE-IV : Quantum Computing

Professional Elective - V

1	7	PE-V	AIDS	23ADS1741	PE-V : Blockchain Technology
2	7	PE-V	AIDS	23ADS1743	PE-V : Industrial and Social Applications of Digital Twins
3	7	PE-V	AIDS	23ADS1744	PE-V : Graph Analytics
4	7	PE-V	AIDS	23ADS1745	PE-V : Human Computer Interaction
5	7	PE-V	AIDS	23ADS1746	PE-V : Intelligent Systems
6	7	PE-V	AIDS	23ADS1747	PE-V : Edge AI & IoT Analytics
7	7	PE-V	AIDS	23ADS1748	PE-V : Software Testing

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B.Tech in Artificial Intelligence and Data Science

VII-SEMESTER

23ADS1701 : Big Data and Cloud Computing

Course Outcomes :

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

1. Understand and explain the **fundamental concepts of Big Data**, its characteristics, sources, value, and real-world applications.
2. Describe and analyze **cloud computing principles**, including service models, deployment models, benefits, risks, and economic considerations.
3. Apply **big data storage and processing technologies** such as HDFS, NoSQL databases, Hadoop, and Spark to handle large-scale datasets.
4. Perform **big data analytics using Spark**, including Spark SQL, Spark Streaming, and basic machine learning techniques for data-driven decision making.
5. Deploy and manage big data applications in cloud environments, and demonstrate understanding of virtualization, SDN, and software-defined storage concepts.

Unit I: Introduction to Big Data

7 Hrs.

Course overview and motivation, Evolution of data processing systems, Definition of Big Data, Sources of Big Data, Characteristics of Big Data (Volume, Velocity, Variety, Veracity, Value), Value and applications of Big Data

Unit II: Cloud Computing Fundamentals

6 Hrs.

Definition and evolution of Cloud Computing, Enabling technologies, Cloud service models (IaaS, PaaS, SaaS), Cloud deployment models (Public, Private, Hybrid, Community), Popular cloud platforms and use cases, Benefits, risks, and challenges, Economic models and Service Level Agreements (SLAs)

Unit III: Cloud Infrastructure and Storage for Big Data

7 Hrs

Data centers: history and architecture, Datacenter components and design considerations, Power efficiency, PUE, redundancy, and challenges, Cloud management and software deployment, Cloud storage concepts, Distributed file systems (HDFS, Ceph FS), Cloud databases (HBase, MongoDB, Cassandra, DynamoDB), Cloud object storage (Amazon S3, OpenStack Swift, Ceph), NoSQL databases (Key-value, Document, Column, Graph)

Unit IV: Big Data Processing and Programming Models

7 Hrs

Vector space model, Distributed programming for cloud environments, Hadoop ecosystem overview, MapReduce programming model with YARN, Data-parallel and iterative analytics, Introduction to Spark architecture, Graph-parallel processing (GraphLab / PowerGraph), Stream processing concepts (Samza)

Unit V: Big Data Analytics using Spark

6 Hrs.

Spark SQL and structured data processing, Big data collection techniques, Data Lake concepts, Spark Streaming architecture and applications, Big Data Analytics workflow, Introduction to Spark Machine Learning (MLlib), Use cases of machine learning with big data

Unit VI: Big Data Deployment and Virtualization

6 Hrs.

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B.Tech in Artificial Intelligence and Data Science

Big data deployment strategies, Hadoop-based deployment, Cloud-based deployment (AWS, Azure, Cloudera), Virtualization concepts, CPU, memory, and I/O virtualization, Case study: Amazon EC2, Software Defined Networks (SDN), Software Defined Storage (SDS)

Total Lecture | **39 Hours**

Textbooks:

1. Rajkumar Buyya, Christian Vecchiola, and S. Thamarai Selvi, Mastering Cloud Computing, McGraw-Hill Education.
2. Rudy Lai and Brooke Potaczek, Hands-On Big Data Analytics with PySpark, Packt Publishing
3. Thomas Erl, Ricardo Puttini, and Zaigham Mahmood, Cloud Computing: Concepts, Technology & Architecture, Pearson.

Reference Books:

1. Tom White, Hadoop: The Definitive Guide, 4th Edition, O'Reilly Media.
2. Vijay Garg, Big Data Analytics with Hadoop, 1st Edition, Pearson Education.
3. Seema Acharya and Subhashini Chellappan, Big Data and Analytics, Wiley India.
4. Bill Chambers and Matei Zaharia, Spark: The Definitive Guide – Big Data Processing Made Simple, O'Reilly Media.

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VII-SEMESTER

23ADS1702 : Lab. Big Data and Cloud Computing

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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

23ADS1703 : Neural Networks and Deep Learning

Course Outcomes :

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

1. Understand the fundamentals of artificial neural networks and deep neural networks.
2. Apply supervised and unsupervised neural network learning algorithms to solve computational problems.
3. Analyze the structure and behavior of deep learning models for effective model development.
4. Evaluate the performance of deep learning models developed for real world problems.
5. Create deep learning models for given real-world problems

Unit I:	7 Hrs.
Introduction: Biological Neurons and their Artificial Models, Evolution of Artificial Neural Networks, Application Scope of Neural Networks, Basic Model of Artificial Neural Network- McCulloch-Pitts, Important Terminologies of Artificial Neural Network	
Unit II:	6 Hrs.
Supervised Learning Network: Neural Network Learning Rules, Hebbian Network, Perceptron Network, Adaptive Linear Neuron(ADALINE), Multiple Adaptive Linear Neuron(MADALINE), Back-Propagation Network	
Unit III:	7 Hrs.
Associative Memory and Unsupervised Learning Networks: Training Algorithms for Pattern Association-Autoassociative Memory Network, Heteroassociative Memory Network, Bidirectional Associative Memory (BAM), Hopfield Networks, Iterative Autoassociative Memory Networks-Temporal Associative Memory Network	
Unit IV:	6 Hrs.
Deep Learning Neural Networks: History of Deep Learning- A Probabilistic Theory of Deep Learning, Gradient Learning, Chain Rule and Backpropagation, Regularization: Dataset Augmentation, Noise Robustness, Early Stopping, Bagging and Dropout, Batch Normalization, VC Dimension and Neural Nets.	
Unit V:	7 Hrs.
Convolutional Neural Networks: The Convolution Operation, Motivation, Pooling, Variants of the basic Convolution Function, Structured Outputs, Data Types, Efficient Convolution Algorithms, Applications: Computer Vision, Image Generation, Image Compression.	
Unit VI:	6 Hrs.
Recurrent Neural Networks: Introduction- Recursive Neural Networks, Bidirectional RNNs , Deep Recurrent Networks, Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders, Contractive Encoders.	
Total Lecture	
	39 Hours

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Textbooks:

- | | |
|----|--|
| 1. | Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016. |
| 2. | Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications, 2021. |

Reference Books:

- | | |
|----|---|
| 1. | Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly, 2018. |
| 2. | Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media, 2017. |
| 3. | Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", Springer International Publishing, 1st Edition, 2018. |
| 4. | Learn Keras for Deep Neural Networks, Jojo Moolayil, Apress, 2018 |
| 5. | Deep Learning Projects Using TensorFlow 2, Vinita Silaparasetty, Apress, 2020 |
| 6. | Deep Learning with Python, FRANÇOIS CHOLLET, MANNING SHELTER ISLAND, 2017. |
| 7. | S Rajasekaran, G A Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm, Synthesis and Applications", PHI Learning, 2017. |

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

1

MOOCs Links and additional reading, learning, video material

- | | |
|----|---|
| 1. | https://onlinecourses.nptel.ac.in/noc22_cs40/preview |
|----|---|

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VII SEMESTER

23ADS1704 : Lab Neural Networks and Deep Learning

Course Outcomes

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

1. Understand the fundamental concepts of deep learning and neural network architectures
2. Apply different techniques to develop and optimize deep learning models.
3. Analyze the performance of deep learning models using appropriate evaluation techniques.
4. Design and implement deep learning solutions for real-world problems using modern tools and frameworks.

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Implement simple vector addition, Matrix Multiplication using Google Colab.
2	Implement a Perceptron model using Google Colab.
3	Implement a Feed-Forward Neural Network.
4	Develop an Image Classification model using a Convolutional Neural Network (CNN) .
5	Implement Transfer Learning for Image Classification using pre-trained models.
6	Implement an LSTM-based Autoencoder using Google Colab.
7	Implement an Object Detection model using CNN.
8	Train and evaluate an image classification model using a pre-trained deep learning.
9	Perform Sentiment Analysis using a Recurrent Neural Network (RNN).
10	Develop a Recommendation System from sales data using deep learning.

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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

23ADS1705 : Generative AI

Course Outcomes :

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

1. **Understand** the fundamentals of Artificial Intelligence, Neural Networks, and Natural Language Processing techniques.
2. **Understand** deep learning architectures, training processes, and optimization techniques used in NLP.
3. **Apply** deep learning models and advanced neural network architectures for Natural Language Processing tasks.
4. **Analyze** generative AI models and transformer-based architectures for solving NLP problems.

Unit I:

6 Hrs.

Foundation of AI and Neural network: History and evolution of AI/ML, Deep learning revolution, Transfer learning, History of Neural Natural Language Processing: one hot encoding, Bag of words, TFIDF, word2vec, avgWord2vec.

Unit II:

7 Hrs.

Deep Learning for NLP: Basic deep learning concepts, Structure of Artificial Neural Networks, Steps in Training an Artificial Neural Network, Forward propagation, backward propagation, activation functions, loss functions, optimizers

Unit III:

7 Hrs.

Advanced NLP Concepts: Introduction to advanced architectures, Long Short-Term Memory Networks (LSTMs), LSTM RNN, GRU RNN, Bidirectional LSTM RNN

Unit IV:

6 Hrs.

Introduction to Generative AI Models: Generative Adversarial Networks (GANs), Encoder Decoder, Variational Autoencoders (VAEs), Transformers, Attention Mechanism in detail, seq to seq, Transformers (BERT, GPT, T5).

Total Lecture

26 Hours

Textbooks:

1. Hands on Large Language Model, by Jay Alammar & Maarten Grootendorst, Oreilly
2. Generative AI for Everyone: Deep learning, NLP, and LLMs for creative and practical applications, BPB publications, Karthikeyan Sabesan, Sivagamisundari, Nilip Dutta
3. "Introduction to Generative AI", Numa Dhamani, Kindle Edition, 2024

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Reference Books:

1. "Generative Adversarial Networks Cookbook: Over 100 recipes to build generative models using Python, TensorFlow, and Keras" by Josh Kalin.

MOOCs Links and additional reading, learning, video material

1. <https://www.pccoepune.com/MDM/pdf/syllabus/Syllabus-Generative-AI.pdf>
2. <https://github.com/krishnaik06/Roadmap-To-Learn-Generative-AI-In-2024>
3. ChatGPT

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VII SEMESTER

23ADS1706 : Lab. Generative AI

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VII SEMESTER

23ADS1707 : Optimization Techniques

Course Outcomes :

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

1. **Understand** and formulate unconstrained and constrained optimization problems using mathematical optimization techniques.
2. **Apply** linear, non-linear, and integer programming methods to solve engineering and real-world optimization problems.
3. **Analyze** and evaluate optimization models using suitable algorithms and operational research techniques.
4. **Formulate** and solve complex optimization problems using transportation, dynamic programming, and advanced optimization methods.

Unit I:	7 Hrs.
Unconstrained & constrained optimization :Unconstrained optimization: Optimizing single-variable functions, Conditions for local minimum & maximum,Optimizing multivariable functions Constrained Optimization:Optimizing multivariable functions with equality constraints:Direct Substitution ,Lagrange Multipliers . Optimizing multivariable functions with inequality constraints:Kuhn Tucker (KKT) ,Necessary conditions ,Sufficient conditions	
Unit II:	6 Hrs.
Non-Linear Programming :Newton's Algorithm ,Non-linear least squares , Multiobjective optimization	
Unit III:	7 Hrs.
Optimization in operations research:Dynamic Programming :Floyd-Warshall's Algorithm ,Integer Programming ,Branch & Bound Approach ,Pure & mixed strategy in theory of games	
Unit IV:	6 Hrs.
Linear Optimization Programming:Transportation Linear optimization ,Balanced ,Unbalanced Methods:Northwest corner cell method ,Least cost method , Vogel's Approximation method ,Transshipment Problem , Stepping Stone	
Total Lecture	26 Hours

Textbooks:

1.	Operations Research: Applications and Algorithms, 3rd , Winston W L, Cengage Learning
2.	Optimization: Theory and Applications, L. Cesari, Springer
3.	Model Building in Mathematics Programming, H. Paul Williams, Wiley

Reference Books:

1.	Integer and Combinatorial Optimization, G.L. Nemhauser and L.A. Wolsey, Wiley
2.	Discrete Optimization, R.G. Parker and R.L. Rardin.

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VII SEMESTER

23ADS1708 : Lab Optimization Techniques

Course Outcomes

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

1. Apply mathematical and numerical optimization techniques for solving both unconstrained and constrained single- and multi-variable problems. Apply the basic concepts of applied mechanics for solution of problems on planar force system.
2. Implement advanced optimization algorithms including Quasi-Newton methods, Sequential Quadratic Programming (SQP), Genetic Algorithms, and multi-objective techniques like NSGA-II for solving complex engineering and data science problems. Analyze pin jointed truss frame structure and beam structure analytically and graphically.
3. Develop computational skills in solving real-world optimization problems in operations research

Minimum Eight Practical's to be performed from the list as below

SN	Experiments based on
1	Implement optimization of a single-variable function
2	Visualize first and second derivatives to determine local minima/maxima.
3	Solve a constrained optimization problem using the method of Lagrange multipliers
4	Implement Kuhn-Tucker conditions for an inequality constrained problem.
5	Implement Quasi-Newton methods (e.g., BFGS vs. Newton's method) for unconstrained problems.
6	Implement Sequential Quadratic Programming (SQP) for a constrained nonlinear problem.
7	Use Genetic Algorithms for function optimization or feature selection
8	Perform Multi-objective optimization using NSGA-II
9	Implement Dynamic Programming for shortest path problem (e.g., Bellman-Ford).
10	Use Simplex Algorithm to solve a linear programming problem

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VII SEMESTER

23ADS1721: PE-IV Wireless Sensor Networks

Course Outcomes :

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

1. Describe the overview of wireless sensor networks and enabling technologies for wireless sensor networks .
2. Apply the design principles of WSN architectures and operating systems for simulating environment situations.
3. Apply various concepts for assignment of MAC addresses.
4. Select the appropriate infrastructure, topology, joint routing and information aggregation for wireless sensor networks
5. Analyse the sensor network platform and tools state-centric programming.

Unit I:	7 Hrs.
OVERVIEW OF WIRELESS SENSOR NETWORKS: Single-Node Architecture - Hardware Components- Network Characteristics- unique constraints and challenges, Enabling Technologies for Wireless Sensor Networks- Types of wireless sensor networks	
Unit II:	5 Hrs.
ARCHITECTURES: Network Architecture- Sensor Networks Scenarios- Design Principle, Physical Layer and Transceiver Design Considerations, Optimization Goals and Figures of Merit, Gateway Concepts, Operating Systems and Execution Environments- Introduction to TinyOS and nesC- Internet to WSN Communication	
Unit III:	7 Hrs.
NETWORKING SENSORS: MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - SMAC, - B-MAC Protocol, IEEE 802.15.4 standard and ZigBee,	
Unit IV:	8 Hrs.
The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols Energy Efficient Routing, Geographic Routing.	
Unit V:	7 Hrs.
INFRASTRUCTURE ESTABLISHMENT: Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control	
Unit VI:	7 Hrs.
SENSOR NETWORK PLATFORMS AND TOOLS: Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node level Simulators, State-centric programming.	
Total Lecture	39 Hours

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Textbooks:

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| 1. | Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2005. |
| 2. | Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks-An Information Processing Approach", Elsevier, 2007 |
| 3. | Waltenegus Dargie, Christian Poellabauer, "Fundamentals Of Wireless Sensor Networks - Theory And Practice", John Wiley & Sons Publications, 2011 |

Reference Books:

- | | |
|----|---|
| 1. | Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks-Technology, Protocols, and Applications" |
| 2. | John Wiley, 2007. 2. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003 |

MOOCs Links and additional reading, learning, video material

https://www.youtube.com/watch?v=GUSrkWJ_Z2g

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VII SEMESTER

23ADS1722 : PE-IV Data Mining and Warehousing

Course Outcomes :

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

1. Understand the concepts related to data preparation, data modeling, and knowledge extraction.
2. Apply the techniques for data pre-processing and modeling for knowledge extraction.
3. Apply the supervised and unsupervised data mining techniques for knowledge extraction.
4. Analyze the data to apply appropriate data modeling and mining technique.

Unit I:	7 Hrs.
Data Warehousing & modeling: Basic Concepts: Data Warehousing: A multitier Architecture, Data warehouse models: Enterprise warehouse, Data mart and virtual warehouse, Extraction, Transformation and loading, Data Cube: A multidimensional data model, Stars, Snowflakes and Fact constellations: Schemas for multidimensional Data models, Dimensions: The role of concept Hierarchies, Measures: Their Categorization and computation, Typical OLAP Operations	
Unit II:	6 Hrs.
Data warehouse implementation& Data mining: Efficient Data Cube computation: An overview, Indexing OLAP Data: Bitmap index and join index, Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP. : Introduction: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Preprocessing, Measures of Similarity and Dissimilarity	
Unit III:	7 Hrs.
Association Analysis: Association Analysis: Problem Definition, Frequent Item set Generation, Rule generation. Alternative Methods for Generating Frequent Item sets, FP-Growth Algorithm, Evaluation of Association Patterns.	
Unit IV:	6 Hrs.
Clustering Analysis: Overview, K-Means, Agglomerative Hierarchical Clustering, DBSCAN, Cluster Evaluation, Density-Based Clustering, GraphBased Clustering, Scalable Clustering Algorithms	
Unit V:	7 Hrs.
Data mining using Prediction methods: Linear and nonlinear regression, Multiple regression, Logistic Regression	
Unit VI:	6 Hrs.
Outlier Detection Techniques: Outliers and outlier analysis, Outlier detection methods, Statistical approaches, Proximity based approaches, Clustering based approaches, classification based approaches	
Total Lecture	
39 Hours	

Textbooks:

1. Data Mining: Concepts and Techniques, J. Han, M. Kamber, 3rd, Morgan Kaufman
2. Data Warehousing in the Real World, Sam Anahory, Dennis Murray, 10th, Pearson

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VII SEMESTER

23ADS1723 : PE IV: Cyber Security

Course Outcomes :

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

1. Understand the concept of Cyber security and issues and challenges associated with it.
2. Understand the cyber crimes, their nature, legal remedies and as to how report the crimes through available platforms and procedures.
3. Understand the reporting procedure of inappropriate content, underlying legal aspects and best practices for the use of Social media platforms.
4. Understand the basic concepts related to E-Commerce and digital payments
5. Understand the basic security aspects related to Computer and Mobiles.

Unit I:	6 Hrs.
Introduction to Cyber security: Defining Cyberspace and Overview of Computer and Web-technology, Architecture of cyberspace, Communication and web technology, Internet, World wide web, Advent of internet, Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace, Concept of cyber security, Issues and challenges of cyber security.	
Unit II:	7 Hrs.
Cybercrime and Cyber law: Classification of cybercrimes, Common cybercrimes- cybercrime targeting computers and mobiles, cybercrime against women and children, financial frauds, social engineering attacks, malware and ransomware attacks, zero day and zero click attacks, Cybercriminals modus-operandi, Reporting of cybercrimes, Remedial and mitigation measures, Legal perspective of cybercrime, IT Act 2000 and its amendments, Cybercrime and offences, Organizations dealing with Cybercrime and Cyber security in India, Case studies.	
Unit III:	6 Hrs.
Social Media Overview and Security: Introduction to Social networks. Types of social media, social media platforms, social media monitoring, Hashtag, Viral content, social media marketing, social media privacy, Challenges, opportunities and pitfalls in online social network, Security issues related to social media, Flagging and reporting of inappropriate content, Laws regarding posting of inappropriate content, best practices for the use of social media, Case studies.	
Unit IV:	7 Hrs.
E-Commerce and Digital Payments: Definition of E- Commerce, Main components of E-Commerce, Elements of E-Commerce security, E-Commerce threats, E-Commerce security best practices,	

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Introduction to digital payments, Components of digital payment and stake holders, Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), e-Wallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures. RBI guidelines on digital payments and customer protection in unauthorized banking transactions. Relevant provisions of Payment Settlement Act, 2007

Unit V: **7 Hrs.**

Digital Devices Security, Tools and Technologies for Cyber Security: End Point device and Mobile phone security, Password policy, Security patch management, Data backup, Downloading and management of third party software, Device security policy, Cyber Security best practices, Significance of host firewall and Anti-virus, Management of host firewall and Anti-virus, Wi-Fi security, Configuration of basic security policy and permissions.

Unit VI: **6 Hrs.**

Data Privacy and Data Security: Defining data, meta-data, big data, nonpersonal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations (GDPR), 2016 Personal Information Protection and Electronic Documents Act (PIPEDA), Social media- data privacy and security issues.

Total Lecture 39 Hours

Textbooks:

1. Cyber Crime Impact in the New Millennium, by R. C Mishra, Author Press. Edition
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd.
3. Security in the Digital Age: Social Media Security Threats and Vulnerabilities by Henry A. Oliver, Create Space Independent Publishing Platform
4. Electronic Commerce by Elias M. Awad, Prentice Hall of India Pvt Ltd.
5. Cyber Laws: Intellectual Property & E-Commerce Security by Kumar K, Dominant Publishers

Reference Books:

1. Network Security Bible, Eric Cole, Ronald Krutz, James W. Conley, 2nd Edition, Wiley India Pvt. Ltd
2. Fundamentals of Network Security by E. Maiwald, McGraw Hill.

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VII SEMESTER

23ADS1725 : PE-IV : Soft Computing

Course Outcomes :

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

1. Understand and explain the foundational principles of computational learning theory and instance-based learning methods.
2. Implement and analyze k-Nearest Neighbor (k-NN) and other instance-based algorithms for pattern recognition and prediction.
3. Apply rule-based learning techniques to derive first-order logical rules from data.
4. Evaluate the performance and applicability of learning algorithms using theoretical and empirical methods.

Unit I:	6 Hrs.
Neural Networks: History, overview of biological Neuro-system, Mathematical Models of Neurons, ANN architecture, Learning rules, Learning Paradigms-Supervised, Unsupervised and reinforcement Learning, ANN training Algorithms-perceptions, Training rules, Delta, Back Propagation Algorithm, Multilayer Perceptron Model, Hopfield Networks, Associative Memories, Applications of Artificial Neural Networks.	
Unit II:	7 Hrs.
Fuzzy Logic: Introduction to Fuzzy Logic, Classical and Fuzzy Sets: Overview of Classical Sets, Membership Function, Fuzzy rule generation. Operations on Fuzzy Sets: Compliment, Intersections, Unions, Combinations of Operations, Aggregation Operations.	
Unit III:	7Hrs.
Fuzzy Arithmetic: Fuzzy Numbers, Linguistic Variables, Arithmetic Operations on Intervals & Numbers, Lattice of Fuzzy Numbers, Fuzzy Equations.	
Unit IV:	6 Hrs.
Introduction of Neuro Fuzzy Systems, Architecture of Neuro Fuzzy Networks.	
Unit V:	7 Hrs.
Application of Fuzzy Logic: Engineering, Economics, etc.	
Unit VI:	6 Hrs.
Computational Learning Theory: Instance-Based Learning: k-Nearest-neighbor algorithm, Learning first-order rules etc.	
Total Lecture	
39 Hours	

Textbooks:

1.	R. A. Aliev, R. R. Aliev, "Soft Computing and Its Applications"
2.	Bar Kosko, "Neural Networks and Fuzzy Systems", Prentice-Hall
3.	Melanie Mitchell, "An Introduction to Genetic Algorithms (Complex Adaptive Systems)", MIT Press

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VII SEMESTER

23ADS1727: PE-IV: Data and Cyber Security

Course Outcomes :

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

1. Explain the fundamentals of data and cyber security concepts.
2. Apply cryptographic techniques to secure digital information.
3. Analyze network vulnerabilities and implement appropriate security controls.
4. Evaluate cyber attacks, perform vulnerability assessment, and develop incident response strategies.
5. Interpret cyber laws, ethical issues, and security governance frameworks.
6. Assess emerging cybersecurity technologies and recommend suitable security solutions.

Unit I: Introduction to Data and Cyber Security

7 Hrs.

Fundamentals of Information Security; Data Security vs. Cyber Security ;CIA Triad (Confidentiality, Integrity, Availability) ;Authentication, Authorization, Accountability ; Cyber Threat Landscape ; Types of Cyber Attacks ; Malware: Virus, Worm, Trojan, Ransomware, Spyware ; Social Engineering and Phishing ;Cyber Kill Chain ; Security Policies and Standards

Unit II: Cryptography and Data Protection

6Hrs.

Fundamentals of Cryptography ; Symmetric Key Cryptography (AES, DES) ; Asymmetric Key Cryptography (RSA, ECC) ; Hash Functions (SHA Family) ; Digital Signatures ; Public Key Infrastructure (PKI) ; Key Management ; Data Encryption Techniques ;Secure Storage and Backup

Unit III: Network Security

7 Hrs.

Network Security Architecture ; TCP/IP Security Issues ; Firewalls and Firewall Policies ; Intrusion Detection Systems (IDS) ; Intrusion Prevention Systems (IPS) ; Virtual Private Networks (VPN) ; Secure Socket Layer (SSL/TLS) ; Wireless Security (Wi-Fi Security Protocols) ; Email and Web Security

Unit IV: Cyber Attacks, Vulnerability Assessment and Incident Response

6 Hrs.

Vulnerability Assessment ;Penetration Testing Methodology ; WASP Top 10 ; SQL Injection ; Cross-Site Scripting (XSS) ; Cross-Site Request Forgery (CSRF) ; Buffer Overflow ; Password Attacks ; Incident Response Lifecycle ;Disaster Recovery and Business Continuity

Unit V: Cyber Laws, Ethics and Governance

7 Hrs.

Cyber Ethics ; Cybercrime Investigation ; Digital Evidence ; Cyber Laws ; Data Privacy ; IT Act (India) ; GDPR Overview ; ISO/IEC 27001 ; Risk Management; Security Auditing and Compliance

Unit VI: Emerging Trends in Cyber Security

6 Hrs.

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Cloud Security ; Internet of Things (IoT) Security ; Artificial Intelligence in Cyber Security ; Blockchain Security ; Zero Trust Architecture ; Endpoint Detection and Response (EDR) ; Security Operations Center (SOC); Digital Forensics ; Cyber Threat Intelligence ; Future Trends in Cyber Security

Total Lecture 39 Hours

Textbooks:

1. William Stallings, *Cryptography and Network Security: Principles and Practice*, Pearson. Charles P. Pfleeger and Shari Lawrence Pfleeger, *Security in Computing*, Pearson. .
2. Nina Godbole and Sunit Belapure, *Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives*, Wiley.
3. Michael E. Whitman and Herbert J. Mattord, *Principles of Information Security*, Cengage

Reference Books:

1. Bruce Schneier, *Applied Cryptography*, Wiley.
2. Eric Cole, *Network Security Bible*, Wiley.
3. Joseph Migga Kizza, *Guide to Computer Network Security*, Springer
4. OWASP Foundation, *OWASP Top 10 Project* (latest edition)
5. Matt Bishop, *Computer Security: Art and Science*, Addison-Wesley

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VII SEMESTER

23ADS1728 : PE-IV: Advanced Probability and Statistics

Course Outcomes :

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

1. Understand the characteristics of financial data and basic time series models used in financial analysis.
2. Apply statistical and econometric methods to address practical problems in financial data analysis.
3. Analyze financial datasets to identify patterns and relationships using advanced regression techniques
4. Design advanced models for financial data to support strategic decision-making.

Unit I:	7 Hrs.
Introduction to Random variables: discrete & continuous Random variables Discrete random variables - Uniform, Bernoulli, Binomial, Geometric, Poisson Distributions, Hyper-geometric, Negative Binomial Continuous Random variables: Uniform, Normal, Exponential, Gamma, Cauchy, Beta1 and Beta2	
Unit II:	6 Hrs.
Multivariate Statistics: Samples and Populations, Orthogonality, Data appropriate for multivariate Statistics, Degree of relationship among variables, Significance of Group differences.	
Unit III:	7 Hrs.
Prediction of Group membership , bi-variate statistics: correlation and regression, data screening and Transformation, multiple regressions, multiway frequency analysis, analysis of co-variance.	
Unit IV:	6 Hrs.
Discriminant function analysis, limitations, fundamental equations, types of discriminant function analysis, Principal components, factor analysis.	
Unit V:	7 Hrs.
Markov Chain , Stochastic processes, Setting up Markov chains, Balance equations, Non-parametric interference, Empirical Distribution Function (or eCDF), Kernel Density Estimation (KDE), Statistical Functionals, Plug-in estimator, confidential interval, Percentiles, quantiles, Normal-based confidence intervals, DKW inequality, Parametric Interference, Consistency, Asymptotic Normality, Basics of parametric inference, Method of Moments Estimator (MME)	
Unit VI:	6 Hrs.
Properties of Method of Moments Estimator (MME), Basics of MLE, Maximum Likelihood Estimator (MLE), Properties of MLE, Basics of hypothesis testing, The Wald test, t-test, Kolmogorov-Smirnov test (KS test), p-values, Permutation test	
Total Lecture	
39 Hours	

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Textbooks:

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| 1. | An Introduction to Probability and Statistics. Vijay K Rohatgi and A.K.Md. Ehsanes Saleh, 2 nd edition, Wiley |
| 2. | Using Multivariate Statistics, 7/e by Linda S. Fidell, Barbara G. Tabachnick. |
| 3. | Probability and Statistics for Data Science: Math + R + Data (Chapman & Hall/CRC Data Science Series) |

Reference Books:

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| 1. | "Probability & Statistics", K.V. Iyengar & B. Krishna Gandhi, S.Chand. |
| 2. | "Probability & Statistics", William Mendenhall & Others, Cengage Publications. |
| 3. | "An introduction to probability theory and its applications", W. Feller, John Wiley and Sons |

MOOCs Links and additional reading, learning, video material

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| 1. | https://onlinecourses.nptel.ac.in/noc20_ma18/preview |
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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

23ADS1729 : PE-IV Quantum Computing

Course Outcomes :

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

1. Understand core quantum computing principles and demonstrate familiarity with basic quantum programming, cryptography, and error correction concepts.
2. Apply essential mathematical concepts such as complex numbers, vector spaces, matrices, and Dirac notation to represent and interpret quantum states and operations.
3. Apply knowledge of quantum gates and circuits to build and simulate simple quantum systems involving single and multi-qubit operations.
4. Analyze key quantum algorithms such as Deutsch–Jozsa, Grover's, and Shor's to identify their structure, working, and computational benefits over classical algorithms.

Unit I:	6 Hrs.
Introduction to Quantum Computing: Classical vs. quantum computing Quantum principles: superposition, entanglement, Applications and motivation, Limitations of classical computing, Overview of quantum advantage, Basic architecture of a quantum computer	
Unit II:	7 Hrs.
Mathematical Foundations: Complex numbers and linear algebra essentials, Vector spaces, matrices, and tensor products, Dirac notation (bra-ket), Unitary operators and Hermitian matrices	
Unit III:	7 Hrs.
Qubits and Quantum Gates: Qubit representation, superposition, Bloch sphere visualization, Single-qubit gates: Pauli-X, Y, Z, Hadamard, Phase (S, T), Multi-qubit reversible gates: CNOT, Toffoli, Fredkin, SWAP, Hadamard gates, Deutsch Gate, Quantum circuits and gate operations, Measurement and collapse, Quantum circuit simulation basics	
Unit IV:	7 Hrs.
Quantum Algorithms: Deutsch & Deutsch–Jozsa Algorithm, Grover's Search Algorithm, Simon's Algorithm, Shor's Factoring Algorithm	
Unit V:	6 Hrs.
Quantum Programming: Introduction to Qiskit or Cirq, Writing simple quantum programs, Building quantum circuits in simulators, IBM Quantum Experience interface, Hands-on: Grover and Deutsch–Jozsa on simulators, Applications of quantum computing in Quantum teleportation, Cybersecurity, banking, finance, advance manufacturing and artificial intelligence.	
Unit VI:	6 Hrs.
Quantum Error Correction: Noise, decoherence, and quantum errors No-cloning theorem, Basics of quantum error correction (Shor & Steane codes), Fault-tolerant quantum computation, Quantum cryptography and QKD.	
Total Lecture	
39 Hours	

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Textbooks:

1.	Phillip Kaye, Raymond Laflamme et. al., An introduction to Quantum Computing, Oxford University press, 2007.
2.	Chris Bernhardt, Quantum Computing for Everyone, The MIT Press, Cambridge, 2020.
3.	David McMahon-Quantum Computing Explained-Wiley-Interscience, IEEE Computer Society (2008)
4.	Michael A. Nielsen and Issac L. Chuang, "Quantum Computation and Information", Cambridge (2002).

Reference Books:

1.	Quantum Computation and Quantum Information, M. A. Nielsen & I. Chuang, Cambridge University Press (2013).
2.	Quantum Computing, A Gentle Introduction, Eleanor G. Rieffel and Wolfgang H. Polak MIT press (2014)

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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

23ADS1741 : PE-V Blockchain Technology

Course Outcomes :

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

1. Understand the need, functions and challenges of blockchain technology.
2. Apply different security protocols to build secure applications with blockchain.
3. Analyze the concept of smart contract and hyperledger fabric used in blockchain.
4. Determine the performance of different applications developed with Bitcoin and Ethereum blockchain.

Unit I:	6 Hrs.
Introduction to Blockchain Technology, Concept of Blocks, Transactions, Types of Blockchain, Distributed Consensus, the Chain and the Longest Chain, Cryptocurrency, Blockchain 2.0, Permissioned Model of Blockchain, Permission less Blockchain.	
Unit II:	7 Hrs.
Decentralization Using Blockchain, Crypto Primitives For Blockchain : Symmetric and Public Key Cryptography, Cryptographic Hard Problems, Key Generation, Secure Hash Algorithms, Hash Pointers, Digital Signatures, Merkle Trees, Distributed Hash Tables.	
Unit III:	6 Hrs.
Bitcoins And Cryptocurrency :Introduction, Digital Keys and Addresses, Private and Public Keys in Bitcoins, Transaction Lifecycle, Data Structure for Transaction, Types of Transactions, Transaction Verification, The Structure of Block in Blockchain, Mining, Proof of Work, Bitcoin Network and Payments, Bitcoin Clients and APIs, Wallets, Alternative Coins, Proof of Stake, Proof of Storage, Various Stake Types, Difficulty Adjustment and Retargeting Algorithms, Bitcoin Limitations.	
Unit IV:	7 Hrs.
Smart Contracts :Smart Contract Templates, Oracle, Smart Oracle, Deploying Smart Contract on Blockchain. Permissioned Blockchain: Models and Use-cases, Design Issues, Consensus, Paxos, RAFT Consensus, Byzantine General Problem, Practical Byzantine Fault Tolerance.	
Unit V:	6 Hrs.
Hyperledger: The Reference Architecture, Requirements and Design Goals of Hyperledger Fabric, The Modular Approach, Privacy and Confidentiality, Scalability, Deterministic Transactions, Identity, Auditability, Interoperability, Portability, Membership Services in Fabric, Blockchain Services, Consensus Services, Distributed Ledger, Sawtooth Lake, Corda.	
Unit VI:	7 Hrs.
Attacks on Blockchain, Use Cases of block chain- in various IoT applications: Supply Chain and Logistics, Healthcare, Energy Management, Smart Cities, etc	
Total Lecture 39 Hours	

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Textbooks:

- | | |
|----|---|
| 1. | Blockchain: The Blockchain for Beginnings Guild to Blockchain Technology and Levaraging Blockchain Programming, Josh Thompson, Kindle Edition, 2017, Independent Publishing Platform. |
| 2. | Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained, Imran Bashir, 2nd Revised Edition, 2018, Packt Birmingham Mumbai Publication. |

Reference Books:

- | | |
|----|--|
| 1. | Mastering Bitcoin: Programming the Open Block Chain, Andreas M. Antonopoulos, 2nd Edition 2017, O'Reilly Media. |
| 2. | The Age of Cryptocurrency: How Bitcoin and the Blockchain Are Challenging the Global Economic Order, Paul Vigna and Michael J. Casey, 2016, Picador. |

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VII SEMESTER

23ADS1743 : PE-V- Industrial and Social applications of digital twins

Course Outcomes :

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

1. Understand the fundamental concepts and architecture of digital twins.
2. Analyze the role of digital twins in smart cities and sustainable urban planning.
3. Evaluate the societal impacts, challenges, and ethical concerns in the deployment of digital twins.
4. Develop simple digital twin models using IoT and simulation tools.

Unit I:

7 Hrs.

Introduction to Digital Twins

Definition, history, and evolution of digital twins. Key components: physical entity, digital model, and data connection. Overview of digital twin lifecycle. Technologies enabling digital twins: IoT, AI/ML, sensors, cloud computing, and simulation.

Unit II:

6 Hrs.

Industrial Applications

Smart factories and Industry 4.0. Use cases in manufacturing: predictive maintenance, production optimization, asset management. Digital twins in supply chain and logistics. Case studies from aerospace, automotive, and energy sectors.

Unit III:

7 Hrs.

Healthcare and Biomedical Applications

Digital twins for personalized medicine, patient monitoring, and surgery planning. Integration with wearable sensors and health data platforms. Ethical and regulatory considerations in healthcare digital twins.

Unit IV:

6 Hrs.

Urban and Smart City Applications

Digital twins in urban planning, infrastructure monitoring, traffic management, and disaster response. Role in sustainable development and smart governance. Examples from real-world smart city projects.

Unit V:

7 Hrs.

Simulation, Data Integration and Platforms

Modeling techniques: physics-based, data-driven, and hybrid models. Tools and platforms for creating digital twins (e.g., Siemens MindSphere, Azure Digital Twins). Real-time data integration, feedback mechanisms, and analytics.

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Unit VI:	6 Hrs.
Challenges and Future Trends Scalability, interoperability, and data security. Addressing privacy and ethical concerns. Emerging trends: metaverse integration, autonomous systems, and AI-driven twins. Roadmap and future research directions.	
Total Lecture	39 Hours

Textbooks:	
1.	Michael Grieves, "Digital Twin: Manufacturing Excellence through Virtual Factory Replication", 2016.
2.	Rajiv Ranjan et al., "Digital Twin Technologies and Smart Cities", Springer, 2020.

Reference Books:	
1.	John Soldatos, "Digital Twins for Smart Cities", River Publishers, 2022.
2.	Mark Asch, "Data Assimilation: Methods, Algorithms, and Applications", SIAM, 2016.

MOOCs Links and additional reading, learning, video material	
1.	Siemens Digital Industries – MindSphere Learning Hub
2.	Microsoft Learn – Azure Digital Twins

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VII SEMESTER

23ADS1744 : PE-V: Graph Analytics

Course Outcomes :

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

1. Understand the fundamental concepts of graph theory, including spanning trees, shortest paths, connectivity, planar graphs, graph coloring, and Hamiltonian cycles.
2. Analyze social network structures and graph properties using centrality measures, community detection, link prediction, and anomaly detection techniques.
3. Apply graph clustering and graph mining techniques to discover patterns, communities, and hidden knowledge from complex graph data.
4. Design graph-based solutions for real-world applications using graph databases, graph mining methods, and big graph analytics frameworks such as Neo4j, Hadoop, and MapReduce.

Unit I:	6 Hrs.
Spanning trees, Shortest paths, Matchings and covers, Bipartite Matchings, Cuts and connectivity, K-connected and K-edge connected graphs, Planar graphs, Embedding, Euler's formula, Parameters of planarity. Line graphs and edge coloring, Hamiltonian Cycles..	
Unit II:	7 Hrs.
Social Network Analysis: Network basics, node centrality, assortativity, Transitivity and reciprocity, Degree and degree distribution, path, Properties of real-world network, Link Analysis and prediction, Community structure in Network, Anomaly detection in static network	
Unit III:	7 Hrs.
Graph Clustering: Minimum spanning tree-based clustering, spectral clustering, cut based clustering, Hybrid clustering, density based clustering.	
Unit IV:	6 Hrs.
Advanced graph mining techniques for discovery and prediction of frequent and hidden patterns in graph data using techniques of graph topological properties, community detection, and anomaly detection graph-based dimension reduction, Graph database: Neo4j, Query language	
Unit V:	7 Hrs.
Application of graph mining techniques: Gene Expression analysis, Image segmentation	
Unit VI:	6 Hrs.
Big Graph Data Analytics: Basic knowledge and experience in dealing with Big Data in cloud computing (Hadoop, MapReduce)	
Total Lecture	39 Hours

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Textbooks:

- | | |
|----|---|
| 1. | Deo, Narsingh. Graph theory with applications to engineering and computer science. Courier Dover Publications, 2017 |
| 2. | West, Douglas Brent. Introduction to graph theory. Vol. 2. Upper Saddle River: Prentice hall, 2001 |
| 3. | Wasserman, Stanley, and Katherine Faust. "Social network analysis: Methods and applications." (1994). |

Reference Books:

- | | |
|----|--|
| 1. | Harary, Frank, and Robert Z. Norman. Graph theory as a mathematical model in social science. No. 2. Ann Arbor: University of Michigan, Institute for Social Research, 1953 |
| 2. | Jain, Anil K., and Richard C. Dubes. Algorithms for clustering data. Prentice-Hall, Inc., 1988 |
| 3. | Jain, Anil K., M. Narasimha Murty, and Patrick J. Flynn. "Data clustering: a review." ACM computing surveys (CSUR) 31.3 (1999): 264-323 |
| 4. | Vathy-Fogarassy, Ágnes, and János Abonyi. Graph-based clustering and data visualization algorithms. London: Springer, 2013. |

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VII SEMESTER

23ADS1745 : PE-V Human Computer Interaction

Course Outcomes :

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

1. Understand the Principles of HCI
2. Apply User-Centered Design Methods
3. Evaluate and Critique Interfaces
4. Design and Develop Usable Interfaces
5. Understand Ethical and Social Implications

Unit I:	6 Hrs.
What is HCI?, Disciplines involved in HCI, Why HCI study is important? The psychology of everyday things, Principles of HCI, User-centred Design.	
Unit II:	7 Hrs.
Input-output channels, Human memory, Thinking: Reasoning and Problem Solving, Human emotions, Individual differences, Psychology and Design.	
Unit III:	6 Hrs.
Models of interaction, Ergonomics, Interaction styles, WIMP Interface, Interactivity, Context of interaction, User experience, Paradigms of Interactions.	
Unit IV:	7 Hrs.
What is interaction design?, The software design process, User focus, Scenarios, Navigation Design, Screen Design, Prototyping techniques, Wire-Framing, Understanding the UI Layer and Its Execution Framework	
Unit V:	6 Hrs.
Introduction to : Principles that support usability, Design standards, Design Guidelines, Golden rules and heuristics, Using toolkits, User interface management system (UIMS), Goals of evaluation, Evaluation Criteria, Evaluation through expert analysis, Evaluation through user participation, Choosing an Evaluation Method	
Unit VI:	7 Hrs.
Introduction to: Goal and task hierarchy model, Linguistic model, Physical and device models, Cognitive architectures, Hierarchical task analysis (HTA), Uses of task analysis, Diagrammatic dialog design notations, Computer mediated communication, Ubiquitous Computing, Finding things on web Future of HCI.	
	Total Lecture 39 Hours

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Textbooks:

- | | |
|----|---|
| 1. | Alan Dix (2008). Human Computer Interaction. Pearson Education. ISBN 978-81-317- 1703-5 |
| 2. | The essential guide to user interface design, Wilbert O Galitz, Wiley Dream Tech |

Reference Books:

- | | |
|----|---|
| 1. | Designing the user interface. 3rd Edition Ben Shneidermann, Pearson Education Asia. |
| 2. | Interaction Design Prece, Rogers, Sharps. Wiley Dreamtech. |
| 3. | User Interface Design, Soren Lauesen , Pearson Education. |
| 4. | Human –Computer Interaction, D. R. Olsen, Cengage Learning. |
| 5. | Human –Computer Interaction, Smith - Atakan, Cengage Learning. |

YCCE e- library book links [ACCESSIBLE FROM COLLEGE CAMPUS]

- | | |
|---|---|
| 1 | https://ycce.knimbus.com/portal/v2/default/searchresult?searchItem=human%20computer%20interaction&searchField=doc_title&t=1747222737458 |
| | |

MOOCs Links and additional reading, learning, video material

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|----|---|
| 1. | https://onlinecourses.nptel.ac.in/noc25_cs38/preview |
| 2. | https://archive.nptel.ac.in/courses/106/103/106103115/ |
| | |

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VII SEMESTER

23ADS1746 : PE-V Intelligent Systems

Course Outcomes :

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

1. Understand the fundamental concepts, characteristics, and structure of intelligent systems.
2. Analyze and design knowledge-based systems using reasoning techniques.
3. Apply machine learning, fuzzy logic, and evolutionary algorithms in building intelligent applications.
4. Evaluate and integrate multiple intelligent techniques for solving real-world AI problems

Unit I: Introduction to Intelligent Systems	7 Hrs.
Definition and characteristics of intelligent systems, Historical background and evolution, Difference between conventional and intelligent systems, Applications in various domains, Components of intelligent systems, Symbolic and sub-symbolic approaches, Problem-solving and search paradigms, Agents and environments, Types of agents, Architecture of intelligent systems.	
Unit II: Knowledge Representation and Reasoning	6 Hrs.
Propositional logic, First-order predicate logic, Rule-based systems, Semantic networks and frames, Ontologies and description logics, Inference mechanisms, Forward and backward chaining, Resolution and unification, Case-based reasoning, Knowledge acquisition and engineering.	
Unit III: Machine Learning and Neural Networks	7 Hrs.
Supervised, unsupervised, and reinforcement learning paradigms, Decision trees and k-NN classifiers, Naïve Bayes and SVMs, Introduction to neural networks and perceptrons, Multi-layer perceptron and backpropagation, Convolutional neural networks, Recurrent neural networks and LSTM, Overfitting and regularization, Evaluation metrics for intelligent models, Applications in prediction and classification.	
Unit IV: Fuzzy Logic and Expert Systems	6 Hrs.
Fuzzy sets and fuzzy relations, Membership functions and linguistic variables, Fuzzy logic operations, Fuzzy inference systems (Mamdani and Sugeno models), Fuzzification and defuzzification methods, Expert system components and architecture, Knowledge base and inference engine.	
Unit V: Evolutionary Computation and Swarm Intelligence	7 Hrs.
Genetic algorithms: representation, selection, crossover, and mutation, Fitness functions and convergence, Applications in optimization and search, Particle swarm optimization, Ant colony optimization, Differential evolution	
Unit VI: Hybrid Intelligent Systems and Applications	6 Hrs.
Need for hybrid approaches, Integration of neural networks with fuzzy logic (neuro-fuzzy systems), Genetic-fuzzy systems, Machine learning-enabled expert systems, Intelligent decision support systems, Intelligent agents and multi-agent systems,	
	Total Lecture
	39 Hours

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Textbooks:

- | | |
|----|---|
| 1. | Nils J. Nilsson, "Artificial Intelligence: A New Synthesis," Morgan Kaufmann Publishers, 1998. |
| 2. | S. Rajasekaran and G. A. Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications," PHI Learning, 2017. |

Reference Books:

- | | |
|----|---|
| 1. | Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach," 4th Edition, Pearson, 2020. |
| 2. | Eberhart, Kennedy, and Shi, "Computational Intelligence: Concepts to Implementations," Morgan Kaufmann, 2007. |

MOOCs Links and additional reading, learning, video material

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|----|---|
| 1. | https://nptel.ac.in/courses/106105992 |
| 2. | Coursera: AI For Everyone – Andrew Ng (Stanford University) |

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VII SEMESTER

23ADS1747 : PE-V Edge AI & IoT Analytics

Course Outcomes :

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

1. **Understand** the concepts, architectures, and components of Edge AI and IoT systems.
2. **Apply** data acquisition and preprocessing techniques for IoT sensor data.
3. **Analyze** and select suitable AI models for edge environments.
4. **Evaluate** performance and constraints of Edge AI systems.
5. **Design** and implement real-time IoT analytics solutions using Edge AI tools.

Unit I: Fundamentals of Edge AI and IoT:

7 Hrs.

Overview of IoT systems and layered architecture (Device, Gateway, and Cloud), Edge, Fog, and Cloud Computing concepts and comparison, Introduction to Edge AI and Edge Intelligence, Components of Edge Devices, Edge Computing Architecture and Deployment Layers, Advantages, Limitations, and Challenges of Edge AI, Applications of Edge AI in Smart Homes, Healthcare, Smart Cities, and Industrial IoT.

Unit II: Sensor Data Acquisition and Pre-processing:

6 Hrs.

Types of Sensors and Sensor Data Characteristics, Data Acquisition Techniques and Sampling Methods in IoT Systems, Data Annotation and Labelling Concepts, Data Cleaning, Noise Filtering, and Outlier Detection, Handling Missing Data, Data Normalization and Standardization, Introduction to Time-Series Sensor Data and Feature Extraction, Overview of Data Pre-processing Tools

Unit III: Edge AI Models and Analytic:

7 Hrs.

Introduction to Machine Learning for IoT Applications, Supervised and Unsupervised Learning Techniques, Lightweight Machine Learning Models: Linear Regression, Decision Trees, and K-Nearest Neighbors (KNN), Introduction to TinyML and Edge-Specific Machine Learning Paradigms, Model Selection Criteria for Edge Environments, Training vs inference: cloud vs edge considerations.

Unit IV: Edge Deployment and System Evaluation:

6 Hrs.

Edge Hardware Platforms: Raspberry Pi, Microcontrollers, and Embedded Systems, Hardware Accelerators: GPU, TPU, and NPU, Edge AI Deployment Workflow and Model Deployment Concepts, Performance Evaluation Metrics: Accuracy, Latency, Throughput, and Power Consumption, Edge versus Cloud Performance Comparison.

Unit V: IoT Analytics and Real-Time Processing:

7 Hrs.

Introduction to IoT Analytics and Real-Time Data Analytics Concepts, Stream Processing Fundamentals and Event-Driven Architecture, Communication Protocols: MQTT, REST APIs, and CoAP, Edge Analytics vs Cloud Analytics, Real-Time Data Pipelines, Data Visualization and Dashboard Design Concepts, Overview of AWS IoT and Azure IoT Platforms.

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Unit VI: Applications and Design of Edge AI Systems:	6 Hrs.
Design Methodology for IoT-based Edge AI Systems, System Architecture Design using Block Diagrams and Workflows, Applications of Edge AI in Smart Healthcare, Industrial IoT and Predictive Maintenance, and Smart Agriculture Systems, Anomaly Detection Techniques in Sensor Data, Security, Privacy, and Ethical Considerations in Edge AI Systems, Case Studies of Edge AI Applications and Performance Evaluation Approaches.	
Total Lecture	39 Hours

Textbooks	
1	D. Srinivasa Rao, et al., Edge AI: Merging IoT and Machine Learning for Real-Time Analytics, Xoffencer Publications, 2024.
2	Govind P. Gupta, et al., Edge Intelligence and Analytics for Internet of Things, CRC Press, 2025.
3	Bharat S. Chaudhari, et al., TinyML for Edge Intelligence in IoT and LPWAN Networks, Academic Press, 2024.
Reference Books	
1	Souvik Pal, et al., IoT Edge Intelligence, Springer, 2024.
2	Colin Dow, Hands-On Edge Analytics with Azure IoT, Packt Publishing, 2019.
e-Book	
1	Y. Zhou and X. Chen (Eds.), Edge Intelligence: Edge Computing for 5G and the Internet of Things, MDPI Books, 2025.
2	Rute C. Sofia and John Soldatos (Eds.), Shaping the Future of IoT with Edge Intelligence, River Publishers, 2024 (eBook).
3	Govind P. Gupta, et al., Edge Intelligence and Analytics for Internet of Things, CRC Press, 2025 (ePub/PDF).

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VII SEMESTER

23ADS1748 : PE-V: Software Testing

Course Outcomes :

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

1. Formulate problem by following Software testing life cycle.
2. Design Manual Test cases for Software Project..
3. Demonstrate utilization of testing automation through testing tool.

Unit I:	7 Hrs.
Basic concepts of Testing: Need of Testing, Basic concepts-errors, faults, defects, failures, objective of testing, central issue in testing, Testing activities, V-Model, Sources of information for test cases, Monitoring and Measuring Test Execution, Test tools and Automation, Limitation of Testing.	
Unit II:	6 Hrs.
Unit Testing: Concepts of Unit Testing, Static Unit Testing, Defect Prevention, Dynamic Unit Testing, Mutation Testing, Debugging, Tools for Unit Testing	
Unit III:	6 Hrs.
Control Flow Testing: Outline of Control Flow Testing, Control Flow Graphs, Path in Control Flow Graph, Path selection criteria, All path coverage criteria, Statement coverage, Path coverage	
Unit IV:	7 Hrs.
Data Flow and System Integration Testing: Introduction Data flow testing, Data flow graph, Data flow testing criteria, Fundamentals of System Integration: Types of interfaces and interface errors, System integration testing, Software and Hardware integration.	
Unit V:	7 Hrs.
System Testing: Taxonomy of system test, Basic Test, Functionality test, Robustness test, Performance test, Scalability test, Stress test, Load and Stability test, Reliability test, Regression test, Documentation Test.	
Unit VI	6 Hrs.
Test Design: Test cases, Necessity of test case documentation, Test case design methods, Functional specification-based test case design, Use case bases, application based test case design, level of test execution.	
Total	39 Hrs.

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B. Tech SoE and Syllabus 2023
(Scheme of Examination w.e.f. 2023-24 onward)
(Department of Computer Technology)

**SoE No.
23ADS-101**

B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

MDM6ADS106 : Data Modelling

Course Outcomes :

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

1. **Understand** database management system, through modeling and designing concepts.
2. **Apply** the knowledge of relational algebra, query language to perform the operations on database.
3. **Design** database schema using the entity relation diagrams and relational database aspects.

Unit I:	6 Hrs.
Introduction: Concepts of Data Modelling, Data Modelling Types, Data Model Standards, Business Requirements. Relational data base modeling concepts. Creation logical data model, creation physical data model, implementation of data models into databases. ER approach (subtypes and supertypes, Extensions and Alternatives), advanced Normalization concepts.	
Unit II:	6 Hrs.
Multidimensional Data Model: OLAP and OLTP Concepts, Multidimensional Data Modelling, Concepts of facts, dimension, Types of facts and dimensions, types of schemas. Time dependant data, Data Cube Technology, Modelling for Data Warehouses and Data Marts	
Unit III:	7 Hrs.
Enterprise Data Models and Data Management, aggregate data models, More details on data models, Relationships, Graphs databases, schemaless databases, Materialized views, modelling for data access. Data Models for GIS (Geographical Information System)	
Unit IV:	7 Hrs.
Modelling Unstructured data: Introduction to NoSQL databases, Basic Map Reduce, Partitioning and Combining, Composing Map Reduce Calculations, Key – Value databases. What is Key – Value Store?, Key – Value store features, transactions, structure of data, case studies based on actual data bases	
Total Lecture	26 Hours

Textbooks:

1.	Data Modelling Essentials; Graeme C. SimSion, Graham C. Witt; MORGAN KAUFMANN PUB..
2.	Data Mining Concepts and Techniques , Jiawei Han, Micheline Kamber, Jian Pei, MORGAN KAUFMANN PUB.
	NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence; Sadalage, P. & Fowler; Wiley Publications, 1st Edition ,2019

Reference Books:

1.	Fundamentals of Business Analytics, R. N. Prasad, Seema Acharya, Wiley India
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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

23ADS1709 : Project Phase-II

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VII SEMESTER

23ADS1710 : Campus Recruitment Training (CRT)

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B.Tech in Artificial Intelligence and Data Science

VII SEMESTER

23ADS1711 : Comprehensive Evaluation of Core Knowledge

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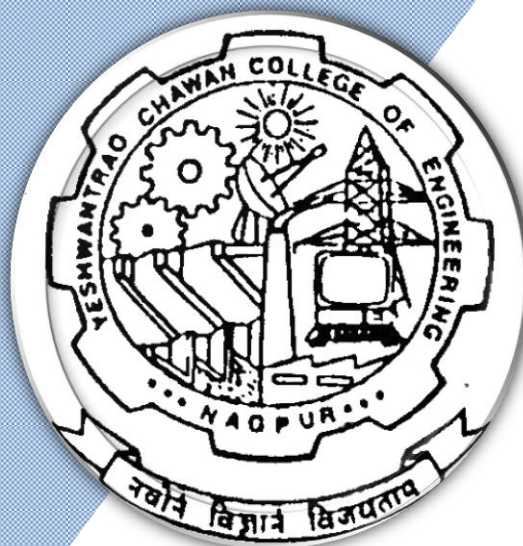
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(Accredited 'A++' Grade by NAAC with a score of 3.6)

Hingna Road, Wanadongri, Nagpur - 441 110



Bachelor of Technology SoE & Syllabus 2023 8th Semester

(Department of Computer Technology)

B. Tech in Artificial Intelligence and Data Science (AIDS)



Yeshwantrao Chavan College of Engineering
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SoE No.
23ADS-101.1

B.TECH SCHEME OF EXAMINATION 2023
(Scheme of Examination w.e.f. 2026-27 onward)
(Department of Computer Technology)
B.Tech. in Artificial Intelligence and Data Science

SN	Sem	Type	BoS/Deptt	Sub. Code	Subject	T/P	Contact Hours				Credits	% Weightage			ESE Duration Hours
							L	T	P	Hrs		MSEs*	TA**	ESE	
EIGHTH SEMESTER															
1	8	PC	AIDS	23ADS1801	Software Engineering	T	2	0	0	2	2	30	20	50	3
3	8	MDM	AIDS		MD Minor Course-VI	T	2	0	0	2	2	30	20	50	3
2	8	STR	AIDS	23ADS1802	Internship / On Job training	P	0	0	18	18	7			100	
TOTAL							4	0	18	22	11				

Grand Total							106	0	82	192	153				
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Multidisciplinary Minor Courses															
		Track1								Track2					
Course	Sem	Data Science								Full Stack Development					
MDM-I	3	(MDM1ADS101) Basics of Data Science								(MDM1ADS201) Front-End Web Development					
MDM-II	4	(MDM2ADS102) Predictive Data Science								(MDM2ADS202) Back-End Web Development					
MDM-III	5	(MDM3ADS103) Multivariate Statistics								(MDM3ADS203) Flutter with Firebase Stack					
MDM-IV	6	(MDM4ADS104) Introduction to Big Data Analytics								(MDM4ADS204) Django Stack					
MDM-V	7	(MDM5ADS105) Data Modelling								(MDM5ADS205) Ruby on Rails Stack					
MDM-VI	8	(MDM6ADS106) Data Visualization								(MDM6ADS206) LAMP Stack					

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B.Tech in Artificial Intelligence and Data Science

VIII SEMESTER

23ADS1801 : Software Engineering

Course Outcomes :

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

1. Understand software engineering process models, incorporating requirement engineering principles and software design fundamentals for a given project.
2. Apply testing principles by selecting and using appropriate testing strategies to effectively evaluate a specific application
3. Use fundamental concepts of software configuration management, version control, and change management in software development.
4. Analyze the cost estimation techniques and the severity of software risk for a given application.
5. Evaluate the effectiveness of basic operations in Subversion (SVN) for maintaining efficient software version control.

Unit I:

6 Hrs.

Introduction to Software Engineering, A Generic View of process, Process models: Water fall Model, RAD Model, Prototyping Model, Component Development Model, Agile Model, Requirement Engineering: Requirement Engineering Task Initialization Eliciting Requirement, Developing Use Case, Analysis Model, Negotiation, Validation

Unit II:

7 Hrs.

Building the Analysis mode: Requirement Analysis, Analysis Modeling Approaches, Data Modeling Concept, Object Oriented Analysis, Types of Modeling, Design Engineering: Design Concept, Design Model, Types of Testing, Basic Path testing, Cyclomatic Complexity

Unit III:

7Hrs.

Software Configuration Management: Elements of Configuration Management, Software Configuration items, SCM Process, SCM Repository, Project Management, Metrics for Process and Projects, Metrics for Process and Projects, Project Estimation

Unit IV:

6 Hrs.

Risk Management: Reactive vs. Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Re- engineering, Reverse Engineering, Subversion.

Total Lecture 26 Hours

Textbooks:

1. Software Engineering—A Practitioner's Approach (Sixth Edition) by Roger S. Pressman McGraw Hill.
2. Object Oriented Software Engineering- Leth Bridge- Pearson Edu

MOOCs Links and additional reading, learning, video material

1. https://onlinecourses.nptel.ac.in/noc22_cs40/preview

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B.Tech in Artificial Intelligence and Data Science

III SEMESTER

MDM6ADS106 : Data Visualization

Course Outcomes :

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

1. Identify data and visualization types to derive insight.
2. Correlate data characteristics with appropriate visualization techniques.
3. Design and develop dashboards for informed decision-making.

Unit I:

7 Hrs.

Foundations of Data Visualization: Overview of data visualization concepts, history, and types of data. Data Abstraction and Task Abstraction models. Understanding the Four Levels of Validation. Scalar and point visualization: color maps, contouring, height plots. Vector visualization: properties, glyphs, and color coding. Visual variables and perception-based design.

Unit II:

6 Hrs.

Visual Analytics & Geo-Spatial Visualization: Designing and analyzing Networks and Trees. Effective representation using tables and layout design. Color and channel manipulations in maps. Geospatial visualization techniques: Choropleth, Hexbin, Dot, Cluster, Cartogram maps. Using geospatial tools and interpreting results for location-based insights.

Unit III:

7 Hrs.

Visualization Tools & Techniques: Introduction to R for visualization using ggplot2, plotly with datasets. Python tools: matplotlib, seaborn, altair, bokeh – comparisons and use cases. Introduction to Tableau: loading data, chart types, interactivity. Creating dashboards using Tableau and best practices.

Unit IV:

6 Hrs.

Visualization of Complex Data Types: Time-series visualization techniques, trends, and forecasts. Text data visualizations: word clouds, keyword maps, and sentiment analysis. Matrix visualizations: adjacency and incidence matrices. Heat maps for density and correlation visualization. Multivariate data representation with parallel coordinates and radar charts.

Total Lecture

26 Hours

Textbooks:

1. Tamara Munzer, Visualization Analysis and Design, CRC Press 2014.
2. Aragues, Anthony. Visualizing Streaming Data: Interactive Analysis Beyond Static Limits. O'Reilly Media, Inc., 2018

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Reference Books:

1.	Chun-hauh Chen, W.K.Hardle, A.Unwin, Hand book of Data Visualization, Springer publication, 2016.
2.	Christian Toninski, Heidrun Schumann, Interactive Visual Data Analysis, CRC press publication, 2020
3.	Alexandru C. Telea, Data Visualization: Principles and Practice, AK Peters, 2014.

MOOCs Links and additional reading, learning, video material

1.	https://onlinecourses.nptel.ac.in/noc21_ge21/preview
2.	https://www.my-mooc.com/en/categorie/data-visualization

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VIII SEMESTER

23ADS1802 : Internship / On Job training

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