

INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
(Deemed to be University Estd. u/s 3 of the UGC Act, 1956)
PALLAVARAM, THALAMBUR, PERIYAPALAYAM-CHENNAI
ACCREDITED BY NAAC WITH 'A++' GRADE

UNDERGRADUATE DEGREE PROGRAMME

B.Sc., Computer Science (Artificial Intelligence and Machine Learning)

Three Years

/

B.Sc., (Hons) Computer Science (Artificial Intelligence and Machine Learning)

Four Years

CURRICULUM & SYLLABUS

REGULATION 2024

Choice Based Credit System (CBCS)

&

Learning Outcomes Based Curriculum Framework (LOCF)

Effective from the Academic Year

2024 -2025

Department of Computer Science
School of Computing Sciences



INSTITUTE OF SCIENCE, TECHNOLOGY & ADVANCED STUDIES (VISTAS)
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DEPARTMENT OF COMPUTER SCIENCE

VISION OF THE DEPARTMENT
Aims to provide quality education in the field of Computer Science with state of art facilities and handle quality research in association with industry and other Universities to produce well trained IT professionals in Computer Science domain.

MISSION OF THE DEPARTMENT	
M1	To Provide knowledge through teaching and training in the field of Computer Science
M2	To concentrate on teaching-learning, research, project and consultancy help to increase the growth of IT and IT Enabled Services.
M3	To train students to get best opportunities and tackle challenges in IT industry.
M4	To equip students with communication skill, Leadership quality, ability to work with team help to improve the society.
M5	To provide value based and technical oriented related students help to build the nation.

PROGRAMME EDUCATIONAL OUTCOMES (PEO)	
PEO1	Graduates are prepared to be employed in IT industries by providing expected Domain Knowledge.
PEO2	Graduates are provided with practical training, hands-on and project experience to meet the industrial needs.
PEO3	Graduates are motivated in career and entrepreneurial skill development to become global leaders.
PEO4	Graduates are trained to demonstrate creativity, develop innovative ideas and to work in teams to accomplish a common goal.
PEO5	Graduates are addressed with social issues and guided to operate problems with Solution.

PROGRAMME OUTCOMES (PO)	
PO1	**Critical Thinking:** Apply knowledge of Artificial Intelligence to identify, analyses problems and to provide effective solution in the area of Computing.
PO2	**Computing Skills:** Analyze a problem, identify and define the Computing requirements appropriate to its solution.
PO3	**Analytical skills:** Ability to design, develop algorithms and provide software solutions to cater the industrial needs.
PO4	**Modern Tool Usage:** Use current techniques, skills, and tools necessary for computing practices.
PO5	**Employability Skills:** Inculcate skills to excel in the fields of Information Technology and its Enabled services, Government and Private sectors, Teaching and Research.
PO6	**Ethics:** Insists ethical responsibilities, human and professional values and make their contribution to the society.
PO7	**Self-Directed and Life-long Learning:** Engaged in lifelong learning to equip them to the changing environment and be prepared to take-up mastering programmes.

PO8	**Individual and Team Work:** Function effectively as an individual, and as a member or a leader in diverse team and multidisciplinary settings.
PO9	**Project Management:** Demonstrate knowledge and understanding of the problem and management principles and apply these to one's own work.

PROGRAMME SPECIFIC OUTCOMES (PSO)	
PSO1	Ability to analyse a problem, and identify and define the AI & ML requirements appropriate to its solution.
PSO2	Ability to design, implement, and evaluate a Machine learning system, process, component, or program to solve the given problem.
PSO3	Improve their leading role in the community, enabling him or her to take responsibilities and contribute to solving problems through innovative thinking, collective work, reflection, and self-development
PSO4	Design, develop, and implement AI and ML systems by applying fundamental principles, algorithms, and techniques.

KNOWLEDGE IS POWER

BOARD OF STUDIES

List of Members

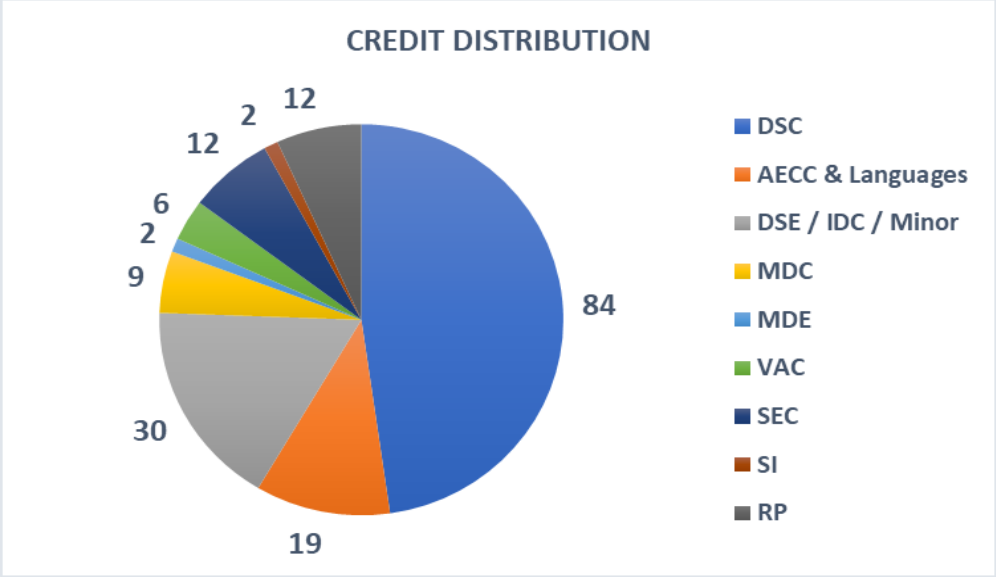
Department of Computer Science

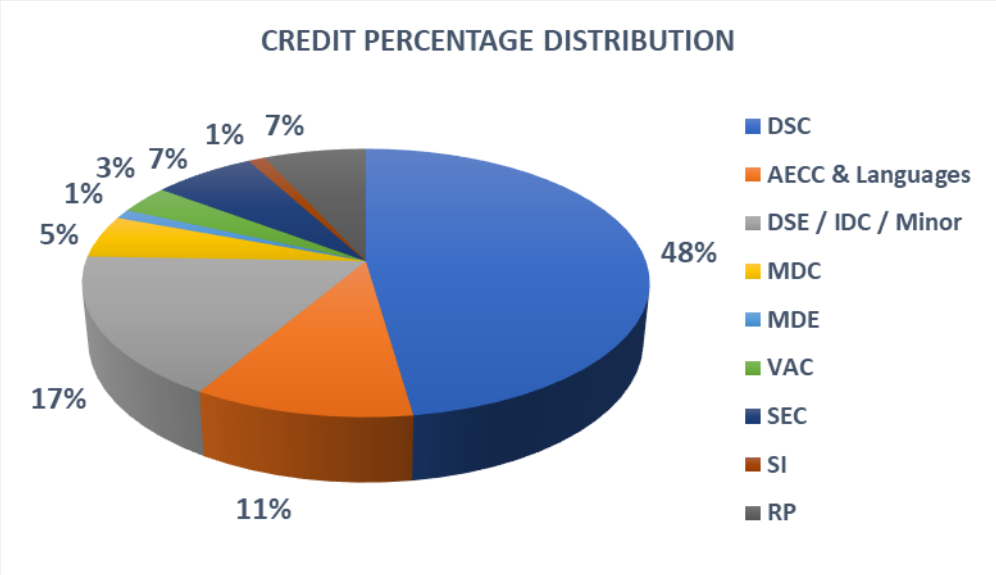
S. No.	Name & Designation	Address	Role
1.	Dr. R. Sivakumar	Dean, School of Computing Sciences, VISTAS	Chair Person
2.	Dr. P. Magesh Kumar	Director, School of Computing Sciences, VISTAS.	
3.	Dr. R. Parameswari	Professor & Head, Department of Computer Science, VISTAS	Internal Member
4.	Dr. S. Perumal	Professor, Department of Computer Science, VISTAS	Internal Member
5.	Dr. G. Thailambal	Professor, Department of Computer Science, VISTAS	Internal Member
6.	Dr. S. Mangayarkarasi	Professor, Department of Computer Science, VISTAS	Internal Member
7.	Dr.A.S. Arunachalam	Professor, Department of Computer Science, VISTAS	Internal Member
8.	Dr.T.Sreekala	Professor, Department of Computer Science, VISTAS	Internal Member
9.	Dr.R.Durga	Professor, Department of Computer Science, VISTAS	Internal Member
10.	Dr.A.Akila	Associate Professor, Department of Computer Science, VISTAS	Internal Member
11.	Dr.A.S.Aneetha	Associate Professor, Department of Computer Science, VISTAS	Internal Member
12.	Mr. R. Balamurugan	Assistant Professor, Department of Computer Science, VISTAS	Internal Member
13.	Ms. R. Padma	Assistant Professor, Department of Computer Science, VISTAS	Internal Member

CREDIT DISTRIBUTION

B.Sc., (Hons) in Computer Science (Artificial Intelligence and Machine Learning)
Minimum credits to be earned: 176
B.Sc., Computer Science (Artificial Intelligence and Machine Learning)
Minimum credits to be earned: 132

Component	I Sem	II Sem	III Sem	IV Sem	V Sem	VI Sem	3 Yrs. Total Credits	VII Sem	VIII Sem	4 Yrs Total Credits
DSC	8	8	8	8	12	16	60	12	12	84
AECC & Languages	4	4	4	7	-	-	19	-	-	19
DSE / IDC / Minor	3	4	3	4	4	4	22	4	4	30
MDC	3	3	3	-	-	-	9	-	-	9
MDE	-	-	2	-	-	-	2	-	-	2
VAC	2	1	-	1	2	-	6	-	-	6
SEC	2	2	2	2	2	2	12	-	-	12
SI	-	-	1	-	1	-	2	-	-	2
RP	-	-	-	-	-	-	-	6	6	12
Total Credits	22	22	23	22	21	22	132	22	22	176





ABBREVIATIONS

DSC	Disciplinary Specific Core
AECC	Ability Enhancement Compulsory Courses
DSE	Disciplinary Specific Elective
IDC	Interdisciplinary / Minor Courses
MDC	Multidisciplinary Courses
MDE	Multidisciplinary Elective
VAC	Value Added Courses
SEC	Skill Enhancement Courses
SI	Summer Internship
RP	Research Project

CURRICULUM STURCTURE

B.Sc., Computer Science (Artificial Intelligence and Machine Learning) Three Years

/

BSc., (Hons) in Computer Science (Artificial Intelligence and Machine Learning) Four Years

Total number of Credits: 176

	B.Sc., Computer Science (Hons) Minimum Credits to be earned :176 **B.Sc., Computer Science Minimum Credits to be earned: 132**									
SEMESTER 1										
			Hours/Week					**Maximum Marks**		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
LANG 1	24LTAM11 /24LHIN11/ 24LFRE11	Tamil I / Hindi I / French I	2	0	0	1	2	40	60	100
ENG 1	24LENG11	English I	2	0	0	1	2	40	60	100
DSC 1	24CBAL11	Object Oriented Programming using Python	3	0	0	2	3	40	60	100
DSC 2	24CBAL12	Artificial Intelligence	3	1	0	2	4	40	60	100
MDC 1	24BMA001	Mathematics- I	2	1	0	0	3	40	60	100
DSE 1/ IDC 1 / Minor 1	24DBAL1-	Discipline Specific Elective-I	3	0	0	2	3	40	60	100
DSC 1 (Lab)	24PBAL11	Practical I - Python Programming	0	0	2	1	1	40	60	100
VAC 1	24DVAC11	Universal Human Values	1	0	0	1	1	-	100	100
SEC 1	24SSKU11	Soft Skills I	2	0	0	1	2	40	60	100
SEC 2		Orientation programme / Industrial Visit	-	-	-	-	-	-	-	-
			17	**2**	**4**	**-**	**21**	**-**	**-**	**-**

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 2										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
LANG 2	24LTAM21 /24LHIN21/ 24LFRE21	Tamil II / Hindi II / French II	2	0	0	1	2	40	60	100
ENG 2	24LENG21	English II	2	0	0	1	2	40	60	100
DSC 3	24CBAL21	Statistical Structure in Data using R	3	0	0	2	3	40	60	100
DSC 4	24CBAL22	Data Structures using Python	3	0	0	2	3	40	60	100
MDC 2	24BMA002	Mathematics- II	2	1	0	0	3	40	60	100
DSE 2 / IDC 2 / Minor 2	24DBAL2-	Discipline Specific Elective-II	4	0	0	2	4	40	60	100
DSC 3 (Lab)	24PBAL21	Practical II - R Programming	0	0	2	1	1	40	60	100
DSC 4 (Lab)	24PBAL22	Practical III- Data Structures using Python	0	0	2	1	1	40	60	100
VAC 2	24DVAC21	Communication Skills	2	0	0	1	2	40	60	100
SEC 3	24SSKU21	Soft Skills II	2	0	0	1	2	40	60	100
			20	**1**	**4**	**-**	**23**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

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SEMESTER 3										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
LANG 3	24LTAM31/ 24LHIN31/ 24LFRE31	Tamil III / Hindi III / French III	2	0	0	1	2	40	60	100
ENG 3	24LENG31	English III	2	0	0	1	2	40	60	100
AECC 1	24EVS031	Environmental Studies	3	0	0	2	3	40	60	100
DSC 5	24CBAL31	Object Oriented Programming Languages	3	0	0	2	3	40	60	100
DSC 6	24CBAL32	Advanced Data Base System	3	0	0	2	3	40	60	100
DSE 3 / IDC 3 / Minor 3	24DBAL3-	Discipline Specific Elective-III	3	0	0	2	3	40	60	100
DSC 5 (Lab)	24PBAL31	Practical IV - Object Oriented Programming Languages Lab	0	0	2	1	1	40	60	100
DSC 6 (Lab)	24PBAL32	Practical V - Advanced Data Base System Lab	0	0	2	1	1	40	60	100
MDE 1	24EMDE31	Indian Knowledge System	2	0	0	1	2	40	60	100
SEC 4	24SSKU31	Soft Skills III	2	0	0	2	2	40	60	100
SI 1	24IBAL31	Internship I	0	0	2	1	1	-	100	100
			19	**1**	**6**	**-**	**23**	**-**	**-**	**-**

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SEMESTER 4										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
LANG 4	24LTAM41/ 24LHIN41/ 24LFRE41	Tamil IV / Hindi IV / French IV	2	0	0	1	2	40	60	100
ENG 4	24LENG41	English IV	2	0	0	1	2	40	60	100
DSC 7	24CBAL41	Machine Learning and its Applications	3	0	0	2	3	40	60	100
DSC 8	24CBAL42	Natural Language Processing	3	0	0	2	3	40	60	100
MDC 3	24BMA003	Statistics-I	2	1	0	2	3	40	60	100
DSE 4 / IDC 4 / Minor 4	24DBAL4-	Discipline Specific Elective-IV	4	0	0	2	4	40	60	100
DSC 7 (Lab)	24PBAL41	Practical VI -Machine Learning using WEKA Lab	0	0	2	1	1	40	60	100
DSC 8 (Lab)	24PBAL42	Practical VII – Natural Language Processing Lab	0	0	2	1	1	40	60	100
SEC 5	24SBAL41	Industry Oriented Employability skills	1	0	2	1	2	40	60	100
VAC 3	24DVAC41	Yoga Education / NSS / NCC	0	0	2	1	1	-	100	100
SEC 6		In-plant Training/ Industrial Tour/ Summer Term	-	-	-	-	-	-	-	-
			18	**-**	**8**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 5										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 9	24CBAL51	Programming in MATLAB	3	0	0	2	3	40	60	100
DSC 10	24CBAL52	Data Visualization	3	0	0	2	3	40	60	100
DSC 11	24CBAL53	Big Data Analytics	3	1	0	2	4	40	60	100
DSE 5 / IDC 5 / Minor 5	24DBAL5-	Discipline Specific Elective-V	4	0	0	2	4	40	60	100
DSC 9 (Lab)	24PBAL51	Practical VIII - Programming in MATLAB Lab	0	0	2	1	1	40	60	100
DSC 10 (Lab)	24PBAL52	Practical IX - Data Visualization Lab	0	0	2	1	1	40	60	100
SEC 7	24SBAL51	Entrepreneurial Development	2	0	0	1	2	40	60	100
VAC 4	24DVAC51	Web Designing	2	0	0	1	2	40	60	100
SI 2	24BINP51	Internship II	0	0	2	1	1	-	100	100
SEC 8		Skill Enhancement Training / Student Club Activities/ Institution Innovation Council Activities	-	-	-	-	-	-	-	-
			17	**1**	**6**	**-**	**21**	**-**	**-**	**-**

CIA - Continuous Internal Assessment **SEE - Semester End Examination**

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 6										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 12	24CBAL61	Data Science using Python	3	0	0	2	3	40	60	100
DSC 13	24CBAL62	Web Mining & Recommender Systems	3	1	0	2	4	40	60	100
DSC 14	24CBAL63	Cognitive Computing	4	0	0	2	4	40	60	100
DSC 15	24CBAL64	Robotics and its Applications	4	0	0	2	4	40	60	100
DSE 6 / IDC 6 / Minor 6	24DBAL6-	Discipline Specific Elective-VI	4	0	0	2	4	40	60	100
DSC 12 (Lab)	24PBAL61	Practical X - Data Science using Python Lab	0	0	2	2	1	40	60	100
SEC 9	24SBAL61	Mini Project	2	0	0	2	2	-	100	100
SEC 10		On Job Training / Apprenticeship / Startup	-	-	-	-	-	-	-	-
			20	1	**2**	-	**22**	-	-	-

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 7										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 16	24CBAL71	Mobile Application Development for Machine Learning	3	0	0	2	3	40	60	100
DSC 17	24CBAL72	Neural Networks	4	0	0	2	4	40	60	100
DSC 18	24CBAL73	Deep Learning	3	1	0	2	4	40	60	100
DSE 7 / IDC 7 / Minor 7	24DBAL7-	Discipline Specific Elective-VII	4	0	0	2	4	40	60	100
DSC 16 (Lab)	24PBAL71	Practical XI - Mobile Application Development for Machine Learning Lab	0	0	2	1	1	40	60	100
RP 1	24RBAL71	Research Project I	0	0	12	4	6	40	60	100
			14	**1**	**14**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

SEMESTER 8										
			Hours/Week					Maximum Marks		
Category	**Code**	**Course**	**L**	**T**	**P**	**O**	**C**	**CIA**	**SEE**	**Total**
DSC 19	24CBAL81	Introduction to Reinforcement Learning	3	0	0	2	3	40	60	100
DSC 20	24CBAL82	Software Testing	3	0	0	2	3	40	60	100
DSC 21	24CBAL83	Pattern Recognition	4	0	0	2	4	40	60	100
DSE 8 / IDC 8 / Minor 8	24DBAL8-	Discipline Specific Elective-VIII	3	1	0	2	4	40	60	100
DSC 19 (Lab)	24PBAL81	Practical XII - Introduction to Reinforcement Learning Lab	0	0	2	1	1	40	60	100
DSC 20 (Lab)	24PBAL82	Practical XIII -Software Testing using Selenium Lab	0	0	2	1	1	40	60	100
RP 2	24RBAL81	Research Project II	0	0	12	4	6	-	60	100
			13	**1**	**14**	**-**	**22**	**-**	**-**	**-**

CIA - Continuous Internal Assessment SEE - Semester End Examination

***L – Lecture, *T- Tutorial, *P- Practical, *O - Outside the class effort / self-study**

DISCIPLINE SPECIFIC CORE COURSES

Category	Code	Course	L	T	P	O	C
DSC 1	24CBAL11	Object Oriented Programming using Python	3	0	0	2	3
DSC 2	24CBAL12	Artificial Intelligence	3	1	0	2	4
DSC 1 (Lab)	24PBAL11	Practical I - Python Programming	0	0	2	1	1
DSC 3	24CBAL21	Statistical Structure in Data using R	3	0	0	2	3
DSC 4	24CBAL22	Data Structures using Python	3	0	0	2	3
DSC 3 (Lab)	24PBAL21	Practical II - R Programming	0	0	2	1	1
DSC 4 (Lab)	24PBAL22	Practical III- Data Structures using Python	0	0	2	1	1
DSC 5	24CBAL31	Object Oriented Programming Languages	3	0	0	2	3
DSC 6	24CBAL32	Advanced Data Base System	3	0	0	2	3
DSC 5 (Lab)	24PBAL31	Practical IV - Object Oriented Programming Languages	0	0	2	1	1
DSC 6 (Lab)	24PBAL32	Practical V - Advanced Data Base System	0	0	2	1	1
DSC 7	24CBAL41	Machine Learning and its Applications	3	0	0	2	3
DSC 8	24CBAL42	Natural Language Processing	3	0	0	2	3
DSC 7 (Lab)	24PBAL41	Practical VI -Machine Learning using WEKA	0	0	2	1	1
DSC 8 (Lab)	24PBAL42	Practical VII – Natural Language Processing	0	0	2	1	1

DSC 9	24CBAL51	Programming in MATLAB	3	0	0	2	3
DSC 10	24CBAL52	Data Visualization	3	0	0	2	3
DSC 11	24CBAL53	Big Data Analytics	3	1	0	2	4
DSC 9 (Lab)	24PBAL51	Practical VIII - Programming in MATLAB	0	0	2	1	1
DSC 10 (Lab)	24PBAL52	Practical IX - Data Visualization	0	0	2	1	1
DSC 12	24CBAL61	Data Science using Python	3	0	0	2	3
DSC 13	24CBAL62	Web Mining & Recommender Systems	3	1	0	2	4
DSC 14	24CBAL63	Cognitive Computing	4	0	0	2	4
DSC 15	24CBAL64	Robotics and its Applications	4	0	0	2	4
DSC 12 (Lab)	24PBAL61	Data Science using Python	0	0	2	1	1
DSC 16	24CBAL71	Mobile Application Development for Machine Learning	3	0	0	2	3
DSC 17	24CBAL72	Neural Networks	4	0	0	2	4
DSC 18	24CBAL73	Deep Learning	3	1	0	2	4
DSC 16 (Lab)	24PBAL71	Mobile Application Development for Machine Learning	0	0	2	1	1
DSC 19	24CBAL81	Introduction to Reinforcement Learning	3	0	0	2	3
DSC 20	24CBAL82	Software Testing	3	0	0	2	3
DSC 21	24CBAL83	Pattern Recognition	4	0	0	2	4
DSC 19 (Lab)	24PBAL81	Introduction to Reinforcement Learning	0	0	2	1	1
DSC 20 (Lab)	24PBAL82	Software Testing using Selenium	0	0	2	1	1

DISCIPLINE SPECIFIC ELECTIVE COURSES

Category	Code	Course	L	T	P	O	C
DSE 1 / IDC 1 / Minor 1	24DBAL11	Introduction to Cyber Security	3	0	0	2	3
	24DBAL12	Information Security					
DSE 2 / IDC 2 / Minor 2	24DBAL21	Operating Systems	4	0	0	2	4
	24DBAL22	Process Management					
DSE 3 / IDC 3 / Minor 3	24DBAL31	Software Engineering	3	0	0	2	3
	24DBAL32	Network Security					
DSE 4 / IDC 4 / Minor 4	24DBAL41	Data Communication and Networking	4	0	0	2	4
	24DBAL42	Ethical Hacking					
DSE 5 / IDC 5 / Minor 5	24DBAL51	Internet of Things	3	1	0	2	4
	24DBAL52	Business Intelligence and Analytics					
DSE 6 / IDC 6 / Minor 6	24DBAL61	Cloud computing	4	0	0	2	4
	24DBAL62	Client Relationship Management					
DSE 7 / IDC 7/ Minor 7	24DBAL71	Games and information	4	0	0	2	4
	24DBAL72	Security Issues in Machine Learning					
DSE 8 / IDC 8 / Minor 8	24DBAL81	Block Chain Technology	3	1	0	2	4
	24DBAL82	Design Thinking					

AECC & LANGUAGES

Category	Code	Course	L	T	P	O	C
LANG 1	24LTAM11/ 24LHIN11/ 24LFRE11	Tamil I / Hindi I/ French I	2	0	0	1	2
ENG 1	24LENG11	English I	2	0	0	1	2
LANG 2	24LTAM21/ 24LHIN21/ 24LFRE21	Tamil II / Hindi II / French II	2	0	0	2	2
ENG 2	24LENG21	English II	2	0	0	2	2
LANG 3	24LTAM31/ 24LHIN31/ 24LFRE31	Tamil III / Hindi III/ French III	2	0	0	2	2
ENG 3	24LENG31	English III	2	0	0	2	2
LANG 4	24LTAM41/24LHIN41/ 24LFRE41	Tamil IV / Hindi IV / French IV	2	0	0	1	2
ENG 4	24LENG41	English IV	2	0	0	1	2

MULTIDISCIPLINARY COURSES

Category	Code	Course	L	T	P	O	C
MDC 1	24BMA001	Mathematics- I	2	1	0	0	3
MDC 2	24BMA002	Mathematics – II	2	1	0	0	3
MDC 3	24BMA003	Statistics-I	2	1	0	2	3

ABILITY ENHANCEMENT COMPULSORY COURSES

AECC 1	24EVS031	Environmental Studies	3	0	0	2	3

MULTIDISCIPLINARY ELECTIVES

MDE 1	24EMDE31	Indian Knowledge System	2	0	0	1	2

VALUE ADDED COURSES

Category	Code	Course	L	T	P	O	C
VAC 1	24DVAC11	Universal Human Values	1	0	0	1	1
VAC 2	24DVAC21	Communication Skills	2	0	0	1	2
VAC 3	24DVAC41	Yoga Education / NSS / NCC	0	0	2	1	1
VAC 4	24DVAC51	Web Designing	2	0	0	1	2

SKILL ENHANCEMENT COURSES

Category	Code	Course	L	T	P	O	C
SEC 1	24SSKU11	Soft Skills I	2	0	0	1	2
SEC 2		Orientation Programme / Industrial Visit	-	-	-	-	-
SEC 3	24SSKU21	Soft Skills II	2	0	0	1	2
SEC 4	24SSKU31	Soft Skills III	2	0	0	2	2
SEC 5	24SBAL41	Industry Oriented Employability skills	1	0	2	1	2
SEC 6	24SBAL42	In-plant Training/ Industrial Tour/ Summer Term	-	-	-	-	-
SEC 7	24SBAL51	Natural Language Processing Lab	2	0	0	1	2
SEC 8	24SBAL52	Skill Enhancement Training / Student	-	-	-	-	-

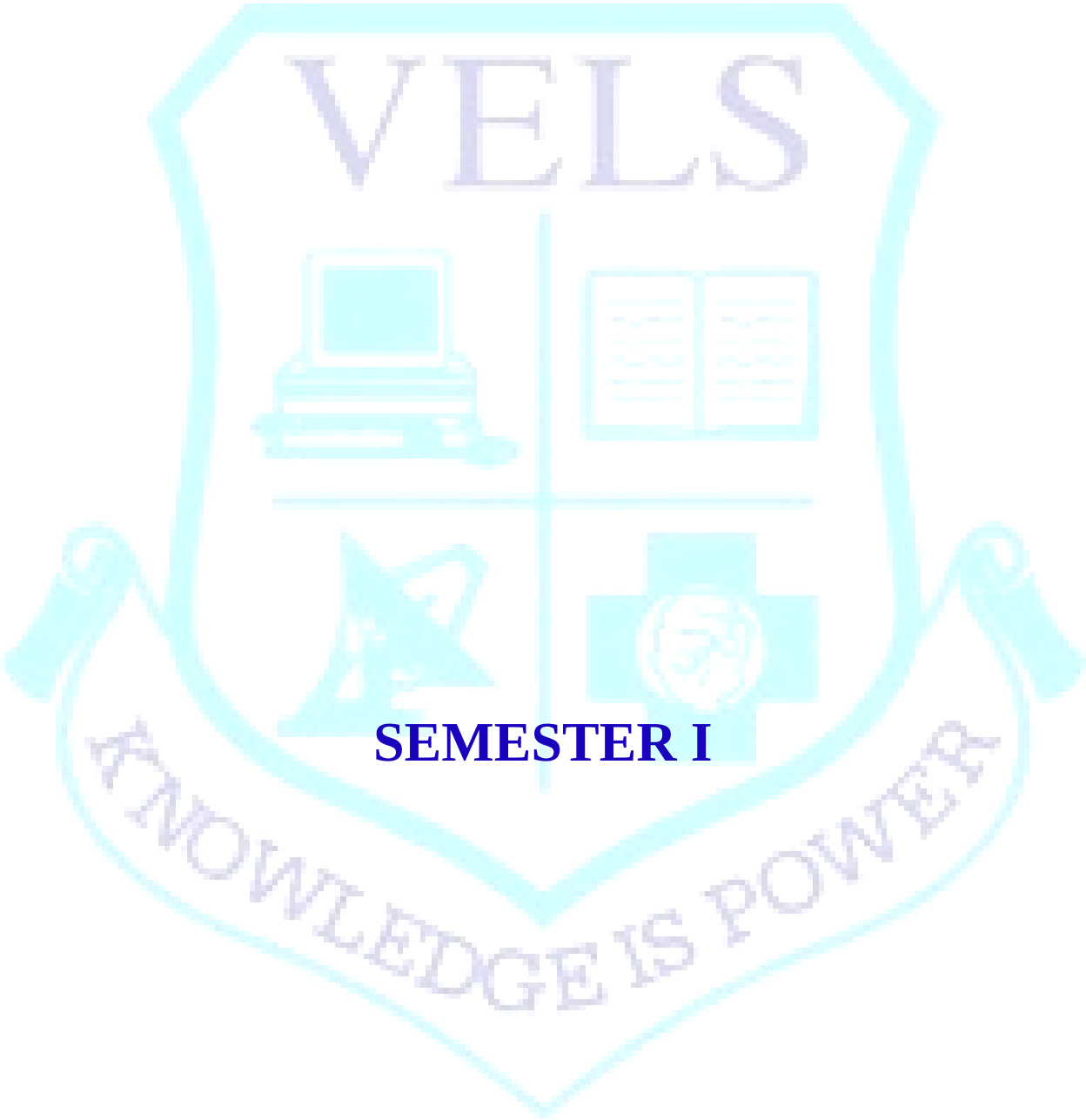
		Club Activities/ Institution Innovation Council Activities					
SEC 9	24SBAL61	Mini Project	2	0	0	2	2
SEC 10	24SBAL62	On Job Training / Apprenticeship / Startup	-	-	-	-	-

SUMMER INTERNSHIP

Category	Code	Course	L	T	P	O	C
SI 1	24IBAL31	Internship I	0	0	2	1	1
SI 2	24IBAL51	Internship II	0	0	2	1	1

RESEARCH PROJECT

Category	Code	Course	L	T	P	O	C
RP 1	24RBAL71	Research Project I	0	0	12	2	6
RP 2	24RBAL81	Research Project II	0	0	12	2	6



SEMESTER I

24LTAM11 **தமிழ்மொழிப்பாடம்-1**

L	T	P	O	C
2	0	0	1	2

மொழிவரலாறு – சங்க இலக்கியம் – அற இலக்கியம் – மொழித்திறன்

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், தற்கால தமிழ் இலக்கிய வகைமைகளான மரபுக்கவிதை, புதுக்கவிதை, உரைநடை ஆகியவற்றை அறிமுகப்படுத்துதல், தமிழர்தம் வாழ்வியல் நெறிகளையும் பண்பாட்டுச் செழுமைகளையும் இன்றைய தலைமுறையினர் அறியச் செய்தல், மாணவர்களுக்குத் தமிழைத் தவறின்றி எழுதுவதற்குத் தேவையான பயிற்சி அளித்து அவர்களின் மொழித்திறனை மேம்படுத்துதல், செய்யுளின் நலத்தைப் பாராட்டும் முறைமையை அறியச் செய்து அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களுக்கு வேலைவாய்ப்பை உருவாக்குவதும் இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு- 1: தமிழ் மொழி வரலாறு **8 மணி நேரம்**

மொழிக்குடும்பம் - இந்திய மொழிக்குடும்பங்கள் - இந்திய ஆட்சி மொழிகள் - திராவிட மொழிக்குடும்பங்கள் - திராவிட மொழிகளின் வகைகள் –திராவிட மொழிகளின் சிறப்புகள் - திராவிட மொழிகளின் வழங்கிடங்கள் - திராவிட மொழிகளுள் தமிழின் இடம் - தமிழ்மொழியின் சிறப்புகள் - தமிழ் பிறமொழித் தொடர்புகள்.

அலகு -2 **8 மணி நேரம்**

புறநானூறு- பாடல் எண்: , 182, 183, – இரண்டு பாடல்கள்.

குறுந்தொகை- பாடல் எண்: 2, 167, - இரண்டு பாடல்கள்

பரிபாடல் - முருகன். வையை - இரண்டு பாடல்கள்

அலகு - 3 அற இலக்கியங்கள் **8 மணி நேரம்**

திருக்குறள்- வான்சிறப்பு (அறம்), பெருமை (பொருள்), பிரிவாற்றாமை (இன்பம்),. மூன்று அதிகாரங்கள் முழுமையும்

1. நாலடியார் - இரண்டு பாடல்கள். (2, 3)
2. மூதுரை - இரண்டு பாடல்கள். (2, 8)

அலகு 4 மொழி **07 மணி நேரம்**

பிழை நீக்கி எழுதுதல் - ஒற்றுப்பிழை நீக்கி எழுதுதல் - தொடர்பிழை நீக்கி எழுதுதல் - ஒற்று மிகும் இடங்கள் - ஒற்று மிகா இடங்கள் - பிற மொழிச் சொற்களை நீக்கி எழுதுதல் – பயிற்சிகள்.

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

1. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
2. **தவறின்றித் தமிழ் எழுதுவோம்**, மா. நன்னன், ஏகம் பதிப்பகம், 1999.
3. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
4. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
5. **புதிய தமிழ் இலக்கிய வரலாறு**, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
6. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
7. **பாடநூல் தேடலுக்கான இணையம்** - https://archive.org/

24LHIN11 **HINDI-I**

L	T	P	O	C
2	0	0	1	2

वर्ष I – सत्र I (गद्य, पत्र लेखन & व्यावहारिक हहन्दी)

Prose, Letter Writing & Functional Words)

COURSE OBJECTIVES:

- To understand the rural life style, social responsibilities and social values
- To create awareness about the importance of varied culture
- To enable the students to develop communication skill in Hindi and to use Azhagi, Azhagi+ fonts

UNIT I : पं.श्रीिाम शमाष कृत 'स्मृतत' (कहानी) **6**

'Smruti' (Kahani) by Pandit Sriram Sharma.

UNIT II : शिद जोशी कृत 'अततति तुम कब जावोगे' (व्यंग्य) **6**

'Athiti tum kab jaaoge' (Vyangy) by Harishankar Parsayi.

UNIT III: िाहुल सांस्कृतयायन कृत 'अिातो घुमक्कड़ जजज्ञासा' (यात्रा वृत्तान्त) **6**

'Atatho Ghumakkad Jigyasa' (Yatra Vruthanth) by Rahul Sanskrityayan.

UNIT IV: व्यावहारिक हहन्दी- पत्र लेखन में प्रयुक्त वाक्यांश, कौशल ववकास – भाव एक भार्ा अनेक **6**

Functional Hindi-Phrases use in Letter Writing.

Skill development - Bhav Ek Bhasha Anek

UNIT V : पत्र लेखन – परिचय व प्रकाि, 3 अनोपचारिक पत्र अलगी, अलगी + फ़ॉन्ट का परिचय **6**

Letter Writing- Intro. & Types & 3 Personal Letters

Introduction to Azhagi, Azhagi + fonts

Total: 30 Hours

COURSE OUTCOMES:

At the end of this course Students will be able to

CO1 Gain knowledge about the rural life style
CO2 Understand social values
CO3 Understand importance of varied culture
CO4 Journalise in Functional Hindi
CO5 Use Azhagi, Azhagi+ fonts

TEXT BOOKS:

1. Pandit Shriram Sharma, Shikaar, Sahitya Sadan, 1932.
2. Sharad Joshi, Yatha Sambhav, Bharatiya Gyanpeet, 2014.
3. Rahul Sanskrityayan, Ghumakkad Shastra, Rajkamal Prakashan, 1949.

REFERENCE BOOK:

1. Kendriya Hindi Sansthan, Banking Hindi Patyakram, 2012.
2. NCERT, Sparsh, Class 9.
3. Main Aur Mera Vyakaran, New Saraswati House, New Delhi.
4. Govind Ballabh Sharma, Hindi Vyavaharik Tankan Kala Evam Tankan Abhyas, Neelkanth Publishers Pvt. Ltd., 2022.

WEB RESOURCES:

1. Pandit Sriram Sharma ka kahani: https://www.evidyarthi.in
2. Harishankar parasayi ka Vyangy: http://gadyakosh.org
3. Rahul Sanskrityayan ka yatravruttant: https://www.hindwi.org
4. Prayojanmoolak Hindi:https://hi.mwikipedia.org
5. https://www.azhagi.com/hnd/helphtml/Introduction.html

24LFRE11 **FRENCH – I**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

The lessons are being chosen:

1) To greet, to express excuse and to introduce oneself
2) To introduce another person
3) To express his/her ideas, opinions and weekend projects
4) To request someone to do something, polite manners
5) To accept, refuse, enquire and indicate the time and date
6) To express himself / herself in positive and negative manner

UNITS:

1) SALUT

les nombres, Les jours de la semaine et du mois, La nationalité **4**

2) ENCHANTÉ

Les verbes Etre, Avoir, Aller, Regular ER verbes, Present tense. **6**

3) J'ADORE

La negation, l'adjectif possessif, le futur proche **4**

4) TU VEUX BIEN

Les articles de finis/indéfinis, Les pronoms après une préposition (avec lui, chez moi), Le passé composé **7**

5) ON SE VOIT QUAND

Les pronoms compléments directs me, te, nous, vous, L'interrogation avec est-ce que, L'heure et la date. **5**

6) BONNE IDÉE

Les articles partitifs, Le masculin et le féminin des adjectifs, Les pronoms compléments directs le, la, les, La négation : ne… pas de. **4**

Total: 30 Hours

COURSE OUTCOMES:

1) The students would be able to greet, to excuse and to introduce himself.
2) The students would be able to introduce someone.
3) The students would be able to express his ideas, opinions and weekend projects.
4) The students would be able to ask someone to do something, polite manner.
5) The students would be able to accept, refuse enquire and indicate the time and date.
6) The students would be able to express himself in positive and negative manner.

Text Books :

1. LATITUDES 1 (A1/A2) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau

REFERENCE BOOKS:

1. SAISON A1 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

24LENG11 **ENGLISH - I**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

CO1: To enable students to develop their communication skills effectively.

CO2: To make students familiar with usage skills in the English Language.

CO3: To enrich their vocabulary in English.

CO4: To develop communicative competence.

UNIT I- PROSE **Credit Hours 06**

- Dangers of drug abuse - Hardin B.Jones
- Tight corners - E.V.Lucas

UNIT II -POETRY **06**

- Ecology - A.K.Ramanujan
- The owl and the chimpanzee - Jo Camacho

UNIT III - SHORT STORY **06**

- The Dear Departed - Stanley Houghton
- The Fool's Paradise- Isaac Bashevis Singer

UNIT IV -GRAMMAR **06**

- Parts of speech, Articles

UNIT V -GRAMMAR **06**

- One-word substitution, prefix, suffix, synonym, antonym.

Total: 30 Hours

COURSE OUTCOMES:

At the end of this course, the students would have learnt to

CO1	Understand the characteristic features of the language used in the text.
CO2	Strengthen their knowledge of basic grammar
CO3	Improve narrative skills after studying diverse prose and play.
CO4	Understand to classify parts of speech and articles.
CO5	Develop critical writing skills in the textual content of the syllabus.

REFERENCE BOOKS:

1. Jeya Santhi (2015), English for Communication Enrichment:
2. Anu Chitra (2012), Dr. M. Narayana Rao and Dr. B. G.Barki–Anu's Current English for Communication
3. Anu Chithra (2010),Dr. Ananthan, R. Effective Communication. Ed. Chennai.

24CBAL11 OBJECT ORIENTED PROGRAMMING USING PYTHON

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

Describe the Discipline Specific Course syntax and semantics of Python programming language, Discover the need for working with the strings and functions and to Infer the Object-oriented Programming concepts in Python.

UNIT- I PARTS OF PYTHON PROGRAMMING LANGUAGE **9**

Identifiers, Keywords, Statements and Expressions, Variables, Operators, Precedence and Associativity, Data Types, Indentation, Comments, Reading Input, Print Output, Type Conversions, The type() function and Is Operator, Dynamic and Strongly Typed Language, Control Flow Statements, The if Decision Control Flow Statement, The if…else Decision Control Flow Statement, The if…elif…else Decision Control Statement, Nested if Statement, The while Loop, The for Loop, The continue and break Statements, Catching Exceptions Using try and except Statement, Functions, Built-In Functions, Commonly Used Modules, Function Definition and Calling the Function, The return Statement and void Function, Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments

UNIT-II STRINGS & DICTIONARIES **9**

Creating and Storing Strings, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings, Lists, Creating Lists, Basic List Operations, Indexing and Slicing in Lists, Built-In Functions Used on Lists, List Methods, The del Statement. Dictionaries: Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, The del Statement ,Tuples and Sets, Creating Tuples, Basic Tuple Operations, Indexing and Slicing in Tuples, Built-In Functions Used on Tuples, Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Tuple Methods, Using zip() Function, Sets, Set Methods, Traversing of Sets, Frozen set..

UNIT-III FILES **9**

Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, The Pickle Module, Reading and Writing CSV Files, Pythons 10 and os. path Modules, Regular Expression Operations, Using Special Characters, Regular Expression Methods, Named Groups in Python Regular Expressions, Regular Expression with glob Module..

UNIT – IV OBJECT-ORIENTED PROGRAMMING, CLASSES AND OBJECTS **9**

Creating Classes in Python, Creating Objects in Python, The Constructor Method, Classes with Multiple Objects, Class Attributes versus Data Attributes, Encapsulation, Inheritance, The Polymorphism

UNIT– V CASE STUDY **9**

Working with the sample Python programs – Using Functions, Strings, Dictionaries, Files and OOP Concepts.

Total: 45 Hours

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: Interpret the fundamental Python syntax and semantics and be fluent in the use of Python control flow statements.

CO-2: Determine the methods to create and manipulate Python programs by utilizing the data Structures like lists, dictionaries, tuples and sets.

CO-3: Articulate the Object-Oriented Programming concepts such as encapsulation, inheritance and polymorphism as used in Python.

CO-4: An understanding of the concepts of user defined functions.

CO-5: To gain the knowledge of Python Attributes and Constructors

TEXT BOOKS:

1. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.
2. Jeeva Jose, Introduction to Computing & Problem Solving With PYTHON, Khanna Publishing House, 2023.
3. Gowrishankar S, Veena A,(2018) "Introduction to Python Programming",1st Edition, CRC Press/Taylor &Francis, 2018. ISBN-13: 978-0815394372

REFERENCE BOOKS:

1. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", 1st Edition, O'Reilly Media, 2016. ISBN-13:978-1491912058

2. Aurelien Geron, Hands-On Machine Learning with Scikit-Learn and Tensor Flow: Concepts, Tools, and Techniques to Build Intelligent Systems", 1st Edition, O'Reilly Media, 2017. ISBN – 13: 978-1491962299.

3. Wesley J Chun, "Discipline Specific Course Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365

4. MiguelGrinberg, "Flask Web Development: Developing Web Applications with Python", 2nd Edition, O'Reilly Media, 2018. ISBN-13: 978-1491991732.

24CBAL12 **ARTIFICIAL INTELLIGENCE**

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES:

To introduce the basic principles, techniques, and applications of Artificial Intelligence. Emphasis will be placed on the teaching of these fundamentals, not on providing a mastery of specific software tools or programming environments. Assigned projects promote a 'hands-on'approach for understanding, as well as a challenging avenue for exploration and creativity.

UNIT I PROBLEM, PROBLEM SPACES AND SEARCH **12**

What is AI? – AI Problems – What is an AI technique – Defining the problem as a state space search – Production system - Production system – Characteristics – Problem Characteristics?

UNIT II HEURISTIC SEARCH TECHNIQUES **12**

Generate and test – Hill Climbing – Best first Search – Problem Reduction – Constraints Satisfaction – Means end analysis.

UNIT III KNOWLEDGE REPRESENTATION **12**

Representations and Mappings – Approaches to Knowledge Representation. Using predicate Logic: Representing simple facts in logic – Computable functions and prediction – Resolution – The basic of resolution – Resolution in Propositional Logic – The Unification algorithm – Resolution in Predicate Logic.

UNIT IV REPRESENTING KNOWLEDGE USING RULES **12**

Procedural versus – Declarative Knowledge – logic Programming – Forward versus Backward Reasoning – Matching

UNIT V GAME PLAYING **12**

The Minimax search procedure – Adding Alpha Beta cut offs – Addition Refinements – Waiting for Quiescence – Secondary Searches – Using Book moves.

Total: 60 Hours

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: Knowledge of what constitutes "Artificial" Intelligence and how to identify systems with Artificial Intelligence..

CO-2: Explain how Artificial Intelligence enables capabilities that are beyond conventional technology, for example, chess-playing computers, self-driving cars, robotic vacuum cleaners.

CO-3: Ability to apply Artificial Intelligence techniques for problem solving.

CO-4: Understand the basic concepts of machine learning and some typical applications

CO-5: Understand the core concepts of artificial intelligence and applications

TEXT BOOKS:

1. M.C. Trivedi, Introduction to AI and Machine Learning, Khanna Book Publishing Company, 2024.
2. Russell, S. and Norvig, P., "Artificial Intelligence - A Modern Approach", 3rd edition,Prentice Hall
3. Elain Rich Kevin knight "Artificial Intelligence" - Tata McGraw Hill.
4. Artificial Intelligence and Intelligent Systems – N.P.PADHY.

REFERENCE BOOKS:

1. Introduction to Artificial Intelligence Rajenda Akeskar PHI.
2. Artificial Intelligence by PH, Winston – Addison Wesley.
3. Introduction to Artificial Intelligence and Expert System by Patter

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24BMA001 **MATHEMATICS-I**

L	T	P	O	C
2	1	0	0	3

COURSE OBJECTIVES:

- To learn various concept in matrix
- To apply the concept of Sets to promote critical thinking, problem-solving technique and interdisciplinary connections.
- To analyse the relationships, decisions making and modeling complex systems using Partial Order Relations.

UNIT-I MATRICES & DETERMINANTS: 9

Matrices: Definition, Types of Matrices, Addition, Subtraction, Scalar Multiplication and Multiplication of Matrices, Adjoint, Inverse, Cramer's Rule, Rank of Matrix Dependence of Vectors**. Determinants:** Definition, Minors, Cofactors, Properties of Determinants

Unit-II: SETS 9

Sets: Sets, Subsets, Equal Sets Universal Sets, Finite and Infinite Sets, Operation on Sets, Union, Intersection and Complements of Sets, Cartesian Product, Cardinality of Set, Simple Applications.

Unit-III: RELATIONS & FUNCTIONS 9

Relations: Properties of Relations, Equivalence Relation. **Functions:** Partial Order Relation Function: Domain and Range, Onto, Into and One to One Functions, Composite and Inverse Functions.

Unit-IV: PARTIAL ORDER RELATIONS 9

Partial Order Sets, Representation of POSETS using Hasse diagram, Chains, Maximal and Minimal Point, GLB, LUB.

Unit-V: NUMBER SYSTEM AND CONVERSIONS **9**

Number Systems: Binary Numbers, Octal Numbers, Decimal numbers, Hexa Decimal numbers. **Number base conversions**: Octal and Hexa Decimal Numbers - Complements - Signed Binary Numbers - Binary Arithmetic - Binary Codes - Decimal Code

Total: 45 hours

COURSE OUTCOMES:

At the end of this course the students will be able to,

CO1: Apply the concept of Matrix and solving simultaneous equations

CO2: Understand the ideas of Sets and its applications.

CO3: Identify the relations for various functions.

CO4: Apply the concept of partial order relation for various sets.

CO5: Understand the conversion of various number system.

TEXT BOOKS:

1. Kolman, Busby, Ross and Rehman,(2003) Discrete Mathematical Structures for Computer Science, Pearson Education, 5th Edition.

REFERENCE BOOKS:

1. D.S. Malik and M.K. Sen,(2004) Discrete Mathematical Structures: Theory and Applications, Thomson.
2. Goodaire & Parmenter (2000) : Discrete Mathematics & Graph Theory, Pearson Education,.
3. Kenneth H. Rosen(2004), Discrete Mathematics and its Applications, Tata McGraw Hill, 5th Ed.,.
4. C.L. Liu (1986.), Elements of Discrete Mathematics, 2nd Edition, McGraw Hill.

WEB RESOURCES

1. **https://www.geeksforgeeks.org/mathematics-partial-orders-lattices/**
2. **https://www.ipsgwalior.org/download/number%20system.pdf**

24PBAL11 PYTHON PROGRAMMING LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

To implement Python programs with conditionals and loops. Also represent compound data using Python lists, tuples, dictionaries and Read and write data from/to files in Python.

LIST OF PROGRAMS:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. First n prime numbers
8. Multiply matrices
9. Programs that take command line arguments (word count)
10. Find the most frequent words in a text read from a file
11. Simulate elliptical orbits in Pygame
12. Simulate bouncing ball using Pygame

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: To implement the python programming features in practical applications. To write, test, and debug simple Python programs.

CO-2: To implement Python programs with conditionals and loops. Use functions for structuring Python programs. Represent compound data using Python lists, tuples, dictionaries , turtles, Files and modules.

CO-3: Understand the numeric or real life application problems and solve them.

CO-4: Apply a solution clearly and accurately in a program using Python.

CO-5: Apply the best features available in Python to solve the situational problems.

WEB RESOURCES:

1. .http://interactivepython.org/courselib/static/pythonds
2. http://www.ibiblio.org/g2swap/byteofpython/read/
3. http://www.diveintopython3.net/ 4. http://greenteapress.com/wp/think-python-2e/

24DVAC11 **UNIVERSAL HUMAN VALUES**

L	T	P	O	C
1	0	0	1	1

COURSE OBJECTIVES:

The candidates will be able to appreciate the complementarity between the values and skills for sustained happiness and prosperity. To influence the students to approach the life and profession with a holistic perspective towards a value-based living in a natural way. To highlight plausible implications of holistic understanding of ethical human conduct.

UNIT I – INTRODUCTION TO VALUE EDUCATION 5

Living a fulfilling life. Value education. Skill education. Complementarity of Values and Skills. Development of a holistic perspective. Right understanding, relationship and physical facility. Understanding the happiness and prosperity.

UNIT - II: HARMONY AT MULTIPLE LEVELS 5

Human being as co-existence of the self and the human body. Understanding harmony in the self. Harmony in the family and understanding values in human-human relationships. Harmony in the society and understanding universal human order. Harmony in nature and understanding the interconnectedness, self-regulation and mutual fulfillment. Harmony in existence and understanding co-existence at various levels

UNIT - III: IMPLICATIONS OF THE RIGHT UNDERSTANDING 5

Ethical human conduct. Implications of value-based living. Right understanding of professional ethics. Humanistic education. Holistic technologies, production systems and management models. Strategies for transition towards value-based life and profession.

Total: 15 Hours

COURSE OUTCOMES:

At the end of the course learners will be able to:

CO1: Develop qualities like responsibility and the ability to handle problems with sustainable solutions.

CO2: Appraise human values and the harmony at various levels.

CO3: Perceive a better critical ability.

CO4: Develop qualities pertaining to value-based living.

CO5: Apply what they have learnt to their own self in real life settings.

TEXT BOOKS:

1. R.R. Gaur, R. Asthana, G.P. Bagaria. (2023). A Foundation Course in Human Values and Professional Ethics. 3rd Revised Edition. Excel Books, New Delhi.

REFERENCE BOOKS:

1. A. Nagaraj, Jeevan Vidya Prakashan, Amar Kantak. Jeevan Vidya(1999): Ek Parichaya.
2. Rakesh Gupta. (2008). Jeevan Vidya: An Introduction (Introductory Book to Madhyasth Darshan-Coexistentialism). English Version.
3. A. N. Tripathi. (2004). Human Values. First Edition. New Age International Publishers, New Delhi.

24SSKU11 **SOFT SKILLS -I**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

CO1: To learn and apply basic etiquette for personal and professional interactions.

CO2: To develop effective stress management techniques for maintaining mental and emotional well-being.

CO3: To enhance self-awareness for personal growth and informed decision-making.

CO4: To gain an overview of essential 21st-century skills necessary for success in a rapidly changing world.

CO5: To foster creativity and critical thinking skills for innovative problem-solving and adaptability.

Credit Hours

Unit I Introduction to Soft skills **6**

- Soft Skills vs Hard Skills
- 15 important Soft Skills
- Communication Skills, Time Management, Leadership Skills

Unit II - Overview of 21st Century Skills. **6**

- Lateral Thinking – Left Brain/Right Brain Functionality
- Problem solving skills

Unit III - Self Awareness **6**

- Human Values
- Mindfulness
- SWOT Analysis
- PDCA Approach

Unit IV - Creativity/Critical Thinking **6**

- Six Thinking Traits
- Creative writing exercises
- Open mindedness

Unit V - Personal Hygiene and Stress Management **6**

- Basic Etiquettes
- Health and Personal Grooming
- Stress-meaning and nature, Eustress, Distress
- Stress management strategies

Total: 30 Hours

COURSE OUTCOMES:

At the end of this course, the students would have learnt to

CO1	Demonstrate basic etiquette in various personal and professional settings.
CO2	Effectively manage stress using learned techniques.
CO3	Show increased self-awareness and make informed decisions.
CO4	Understand and articulate key 21st-century skills.
CO5	Apply creativity and critical thinking to solve problems innovatively.

Reference Books

1. Alex, Dr. K. (2014). Soft Skills (1st edition) S Chand & Company
2. Taylor,(2005). Grant English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd
3. Tiko, Champa& Jaya Sasikumar. Writing with a purpose. OUP New Delhi 1979
4. Nelson-Jones, R. (1992). Life skills, a handbook, Trowbridge, Wilts: Detesios Ltd.
5. Tuhovsky, Ian (2019). Communication Skills Training (2nd edition) Rupa Publication India.

SEMESTER II

24LTAM21 **தமிழ் மொழிப்பாடம்-2**

L	T	P	O	C
2	0	0	1	2

காப்பியம், பக்தி இலக்கியம், கலைகள், நாகரிகம்-பண்பாடு

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், அற இலக்கியங்கள், சிற்றிலக்கியம், சிறுகதை ஆகியவற்றை அறிமுகப்படுத்துதல், தற்காலப் பேச்சுத் தமிழ் எழுத்துத்தமிழ் ஆகியவற்றின் வளர்நிலைகளை மாணவர்களை அறியச் செய்தல், அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களின் மொழித் திறனை மேம்படுத்த அவர்களுக்குக் கடிதம் எழுதும் கலையைக் கற்றுக்கொடுத்தல், அணி இலக்கணத்தை அறியச் செய்தல் என்பன இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு 1 காப்பியங்கள் 08 மணி நேரம்

சிலப்பதிகாரம்- கனாத்திறம் உரைத்தக் காதை முழுவதும்.

மணிமேகலை- *மலர்வனம்* புக்க காதை முழுவதும்.

கம்பராமாயணம் - குகப் படலம் (தேர்ந்தெடுக்கப்பட்ட ஒன்பது பாடல்கள்)

அலகு 2: பக்தி இலக்கியம் 08 மணி நேரம்

1. மாணிக்கவாசகர் - திருவாசகம் – மூன்று பாடல்கள்
   - ✓ புல்லாகி பூடாகி (சிவபுராணம்)
   - ✓ எல்லாப் பிறப்பும் (சிவபுராணம்)
   - ✓ உற்றாரை யான் வேண்டேன் (திருப்புலம்பல்)
2. ஆண்டாள் - திருப்பாவை – மூன்று பாடல்கள் (1, 3, 4)
   - ✓ மார்கழித் திங்கள் ... (பாசுரம் 1)
   - ✓ ஓங்கி உலகளந்த... (பாசுரம் 3)
   - ✓ ஆழிமழைக் கண்ணா... (பாசுரம் 4)

3. வீரமாமுனிவர் - தேம்பாவணி – வளன் சினித்தப் படலம்
4. சீறாப்புராணம்- மானுக்கு பிணை நின்ற படலம்

அலகு 3 கலைகள் **07 மணி நேரம்**

சிற்பம் - ஓவியம் - இசை - கூத்து - ஒப்பனை - ஆடை அணிகலன்கள்.

அலகு 4 நாகரிகம், பண்பாடு **07 மணி நேரம்**

சொற்பொருள் விளக்கம் - பண்டைத் தமிழர் வாழ்வியல் - அகம் - களவு - கற்பு - குடும்பம் - விருந்தோம்பல் - உறவு முறைகள் - சடங்குகள் - நம்பிக்கைகள் - பொழுதுபோக்கு - புறம் - போர் முறைகள் - நடுகல் வழிபாடு - கொடைப்பண்பு.

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்:

1. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
2. **தவறின்றித் தமிழ் எழுதுவோம்**, மா. நன்னன், ஏகம் பதிப்பகம், 1999.
3. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
4. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
5. **புதிய தமிழ் இலக்கிய வரலாறு**, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
6. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
7. **பாடநூல் தேடலுக்கான இணையம்** - https://archive.org/

24LHIN21 **HINDI -II**

L	T	P	O	C
2	0	0	1	2

Prose, Official Letter Writing & Functional Hindi

वर्ष – सत्र II (गद्य, पत्र लेखन & व्यावहारिक हहन्दी)

COURSE OBJECTIVES:

- To inculcate the human values, importance of patriotism and hard work
- To train students in function Hindi
- To introduce the usage of Inscript Keyboard

UNIT I : मुंशी प्रेमचंद कृत 'बूढी काकी' (कहानी)
'Boodee kaki'' (Kahani) by Munshi Premchand **6**

UNIT II : जयशंकि प्रसाद कृत 'पुरस्कार' (कहानी)
'Puraskar' (Kahani) by Prasad **6**

UNIT III: हरिशंकि पिसाई कृत 'मैं निक से बोल रहा हूूँ' (व्यंग्य)
'Main Narak Se Bhol Raha Hun' (Vyangy) by Harishankar Parsayi, **6**

UNIT IV: व्यावहारिक हहन्दी 1 – 50 – तकनीहक शब्द, 50 – पदनाम व ववभागीय नाम, भाव एक भार्ा अनेक
Functional Hindi- Technical & Designation &
Department Names-50., Bhav Ek Bhasha Anek **6**

UNIT V : व्यावहारिक हहन्दी 2 – पत्र लेखन – 3 औपचारिक पत्र, इजन्स्टिट्यूट कीबोर्ष का परिचय
Functional Hindi-Letter Writing- 3 Official Letters. **6**
Inscript Keyboard knowledge

Total: 30 Hours

TEXT BOOK :

1. Ed. Subhash chandar, Boodi Kaki by Premchand, Natioonal Book Trust, 2012.
2. Jaishankar Prasad, Pratinidhi Kahaniyan, Raj Kamal Prakashan, 2015.
3. Harishankar Parsai, Pratinidhi vyangy, Rajkamal, 2007.
4. Kendriya Hindi Prashikshan Sansthan, Parangat, Bharat Sarkar, 2015.

REFERENCE BOOKS

1. Kendriya Hindi Sansthan, Banking Hindi Patyakram, 2012.

WEBLINK

1. Munshi Premchand, Manasarovar, 2007, http://gadyakosh.org
2. Jaishankar Prasad/ http://gadyakosh.org
3. Harishankar Parsai/ https://hindikahani.hindi-kavita.com
4. Prayojanmoolak Hindi:https://hi.mwikipedia.org
5. https://rajbhasha.gov.in/en/introduction

COURSE OUTCOMES:

At the end of this course Students will be able to

CO1 Know the human values

CO2 Know the importance of patriotism

CO3 Know the value of hard work in human life

CO4 Journalise the Functional Hindi

CO5 Use Inscript Keyboard

24LFRE21 **FRENCH - II**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

The lessons are being chosen:

1) To express his / her where abouts and to ask seek direction
2) To express obligation and restriction
3) To describe a place
4) To narrate and to question
5) To describe someone
6) To express his desire and to speak about the futur

UNITS:

1) C'EST OÙ **5**

L'impératif, Les articles contractés au, à la…, Le passé composé et l'accord du participe passé avec être.

2) N'OUBLIEZ PAS **5**

Le pronom relatif Qui, que, où, Les pronoms compléments indirects (me, te, lui, leur…)

3) BELLE VUE SUR LA MER -- **4**

Les adjectifs démonstratifs, Y- pronom complément.

4) QUEL BEAU VOYAGE! **4**

Les verbes pronominaux, En- pronom complément.

5) OH ! JOLI **5**

L'imparfait, L'imparfait ou le passé composé.

6) Et après ? **7**

Le futur simple, Le subjonctif présent.

Total: 30 Hours

COURSE OUTCOMES:

1) The students would be able to express his/her where about and to ask direction
2) The students would be able to express obligation and restriction
3) The students would be able to describe a place
4) The students would be able to narrate and to question
5) The students would be able to describe someone
6) The students would be able to express his desire and to speak about the future

TEXT BOOKS:

1. LATITUDES 1 (A1/A2) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau

REFERENCE BOOKS:

1. SAISON A1 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

24LENG21 **ENGLISH – II**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

- To read and understand different types of prose, poetry, and fiction.
- To think critically about texts and express ideas clearly.
- To recognize and discuss key themes and styles in literary works.
- To learn and use grammar rules correctly in writing and speaking.
- To write more effectively by applying grammar and literary techniques.

Credit Hours

Unit I -Prose 12

- If you are wrong, admit it- Dale Garnegie
- Words of Wisdom- Chetan Bhaghat

Unit II - Poetry **12**

- La Belle Dame Sans Merci - John Keats
- Ozymandias- P.B.Shelley

Unit III - Fiction **12**

- The School for Empathy - E.V. Lucas
- The Lamb to the Slaughter-Roald Dahl

Unit IV - Grammar **12**

- Types of sentences, Concord

Unit V - Grammar **12**

- Tenses, Voices

Total: 30 hours

COURSE OUTCOMES:

At the end of this course students will be able to:

CO1: Identify poetic expressions in the course of daily speech

CO2: Students will develop skills that enable them to communicate effectively in writing.

CO3: Students will develop skills that enable them to communicate effectively in writing.

CO4: Discriminate against different sensibilities in approaching life.

CO5: Strengthen the ability to solve problems, as highlighted in the selections.

REFERENCE BOOKS:

1. Dr. M. Narayana Rao and Dr. B. G. Barki Current English for Communication (Anu Chitra). June 2012.
2. General English for competitive examinations by V.Rajagopalan (Mcgraw HillEducation) - 2010.

24CBAL21 STATISTICAL STRUCTURE IN DATA USING R

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

To use R for statistical programming, computation, graphics, and modeling, write functions and use R in an efficient way and be able to develop programs and use for their research..

UNIT I INTRODUCTION 9

Introduction, How to run R, R Sessions, and Functions, Basic Math, Variables, Data Types, Vectors, Conclusion, Advanced Data Structures, Data Frames, Lists, Matrices, Arrays, Classes.

UNIT II R PROGRAMMING STRUCTURES 9

Control Statements, Loops, – Looping Over Non vector Sets,- If-Else, Arithmetic, and Boolean Operators and values, Default Values for Argument, Return Values, Deciding Whether to explicitly call return- Returning Complex Objects, Functions are Objective, No Pointers in R, Recursion, A Quicksort Implementation-Extended Extended Example: A Binary Search Tree..

UNIT III MATH AND SIMULATION IN R 9

Math Function, Extended Example Calculating Probability- Cumulative Sums and Products-Minima and Maxima- Calculus, Functions Fir Statistical Distribution, Sorting, Linear Algebra Operation on Vectors and Matrices, Extended Example: Vector cross Product-Extended Example: Finding Stationary Distribution of Markov Chains, Set Operation, Input /out put, Accessing the Keyboard and Monitor, Reading and writer Files.

UNIT IV GRAPHICS AND PROBABILITY DISTRIBUTIONS 9

Creating Graphs, The Workhorse of R Base Graphics, the plot() Function – Customizing Graphs, Saving Graphs to Files. Normal Distribution - Binomial Distribution – Poisson Distributions Other Distribution, Basic Statistics, Correlation and Covariance, T-Tests,- ANOVA.

UNIT V LINEAR MODELS AND CASE STUDY 9

Simple Linear Regression, -Multiple Regression Generalized Linear Models, Logistic Regression, – Poisson Regression- other Generalized Linear Models-Survival Analysis, Nonlinear Models, Splines- Decision- Random Forests – Case study on simple R programs.

Total: 45 Hours

TEXT BOOKS:

1. “Beginner's Guide for Data Analysis using R Programming” by Jeeva Jose, Khanna Publishing House, 2024.

2. Cornillon Pierre Andre Et AI(2015),“R for statistics”,TandF India, ISBN 9781439881453.

3. Venables, W. N., and Ripley, B. D.(2012) “Modern Applied Statistics with S” , 4th ed., Springer- Verlag, New York.

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: Understand the basics of R programming including matrix and vectors etc..

CO-2: Identify and implement appropriate control structures to solve a particular Programming problem.

CO-3: Understand the foundations of and be able to design and describe simulation studies

CO-4: Expertise in the probability distribution tools such as ANOVA.

CO-5: To expand their knowledge of R and build the Linear Models in R.

24CBAL22 DATA STRUCTURES USING PYTHON

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

This course will enable students to

1. Implement Object Oriented Programming concepts in Python.
2. Understand Lists, Dictionaries and Regular expressions in Python.
3. Understanding how searching and sorting is performed in Python.
4. Understanding how linear and non-linear data structures works.
5. To learn the fundamentals of writing Python scripts

UNIT I OOPS CONCEPTS 9

Oops Concepts- class, object, constructors, types of variables, types of methods. Inheritance: single, multiple, multi-level, hierarchical, hybrid, Polymorphism: with functions and objects, with class methods, with inheritance, Abstraction: abstract classes..

UNIT II DATA STRUCTURES 9

Data Structures – Definition, Linear Data Structures, Non-Linear Data Structures Python Specific Data Structures: List, Tuples, Set, Dictionaries, Comprehensions and its Types, Strings, slicing.

UNIT III ARRAYS AND SEARCH 9

Arrays - Overview, Types of Arrays, Operations on Arrays, Arrays vs List. Searching -Linear Search and Binary Search. Sorting - Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort

UNIT IV LINKED LIST AND STACKS 9

Linked Lists – Implementation of Singly Linked Lists, Doubly Linked Lists, Circular Linked Lists.Stacks - Overview of Stack, Implementation of Stack (List & Linked list), Applications of StackQueues:Overview of Queue, Implementation of Queue(List & Linked list), Applications of Queues, Priority Queues..

UNIT V GRAPHS AND BINARY TREE 9

Graphs -Introduction, Directed vs Undirected Graphs, Weighted vs Unweighted Graphs, Representations, Breadth First Search, Depth First Search. Trees - Overview of Trees, Tree Terminology, Binary Trees: Introduction, Implementation, Applications. Tree Traversals, Binary Search Trees: Introduction, Implementation, AVL Trees: Introduction, Rotations, Implementation.

TOTAL: 45 Hours

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: Examine Python syntax and semantics and apply Python flow control and functions.

CO-2: Create, run and manipulate Python Programs using Discipline Specific Course data structures like Lists.

CO-3: Apply Dictionaries and use Regular Expressions.

CO-4: Interpret the concepts of Object-Oriented Programming as used in Python.

CO-5: Master object-oriented programming to create an entire python project using objects and classes.

TEXT BOOKS:

1. Venkatesh, Nagaraju Y, Introduction to Python Programming, Khanna Publishing House, 2021.
2. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser(2013)-Data Structures and Algorithms in Python-Wiley.
3. Narasimha Karumanchi(2016)-Data Structure and Algorithmic Thinking with Python Data Structure and Algorithmic Puzzles-Careermonk Publications.

REFERENCE BOOKS:

1. Hands-On Data Structures and Algorithms with Python: Write complex and powerful code using the latestfeatures of Python 3.7, 2nd Edition by Dr. Basant Agarwal, Benjamin Baka.
2. Data Structures and Algorithms with Python by Kent D. Lee and Steve Hubbard.
3. Problem Solving with Algorithms and Data Structures Using Python by Bradley N Miller and David L.Ranum.
4. Discipline Specific Course Python Programming -Second Edition,R. Nageswara Rao, Dreamtech Press

24BMA002 **MATHEMATICS-II**

L	T	P	O	C
2	1	0	0	3

COURSE OBJECTIVES:

- To enable professional undergraduate students to understand the importance of
- Mathematics
- To provide basic knowledge of Discrete Mathematics and Probability.
- The main aim of this course is to help the students to read, classify and then interpret the data given to them and draw conclusions. Students understand the concepts like Logic, tautology and Probability.

UNIT 1: FUNDAMENTALS OF LOGIC [9 Hrs]

Fundamentals of logic: Introduction to logic, propositional logic, logical connectives and truth table, negation conjunction, disjunction.

UNIT 2: LOGIC AND TATUOLOGY [9 Hrs]

Conditional, bi-conditional or double implication, converse, inverse and contra positive, tautology and contradiction.

UNIT 3: PERMUTATIONS AND COMBINATIONS [9 Hrs]

Introduction -Fundamental Principle of Counting-Permutations: Problems on permutations – Combinations - Problems on combinations, Difference between permutations and combinations.

UNIT 4: BASICS OF PROBABILITY [9 Hrs]

Basics of probability: Basic Probability- Axioms of Probability- Addition and Multiplication theorem without proof-Conditional Probability-simple problems

UNIT 5: RANDOM VARIABLES [9 Hrs]

Random variable - Discrete random variables- Mean- Expectations- Variance- Independent random variables- simple problems, Continuous random variables- Mean- Expectations- Variance- simple problems.

Total : 45 Hours

COURSE OUTCOMES:

At the end of the course the students will be able to

CO1:	Apply the basic concepts of Mathematical reasoning.	**K3**
CO2:	Understand the types of logic	**K4**
CO3:	concept based on permutation and combinations.	**K3**
CO4:	Apply the concepts of Probability.	**K5**
CO5:	Understand the concepts of Random Variables.	**K3**

TEXT BOOKS:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, McGraw Hill.
2. R A Johnson And C.B.Gupta., Probability and statistics for engineers (Erwin Miller and John E.Freund), 7th edition, Pearson Education / PHI.

REFERENCE BOOKS:

1. R. P. Grimaldi, (2007)"Discrete and Combinatorial Mathematics", Pearson Education, Fifth Edition.
2. Thomas Koshy, (2005) "Discrete Mathematics with Applications", Academic Press.
3. Birhauser, Berlin,(1999),S.I.Resnick, A Probability Path.

WEB RESOURCES:

1. https://courses.umass.edu/phil110-gmh/text/c01.pdf
2. https://www.cuemath.com/data/permutations-and-combinations/
3. https://www.toppr.com/guides/maths/probability/introduction-to-probability/

24PBAL21 **R PROGRAMMING LAB**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The course is designed to provide Basic knowledge of R Programming. This Lab course will yield a complete knowledge on how to write basic programs and high level applications using concepts R programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn how to program in R and how to use R for effective data analysis. It refers to a statistical programming environment and describes generic programming language concepts as they are implemented in a high-level statistical language. The course covers practical issues in statistical computing. Students interested in using computation to enhance their problem solving abilities.

LIST OF PROGRAMS:

1. Write a R Program to Make a Simple Calculator.
2. Write a program to find Sum of Natural Numbers Using Recursion.
3. Write a program to find Fibonacci Sequence Using Recursion in R.
4. Write a program to implement R Program for the Factors of a Number.
5. Write a program to to Find the Sum of Natural Numbers.
6. Write a program to Check if a Number is Positive, Negative or Zero.
7. Write a program to Find the “Hello World” Program.
8. Write a program to Program to Add Two Vectors.
9. Write a function to Find Minimum and Maximum.
10. Write a program to Sort a Vector.
11. Write a R Program to Check for Leap Year.
12. Write a program to multiply two Matrices.

COURSE OUTCOMES:

At the end of the Course, the Student will be able to

CO1:Show the installation of R Programming Environment.

CO2: Utilize and R Data types for developing programs.

CO3: Make use of different R Data Structures.

CO4: Develop programming logic using R Packages.

CO5:Analyze the data sets using R programming capabilities.

REFERENCE BOOKS:

1. 1. “Beginner's Guide for Data Analysis using R Programming” by Jeeva Jose, Khanna Publishing House, 2024.
2. JaredP.Lander, R for Everyone: Advanced Analytics and Graphics, 2nd Edition,PearsonEducation,2018.
3. S.R.ManiSekhar and T.V.SureshKumar, Programming with R, 1st Edition,,CENGAGE,2017.

WEB RESOURCES:

1. https://www.r-project.org/
2. https://www.tutorialspoint.com/r/index.htm

24PBAL22 DATA STRUCTURES USING PYTHON

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

This course covers techniques for the data structures and algorithms analysis. The course aims to enable the student to understand in-depth data structures and to know how to apply them to resolve practical issues. Topics include: Stack, Queue, Link List, Searching, Sorting, Recursion and Trees.

LIST OF PROGRAMS:

1. Write a Python program for class, Flower, that has three instance variables of type str, int, and float that respectively represent the name of the flower, its number of petals, and its price. Your class must include a constructor method that initializes each variable to an appropriate value, and your class should include methods for setting the value of each type, and retrieving the value of each type.
2. Develop an inheritance hierarchy based upon a Polygon class that has abstract methods area( ) and perimeter( ). Implement classes Triangle, Quadrilateral, Pentagon, that extend this base class, with the obvious meanings for the area( ) and perimeter( ) methods. Write a simple program that allows users to create polygons of the various types and input their geometric dimensions, and the program then outputs their area and perimeter.
3. Write a python program to implement Method Overloading and Method Overriding.
4. Write a Python program to illustrate the following comprehensions:

   a) List Comprehensions b) Dictionary Comprehensions
   c) Set Comprehensions d) Generator Comprehensions

5. Write a Python program to generate the combinations of n distinct objects taken from the elements of a given list. Example: Original list: [1, 2, 3, 4, 5, 6, 7, 8, 9] Combinations of 2 distinct objects: [1, 2] [1, 3] [1, 4] [1, 5] .... [7, 8] [7, 9] [8, 9].
6. Write a program for Linear Search and Binary search.
7. Write a program to implement Bubble Sort and Selection Sort.
8. Write a program to implement Merge sort and Quick sort.
9. Write a program to implement Stacks and Queues.
10. Write a program to implement Singly Linked List.
11. Write a program to implement Doubly Linked list.
12. Write a program to implement Binary Search Tree.

COURSE OUTCOMES:

At the end of the course the students are able to:

CO1. Understand various data representation techniques in the real world.

CO2. Implement linear and non-linear data structures.

CO3. Analyze various algorithms based on their time and space complexity.

CO4. Develop real-time applications using suitable data structure.

CO5. Identify suitable data structure to solve various computing problems

TEXT BOOKS:

1. Data Structures and Algorithms Using Python, Rance D. Necaise, JOHN WILEY & SONS, INC.
2. ReemaThareja, Python Programming using Problem Solving Approach, First Edition,Oxford Higher Eduction.

24DVAC21 **COMMUNICATION SKILLS**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

CO1: To develop effective verbal and non-verbal communication techniques for various contexts.

CO2: To enhance listening skills for better comprehension and engagement in conversations.

CO3: To improve written communication abilities, focusing on clarity, coherence, and style.

CO4: To build confidence in public speaking through practice and constructive feedback.

CO5: To cultivate interpersonal skills for successful collaboration and professional interactions.

Credit Hours

UNIT I –INTRODUCTION TO COMMUNICATION SKILLS 6

- Fundamentals of Communications
- Elements of Communication, Types of Communication

UNIT II - PRACTICAL ENGLISH 24CBAL31 6

- Importance of the language - Word Usage and Jargon
- Tenses and the effectiveness - Basics of grammar (Noun/Verb/Adverb/Conjunction)

UNIT III - EFFECTIVE COMMUNICATION 6

- LSRW (Listening, Speaking, Reading & Writing)
- Pronunciation - Vocabulary Building
- Intonations & its importance

UNIT IV - WORKPLACE COMMUNICATION 6

- Basics of telephone etiquette
- E-Mail writing
- Presentation Skills
- Interpersonal Skills
- Business English

UNIT V - QUANTITATIVE ABILITY 6

- Verbal Ability - Verbal Analogy
- Debating Skills - Public Speaking

Total : 30 Hours

COURSE OUTCOMES:

At the end of this course students will be able to:

CO1: Enhance communication skills.
CO2: Enhance LSRW Skills (LSRW Listening, Speaking, Reading & Writing).
CO3: Express opinions at free will in social/ personal gathering.
CO4: Impact leadership qualities among participants.
CO5: Engage in conversation with others to exchange ideas.

REFERENCE BOOKS:

- Elizabeth Harren, 7 April, 2022, last updated: 16 November, 2023
- Kerry Patterson, Joseph Grenny, Ron McMillan, Al Switzler (McGraw-Hill)
- Ethan Beute and Stephen Pacinelli (Greenleaf)

24SSKU21 **SOFT SKILLS -II**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

- To develop strategies to enhance teamwork and collaboration in professional settings.
- To cultivate a positive attitude and mindset to foster constructive relationships and productivity.
- To develop leadership, decision-making and team bonding skills

Credit Hours

UNIT I - PROFESSIONAL BEHAVIOUR 6

- Team Building – Team Bonding
- Inter-Personal Relationship– Intra-Personal Relationship

UNIT II - PERSONALITY DEVELOPMENT 6

- Types of Personality
- Self-Confidence - Confidence Building
- Attitude (Positive/Negative)

UNIT III - TELEPHONE ETIQUETTE 6

- Basics of telephone etiquette
- Giving clear and concise information
- Tone & rate of speech
- Intonations & its Importance
- Whatsapp Communications

UNIT IV - DECISION MAKING 6

- Types of Decisions – planned-unplanned, individual-group, major-minor
- Types of Leadership styles – Autocratic, democratic, lesse-faire, participative, beurocratic

UNIT V - PROFESSIONAL ETIQUETTE 6

- Respect – Salutations
- Official Behaviour

Total : 30 Hours

COURSE OUTCOMES:

At the end of this course, students will be able to:

CO1: Understand the principles of effective team building and apply strategies to foster team bonding and cohesion in professional settings.

CO2: Become self-confident individuals by mastering interpersonal skills, team management skills and leadership skills.

CO3: Practice techniques for effective communication in telephone conversations.

CO4: Evaluate decision-making processes and their implications in professional settings.

CO5: Exhibit professional conduct and demeanor in various professional situations.

REFERENCE BOOKS:

1. Language Service, University at Oberta de Catalunya
2. Taylor (2005), Grant English Conversation Practice. Tata McGraw Hill Education Pvt. Ltd
3. Tiko, Champa& Jaya Sasikumar (1979), Writing with a purpose. OUP New Delhi.
4. Alex, Dr. K. (2014), Soft Skills (1st edition) S Chand & Company.
5. Nelson-Jones, R. (1992), Life skills, a handbook, Trowbridge, Wilts: Detesios Ltd.

SEMESTER III

24LTAM31 **தமிழ்மொழிப்பாடம்-3**

L	T	P	O	C
2	0	0	1	2

மொழிவரலாறு – சங்க இலக்கியம் – அற இலக்கியம் – மொழித்திறன்

பாடத்திட்ட நோக்கம்:

மாணவர்களின் இலக்கிய நாட்டத்தை மேம்படுத்துதல், தற்கால தமிழ் இலக்கிய வகைமைகளான மரபுக்கவிதை, புதுக்கவிதை, உரைநடை ஆகியவற்றை அறிமுகப்படுத்துதல், தமிழர்தம் வாழ்வியல் நெறிகளையும் பண்பாட்டுச் செழுமைகளையும் இன்றைய தலைமுறையினர் அறியச் செய்தல், மாணவர்களுக்குத் தமிழைத் தவறின்றி எழுதுவதற்குத் தேவையான பயிற்சி அளித்து அவர்களின் மொழித்திறனை மேம்படுத்துதல், செய்யுளின் நலத்தைப் பாராட்டும் முறைமையை அறியச் செய்து அதன்வழி சிந்தனை வளத்தைப் பெருகச் செய்தல் என்பனவும் மேற்கண்டவழி மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்து அவர்களுக்கு வேலைவாய்ப்பை உருவாக்குவதும் இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு- 1: தமிழ் மொழி வரலாறு 8 மணி நேரம்

மொழிக்குடும்பம் - இந்திய மொழிக்குடும்பங்கள் - இந்திய ஆட்சி மொழிகள் - திராவிட மொழிக்குடும்பங்கள் - திராவிட மொழிகளின் வகைகள் –திராவிட மொழிகளின் சிறப்புகள் - திராவிட மொழிகளின் வழங்கிடங்கள் - திராவிட மொழிகளுள் தமிழின் இடம் - தமிழ்மொழியின் சிறப்புகள் - தமிழ் பிறமொழித் தொடர்புகள்.

அலகு -2 8 மணி நேரம்

புறநானூறு- பாடல் எண்: , 182, 183, – இரண்டு பாடல்கள்.

குறுந்தொகை- பாடல் எண்: 2, 167, - இரண்டு பாடல்கள்

பரிபாடல் - முருகன். வையை - இரண்டு பாடல்கள்

அலகு-3அறஇலக்கியங்கள் 8 மணிநேரம்

திருக்குறள்- வான்சிறப்பு (அறம்), பெருமை (பொருள்), பிரிவாற்றாமை (இன்பம்),. மூன்று அதிகாரங்கள் முழுமையும்

1. நாலடியார் - இரண்டு பாடல்கள். (2, 3)
2. மூதுரை - இரண்டு பாடல்கள். (2, 8)

அலகு 4 மொழி 7 மணி நேரம்

பிழை நீக்கி எழுதுதல் - ஒற்றுப்பிழை நீக்கி எழுதுதல் - தொடர்பிழை நீக்கி எழுதுதல் - ஒற்று மிகும் இடங்கள் - ஒற்று மிகா இடங்கள் - பிற மொழிச் சொற்களை நீக்கி எழுதுதல் – பயிற்சிகள்.

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

8. **தமிழர் நாகரிகமும் பண்பாடும்**, டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
9. **தவறின்றித் தமிழ் எழுதுவோம்**, மா. நன்னன், ஏகம் பதிப்பகம், 1999.
10. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
11. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
12. **புதிய தமிழ் இலக்கிய வரலாறு**, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
13. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
14. **பாடநூல் தேடலுக்கான இணையம்** - https://archive.org/

24LHIN31 **HINDI -III**

L	T	P	O	C
2	0	0	1	2

वर्ष II–सत्र III (आहद & मध्य कालीन पद्य, हहन्दी अनुवाद & ववज्ञापन)

COURSE OBJECTIVES :

- To enrich the knowledge of students about through Thirukkural
- To enable them to learn life values through ancient and medievial poems of Hindi Literature
- To develop translation and advertisements skills in Hindi

UNIT I : ततरुवल्लुवि कृत ततरुक्कुिल – 5, अमीि खुसिो कृत पहेतलयाूँ - 5
'Thirukkural'- 5 Kural-by Thiruvalluvar & Amir Khusro-5 Paheliyan, **6 hours**

UNIT II: कबीि के दोहे – 5
'Kabir Ke Dohe',-5, **6 hours**

UNIT III: तुलसीदास के पद – 2 & सूिदास के पद – 2
'Tulsidas Ke Pad'-2 & SurdasKe Pad-2 **6 hours**

UNIT IV: व्यावहारिक हहन्दी 1 – अनुवाद का परिचय (अिष, परिभार्ा व प्रकाि)
& 5 - अभ्यास अनुछेद

Functional Hindi 1 - Introduction to Translation
(Meaning, Definition &Types) & Exercise passages – 5 **6hours**

UNIT V: व्यावहारिक हहन्दी 2 - ववज्ञापन का परिचय (अिष, परिभार्ा व प्रकाि) & 4 – नमूना ववज्ञापन

Advertisement –Introduction.(Meaning, Definition &
Types) & Model Advertisement **6 hours**

Total:30hrs

Text Book:

Thirukkural, Bharatiya Gyanpeet, 2014.
Amir Khusro Ki Paheliyan, Prakrit Bharati Acadamy, 2006. Amar Prakash, Kahir Dohavali, Mahamaya Publication, 2020. Tulsidas, Dohavali, Geeta Press, Gorakhpur.
Vagdev, Surdas Ke Padavali, Prabhat Prakashan, 2011.

Reference book:

Rachana Vyas, Amir Khusro Ki Paheliyan, Lokoday Prakashan Pvt. Ltd., 2022. Kendriya Hindi Sansthan, Banking Hindi Patyakram, 2012.
Kendriya Hindi Prashikshan Sansthan, Parangat, Bharat Sarkar, 2015.

Weblinks:

Thirukkural hindi translation by Venkata Krishnan
Ameer khusro ki paheliyan - https://www.hktbharat.com
Kabir ke Dohe - Kabir granthavali , Surhranthavali-http://kavitakosh.org
Tulsidas ke pad - http://kavitakosh.org

COURSE OUTCOMES:

At the end of this course Students will

CO1 Know the valuable messages in social responsibilities
CO2 & CO3 Know the life values
CO4 Gain knowledge of translation in functional Hindi
CO5 Gain knowledge about advertisement skills in Hindi

24LFRE31 **FRENCH -III**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES :

The lessons are being chosen:

1) to express certainty and uncertainty
2) to express one's desire to do something
3) to express one's willingness and unwillingness to do something
4) to express one's joy and sorrow
5) to express one's fear, concern and astonishment
6) to express one's anger and regrets

UNITS

1) Très drôle le passe recent, passe compose et l'imparfait 6 hours.

2) Vous avez dit culture l'interrogation et le subjonctif. 5 hours

3) Envie d'ailleurs les verbes aller/ retourner, venir/ revenir, ne...pas...ni, ne…ni…ni. 4 hours

4) Voila l'été le comparatif, superlatif et l'accord du participe passe avec avoir. 7 hours

5) Terre inconnue le plus-que parfait 3 hours

6) Vivement dimanche le pronom en et y, le subjonctif et les conjugaisons irrégulières. 5 hours

Total: 30hrs

COURSE OUTCOMES:

At the end of this course Students will be able to

CO1 The students would be able to express certainty and uncertainty
CO2 The students would be able to express one's desire to do something
CO3 The students would be able to express one's willingness and unwillingness to do Something.
CO4 The students would be able to express one's joy and sorrow
CO5 The students would be able to express one's fear, concern and astonishment
CO6 The students would be able to express one's anger and regrets

TEXT BOOKS:

1. LATITUDES 1 (A2/B1) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau

REFERENCE BOOKS:

1. SAISON A2 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu, Catherine Houssa, Émilie Kasazian

24LENG31 **ENGLISH III**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

CO1: To enhance reading comprehension skills for understanding complex texts in competitiveexams.

CO2: To develop vocabulary and language proficiency to tackle verbal reasoning sectionseffectively.

CO3: To improve grammar and writing skills for precise and coherent expression in writtenexams.

CO4: To practice critical thinking and analytical reasoning abilities required for exam questions.

CO5: To familiarise students with exam formats, strategies, and time management techniquesfor success in competitive exams.

Credit Hours

Unit I -Vocabulary 12

Homophones, Homonyms, Note-taking, Paraphrasing

Unit II - Comprehension 12

Reading comprehension, Critical reading, Cloze test

Unit III - Grammar 12

Idioms and Phrases, Question tag, Verbal phrases, Prepositions

Unit IV - Grammar 12

Voices, Direct & Indirect speech, Simple, Compound, Complex

Unit V - Academic Writing 12

Precis writing, Report writing **Total** **60 hours**

COURSE OUTCOMES:

At the end of this course, the students would have learnt to

CO-1	Students imbibe the rules of language unconsciously and tune in to deduce language structure and usage.
CO2	Students develop their abilities as critical readers and writers.
CO3	Students decipher the mechanism of language and use it for success in competitive examinations and job-related speaking and writing tasks.

REFERENCE BOOKS:

- General English for competitive examinations by V. Rajagopalan (McGraw Hill Education) -2010.
- Technical Communication – Principles and Practices By Meenakshi Raman & Sangeeta K. Sharma, Oxford Univ. Press, 2016, New Delhi.

24EVS031 ENVIRONMENTAL STUDIES

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVE:

- **To inculcate the importance of environmental pollution, preservation of nature and environmental management for human welfare.**

UNIT-I HUMAN COMMUNITIES AND THE ENVIRONMENT 9

The man-environment interaction: Humans as hunter-gatherers; Mastery of fire; Origin of agriculture; Emergence of city-states; Great ancient civilizations and the environment, Indic Knowledge and Culture of sustainability; Middle Ages and Renaissance; Industrial revolution and its impact on the environment; Environmental Ethics and emergence of environmentalism: Anthropocentric and eco-centric perspectives (Major thinkers); The Club of Rome- Limits to Growth; UN Conference on Human Environment 1972; World Commission on Environment and Development and the concept of sustainable development; Rio Summit and subsequent international efforts.

UNIT II NATURAL RESOURCES AND SUSTAINABLE DEVELOPMENT 9

Renewable and non-renewable resources - Natural resources and associated problems. a) Forest resources b) Water resources c) Mineral resources d) Food resources e) Energy resources: f) Land resources; Role of an individual in conservation of natural resources- Equitable use of resources for sustainable lifestyles. Introduction to sustainable development: Sustainable Development Goals (SDGs)- targets and indicators, challenges and strategies for SDGs.

UNIT-III ECOSYSTEM AND BIODIVERSITY 9

Ecosystems and ecosystem services: Major ecosystem types in India and their basic characteristics-forests, wetlands, grasslands, agriculture, coastal and marine; Ecosystem services-classification and their significance. Biodiversity and its distribution: Biodiversity as a natural resource; Levels and types of biodiversity; Biodiversity in India and the world; Biodiversity hotspots; Species and ecosystem threat categories. Threats to biodiversity and ecosystems: Land use and land cover change; Commercial exploitation of species; Invasive species; Fire, disasters and climate change. Major conservation policies: in-situ and ex-situ conservation approaches;

UNIT-IV ENVIRONMENTAL POLLUTION AND HEALTH 9

Understanding pollution: Production processes and generation of wastes; Assimilative capacity of the environment; Definition of pollution; Point sources and non-point sources of pollution; Causes, effects and control measures of a) Air pollution b) Water pollution c) Soil pollution d) Marine pollution e) Noise pollution f) Thermal pollution g) Nuclear hazards. Solid waste Management. Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies.

UNIT-V ENVIRONMENTAL TREATIES AND LEGISLATION 9

Major International Environmental Agreements: Convention on Biological Diversity (CBD); Cartagena Protocol on Biosafety; Nagoya Protocol on Access and Benefit-sharing; Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES); Ramsar Convention on Wetlands of International Importance; United Nations Convention to Combat Desertification (UNCCD); Vienna Convention for the Protection of the Ozone Layer; Environmental laws: Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act - Issues involved in enforcement of environmental legislation. Public awareness.

Total: 45 hours

COURSE OUTCOME:

At the end of this course, learners will be able to:

CO1: Gain insights into the international efforts to safeguard the Earth's environment and Resources.

CO2: Understand the concept of natural resources; identify types of natural resources, their distribution and use with special reference to India.

CO3: Understand the concepts of ecosystems, biodiversity and conservation.

CO4: Sensitize themselves to adverse health impacts of pollution.

CO5: Understand the sectoral effects on the local, regional, and global environmental issues

Text Books:

1. Fisher, Michael H. (2018) An Environmental History of India- From Earliest Times to the TwentyFirst Century, Cambridge University Press.

2. William P. Cunningham and Mary Ann Cunningham, Environmental Science: A Global Concern

14th Edition, 2021.

3. Sinha, N. (2020) Wild and Wilful. Harper Collins, India.

4. Climate change: Science and politics (2021), Centre science and Environment, New Delhi,

Reference Books

1. Daniel B. Botkin and Edward A. Keller, Environmental Science: Earth as a Living Planet, 9th

Edition, New Age International 2022.

2. Jadhav H and Bhosale VM, Environmental Protection and Laws. Himalaya Publishing House, Delhi 284pgs 2023.

Web link and we source:

1. https://easyengineering.net/ge6351-environmental-science-and/

2. https://learnengineering.in/ge8291-environmental-science-and-engineering

3. https://cpcb.nic.in/ standards/

24CBAL31 OBJECT ORIENTED PROGRAMMING LANGUAGES

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES: The course provides insight knowledge about object oriented programming concepts and programming language in C++ and JAVA.

UNIT I OBJECT ORIENTED PROGRAMMING AND BASICS OF C++ 12

Principles Of Object Oriented Programming – Beginning With C++ - Applications Of C++ - Tokens –Keywords- Expressions – Data Types – Storage Classes – Operators –Manipulators- Type Cast Operator – Arrays –Strings-Control Structures – Operator Overloading -Functions In C++ - Function Prototyping – Call by Reference – Inline Functions –Recursion – Function Overloading – Friend And Virtual Function.

UNIT II CLASSES AND OBJECTS AND OPERATOR OVERLOADING 12

Introduction – Classes And Objects – Constructors –Parameterized Constructors – Copy Constructor – Dynamic Constructors – Destructors – Introduction To Operator Overloading – Overloading Unary Operator – Overloading Binary Operator – Type Conversions.

UNIT III INHERITANCE AND POLYMORPHISM 12

Introduction- Defining Derived Classes - Inheritance – Types Of Inheritance – Abstract Classes - Introduction to Virtual Functions - Pure Virtual Function-Polymorphism – Exception Handling.

UNIT IV JAVA INTRODUCTION, ARRAYS AND STRINGS 12

Java Evolution - Overview Of Java Language – Constants – Variables – Data Types – Operators And Expressions – Class, Objects And Methods – Arrays, Strings And Vectors.

UNIT V PACKAGES AND MULTITHREADING 12

Introduction – Java API Packages – Creating Packages – Accessing a Package – Adding a Class To a package – Multithreading – Creating Threads - Life Cycle of a Thread – Thread Exceptions –Inter –Thread Communication.

Total: 60 Hours

REFERENCE BOOKS:

1. Balaguruswamy E. (2023). Programming with JAVA: A Primer. 7th edition. India: McGraw Hill Education

2. Schildt, H. (2022). Java: The Complete Reference. 12th edition.McGraw-Hill Education.

Paul Deitel and Harvey Deitel, "C++ How to Program", Nineth Edition, Prentice Hall, 2015.

3. Herbert Schildt, "Java The complete reference", Eighth Edition, McGraw Hill Professional, 2011.

4. Balagurusamy E., "Object oriented programming using C++ and JAVA", First Edition, Tata McGraw–Hill Education 2012.

COURSE OUTCOMES:

CO-1: Develop an in-depth understanding of functional, logic, and object-oriented programming paradigms

CO-2: An understanding of the concepts of inheritance and polymorphism and ability to overload operators in C++.

CO-3: An understanding of the difference between function overloading and function overriding

CO-4: An ability to incorporate exception handling in object-oriented programs

CO-5: An ability to use template classes and the STL library in C++

CO-6: An ability to write object-oriented programs of moderate complexity in C++

CO-7: Learn syntax, features of, and how to utilize the Standard Template Library. Learn other features of the C++ language including templates, exceptions, forms of casting, conversions, covering all features of the language.

CO-8: An ability to write object-oriented programs of moderate complexity in Java.

CO-9: An understanding the concepts of class, objects and methods in java and strings.

CO-10: An ability to create packages, accessing a package and adding a class to package and threads.

24CBAL32 **ADVANCED DATABASE SYSTEM**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

This course aims to give students in depth information about system implementation techniques, data storage, representing data elements, database system architecture, the system catalog, query processing and optimization, transaction processing concepts, concurrency control techniques, distributed databases and client server architecture, advanced database concepts, and emerging technologies and applications.

UNIT I DATABASE SYSTEM 12

Introduction to Database System Database and Users: Introduction (Basic Concepts: Data, Database, Database systems, Database Management Systems), Characteristics of Database Approach, Actors on Scene, Workers behind the Scene, Advantages of using the DBMS approach Database System Concepts and Architecture: Data Models, Schemas, Instances, the three schema architectures and data independence, Database Languages and interfaces, Database System environment, Centralized and client / Server Architecture for DBMS, Classifications of Database Management Systems.

UNIT II ER DIAGRAMS 12

Entity Relationship Diagram Using high level conceptual data models for database design (Design Phases of database design), Entity types, Entity Sets, Attributes and keys, Relationship Types, Relationship sets, Roles and structural constraints, Weak entity Types, Refining the ER diagram for company Database, Entity Relationship Diagram Naming conventions Design issues, Example of other Notation: UML class diagram, Relationship types of degree higher than 2 Subclasses, Super Classes, Inheritance Specialization and Generalization Relational Database design by ER and EER

UNIT III RELATIONAL DATABASES 12

Informal Design Guidelines for Relational Schema, Functional Dependencies, Normal Forms based on Primary keys, General definitions of 1NF, 2NF and 3NF, Boyce-Codd Normal Forms (BCNF), Multi-valued Dependency and Fourth Normal Form. Relational Model concepts: Relational Model concepts, Relational Model constraints and Relational Database Schemas

UNIT IV SQL & PL/SQL COMMANDS 12

SQL Concepts :Basics of SQL, DDL,DML,DCL, structure – creation, alteration, defining constraints – Primary key, foreign key, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions –numeric, date, string functions, set operations, sub-queries, correlated sub-queries, Use of group by, having, order by, join and its types, Exist, Any, All , view and its types. transaction control commands – Commit, Rollback, Savepoint. PL/SQL Concepts PL/SQL Block, Stored Procedures, Functions and Packages (Except Cursor Management)

UNIT V MySQL OPERATIONS 12

MySQL -connecting to and disconnecting from the server-Creating and selecting a Database-Creating a Table-Loading data into a table-Retrieving information from a table-Using MySQL in Batch Mode Grouping-Joins-Arithmetic and string functions-Advanced Functions-SET Operators-Creating Complex Queries-DML Operations-Insert, Update & Delete-TSQL

Total : 60 Hours

REFERENCE BOOKS :

1. Raghu Ramakrishnan, Johannes Gehrke, “Database Management Systems”, third edition, McGraw – Hill, 2018
2. Benjamin Rosenzweig, Elena Rakhimov, “Oracle PL/SQL by Example”, fifth edition, Prentice Hall, 2015
3. DateC.J,“AnIntroductiontoDatabaseSystems”,AddisonWesleyLongman,8thEdition,2003.
4. Catell, R.G.G., Barry, D.K., Berler, M., et al, “The Object Data Standard: ODMG 3.0”,Morgan Kaufmann,2000.
5. Silberschatz A., Korth H., and Sudarshan S, “Database System Concepts”, McGraw- Hill,6th Edition,2010.
6. harlesF.Goldfarb,PaulPrescod,“TheXMLHandbook,PrenticeHall”,5thEdition, 2004
7. Thomas M. Connolly, Carolyn Begg, “Database Systems: Practical approach to Design, Implementation and Management”, Pearson Education Limited, 6th edition,2012.

WEB RESOURCES:

1. https://vpmpce.wordpress.com/dbms-3330703/-sTUDY material
2. https://downloads.mysql.com/docs/mysql-tutorial-excerpt-5.7-en.pdf

COURSE OUTCOMES:

CO-1: Ability to define a problem at the view level & ability to understand the physical structure of the database to handle data.

CO-2: Ability to normalize the database & understand the internal data structure.

CO-3: Students would clearly understand the transaction system & could extract data efficiently.

CO-4: Make backup copies and recover the state of the DB after a system failure.

CO-5: Define links between databases on different nodes and work with the multiple databases

24PBAL31 OBJECT ORIENTED PROGRAMMING LANGUAGES LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The purpose of this course is to introduce to students to the field of programming using C++ and Java. Be able to use the Java SDK environment to create, debug and run simple Java programs.

1. Design C++ classes with static members, methods with default arguments.
2. Implement complex number class with necessary operator overloading and type conversions such as integer to complex, double to complex, complex to double etc using C++.
3. Manage bank account using inheritance concept using C++
4. Design stack and queue classes with necessary exception handling using C++.
5. Develop with suitable hierarchy, classes for Point, Shape, Rectangle, Square, Circle, Ellipse, Triangle, Polygon, etc
6. Programs illustrating various data types in java.
7. Programs to implement method overloading in java.
8. Programs illustrating the implementation of various forms of inheritance (single, hierarchical, multilevel).
9. Programs to implement polymorphism and method overriding in java.
10. Programs implementing exception handling.
11. Programs to illustrate interfaces in java.
12. Programs to create package in java

24PBAL32 **ADVANCED DATA BASE SYSTEM LAB**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The student learns to work in PL/SQL Cursors, Stored Procedures, Collections, Transactions and Error Handling. The students will also able to implement Timestamp ordering Protocol and Deadlock Avoidance concepts.

1. Learning basic DDL, DML, DCL and TCL commands
2. Working with dualtable.
3. PL/SQL-Data types, control structures.
4. Creating Stored Procedures with PL/SQL.
5. Error handling in PL/SQL.
6. Cursor Management in PL/SQL.
7. Writing Programs on Packages &Triggers.
8. PL/SQL – Collections
9. PL/SQL - Transactions
10. Embedding PL/SQL in high level language.
11. Implement Timestamp Ordering Protocol in PL/SQL.
12. Implement Deadlock Avoidance in PL/SQL.

24SSKU31 **SOFT SKILLS III**

L	T	P	O	C
2	0	0	2	2

COURSE OBJECTIVES:

- To enable students to develop their soft skills and Body Language
- To enhance students Reading, Writing, Listening and Speaking skills
- To develop their self-confidence to excel at Interviews

UNIT I: SKILL ENHANCEMENT 06

Time Management – Planning and Organisation – Scheduling – Prioritization – Delegation – Task Management – Stress Management – Overcoming anxiety – Confidence Building – Body Language

UNIT II: RESUME / COVER LETTER WRITING 06

SWOT Analysis – Details and Resume Writing – Resume Examples – Building Resume using SWOT – Writing Resume – Writing Cover Letter – Resume Correction – Resume Feedback

UNIT III: INTERVIEW SKILLS 06

Interview Do's and Don'ts – First Impression – Grooming – Body Language – Frequently asked questions – Useful Language – Mock Interview

UNIT IV: QUANTITATIVE ABILITY 06

Permutation & Combinations – Probability – Profit & Loss – Ratio Proportions & Variations – Cubes – Venn Diagrams – Logical Reasoning – Critical Reasoning

UNIT V: REVISIONARY MODULES 06

Group Discussions – HR Process – Interview Process – Mock Group Discussions

Total 30 Hours

TEXT BOOKS :

- Meena. K and V.Ayothi (2013) A Book on Development of Soft Skills (Soft Skills: A Road Mapto Success) P.R. Publishers & Distributors.
- Soft Skills – Know Yourself & Know the World, S.Chand & Company LTD, Ram Nagar, New Delhi
- Prasad, H. M. How to Prepare for Group Discussion and Interview. New Delhi: Tata McGraw-Hill Publishing Company Limited, 2001.
- Pease, Allan. Body Language. Delhi: Sudha Publications, 1998.

WEB RESOURCES:

- https://www.skillsyouneed.com/ips/communication-skills.html
- https://www.businessnewsdaily.com/5836-top-interviewing-skills.html
- https://gdpi.hitbullseye.com/Group-Discussion.php

COURSE OUTCOMES:

CO1 To develop participants social and professional skills

CO2 To help participants manage time effectively

CO3 To build a strong resume to suit corporate requirements

CO4 To face interviews confidently

CO5 To enhance their aptitude abilities

SEMESTER IV

24LTAM41 **தமிழ்மொழிப்பாடம்-4**

L	T	P	O	C
2	0	0	1	2

மரபுக்கவிதை,புதுக்கவிதை,ஊடகத்தமிழ்,கணினித்தமிழ்

பாடத்திட்ட நோக்கம்:

தமிழர்தம் தொன்மைச் சிறப்பையும், பண்பாட்டுச் செழுமையையும் உலகிற்குப் பறைசாற்றும் சங்க இலக்கியங்களான எட்டுத்தொகை, பத்துப்பாட்டு நூல்களை அறியச் செய்தல், அதன்வழி பண்டைத் தமிழரின் விழுமியங்களை எடுத்துரைத்தல், இலக்கால இலக்கிய வகைமையான நாடக இலக்கியத்தை அறியச் செய்தல், ஊடகங்களில் தமிழின் பயன்பாடு, கணினியில் தமிழ்ப்பயன்பாடு என்பனவற்றை மாணவர்களுக்கு கற்றுக்கொடுத்தல், மாணவர்களை ஆளுமை மிக்கவர்களாக உருவாக்கி, போட்டித்தேர்வுகளுக்குத் தயார் செய்தல் என்பன இந்தப் பாடத்திட்டத்தின் முக்கிய நோக்கமாகும்.

அலகு 1: மரபுக்கவிதை 8 மணி நேரம்

1. பாரதியார் - பாரத தேசம் என்னும் தலைப்பில் ஆறு பாடல்கள். (பாடல் எண்கள் 1, 6, 7, 9, 12, 13)
2. பாரதிதாசன் – தமிழுக்கும் அமுதென்று பேர் என்னும் தலைப்பிலான கவிதை.
3. தேசிக விநாயகம் பிள்ளை - உடல் நலம் பேணல் என்னும் தலைப்பிலான கவிதை
4. முடியரசன் - காவியப் பாவை – "புண்படுமா" என்னும் கவிதை.

அலகு 2: புதுக்கவிதை 8 மணி நேரம்

1. நா. காமராசன் - *கறுப்பு மலர்கள்* தொகுப்பில் *காகிதப்பூக்கள்* என்னும் தலைப்பிலான கவிதை.
2. அப்துல் ரகுமான் - *ஆலாபனை* தொகுப்பில் *போட்டி* என்னும் தலைப்பிலான கவிதை
3. ஆண்டாள் பிரியதர்ஷினி – *முத்தங்கள் தீர்ந்துவிட்டன* தொகுப்பில் *'இங்கே வரும் போது'* என்னும் தலைப்பிலான கவிதை

அலகு 3 :ஊடகத் தமிழ்

இதழியல் - ஊடக வகைகள் - தலையங்கம்- நிகழ்ச்சியை செய்தியாக மாற்றுதல்- கருத்துப் பரிமாற்றம் நாடகம், திரைப்படம்,- வானொலி- தொலைக்காட்சி- மொழி நடையின் தன்மை –

அலகு 4 : கணினித் தமிழ்

கணினித் தமிழ்: கணினித் தமிழின் அடிப்படையும் பயன்பாடும் - கணிப்பொறியின் வரலாறும் வளர்ச்சியும், கணினியும் தமிழும்,

விசைப்பலகை (Keyboard) - எழுத்துருக்கள் (Fonts) - தமிழைத் தட்டச்சு செய்ய உதவும் மென்பொருள்கள், தமிழைத் தட்டச்சு செய்யும் முறைகள் - தமிழ்த் தட்டச்சுப் பயிற்சி - இணையமும் தமிழ்ப் பயன்பாடும் - தேடுபொறி (Search) - வலைப்பூ (Blog), மின்னூலகம் (Online e-Library), - மின்னகராதி(e-Dictionary), - மின் செய்தித்தாள் - e-Paper, - இணையவழித் தமிழ்க் கற்றலும்-கற்பித்தலும் - மின்வழிக் கற்றல் - e Learning.

மொத்தம்: 30 மணி நேரம்

பார்வை நூல்கள்

1. **தமிழர் நாகரிகமும் பண்பாடும்,** டாக்டர் அ. தட்சிணாமூர்த்தி, ஐந்திணைப் பதிப்பகம், 2001.
2. **தவறின்றித் தமிழ் எழுதுவோம்**, மா. நன்னன், ஏகம் பதிப்பகம், 1999.
3. **தவறின்றித் தமிழ் எழுத** - மருதூர் அரங்கராசன், ஐந்திணைப் பதிப்பகம், 2003.
4. **தமிழ் இலக்கிய வரலாறு**, வரதராசன், மு., புது தில்லி : சாகித்திய அக்காதெமி, 2002.
5. **புதிய தமிழ் இலக்கிய வரலாறு**, நீல. பத்மநாபன், சிற்பி பாலசுப்ரமணியம், சாகித்திய அகாடெமி, 2007.
6. **செம்மொழி தமிழின் சிறப்பியல்புகள்** - முனைவர் மறைமலை இலக்குவனார்; https://www.youtube.com/watch?v=HHZnmJb4jSY
7. **பாடநூல் தேடலுக்கான இணையம் -** https://archive.org/

24LHIN41 **HINDI-IV**

वर्ष II – सत्र IV (नई कविता, िाजभार्ा & मंच संचालन)

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES

- To develop interest in various style of Modern and Contemporary Hindi Poetry
- To enable them to know about the Official Language Hindi
- To enable them to converse in Hindi

UNIT I : भाितेन्दु हरिश्चंद्र की मुखरियाूँ – 4
Bharatendu Harishchandra ki Mukhariyan-4. 6hrs.

UNIT II : सुतमत्रानंदन पंत कृत 'भाितमाता ग्रामवासी' (कविता)
Bharatmata Gramavasini by Sumitranandan Pant. 6hrs

UNIT III: ज्ञानेन्द्रपतत कृत 'बीज व्यिा' (कविता)
Beej Vyatha by Gyanendrapati 6hrs.

UNIT IV: िाजभार्ा हहन्दी का परिचय, अनुछेद से प्रश्न तनमाषण
Rajbhasha Ek Samanya Parichay, framing questions in gadhyansh 6hrs.

UNIT V : मंच संचालन (साक्षात्काि) का परिचय
Manch Sanchalan Evam Saakshaatkaar - An introduction 6hrs.

Total:30hrs

COURSE OUTCOMES:

At the end of this course Students will

CO1 CO2 & CO3 Familiar with the different poetic expressions of Modern & Contemporary Hindi Poetry

CO4 Know the importance of official language Hindi CO5
Become conversant in Hindi

TextBook:

- Bhartendu Harishchandra, Ed.Ramji Yadav, Bharatendu Sanchayan, Bharatiya Pustak Parishad, 2011.
- Sumitranandan Pant, Gramya, Lokbharti Prakashan, 2017.
- Gyanedrapati, Gyanendrapati, Prabhakar Publication, 2022.
- Bhatia Kailashchandra, Rajbhasha Hindi, Vani Prakashan,2018.

Reference Book:

- Mahesh Sharma, Bhashan Kala, Prabhat Prakashan, 2019.
- Raghavan T.E.S. Rajbhasha Hindi Amarkosh

Weblinks:

- -http://kavitakosh.org Bharatendu Harishchandra
- https://www.amarujala.com/kavya/kavya-charcha/bhartendu-harishchandra-poems- naye-jamane-ki-mukariyan?page=5
- Sumitranandan Pant- http://kavitakosh.org
- https://www.hindiadda.com/beej-vyatha-gyanendrapati/ Hindi
- Rajbhasha: https://navodaya.gov.in

24LFRE41 **FRENCH IV**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES :

The lessons are being chosen:

- to propose to do something and respond to a proposal
- to respond to a request
- to accuse, to blame
- to complain, to protest
- to express cause and consequence 6) to express opinion about facts

Units:

UNIT I :

Entreprendre

Les pronoms démonstratifs, les pronoms interrogatifs. 6 hours

UNIT II :

Vous avez gagne

Les pronoms en et y, les formation des adverbes en-ment 5 hours

UNIT III :

Ne quittez pas

La mise en relief (c'est ..... qui, c'est …….que). 4 hours

UNIT IV :

Argent trop cher

l'opposition- toujours/ne…jamais. 4 hours

UNIT V :

Le pétrole fou

la cause et la consequence. 5 hours

Parlez-moi d'amour

le conditionnel present, le gérondif. 6 hours

Total no. of hours: 30 hours

COURSE OUTCOMES :

CO1 : The students would be able to propose to do something and respond to a proposal
CO2 : The students would be able to respond to a request
CO3 : The students would be able to accuse, to blame
CO4 : The students would be able to complain, to protest
CO5 : The students would be able to express cause and consequence 12.
The students would be able to express opinion about facts

REFERENCE BOOKS:

1. Prescribed book: LATITUDES 1 (A2/B1) MÉTHODE DE FRANÇAIS - Régine Mérieux and Yves Loiseau
2. REFERENCE BOOKS book: SAISON A2 - MÉTHODE DE FRANÇAIS - Marie-Noëlle Cocton, Élodie Heu,

24LENG41 **ENGLISH IV**

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

CO1: To develop effective oral communication skills for professional contexts such aspresentations and meetings.

CO2: To enhance written communication abilities, including business correspondence andreports.

CO3: To improve professional vocabulary and language usage appropriate for various fieldsand industries.

CO4: To practice critical thinking and problem-solving skills through case studies anddiscussions.

CO5: To prepare students for job interviews, networking, and career advancement throughprofessional English proficiency.

Credit Hours

Unit I - Technical Writing **6**

- Spelling, Punctuation, Spot the error
- Hints development,
- Cliches, Redundancies
- Modifiers.

Unit II - Creative Writing **6**

- Instructions and recommendations
- Interpretation of graphs, charts and pictures

Unit III - Professional Writing **6**

- Agenda
- Minutes of the meeting
- Review Circular

Unit IV - Organization of Writing **6**

- Paragraph Writing
- Essay writing
- Proposal Writing

Unit V - Speech Writing **6**

- Welcome address
- Vote of thanks
- Oral presentation
- E-mail and SMS text

Total Hours **30**

COURSE OUTCOMES:

At the end of this course, students would have learnt to,

CO1 demonstrate proficiency in language use.

CO2 master the nuances of Spoken and Written Communication skills in professional contexts.

CO3 develop confidence and clarity in Professional English usage.

REFERENCE BOOKS:

- Professional English by Meenakshi Raman and Sangeetha Sharma -2018.
- General English for all competitive examinations by S.C. Gupta -2016.

24CBAL41 MACHINE LEARNING AND ITS APPLICATIONS

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

This course provides basics for understanding underlying machine learning theory and to formulate machine learning problems corresponding to different applications.

UNIT I INTRODUCTION 15

Learning Problems – Perspectives and Issues – Concept Learning – Version Spaces and Candidate Eliminations – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

UNIT II NEURAL NETWORKS AND GENETIC ALGORITHMS 15

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evalution and Learning.

UNIT III BAYESIAN AND COMPUTATIONAL LEARNING 15

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probability Learning – Sample Complexity – Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

UNIT IV INSTANTBASED LEARNING 15

K- Nearest Neighbour Learning – Locally weighted Regression – Radial Bases Functions – Case Based Learning.

UNIT V ADVANCED LEARNING 15

Learning Sets of Rules – Sequential Covering Algorithm – Learning Rule Set – First Order Rules – Sets of First Order Rules – Induction on Inverted Deduction – Inverting Resolution – Case Study: Analytical Learning – Perfect Domain Theories – Explanation Base Learning – FOCL Algorithm – Reinforcement Learning – Task .

Total: 75 hours

TEXT BOOKS:

1. N. Bhaskar, Vasundhara, Machine Learning, Khanna Publishing House, 2024.
2. Mitchell , "Machine learning" , Tata Mcgraw Hill Education Private Limited ,ISBN 9781259096952,2013
3. Stephen Marsland, Taylor & Francis, " Machine Learning: An Algorithmic Perspective", 2nd Edition. Mit Press,2012.

REFERENCE BOOKS:

1. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing, 2024
2. Company, 2024.Understanding Machine Learning. Shai Shalev-Shwartz and Shai Ben-David. Cambridge University Press. 2017.
3. The Elements of Statistical Learning. Trevor Hastie, Robert Tibshirani and Jerome Friedman.Second Edition. 2009.
4. Foundations of Data Science. Avrim Blum, John Hopcroft and Ravindran Kannan. January 2017.
5. Pattern Recognition and Machine Learning. Christopher Bishop.Springer.2006.[CB-2006].

COURSE OUTCOMES:

CO-1: Develop an appreciation for what is involved in learning models from data.

CO-2: Understand how to evaluate models generated from data.

CO-3: Understanding limitations of various machine learning algorithms.

CO-4: Generate Report on the expected accuracy that can be achieved by applying the models.

CO-5: Able to implement deep learning model for language, vision, speech, decision making.

24CBAL42 NATURAL LANGUAGE PROCESSING

3	0	0	2	3

COURSE OBJECTIVES:

The Course provides the models, methods, and algorithms of statistical Natural Language Processing (NLP) for common NLP tasks, such as speech recognition, machine translation, spam filtering, text classification and spell checking.

UNIT I OVERVIEW AND LANGUAGE MODELING 12

Overview - Origins and challenges of NLP-Language and Grammar-Processing Indian Languages - NLP Applications-Information Retrieval - Language Modeling: Various Grammar - based Language Models - Statistical Language Model.

UNIT II WORD LEVEL AND SYNTACTICANALYSIS 12

WordLevelAnalysis-RegularExpressions-Finite-StateAutomata-MorphologicalParsing - Spelling Error Detection and correction - Words and Word classes - Part-of Speech Tagging. Syntactic Analysis–Context-free Grammar-Constituency-Parsing- Probabilistic Parsing.

UNIT III SEMANTIC ANALYSIS AND DISCOURSE PROCESSING 12

Semantic Analysis - Meaning Representation - Lexical Semantics – Ambiguity - Word Sense Disambiguation - Discourse Processing – cohesion - Reference Resolution - Discourse Coherence and Structure.

UNIT IV NATURAL LANGUAGEGENERATION AND MACHINE TRANSLATION 12

Natural Language Generation - Architecture of NLG Systems - Generation Tasks and Representations - Application of NLG. Machine Translation - Problems in Machine Translation - Characteristics of Indian Languages - Machine Translation Approaches - Translation involving Indian Languages.

UNIT V CASE STUDY AND INFORMATION RETRIEVAL 12

Information Retrieval - Design features of Information Retrieval Systems – Classical - Non-classical - Alternative Models of Information Retrieval – case study on valuation Lexical Resources, World Net – Frame Net - Stemmers - POS Tagger – Research Corpora.

Total: 60 Hours

TEXT BOOKS:

1. Tanveer Siddiqui, U.S. Tiwary, "Natural Language Processing and Information Retrieval", Oxford University Press,2012.

REFERENCE BOOKS:

1. Daniel Jurafsky and James H Martin, "Speech and Language Processing: An introduction to Natural Language Processing, Computational Linguistics and Speech Recognition", 2nd Edition, Prentice Hall,2008.

2. James Allen, "Natural Language Understanding", 2nd edition, BenjaminCummings publishing company, 1995.

COURSE OUTCOMES:

CO-1: An ability to apply core computer science concepts and algorithms, such as dynamic programming.

CO-2: Can apply the methods to new NLP problems and will be able to apply the methods to problems outside NLP.

CO-3: The student will be familiar with some of the NLP literature and will read and suggest improvements to published work.

CO-4: To get acquainted with the algorithmic description of the main language levels: morphology, syntax, semantics, and pragmatics, as well as the resources of natural language data.

CO-5: To demonstrate understanding of human languages and be familiar with the most main stream descriptive and theoretical frameworks for handling their properties

24BMA003 **STATISTICS**

L	T	P	O	C
2	0	0	2	3

COURSE OBJECTIVE:

- To learn statistical concepts including measures of central tendency.
- To apply the concept of dispersion to promote critical thinking, problem-solving techniques and interdisciplinary connections.
- To analyze the correlation and regression analysis, sampling, hypothesis testing.

UNIT I DIAGRAMMATIC AND GRAPHICAL REPRESENTATION OF DATA (9 hrs)

Introduction – Scope and Limitations of Statistical methods- Collection of data- Classification of data-Tabulation- Diagrammatic representation of data- Simple bar diagram, Multiple bar diagram, Percentage bar diagram and Pie diagram- Graphical representation of data- Histogram, Frequency polygon and Frequency curves.

UNIT II MEASURES OF CENTRAL TENDENCY (9 hrs)

Introduction- Types of Averages-Mean, Median, Mode- Empirical Relation- Geometric mean and Harmonic Mean-Merits and Demerits.

UNIT III MEASURES OF DISPERSION (9 hrs)

Introduction -Measures of Dispersion- Range, Quartile Deviation, Coefficient of Range and Coefficient of Quartile Deviation - Mean Deviation, Standard Deviation and Coefficient of variation.

UNIT IV CORRELATION AND REGRESSION ANALYSIS (9 hrs)

Introduction - Definition of Correlation - Types of Correlation-Methods of Correlation- Karl Pearson's Correlation Coefficient – Spearman's Rank Correlation Coefficient– Regression Coefficients- Regression Lines and Regression equations.

UNIT IV TESTING OF HYPOTHESIS (9 hrs)

Introduction- Testing of Hypothesis, Single mean test - students t-distribution. F- test, Chisquare test.

Total 45 Hours

TEXT BOOKS:

1. S.P. Gupta, ***Statistical Methods***, 44th Edition, Sultan Chand & Sons,2014.
2. S.C. Gupta and V.K. Kapoor, ***Fundamentals of Applied Statistics***, Sultan Chand & Sons, 3rd Edition, 2023.
3. Beri G, ***Business Statistics***, Tata McGraw Hill Publishing Company Limited, 2009.

REFERENCE BOOKS:

1. P.R. Vittal and V. Malini, ***Statistical and Numerical Methods***, Margham Publications,1st Edition,2007.
2. S.P. Rajagopalan and R. Sattanathan, ***Business Statistics and Operations Research***, Vijay Nicole Pvt. Ltd, 2018.

Web sources

1. https://d3bxy9euw4e147.cloudfront.net/oscms-prodcms/media/documents/IntroductoryBusinessStatistics-OP.pdf
2. http://www.ddegjust.ac.in/studymaterial/mcom/mc-106.pdf

COURSE OUTCOMES:

On completion of this course, the students will be able to:

CO1	Understand the key terminology, concepts tools and techniques used in Statistical Analysis and techniques used diagrammatic methods.	K4
CO2	Evaluate the underlying assumptions of analysis tools of measures of central tendency.	K4
CO3	Apply assumptions of analysis tools of measures of dispersion.	K3
CO4	To Create and interpret a line of best fit. Calculate and interpret the correlation coefficient.	K3
CO5	Analyze the uses and limitations of Testing of hypothesis	K6

24PBAL41 **MACHINE LEARNING USING WEKA LAB**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

Learn how to build a data warehouse and query it. Also obtain Practical Experience Working with all real data sets using WEKA.

1. Build Data Warehouse and Explore WEKA
2. Perform data preprocessing tasks.
3. Demonstration of preprocessing on dataset labor.arff
4. Demonstration of Association rule process on dataset test.arff using apriori algorithm
5. DemonstrationofAssociationruleprocessondatasetcontactlenses.arffusingapriorialgorithm
6. Demonstrate performing Regression on datasets
7. Demonstration of classification rule process on dataset employee.arff using id3 algorithm
8. Demonstration of classification rule process on dataset student.arff using j48Algorithm
9. Demonstration of classification rule process on dataset employee.arff using j48 algorithm
10. Demonstration of classification rule process on dataset employee.arff using naïve bayes algorithm
11. Demonstration of clustering rule process on dataset iris.arff using simplek-means.
12. Demonstration of clustering rule process on dataset student.arff using simplekmeans

23PBAL42 **NATURAL LANGUAGE PROCESSING LAB**

L	T	P	O	C
0	0	2	1	1

COURSE OUTCOMES

CO1 To understand the concepts of morphology, syntax, semantics, discourse & pragmatics of natural language.

CO2 To analyze the understanding of the relationship between NLP and statistics & machine learning.

CO3 To familiarize various NLP software libraries and datasets publicly available.

CO4 To develop systems for various NLP problems namely, spelling correction, morphological analysis, parts-of-speech tagging, parsing and semantic analysis

LIST OF EXERCISES

1. How to tokenize a given text?
2. How to get the sentences of a text document ?
3. How to tokenize text with stop words as delimiters?
4. How to remove stop words and punctuations in a text ?
5. How to perform stemming?
6. How to lemmatize a given text ?
7. How to extract usernames from emails ?
8. How to find the most common words in the text excluding stopwords?
9. How to do spell correction in a given text ?
10. How to classify a text as positive/negative sentiment?
11. How to extract Noun and Verb phrases from a text ?
12. How to find the ROOT word of any word in a sentence?
13. Write a Python program to load the iris data from a given csv file into a dataframe and print the shape of the data, type of the data and first 3 rows.
14. Write a Python NLTK program to find the sets of synonyms and antonyms of a given word.
15. Write a Python NLTK program to print the first 15 random combine labeled male and labeled female names from names corpus.

24SBAL41 **GO POGRAMMING LANGUAGES – INDUSTRY ORIENTED EMPLOYABILITY SKILLS**

L	T	P	O	C
1	0	2	1	2

COURSE OBJECTIVES:

Introduce students to the fundamentals of the Go (Golang) programming language. Teach efficient program design using Go's strong typing, concurrency model, and memory safety. Provide hands-on experience in writing efficient programs for AI/ML pipelines, data handling, and backend services. Familiarize students with Go tools, package management, and best coding practices. Prepare students to develop scalable applications, microservices, and data processing utilities relevant to AIML workflows.

Credit Hours

UNIT I INTRODUCTION TO GO PROGRAMMING **12**

History & features of Go- Setting up Go environment- Go workspace, modules, and packages- Writing and running Go programs- Variables, constants, data types- Operators, expressions, type conversion- Input/Output operations

UNIT II CONTROL STRUCTURES & FUNCTIONS **12**

Decision-making: if, else, switch- Loops: for, range- Functions: declaration, parameters, return values- Variadic functions- Defer, panic, and recover- Error handling approaches- Scope and lifetime of variables

UNIT III COMPOSITE TYPES **12**

Arrays, Slices, And Maps- Strings And Runes- Structs And Methods- Pointers In Go- Interfaces And Polymorphism- Embedding And Composition

UNIT IV CONCURRENCY IN GO **12**

Need for concurrency in large-scale systems- Goroutines- Channels (unbuffered & buffered)- Select statements- Mutex, WaitGroup, and sync package- Practical concurrency patterns- Concurrency in data processing for AIML applications

UNIT V FILE HANDLING, MODULES & STANDARD LIBRARIES **12**

Working with files (open, read, write)- JSON and CSV parsing- Error propagation- Networking basics: HTTP clients and servers- Using Go modules & dependency management- Logging and debugging- Working with external packages.

Total: 60 Hours

REFERENCE BOOKS

1. "The Go Programming Language" – Alan A. A. Donovan & Brian W. Kernighan, Addison-Wesley.
2. “Introducing Go" – Caleb Doxsey, O’Reilly Media.
3. "Go in Action" – William Kennedy, Manning Publications.

COURSE OUTCOMES

CO1: Understand Go’s syntax, control structures, and type system.
CO2: Apply functions, interfaces, structs, and modules in real-world program design.
CO3: Implement Go’s powerful concurrency mechanisms such as goroutines and Channels.
CO4: Build efficient programs for data processing, file handling, and API Communication.
CO5: Develop small-scale applications useful for AI/ML pipelines, including data Ingestion and preprocessing.
CO6: Use Go tools for unit testing, debugging, and performance optimization.

SEMESTER V

24CBAL51 Programming in MATLAB

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

The goal of the course is to increase knowledge and requisite Programming skill and problem solving Using MATLAB. Emphasizes the systematic development of algorithms and programs. Topics include iteration, functions, vectors and arrays, strings, recursion, algorithms, object-oriented programming, and MATLAB graphics. Assignments are designed to build an appreciation for complexity, dimension, fuzzy data, inexact arithmetic, randomness, simulation, and the role of approximation. No programming experience is necessary; some knowledge of calculus is required.

UNIT I MATLAB ENVIRONMENT 12

Defining Variables – functions – Matrices and Vectors –Strings – Input and Output statements -Script files – Arrays in Mat lab – Addressing Arrays – Dynamic Array –Cell Array – Structure Array – File input and output – Opening & Closing – Writing Reading data from files

UNIT II PROGRAMMING IN MATLAB 12

Relational and logical operators – Control statements IF-END, IF-ELSE – END, ELSEIF, SWITCH CASE – FOR loop – While loop – Debugging – Applications to Simulation – miscellaneous MAT lab functions Variables.

UNIT III PLOTTING IN MATLAB 12

Basic 2D plots – modifying line styles – markers and colors – grids – placing text on a plot – Various / Special Mat Lab 2D plot types – SEMILOGX – SEMILOGY – LOG- LOG – POLAR – COMET – Example frequency response of filter circuits.

UNIT IV APPLICATION OF MATLAB 12

Linear algebric equations – elementary solution method – matrix method for linear equation – Cramer’s method – Statistics, Histogram and probability – normal distribution – random number generation – Interpolation – Analytical solution to differential equations – Numerical methods for differential equations.

UNIT V: TOOL BOXES 12

Simulink – Simulink model for a dead zone system, nonlinear system – Applications in DSP – Computation of DFT & FFT – Filter structure – IIR & FIR filter design – Applications in Communication PCM, DPCM, DM, DTMF- Interfacing of Matlab with event driven simulators.

TOTAL: 60 Hours

TEXT BOOKS

1. MATLAB & Simulink Student Version Release 14, ISBN 0-9755787-2- 3, Prentice Hall (December 17, 2004)
2. MATLAB Student Version Release 13, Published by MathWorks (2002). ISBN 10: 0967219590 ISBN 13: 9780967219592.

WEB RESOURCES

1. http://www.glue.umd.edu/~nsw/ench250/matlab.htm.
2. http://www.mathworks.com/

COURSE OUTCOMES:

CO1: To understand features of MATLAB as a programming tool..
CO2: Able to learn Matlab for script and functions and file management
CO3: Use basic flow controls and logical operators.
CO4: To understand miscellaneous MAT lab functions & Variables.
CO5: Able to generate plots and exports this for use in reports and presentation.
CO6: Work with MATLAB: Special Mat Lab 2D plot types – SEMILOGX – SEMILOGY – LOG- LOG – POLAR – COMET
CO7: To be able to perform a wide range of Numerical methods for differential equations.
CO8: To perform able to use Cramer's method, Statistics, Histogram and probability
CO9: Understand MATLAB as a simulation tool boxes using Simulink model.
CO10: o perform Applications in Communication PCM, DPCM, DM, DTMF

24CBAL52 **DATA VISUALIZATION**

L	T	P	O	C
3	0	0	2	3

COURSE OUTCOMES

CO1 To explore design and create data visualizations based on data available data modeling, data processing.

CO2 To conduct exploratory data analysis using visualization by mapping data attributes to graphical attributes

CO3 To learn to evaluate the effectiveness of visualization designs, and think critically about each design decision

CO4 To use knowledge of perception and cognition to evaluate visualization design alternatives.

CO5 To create their own data visualizations, and learn to use Python visualization tools.

UNIT I: INTRODUCTION TABLEAU

Introduction to Tableau: Advantages of Tableau Analytics Platform, Data Preparation Tableau workspace, Working with measures and dimensions. Data types - Data collection - Setting up a Data Connector - Selecting Data Tables – Joins – Unions - Data extracts and live connections - Editing the model's metadata.

UNIT II: CREATING BASIC DATA VISUALIZATIONS

Creating Charts - Chart types -Bar Charts, Legends, Filters and Hierarchies - Line Charts - Highlight Tables - Heat Maps - Bullet Charts - Cumulative Sums with Waterfall Charts.

UNIT III: CREATING ADVANCED DATA VISUALIZATIONS

Aggregate Functions - Calculated Fields - Aggregations in Calculated Fields - Text Operator - Data fields - Logical functions – Parameters - Types of calculations - Quick Table calculations - Level of detailed expression.

UNIT IV: CREATING MAPS

Creating Symbol Maps - Filled Maps - Density Maps - Map Layers - Maps embedded with Pie Charts.

UNIT V: CREATING INTERACTIVE DASHBOARDS

Creating a Dashboard - Dashboard Title - Navigation Buttons - Dashboard Actions - Templates for visualizing Cloud data.

Books for Study

1. Claus O. Wilke, “Fundamentals of Data Visualization”, O’Reilly,

2019.

TEXT BOOKS

1. Alexander Loth, “Visual Analytics with Tableau”, Wiley, 2019.

2. Davy Cielen, Arno D. B. Meysman and Mohamed Ali, “Introducing Data Science”,Manning Publications, 2016.

3. D J Patil, Hilary Mason & Mike Loukides, Ethics and Data Science, O’ Reilly, 2018.

WEB RESOURCES :

1 . https://www.tableau.com/sites/default/files/media/designinggreat-visualizations.pdf

2. https://flowingdata.com/2017/01/24/one-dataset-visualized-25-ways/

3. https://www.tableau.com/learn/tutorials/ondemand/gettingstarted?playlist=554268&signin=4bec05bc7a876b95af7722b08fff9224 4 . https://public.tableau.com/en-us/s/resources

24CBAL53 **BIG DATA ANALYTICS**

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES: To explore, design, and implement basic concepts of big data & analytics methodologies for analyzing structured and unstructured data with emphasis on the relationship between the Data Scientist and its application to the business needs.

UNIT I INTRODUCTION TO BIGDATA 12

Introduction to Big Data Platform – Challenges of Conventional Systems - Nature of Data- Evolution Of Analytic Scalability - Intelligent data analysis- Analytic Processes and Tools - Analysis vs Reporting - Modern Data Analytic Tools

UNIT II MINING DATA STREAMS 12

Introduction to Streams Concepts – Stream Data Model and Architecture - Stream Computing - Sampling Data in a Stream – Filtering Streams – Counting Distinct Elements in a Stream –Real time Analytics Platform (RTAP)Applications

UNIT III ADVANCED ANALYTICS 12

Analyzing, Visualization and Exploring the Data, Statistics for Model Building andEvaluation, Advanced Analytics - K-means clustering, Association rules-Speedup, Linear Regression, Logistic Regression, Naïve Bayes, Decision Trees, Time Series Analysis, Text Analysis

UNIT IV HADOOP AND FRAMEWORKS 12

History of Hadoop- The Hadoop Distributed File System – Components of Hadoop - Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming - Visualizations - Visual data analysis techniques, interaction techniques; Systems and applications Case Studies - Real Time Sentiment Analysis, Stock Market Predictions.

UNIT V CASESTUDY 12

Case study : walmart - uber – Netflix – eBay - :Procter and Gamble – Travel and Tourism – Telcom Industry.

TOTAL: 60 Hours

REFERENCE BOOKS

1. Maheswari, " Data Analytics",McGraw Hill, 1 st Edition,2017.
2. StephanKudyba, Big Data, Mining, and Analytics: Components of Strategic Decision Making,Auerbach Publications, March 12,2014.
3. Michael Minelli (Author), Michele Chambers (Author), AmbigaDhiraj (Author), Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley Publications,2013.

COURSE OUTCOMES:

CO-1: Understand the fundamental concepts of big data platform and know about the basic Concepts of nature and evolution of big data.

CO-2: Understand the data streams concepts and stream computing.

CO-3: Learn about the advanced analytics techniques to gain knowledge of latest Techniques.

CO-4: Become skilled at analyzing, scaling and streaming of Hadoop.

CO-5: Understand the framework of Visual data analysis techniques, interaction Techniques.

24PBAL51 Programming in MATLAB LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

This course will give the fundamental knowledge and practical abilities in MATLAB required to effectively utilize this tool in technical numerical computations and visualization. To acquaint yourself with the statistics method and simulation tool boxes

1. MATLAB Software, Basic Features, Tool Box And Different Functions
2. To Learn Arithmetic, Relational And Logic Operator
3. Matrix Formation And Its Manipulation
4. Vector Manipulation
5. To Get Familiar With Plotting Commands Used In MATLAB
6. To Plot A Unit Circle
7. To Plot Signals Using Impulse, Step, Ramp Functions
8. To Plot A Sine And Cosine Wave
9. Verification Of Superposition Theorem
10. Verification Of Thevenin's Theorem
11. Simulation Of A Half Wave Uncontrolled Rectifier
12. Simulation Of 1-Phase Full Bridge Controlled Rectifier

COURSE OUTCOMES

CO1: Understand Basics of MATLAB coding.

CO2: Write the program for a given problem in MATLAB coding.

CO3: Able to implement loops, branching, control instruction and functions in MATLAB programming environment.

CO4: Able to simulate MATLAB Simulink examples

CO5:Analyze the generation Various Signals and Sequences in MATLAB, including the operations on Signals and Sequences.

24PBAL52 **DATA VISUALIZATION LAB**

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

1. Gaining a basic understanding of the subject (e.g., factual knowledge, methods, principles, generalizations, theories)
2. Learning to analyze and critically evaluate ideas, arguments, and points of view.
3. Learning appropriate methods for collecting, analyzing, and interpreting numerical information
4. Developing specific skills, competencies, and points of view needed by professionals in the field most closely related to this course

LIST OF EXERCISES:

1. Working with Data Types and Data Connector
2. Working with Tables: Joins, Unions, Data Extracts
3. Building Bar Charts with Legends, Filters and Hierarchies
4. Line Charts
5. Heat Maps
6. Bullet Charts
7. Waterfall Charts.
8. Working with Aggregate Functions
9. Working with Logical Functions
10. Creating Symbol Maps
11. Creating Filled Maps
12. Creating Density Maps
13. Constructing Maps embedded with Pie Charts
14. Creating a Dashboard with Title and Navigation Buttons
15. Working with Dashboard Actions
16. Visualizing Cloud data

COURSE OUTCOMES

CO1 To understand the main concepts of data visualization

CO2 To create several different charts using Tableau

CO3 To recognize good (and bad) data visualizations and to use shapes, colors, text and layout appropriately for visualization

CO4 To create ad-hoc reports, data visualizations, and dashboards using Tableau Desktop

SEMESTER VI

24CBAL61 DATA SCIENCE USING PYTHON

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

The objective of this course is to provide comprehensive knowledge of python programming paradigms required for Data Science.

UNIT I INTRODUCTION TO PYTHON 12

Structure of Python Program-Underlying mechanism of Module Execution-Branching and Looping- Problem Solving Using Branches and Loops-Functions - Lists and Mutability-Problem Solving Using Lists and Functions.

UNIT II SEQUENCE DATATYPES AND OBJECT-ORIENTEDPROGRAMMING12

Sequences, Mapping and Sets- Dictionaries- -Classes: Classes and Instances-Inheritance-Exceptional Handling-Introduction to Regular Expressions using "re" module.

UNIT III USING NUMPY 12

Basics of NumPy-Computation on NumPy-Aggregations-Computation on Arrays-Comparisons, Masks and Boolean Arrays-Fancy Indexing-Sorting Arrays-Structured Data:NumPy's Structured Array.

UNIT IV DATA MANIPULATION WITH PANDAS –I 12

Introduction to Pandas Objects-Data indexing and Selection- Operating on Data in Pandas-Handling Missing Data-Hierarchical Indexing - Combining Data Sets.

UNIT V DATA MANIPULATION WITH PANDAS –II AND CASESTUDY 12

Aggregation and Grouping-Pivot Tables-Vectorized String Operations -Working with Time Series- High Performance Pandas-eval() and query()- VISUALIZATION AND MATPLOTLIB:Basic functions of matplotlib-Simple Line Plot, Scatter Plot-Density and Contour Plots-Histograms, Binnings and Density-Customizing Plot Legends, Colour Bars-Three-Dimensional Plotting in Matplotlib.CaseStudy :DataScience in Pharmaceutical Industries, BioTech, and Education.

Total : 60 Hours

TEXT BOOKS:

1. M.C. Trivedi, Data Science and Data Analytics Using Python Programming, Khanna Publishing House, 2024.
2. Jake VanderPlas ,Python Data Science Handbook - Essential Tools for Working with Data, O'ReilyMedia,Inc,2016.
3. Zhang.Y ,An Introduction to Python and Computer Programming, Springer Publications,2016.
4. JoelGrus,DataSciencefromScratchFirstPrincipleswithPython,O'ReillyMedia, 2016.
5. T.R.Padmanabhan, Programming with Python,SpringerPublications,2016.

COURSE OUTCOMES:

CO-1: To demonstrate significant experience with python program development Environment

CO-2: To implement numerical programming, data handling through NumPy Modules.

CO-3: To Clean and prepare data for analysis

CO-4: To Summarize Data

CO-5: To Build Machine Learning models using Scikit-Learn

24CBAL62 WEB MINING & RECOMMENDER SYSTEMS

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES: To give a deep sense of knowledge in understanding the research perspectives used in Web mining and their direct usage in recommender Systems. Become Familiar withtheprocessofhowdataisextractedinRecommenderSystemsindaytodaylife.

Unit I INTRODUCTION TO WEB DATAMINING 12

Need, Importance, Applications of Web Data mining. Capturing-users web activities, Client side v/s middleware v/s server side-data and usage logging.Web Mining and its types, Web Usage Mining, Web StructureMining, Web ContentMining

Unit II WEB USAGEMINING 12

Learning from Browser, Server Logs, Identifying frequent item sets, pattern identification, representing patterns in form of relations/Graphs. Understanding web application or website-Usage, Heat maps. Using statistical tools for usage analysis and machine learning for prospective improvements.

Unit III WEB STRUCTUREMINING 12

Understanding link structure of the web, Static v/s dynamic linking, representing the link structure as graphs, identifying most / least used links, paths, Categorizing links based on required attributes, Clustering links based on required attributes. Web as a graph, identifying nodes, edges, in-degree, out- degree,HITS Algorithm PageRank algorithm.

Unit IV WEB CONTENT MINING 12

Storing web content as text, database, various document types, generating meta-information of web documents, labelling,-tagging, identifying feature sets. Representing web documents, Vector Space Model.TF-IDF, web-page summarization, tokenization, n-gram analysis, Categorizing web pages based on required attributes, Clustering web pages based on required attributes.

Unit V CONTENT-BASED RECOMMENDATION 12

High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, Obtaining item features from tags, Representing item profiles, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Total: 60 Hours

TEXT BOOKS:

1. Bing Liu, Web Data Mining: Exploring Hyperlinks, Content, and Usage Data, 2nd Edition, Springer,2011
2. SoumenChakrabarti, Mining the Web, Morgan-Kaufmann, first edition,2002 JannachD., ZankerM. and FelFeringA., Recommender Systems: An Introduction,Cambridge University Press(2011),1sted.

WEB RESOURCES:

1.https://www.kdnuggets.com/2014/09/most-viewed-web-mining-lectures-videolectures.html

2.https://www.cs.uic.edu/~liub/WebContentMining.html

COURSE OUTCOMES:

CO-1: To learn various techniques to mine the Web and other information networks,

CO -2: To learn to apply the appropriate technique for data analysis

CO -3: To learn how to extract knowledge from web scale datasets by various techniques.

CO -4: To be familiar with classic and recent developments in Web search and web data Mining.

CO -5: To develop state-of-the-art recommender systems that automates a variety of **c**hoice-making strategies

24CBAL63 COGNITIVE COMPUTING

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES

To simulate human thought processes in a computerized model. Using self-

learning algorithms that use data mining, pattern recognition and natural language processing, the computer can mimic the way the human brain works.

UNIT I COGNITIVE COMPUTING 12

Foundation of Cognitive Computing: cognitive computing as a new generation, the uses of cognitive systems, system cognitive, gaining insights from data, Artificial Intelligence as the foundation of cognitive computing, understanding cognition

Design Principles for Cognitive Systems:

Components of a cognitive system, building the corpus, bringing data into cognitive system, machine learning, hypotheses generation and scoring, presentation and visualization services

UNIT II SUPPORT OF A COGNITIVE SYSTEM 12

Natural Language Processing in support of a Cognitive System: Role of NLP in a cognitive system, semantic web, Applying Natural language technologies to Business problems **Representing knowledge in Taxonomies and Ontologies:** Representing knowledge, Defining Taxonomies and Ontologies, knowledge representation, models for knowledge representation, implementation considerations

UNIT III ADVANCED ANALYTICS 12

Relationship between Big Data and Cognitive Computing : Dealing with human-generated data, defining big data, architectural foundation, analytical data warehouses, Hadoop, data in motion and streaming data, integration of big data with traditional data

Applying Advanced Analytics to cognitive computing: Advanced analytics is on a path to cognitive computing, Key capabilities in advanced analytics, Using advanced analytics to create value, Impact of open source tools on advanced analytics

UNIT IV BUSINESS IMPLICATIONS 12

The Business Implications of Cognitive Computing : Preparing for change ,advantages of new disruptive models , knowledge meaning to business, difference with a cognitive systems approach , meshing data together differently, using business knowledge to plan for the future , answering business questions in new ways , building business specific solutions , making cognitive computing a reality , cognitive application changing the market

The process of building a cognitive application:

Emerging cognitive platform, defining the objective, defining the domain, understanding the intended users and their attributes, questions and exploring insights, training and testing

UNIT V APPLICATION 12

Building a cognitive health care application: Foundations of cognitive computing for healthcare, constituents in healthcare ecosystem, learning from patterns in healthcare Data, Building on a foundation of big data analytics, cognitive applications across the health care eco system, starting with a cognitive application for healthcare, using cognitive applications to improve health and wellness, using a cognitive application to enhance the electronic medical record Using cognitive application to improve clinical teaching

Smarter cities-Cognitive Computing in Government: cities operation, characteristics of smart city, rise of open data movement with fuel cognitive cities, internet of everything and smarter cities, understanding the owner ship and value of data, cities are adopting smarter technology today for major functions, smarter approaches to preventative healthcare, building a smarter transportation infrastructure using analytics to close workforce skills gap, creating a cognitive community infrastructure, next phase of cognitive cities

TOTAL: 60 Hours

TEXT BOOKS:

I. Judith H Hurwitz, Marcia Kaufman, Adrian Bowles , "Cognitive computing and Big Data Analytics" , Wiley

REFERENCE BOOKS

1. Wang, Y. (2007e). On the Cognitive Processes of Human Perception with Emotions, Motivations,
2. and Attitudes. International Journal of Cognitive Informatics and Natural Intelligence, 1(4), 1-13.
3. Wang, Y. (2007f). The Theoretical Framework and Cognitive Process of Learning. Proc. 6th International Conference on Cognitive Informatics (ICCI'07), (pp. 470-479). IEEE CS Press.
4. Wang, Y. (2007g). Formal Description of the Mechanisms and Cognitive Process of Memorization. Proc. 6th International Conference on Cognitive Informatics (ICCI'07), (pp. 284-293). IEEE CS Press.
5. Wang, Y. (2008a). Keynote, On Abstract Intelligence and Its Denotational Mathematics Foundations, Proc. 7th IEEE International Conference on Cognitive Informatics (ICCI'08), (pp. 3-13). Stanford University, CA, USA, IEEE CS Press.
6. Wang, Y. (2008b). On Contemporary Denotational Mathematics for Computational Intelligence. Transactions of Computational Science, 2, 6-29.
7. Wang, Y. (2008c). On Concept Algebra: A Denotational Mathematical Structure for Knowledge and Software Modeling. International Journal of Cognitive Informatics and Natural Intelligence, 2(2), 1-18.

24CBAL64 **ROBOTICS AND ITS APPLICATIONS**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

This course introduces the basic concepts of robotics, sensors, robot controls, robot cell design,

and micro robotics and Nano robotics system.

UNIT I INTRODUCTION 12

Robot anatomy – Definition - law of robotics - History and Terminology of Robotics- Accuracy and repeatability of Robotics - Simple problems - Specifications of Robot - Speed of Robot - Robot joints and links - Robot classifications - Architecture of robotic systems- Robot Drive systems - Hydraulic, Pneumatic and Electric system.

UNIT II END EFFECTORS ANDROBOTCONTROLS 12

Mechanical grippers-Slider crank mechanism, Screw type, Rotary actuators, cam type- Magnetic grippers - Vacuum grippers - Air operated grippers-Gripper force analysis - Gripper design - Simple problems - Robot controls - Point to point control, Continuous path control, Intelligent robot - Control system for robot joint - Control actions - Feedback devices - Encoder, Resolver, LVDT - Motion Interpolations - Adaptive control.

UNIT III ROBOT TRANSFORMATIONS AND SENSORS 12

Robot kinematics-Types- 2D, 3D Transformation-Scaling, Rotation, Translation - Homogeneous coordinates, multiple transformation - Simple problems. Sensors in robot – Touch sensors - Tactile sensor – Proximity and range sensors – Robotic vision sensor - Force sensor - Light sensors, Pressuresensors.

UNIT IV ROBOT CELL DESIGN AND APPLICATIONS 12

Robot work cell design and control - Sequence control, Operator interface, Safety monitoring devices in Robot - Mobile robot working principle, actuation using MATLAB, NXT Software Introductions - Robot applications - Material handling - Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersearobot.

UNIT V MICRO/NANO ROBOTICS SYSTEM AND CASE STUDY 12

Micro/Nanorobotics system overview - Scaling effect - Top down and bottom up approach - Actuators of Micro / Nano robotics system - Nano robot communication techniques – Case Study : Fabrication of micro / nano grippers - Wall climbing, micro robot working principles - Biomimetic robot - Swarm robot - Nano robot in targeted drug delivery system.

Total : 60 hours

TEXT BOOKS:

1. S.R. Deb, “Robotics Technology and flexible automation”, Tata McGraw-Hill Education, 2009.

2. Mikell P Groover & Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, "IndustrialRobotics,TechnologyprogrammingandApplications", McGrawHill,2012.

REFERENCE BOOKS:

1. Richard D. Klafter, Thomas .A, Chri Elewski, Michael Negin, "Robotics Engineering an Integrated Approach", PHI Learning,2009.

2. Francis N. Nagy, Andras Siegler, "Engineering foundation of Robotics", Prentice Hall Inc., 1987.

3. P.A. Janaki Raman, "Robotics and Image Processing an Introduction", Tata McGraw Hill Publishing companyLtd.,1995.

COURSE OUTCOMES:

CO-1: To understand the basics of robot like accuracy, speed of robot, joint and links in robots.

CO-2: To understand the purpose of end effectors like magnetic grippers, vacuum grippers and gripper design**.**

CO-3: Explains various sensors like touch sensors, tactile sensor, vision sensors, light and pressure sensors which are used in robots.

CO-4: Explains robot applications like Material handling, Machine loading and unloading, assembly, Inspection, Welding, Spray painting and undersea robot.

CO-5: Effectively discuss Actuators of Micro/Nano robotic system.

24PBAL61 DATA SCIENCE USING PYTHON LAB

L	T	P	O	C
0	0	2	2	1

COURSE OBJECTIVES:

The main goal of this course is to help students learn, understand, and practice big data analytics and machine learning approaches for data science. The students implement Algorithms such as Decision trees, SVM, KNN, Naïve Bayes

List of Exercise:

1. Functions in Python Libraries using Numpy.
2. Functions in Python Library using Pandas.
3. Functions in Python Library using Scikit
4. Perform Data exploration and preprocessing in Python
5. Implement regularized Linear regression
6. Implement Naive Bayes classifier for dataset stored as CSV file.
7. Implement regularized logistic regression
8. Build models using different Ensembling techniques
9. Build models using Decision Trees
10. Build model using SVM with different kernels
11. Implement K-NN algorithm to classify dataset.
12. Build model to perform Clustering using K-means after applying PCA and determining the value of K using Elbow Method.

SEMESTER VII

24CBAL71 MOBILE APPLICATION DEVELOPMENT FOR MACHINE LEARNING

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

The objective of this course is to provide the in-depth coverage of various concepts of mobile application development especially android based applications. This course will help the students in learning to develop and publish their own mobile applications.

Unit I: Mobile App Development 12

Mobile App Development – Android Platform – Android SDK – Eclipse Installation – Building simple Android Applications.

Unit II: Android Application Design Essentials 12

Anatomy of an Android Application – Android Terminologies: Application Context, Activities, Services, Intents – Receiving and broadcasting Intents – Intent Filters – Content Providers.

Unit III: Android User Interface Design Essentials 12

User Interface Design Elements – Designing User Interfaces with Layouts – Drawing and working with animation.

Unit IV: TensorFlow Lite 12

Converting a Machine Learning model to TensorFlow Lite – Saving the model – Loading the Model and allocating Tensors – Performing prediction – Optimizing the model.

Unit – V: TensorFlow Android App Development 12

Editing Layout File – Adding TensorFlow Lite dependencies – Adding TensorFlow Lite model – Writing Activity code for getting insights from data - Case Study: Processing Images on a Mobile

Total Hours:60

Books for Study

1. Ryan Cohen and Tao Wang, “GUI Design for Android Apps”, Apress, 2014.

2. John Horton, “Android Programming for Beginners”, Second Edition, Packt, 2018

REFERENCE BOOKS

1. Ted Hagos, “Learn Android Studio with Kotlin: Efficient Android App Development”, Apress, 2018.

2. Laurence Moroney, “AI and ML for Coders”, O’Reilly, 2020.

3. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd

4. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd

5. Android Application Development All in one for Dummies by Barry Burd,

Edition: IWeb References

1. http://venturebeat.com/2009/01/01/android-netbooks-on-their-way-likelyby-2010

COURSE OUTCOMES

CO1 To understand the Android with Machine Learning

CO2 To analyze the Anatomy of an Android Application Context, Activities, Services, Intents

CO3 To envisage outcomes automatically without human interference

CO4 To learn Machine learning serving mobile application

CO5 To analyze user behavior patterns and suggest apps which will reduce human interference

24CBAL72 **NEURAL NETWORKS**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

- Provide an understanding of the basic mathematical elements of the theory of fuzzy sets.
- Provide an emphasis on the differences and similarities between fuzzy sets and classical sets theories. Explain the concepts of neural networks, fuzzy logic, and genetic algorithms.

UNIT I BASIC LEARNING ALGORITHMS **12**

Biological Neuron – Artificial Neural Model - Types of activation functions – Architecture: Feed forward and Feedback – Learning Process: Error Correction Learning – Memory Based Learning – Hebbian Learning – Competitive Learning - Boltzman Learning – Supervised and Unsupervised Learning – Learning Tasks: Pattern Space – Weight Space – Pattern Association – Pattern Recognition – Function Approximation – Control – Filtering – Beam forming – Memory – Adaptation - Statistical Learning Theory – Single Layer Perceptron – Perceptron Learning Algorithm – Perceptron Convergence Theorem – Least Mean Square Learning Algorithm – Multilayer Perceptron – Back Propagation Algorithm – XOR problem – Limitations of Back Propagation Algorithm.

UNIT II RADIAL-BASIS FUNCTION NETWORKS AND SUPPORT VECTOR **12**

Machines radial basis function networks 12 Cover's Theorem on the Separability of Patterns - Exact Interpolator – Regularization Theory – Generalized Radial Basis Function Networks - Learning in Radial Basis Function Networks Applications: XOR Problem – Image Classification. SUPPORT VECTOR MACHINES: Optimal Hyper plane for Linearly Separable Patterns and Non separable Patterns – Support Vector - insensitive Loss Function – Support Vector Machine for Pattern Recognition – XOR Problem - Machines for Nonlinear Regression

UNIT III COMMITTEE MACHINES AND NEURODYNAMICS SYSTEMS **12**

Ensemble Averaging - Boosting – Associative Gaussian Mixture Model – Hierarchical Mixture of Experts Model(HME) – Model Selection using a Standard Decision Tree – A 39 Priori and Post priori Probabilities – Maximum Likelihood Estimation – Learning Strategies for the HME Model – EM Algorithm – Applications of EM Algorithm to HME Model - Dynamical Systems – Attractors and Stability – Non-linear Dynamical Systems- Lyapunov Stability – Neuro dynamical Systems – The Cohen-GrossbergTheorem.

UNIT IV ATTRACT OR NEURAL NETWORKS **12**

Associative Learning – Attractor Neural Network Associative Memory – Linear Associative Memory – Hopfield Network – Content Addressable Memory – Strange Attractors and Chaos- Error Performance of Hopfield Networks - Applications of Hopfield Networks – Simulated Annealing – Boltzmann Machine – Bidirectional Associative Memory – BAM Stability Analysis – Error Correction in BAMs - Memory Annihilation of Structured Maps in BAMS – Continuous BAMs – Adaptive BAMs –Applications

UNIT V SELF ORGANISING MAPS AND PULSED NEURON MODELS **12**

Self-organizing Map – Maximal Eigenvector Filtering – Sanger's Rule – Generalized Learning Law – Competitive Learning - Vector Quantization – Mexican Hat Networks - Self-organizing Feature Maps – Applications - Spiking Neuron Model – Integrate-and-Fire Neurons – Conductance Based Models – Computing with Spiking Neurons.

TOTAL: 60 hours

TEXT BOOKS :

- 1. Nunes Da SilvaI, Artificial Neural Networks A Practical Course", SPRINGER,ISBN-9783319431611 , January 2017
- 2. Satish Kumar, "Neural Networks: A Classroom Approach", Tata McGraw-Hill Publishing Company Limited, New Delhi,2004.
- 3. Simon Haykin, "Neural Networks: A Comprehensive Foundation", 2nd., Addison Wesley Longman (Singapore) Private Limited, Delhi,2001.
- M.C. Trivedi, Deep Learning and Neural Network_MC Trivedi, Khanna Publishing House, 2024

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: Able to understand the Architecture of different neural networks.

CO-2: Understand about supervised learning and unsupervised learning.

CO-3: Understanding limitations of various learning algorithms.

CO-4: Provides knowledge about associative memory networks.

CO-5: Able to implement learning models for real life applications.

24CBAL73 **DEEP LEARNING**

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES

Deep Learning has received a lot of attention over the past few years and has been employed successfully by companies like Google, Microsoft, IBM, Facebook, Twitter etc. To solve a wide range of problems in Computer Vision and Natural Language Processing. In this course we will learn about the building blocks used in these Deep Learning based solutions. Specifically, we will learn about feed forward neural networks, convolutional neural networks, recurrent neural networks and attention mechanisms. At the end of this course students would have knowledge of deep architectures used for solving various Vision and NLP tasks

UNIT I HISTORY OF DEEPLEARNING 12

Deep Learning Success Stories- McCulloch Pitts Neuron- Thresholding Logic- Perceptrons - Perceptron Learning Algorithm - Multilayer Perceptrons (MLPs)- Representation Power of MLPs- Sigmoid Neurons - Gradient Descent – Feed forward Neural Networks - Representation Power of Feedforward Neural Networks – Feed Forward Neural Networks –Back propagation.

UNIT II ALGORITHMS 12

Gradient Descent (GD)- Momentum Based GD- Nesterov Accelerated GD- Stochastic GD – AdaGrad – RMSProp – Adam- Eigenvalues and eigenvectors - Eigenvalue Decomposition Basics - Principal Component Analysis and its interpretations – Singular ValueDecomposition.

UNIT III AUTO ENCODERS AND REGULARIZATION 12

Autoencoders and relation to PCA - Regularization in autoencoders – Denoising autoencoders Sparse autoencoders - Contractive autoencoders - Regularization: Bias Variance Tradeoff - L2 regularization - Early stopping - Dataset augmentation - Parameter sharing and tying - Injecting noise at input - Ensemble methods –Dropout.

UNIT IV GREEDY LAYERS AND CONVOLUTIONAL NEURAL NETWORKS 12

Greedy Layerwise Pre-training - Better activation functions - Better weight initialization methods - Batch Normalization - Learning Vectorial Representations of Words - Convolutional Neural Networks - LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet - Visualizing Convolutional Neural Networks - Guided Backpropagation - Deep Dream, Deep Art - Fooling Convolutional NeuralNetworks

UNIT V RECURRENT NEURAL NETWORKS ANDAPPLICATIONS 12

Recurrent Neural Networks – Back Propagation Through Time (BPTT) - Vanishing and Exploding Gradients - Truncated BPTT, GRU, LSTMs - Encoder Decoder Models - Attention Mechanism - Attention over images - Applications: Vision, NLP, Speech.

Total: 60 Hours

TEXT BOOKS:

1. Rajiv Chopra, Deep Learning, Khanna Publishing House, 2024
2. Ian Good fellow and Yoshua Bengio and Aaron Courville, "Deep Learning, An MIT Press book", 2012.

REFERENCE BOOKS:

1. M.C. Trivedi, Deep Learning and Neural Network_MC Trivedi, Khanna Publishing House, 2024
2. Raúl Rojas, "Neural Networks: A Systematic Introduction" ,1996.
3. Christopher Bishop, "Pattern Recognition and Machine Learning",2007.

COURSE OUTCOMES

CO-1: Thoroughly Understanding the fundamentals of Deep Learning.

CO-2: To know the main variants of deep learning (such convolutional and recurrent architectures), and their typical applications.

CO-3: Able to visualize the Convolutional Neural Networks, and study vectorial representations of Words.

CO-4: Be able to design and implement deep neural network systems.

CO-5: Be able to structure and prepare scientific and technical documentation describing Project Activities.

24PBAL71 MOBILE APPLICATION DEVELOPMENT FOR MACHINE LEARNING LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The purpose of this course is to understand the principles of mobile application (app) design, architecture and development. It includes app design for the Android platform on the latest versions and the trends available. The importance of the Mobile Application Development, its role in the mobile industry and the user interfaces and services and different flavours of Android.

LIST OF EXERCISES:

1. Calculator App – Setting up the UI using Linear Layouts
2. Calculator App – Using OnClick and implementing CLR functionality
3. Calculator App – Adding the OnDecimalPoint and OnOperator functionalities
4. Calculator App – Adding Subtraction using split and substring methods
5. Calculator App – Adding other required operators and finalizing the App
6. Quiz App – Setting up the UI using cardview
7. Quiz App – Creating the Question Model and preparing the Questions
8. Quiz App – Setting up the Question UI and Question Activity
9. Quiz App – Selecting right and wrong answers and displaying subsequent Question
10. Quiz App – Preparing UI for the Result Activity
11. TensorFlow Regression App – Editing the Layout File
12. TensorFlow Regression App – Adding TensorFlow Lite Dependencies
13. TensorFlow Regression App – Adding TensorFlow Lite Model
14. TensorFlow Regression App – Writing Activity code for inference

COURSE OUTCOMES

CO1 To develop components and different Layout for mobile application development Framework for android
CO2 To develop Simple GUI application with the Use of Built in components and widgets.
CO3 To create databases to store application data locally
CO4 To Test and Show the results on emulators or on physical handheld devices

SEMESTER VIII

24CBAL81 INTRODUCTION TO REINFORCEMENT LEARNING

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES

- Understand the fundamental concepts that Reinforcement Learning is based on Characterize and differentiate between different fundamental approaches to Reinforcement Learning.
- Understand the challenges of using Reinforcement Learning in practice, and current advanced solutions to such challenges

Unit – I: Monte-Carlo Methods **12**

Monte-Carlo methods: policy evaluation, rollouts, on policy and off-policy learning, importance sampling

Unit – II: Temporal Difference Learning **12**

Temporal Difference learning: TD prediction, Optimality of TD(0), SARSA, Q-learning, Games and after states, Maximization Bias and Double Learning**.**

Unit – III: EligibilityTraces **12**

Eligibility traces: n-step TD prediction, TD(lambda), forward and backward views, Q(lambda), SARSA(lambda), replacing traces and accumulating traces.

Unit – IV: Function Approximation **12**

Function Approximation: Value prediction, gradient descent methods, linear function approximation, Control algorithms, Fitted Iterative Methods, Deep Q-learning.

Unit – V: Computer Vision **12**

Policy Gradient methods: non-associative learning - REINFORCE algorithm, exact gradient methods, estimating gradients, approximate policy gradient algorithms, actor-critic methods, Asynchronous Advantage Actor-Critic.Hierarchical RL: MAXQ framework, Options framework, HAM framework, Option discovery algorithms. **Case studies:** Elevator dispatching, Samuel's checker player, TD-gammon, Acrobot, Helicopter piloting**,** Alpha Go

Total Hours:60

Books for Study

1. R. S. Sutton and A. G. Barto. Reinforcement Learning - An Introduction. MIT Press. 2nd Edition. 2018.

2. Richard S. Sutton and Andrew G. Barto, "Reinforcement learning: An introduction", Second Edition, MIT Press, 2019

REFERENCE BOOKS

1. Li, Yuxi. "Deep reinforcement learning." arXiv preprint arXiv:1810.06339 (2018).

2. Wiering, Marco, and Martijn Van Otterlo. "Reinforcement learning." Adaptation, learning, and optimization 12 (2012)

3. Russell, Stuart J., and Peter Norvig. "Artificial intelligence: a modern approach."Pearson Education Limited, 2016.

4. Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. "Deep learning." MIT press, 2016

COURSE OUTCOMES

CO1 To understand the statistical learning techniques where an agent explicitly takes actions and interacts with the world.

CO2 To analyze the basic exploration methods and the exploration/exploitation tradeoff

CO3 To understand value functions, as a general-purpose tool for optimal decisionmaking.

CO4 To Know how to implement dynamic programming as an efficient solution approach to an industrial control problem.

CO5 To determine be able to start using RL for real problems,

24CBAL82 **SOFTWARE TESTING**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

To Study about fundamental concepts of software tests and its application in various scenarios with the help different testing strategies, methods and tools. The student can expose the criteria for test cases and learn the design of test cases. Be familiar with test management and test automation techniques.

UNIT I INTRODUCTION **12**

Testing as an engineering activity – Testing as a process – Testing maturity model – Testing axioms – Basic definitions – Software testing principles – The tester's role in a software developmentorganization – Origins of defects – Cost of defects – Defect classes – The defect repository and testdesign – Defect examples – Developer / Tester Support of developing a defect repository.

UNIT II TEST CASE DESIGN STRATEGIES **12**

Test case Design Strategies – Using Box approach to test case design – Boundary value analysis – Equivalence class partitioning – State based testing – Cause- effect graphing – Compatibility testing –User Documentation testing – Domain testing – Random testing – Requirement based testing – Using White Box approach to test design- Test adequacy criteria – Static testing Vs Structural testing – Code Functional Testing – Coverage and Control Flow Graphs – Covering code Logic – Paths – Code complexity testing – Additional white box testing approaches – Evaluating test adequacy criteria.

UNIT III LEVELS OF TESTING **12**

The need for levels of testing – Unit test – Unit test planning – Designing the Unit Tests – The Test Harness – Running the Unit tests and recording results – Integration tests – Designing integration tests – Integration test planning – Scenario testing – Defect bash elimination – System testing – Acceptance testing – Performance testing – Regression testing – Internationalization testing – Ad-hoc testing – Alpha , Beta tests – Testing OO systems – Usability and Accessibility testing – Configuration testing – Compatibility testing – Testing the documentation – Website testing

UNIT IV TEST MANAGEMENT **12**

People and organizational issues in testing – Organization structures for testing teams – testing services – Test planning –Test plan components – Test plan attachments – Locating test items – test management – test process – Reporting test results – Introducing the test specialist – Skills needed by a test specialist – Building a testing group – The structure of testing group – The technical training program.

UNIT V TEST AUTOMATION **12**

Software test automation – Skills needed for automation – Scope of automation – Design and architecture for automation – Requirement for a test tool – Challenges in automation – Test metrics and measurements – Project , Progress and Productivity metrics.

TOTAL 60 HOURS

TEXT BOOKS:

1. Srinivasan Desikan and Gopalaswamy Ramesh, "Software Testing – Principles and Practices", Pearson Education, 2006.

REFERENCE BOOKS:

1. Ron Patton, "Software Testing", Second Edition, Sams Publishing, Pearson Education, 2007

2. Adithya P.Mathur " Foundations of Software Testing – Fundamental Algorithms and Techniques", Pearson Education India, 2011

3. Mauro Pezze, Michael Young, Software testing and Analysis- Process, Principles and

Techniques, Wiley India, 2012

4. Paul C Jorgensen, "Software Testing A Craftsman's Approach", Auerbach publications, 3rd edition, 2011.

WEB RESOURCES:

1. www.softwaretestingmaterial.com/manual-testing-tutorial/

2. www.softwaretestinghelp.com/manual-testing-tutorial-1/

COURSE OUTCOMES:

At the End of this course, the Student will be able to:

CO -1: Create test planning based on the document.

CO–2: Evaluate and validate a test plan and use of automatic testing tools.

CO-3 - Evaluate various types of software risks and its impact on different software application.

CO-4: Analyze test cases suitable for a software development for different domains

CO-5 : Understand importance of testing techniques in software quality management and assurance.

L	T	P	O	C

24CBAL83 **PATTERN RECOGNITION**

4	0	0	2	4

COURSE OBJECTIVES:

To enable students to critically analyze, design and create innovative products and solutions for the real life problems. To prepare students to critically analyze existing literature in an area of specialization and ethically develop innovative and research oriented methodologies to tackle gaps.

UNIT I PATTERN CLASSIFIER 12

Overview of pattern recognition – Discriminant functions – Supervised learning – Parametric estimation – Maximum likelihood estimation – Bayesian parameter estimation – Perceptron algorithm – LMSE algorithm – Problems with Bayes approach – Pattern classification by distance functions – Minimum distance pattern classifier.

UNIT II UNSUPERVISED CLASSIFICATION 12

Clustering for unsupervised learning and classification – Clustering concept – C- means algorithm– Hierarchical clustering procedures – Graph theoretic approach to pattern clustering – Validity of clustering solutions.

UNIT III STRUCTURAL PATTERN RECOGNITION 12

Elements of formal grammars – String generation as pattern description – Recognition of syntactic description – Parsing – Stochastic grammars and applications – Graph based structural representation.

UNIT IV FEATURE EXTRACTION AND SELECTION 12

Entropy minimization – Karhunen – Loeve transformation – Feature selection through functions approximation – Binary feature selection.

UNIT V RECENT ADVANCES AND CASESTUDY 12

Neural network structures for Pattern Recognition – Neural network based Pattern associators– Unsupervised learning in neural Pattern Recognition – Self-organizing networks – Fuzzy logic – **CASE STUDY :** Fuzzy pattern classifiers – Pattern classification using Genetic Algorithms.

Total: 60 Hours

TEXT BOOKS:

1. Earl Gose and Richard Johnsonbaugh and Steve Jost Pattern Recognition And Image Analysis (With Cd), 1st Edition, Pearson India ISBN-,9789332549791,2015.
2. Robert J.Schalkoff, " Pattern Recognition Statistical, Structural and Neural Approaches", John Wiley & Sons Inc., New York,1992.
3. Tou and Gonzales, " Pattern Recognition Principles" , Wesley Publication Company, London,1974.

REFERENCE BOOKS:

1. DudaR.O.andHarP.E.,"PatternClassificationandSceneAnalysis",Wiley,NewYork,1973.
2. Morton Nadier and Eric Smith P, "Pattern Recognition Engineering", John Wiley & Sons, New York,1993.

COURSE OUTCOMES:

CO-1: Apply mathematical foundations, algorithmic principles and computer science theory in the modeling and design of computer based systems of varying complexity.

CO-2:.Design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, ethical, health, safety, and sustainability in the field of computer engineering

CO-3: Critically analyze existing literature in an area of specialization and develop innovative and research oriented methodologies to tackle gaps identified.

CO-4: Apply performance evaluation methods for pattern recognition and critique comparisons of techniques made in the research literature.

CO-5: Implement simple pattern classifiers, classifier combinations and structural pattern recognizers.

24PBAL81 INTRODUCTION TO REINFORCEMENT LEARNING LAB

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

This course is intended for students interested in artificial intelligence. Reinforcement learning is an area of machine learning in which an agent learns how to behave in an environment by performing actions and assessing the results.

LIST OF EXERCISES:

1. Solving Frozen Lake Problem with Value Iteration
2. Solving Frozen Lake Problem with Policy Iteration
3. Every-visit MC Prediction with Blackjack Game
4. First-visit MC Prediction with Blackjack Game
5. Implementing on-policy MC control
6. Computing Optimal Policy using SARSA
7. Computing Optimal Policy using Q Learning
8. Implementing epsilon-greedy algorithm
9. Implementing Softmax Exploration strategy
10. Implementing Upper Confidence Bound Algorithm
11. Implementing Thomson Sampling strategy
12. Finding the Best Advertisement Banner using Bandits

COURSE OUTCOMES:

CO1 To develop the knowledge of basic and advanced reinforcement learning techniques.

CO2 To develop the Identification of suitable learning tasks to which these learning techniques can be applied.

CO3 To analyze the some of the current limitations of reinforcement learning techniques.

CO4 To determine the Formulation of decision problems, set up and run computational experiments, evaluation of results from experiments

24PBAL82 SOFTWARE TESTING USING SELENIUM LAB

L	T	P	O	C
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COURSE OBJECTIVES:

To study the basics of java programming and to test the coding using testing tool – Selenium. The course covers basic-level Selenium Syllabus topics like Automating a Simple Test and more advanced topics like TestNG Framework.

LIST OF EXERCISES:

1. To start with simple programs in java to understand basics.
2. Write a test case based on controls like Label, Text Box, Button, Option Button, Check Box
3. Write and test a program for a. Login a specific web page. b. Test using email-id.
4. Write and test a program to get the number of list items in a list
5. Write and test a program to get the number of list items combo box.
6. Program for handling pop-up windows.
7. Test a program with thread functions
8. Test a program for handling mouse.
9. Test a program for moving between frames
10. Test a program to handle multiple windows
11. Program for TestNG

DISCIPLINE SPECIFIC ELECTIVES

24DBAL11 INTRODUCTION TO CYBER SECURITY

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

This course provides the foundation for understanding the key issues associated with protecting Information assets. The purpose of the course is to provide the student with an overview of the Field of information security and assurance.

UNIT I INTRODUCTION: 12

Introduction to Cyber Security - Importance and challenges in Cyber Security - Overview of Computer and Web-technology- Cyberspace - Internet infrastructure for data transfer and governance, Internet society, Regulation of cyberspace-Cyber threats - Cyber warfare - CIA Triad - Cyber Terrorism - Cyber Security of Critical- Cyber security -Organizational Implications.

UNIT II - HACKERS AND CYBER CRIMES 12

Types of Hackers - Hackers and Crackers - Cyber-Attacks and Vulnerabilities - Malware threats - Sniffing - Gaining Access - Escalating Privileges - Executing Applications - Hiding Files - Covering Tracks - Worms - Trojans - Viruses – Backdoors-, Cybercriminals modus-operandi- Legal perspective of cyber crime-

UNIT III - ETHICAL HACKING AND SOCIAL ENGINEERING 12

Ethical Hacking Concepts and Scopes - Threats and Attack Vectors - Information Assurance - Threat Modeling - Enterprise Information Security Architecture - Vulnerability Assessment and Penetration Testing - Introduction to Social networks. Types of Social media, Social media platforms - Types of Social Engineering - Insider Attack - Preventing Insider Threats - Social Engineering Targets and Defense Strategies- Modes of digital payments- Banking Cards, Unified Payment Interface (UPI), eWallets, Unstructured Supplementary Service Data (USSD), Aadhar enabled payments, Digital payments related common frauds and preventive measures.

UNIT IV - CYBER FORENSICS AND AUDITING 12

Introduction to Cyber Forensics - Computer Equipment and associated storage media - Role of forensics Investigator - Forensics Investigation Process - Collecting Network based Evidence - Writing Computer Forensics Reports - Auditing - Plan an audit against a set of audit criteria - Information Security Management System Management. Introduction to ISO 27001:2013.14.

UNIT V - CYBER ETHICS AND LAWS 12

Introduction to Cyber Laws - E-Commerce and E-Governance - Certifying Authority and Controller - Offences under IT Act- Computer Offences and its penalty under IT Act 2000 -Intellectual Property Rights in Cyberspace- Laws regarding posting of inappropriate content, Best practices for the use of Social media.

Total: 60 Hours

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: Understand the broad set of technical, social & political aspects of Cyber Security.

CO-2: Explore about Various types of Hackers and Threats and ways of sniffing.

CO-3: Understand the importance of ethical hacking tool and Process..

CO-4: Implementing ethical hacking tools in an organization.

CO-5: Apply methods for authentication, access control, intrusion detection and prevention and conduct research in Cyber Security.

TEXT BOOKS:

1. Donaldson, S., Siegel, S., Williams, C.K., Aslam, A.,(2015) "Enterprise Cyber security -How to Build a Successful Cyber defense Program against Advanced Threats", Apress, 1st Edition.
2. Nina Godbole, Sumit Belapure,(2011) "Cyber Security", Willey.
3. Roger Grimes, "Hacking the Hacker", Wiley,(2017) Ist Edition.
4. Cyber Law by Bare Act,(2000) Govt of India, It Act 2000.
5. 1. Cyber Crime Impact in the New Millennium, by R. C Mishra , Auther Press. Edition2010.
6. 2. Cyber Security Understanding Cyber Crimes, Computer Forensics and LegalPerspectives by Sumit Belapure and Nina Godbole, Wiley India Pvt. Ltd. (FirstEdition, 2011)

L	T	P	O	C
3	0	0	2	3

20DBAL12 INFORMATION SECURITY

COURSE OBJECTIVES:

This course provides the foundation for understanding the key issues associated with protecting information assets. The purpose of the course is to provide the student with an overview of the field of information security and assurance.

UNIT- I : 12

Introduction to Information Security: Attacks, Vulnerability, Security Goals, Security Services and mechanisms - Conventional Cryptographic Techniques : Conventional substitution and transposition ciphers, One-time Pad

UNIT- II: 12

Block cipher and Stream Cipher, Steganography - Symmetric and Asymmetric Cryptographic Techniques: DES, AES, RSA algorithms Authentication and Digital Signatures: Use of Cryptography for authentication,

UNIT- III: 12

Secure Hash function, Key management – Kerberos - Program Security: No malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of- use Errors, Viruses, Trapdoors.

UNIT- IV: 12

Salami attack, Man-in-the- middle attacks, Covert channels - Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong.

UNIT-V: 12

Authentication , Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP,S/MIME

TOTAL: 60 Hours

COURSE OUTCOMES:

At the end of this course students will be able to,

CO1: To acquire knowledge of cryptography and network security.

CO2: To test and evaluate security in systems and networks.

CO3: To use methods for planning and designing secure systems.

CO4: To apply techniques and tools for secure system deployment and operation.

CO5: To Perform continuous testing, assessment and updating of system security.

TEXT BOOKS:

1. "Information Systems Today, Managing in the Digital World", Third Edition by Leonard
2. M. Jessup; Joseph S. Valacich, Publisher: Prentice Hall
3. "Introduction to Information Technology", V. Rajaraman, PHI

REFERENCE BOOKS

1. Information Systems Management in Practice" Barbara C. McNurlin, Ralph H. Sprague, and Publisher: Pearson Education.
2. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
3. Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson
4. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.

   Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

24DBAL21 OPERATING SYSTEMS

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

Student will understand Modern Operating System and their principles. The course will cover theory as well as practice aspects of a subject through scheduled lectures and labs, course will cover details of processes, CPU scheduling, memory management, file system, storage subsystem, input/output management and security protection.

UNIT I OPERATING SYSTEMS OVERVIEW 12

Operating Systems Overview- Overview and Functions of Operating Systems - History and Generation of Operating System - Protection and Security - Distributed Systems - Operating Systems Structures - Services - System Calls.

UNIT II PROCESS MANAGEMENT 12

Processes-Process Concept - Process Scheduling - Operations on Processes - Interprocess Communication; Threads – Overview - Multicore Programming - Multithreading Models; Windows 7 – Thread and SMP Management. Process Synchronization – Critical Section Problem - Mutex Locks – Semaphores – Monitors - CPU Scheduling and Deadlocks.

UNIT III MEMORY MANAGEMENT 12

Memory: Swapping, contiguous memory allocation, paging, page table, segmentation, virtual memory, demand paging, page- replacement, Allocation of frames. Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging (Concepts only) – Page Replacement policies : Least Recently used (LRU) Optimal (OPT) , Second Chance (SC), First in First Out (FIFO), Not recently used (NRU).

UNIT IV-FILE SYSTEM INTERFACE AND MASS STORAGE STRUCTURE 12

File system Interface - Concept of a File – File Access – File Directories - File System Implementation- Mass-Storage Structure: RAID Structure - Disk Structure, Disk Attachment - Disk Scheduling - Swap-Space Management - Stable-Storage Implementation - Overview of Mass-Storage Structure - Tertiary Storage Structure.

UNIT V I/O SYSTEMS AND SECURITY PROTECTION 12

I/O systems - Hardware - Application I/O Interface - Kernel I/O Subsystem - Transforming I/O Requests to Hardware Operations – STREAMS - Protection & Security Protection – Protection -

Goals of Protection - Principles of Protection - Domain of Protection Access Matrix- Implementation of Access Matrix - Access control - Security – Problems - Program Threats – Intruders – Accidental Data Loss - User Authentication - Implementing Security Defenses- Firewalls – Antivirus and Antivirus Techniques.

Total: 60 Hours

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: Analyze the concepts of memory management techniques including virtual memory.

CO-2: Understand about structures and history of operating systems and design issues associated with operating systems.

CO-3: Understand various process management concepts including scheduling, synchronization.

CO-4: Understand about deadlock, deadlock avoidance and prevention

CO-5: Understand about virus and anti virus techniques in OS.

TEXT BOOKS:

1. Ekta Walia, Operating Systems Concepts, Khanna Publishing House, 2022
2. Abraham Silberchatz, Peter B. Galvin, Greg Gagne (2015), "Operating System Concepts" 8th edition.

REFERENCE BOOKS:

1. Stallings (2009) "Operating Systems - Internals and Design Principles", Pearson Education, 6th Edition.
2. Andrew S. Tanenbaum, Herbert Bos (2014) "Modern Operating Systems", Pearson Education, 4th Edition.
3. B.L.Stuart (2012)"Principles of Operating Systems" Cengage learning, India Edition,
4. A.S. Godboie (2009) "Operating Systems" 2nd Edition, TMH.

24DBAL22 **PROCESS MANAGEMENT**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

To provide theoretical and practical practise in software development and process models. To understand Agile development and testing in Scrum. To acquire knowledge about Devops principles. To learn and use Lean UX, Sprint and to understand Design Thinking principles.

UNIT I **12**

Software And Software Engineering - The Nature of Software –The Unique Nature of WebApps- Software Engineering- Software Process- Software Engineering Practice-Software Myths. Software Process Model: A Generic Process Model- Process Assessment and Improvement –Perspective Process Models-Specialized Process Model-The Unified Process.

UNIT II **12**

Stacks- Operations on Stacks, Application of Stack-Infix to Postfix Conversion, Recursion, Maze Problems-Queues-Operations on Queues, Queue Application, Circular Queue

UNIT III **12**

Devops - Introduction to Devops-Principles-Automation-Performance Measurement through KPIS and Metrics-Agile and Devops-Agile Infrastructure-Velocity-Lean Startup UPS.

UNIT IV **12**

Lean Ux and Agile Anti-PatternsSprint -Staggered sprints -Sprint zero and design sprints- Dual-track Agile- Listening to Scrum’s rhythms- Listening to Scrum’s rhythms- Participation- Design is a team sport- Coordinating multiple Lean UX teams- Managing up and out – Agile anti-patterns.

UNIT V **12**

Design Thinking Introduction to Design Thinking – Lean thinking - Actionable Strategy- The Problem with Complexity - Vision and Strategy - Defining Actionable Strategy Act to Learn - Leading Teams to Win.

Total: 60 Hours

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: Gives basic understanding of software development practices and process models

CO-2: Understand Agile development and testing in Scrum.

CO-3: Differentiate Devops and Agile principles.

CO-4: Usage of Lean UX, Sprint and Scrum.

CO-5: Usage of design thinking principlesfor software development

REFERENCE BOOKS:

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023
2. Software Engineering, Ian Somerville, 9th edition, Pearson education.
3. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce
4. R. Maxim. McGraw Hill Education, 2015.
5. KalloriVikraman,(2016) "Introduction to Devops", 1st Edition.
6. Stephen Haunts, (2012)"Essential of Scrum" Addison-Wesley Professional; 1st Edition.
7. Jeff Gothelf, Josh Seiden, (2016) "Lean UX", 2nd Edition.
8. Jonny Schneider,(2017) "Understanding Design Thinking, Lean, and Agile" O'Reilly Media.
9. Jeff Gothelf ,(2017) "Lean vs. Agile vs. Design Thinking", Sense and Respond Press.

Web Resesources:

1. https://www.tutorialspoint.com/sdlc/sdlc_overview.htm
2. https://existek.com/blog/sdlc-models/
3. https://www.agilealliance.org/agile101/
4. https://devops.com/
5. http://theleanstartup.com/principles

24DBAL31 **SOFTWARE ENGINEERING**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- To provide the idea of decomposing the given problem into Analysis, Design, Implementation, Testing and Maintenance phases.
- To provide an idea of using various process models in the software industry according to given circumstances.
- To gain the knowledge of how Analysis, Design, Implementation, Testing and Maintenance processes are conducted in a software project.

UNIT I SOFTWARE PROCESS AND AGILE DEVELOPMENT 12

Introduction to Software Engineering, Software Process, Perspective and Specialized Process Models –Introduction to Agility-Agile process-Extreme programming-XP Process.

UNIT II REQUIREMENTS ANALYSIS AND SPECIFICATION 12

Software Requirements: Functional and Non-Functional, User requirements, System requirements, Software Requirements Document — Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.

UNIT III SOFTWARE DESIGN 12

Design process — Design Concepts-Design Model– Design Heuristic — Architectural Design -Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design –Component level Design: Designing Class based components, traditional Components.

UNIT IV TESTING AND MAINTENANCE 12

Software testing fundamentals-Internal and external views of Testing-white box testing — basis path testing-control structure testing-black box testing- Regression Testing — Unit Testing — Integration Testing — Validation Testing — System Testing And Debugging – Software Implementation Techniques: Coding practices-Refactoring-Maintenance and Reengineering-BPR model-Reengineering process model-Reverse and Forward Engineering.

UNIT V PROJECT MANAGEMENT 12

Software Project Management: Estimation — LOC, FP Based Estimation, Make/Buy Decision COCOMO I & II Model — Project Scheduling — Scheduling, Earned Value Analysis Planning — Project Plan, Planning Process, RFP Risk Management — Identification, Projection — Risk Management-Risk Identification-RMMM Plan-CASE TOOLS.

TOTAL HOURS:60

TEXT BOOKS:

1. Software Engineering, N.S. Gill, Khanna Publishing House, 2023

2. Software Engineering, Ian Somerville, 9th edition, Pearson education.

3. Software Engineering A practitioner's Approach, 8th edition, Roger S Pressman, Bruce R. Maxim. McGraw Hill Education, 2015.

REFERENCE BOOKS:

1. Software Engineering, A Precise Approach, Pankaj Jalote, Wiley India, 2010.

2. Software Engineering: A Primer, Waman S Jawadekar, Tata McGraw-Hill, 2008

3. Fundamentals of Software Engineering, Rajib Mall, PHI, 2005

4. Software Engineering, Principles and Practices, Deepak Jain, Oxford University Press.

COURSE OUTCOMES:

CO1: Understand about process model for developing a software project

CO2: Understand about Requirements Engineering

CO3: To Know to build and analyze model

CO4: Apply Component level design

CO5: An ability to design and conduct experiments, as well as to analyze and interpret data

24DBAL32 **NETWORK SECURITY**

L	T	P	O	C
3	0	0	2	3

COURSE OBJECTIVES:

- To learn the fundamentals of cryptography.
- To learn the key management techniques and authentication approaches.
- To explore the network and transport layer security techniques.
- To understand the application layer security standards.
- To learn the real time security practices.

UNIT I INTRODUCTION 12 Basics of cryptography, conventional and public-key cryptography, hash functions, authentication, and digital signatures.

UNIT II KEY MANAGEMENT AND AUTHENTICATION 12 Key Management and Distribution: Symmetric Key Distribution, Distribution of Public Keys, X. Certificates, Public-Key Infrastructure. User Authentication: Remote User-Authentication Principles, Remote User-Authentication Using Symmetric Encryption, Kerberos Systems, Remote User Authentication Using Asymmetric Encryption.

UNIT III ACCESS CONTROL AND SECURITY 12 Network Access Control: Network Access Control, Extensible Authentication Protocol, IEEE 802 Port-Based Network Access Control - IP Security - Internet Key Exchange (IKE). Transport-Level Security: Web Security Considerations, Secure Sockets Layer, Transport Layer Security, HTTPS standard, Secure Shell (SSH) application.

UNIT IV APPLICATION LAYER SECURITY 12 Electronic Mail Security: Pretty Good Privacy, S/MIME, DomainKeys Identified Mail. Wireless Network Security: Mobile Device Security

UNIT V SECURITY PRACTICES 12 Firewalls and Intrusion Detection Systems: Intrusion Detection Password Management, Firewall

Characteristics Types of Firewalls, Firewall Basing, Firewall Location and Configurations. Blockchains, Cloud Security and IoT security

TOTAL HOURS:60

TEXT BOOKS:

1. Cryptography and Network Security: Principles and Practice, 6th Edition, William Stallings, 2014, Pearson, ISBN 13:9780133354690.

REFERENCE BOOKS:

1.Network Security: Private Communications in a Public World, M. Speciner, R. Perlman, C. Kaufman, Prentice Hall, 2002.

2.Linux iptables Pocket Reference, Gregor N. Purdy, O'Reilly, 2004, ISBN-13: 978-0596005696.

3.Linux Firewalls, by Michael Rash, No Starch Press, October 2007, ISBN: 978-1-59327-141-1.

4.Network Security, Firewalls And VPNs, J. Michael Stewart, Jones & Bartlett Learning, 2013, ISBN-10: 1284031675, ISBN-13: 978-1284031676.

5.The Network Security Test Lab: A Step-By-Step Guide, Michael Gregg, Dreamtech Press, 2015, ISBN-10:8126558148, ISBN-13: 978-8126558148

COURSE OUTCOMES:

At the end of this course, the students will be able:

CO1:Classify the encryption techniques

CO2:Illustrate the key management technique and authentication.

CO3:Evaluate the security techniques applied to network and transport layer CO4:Discuss the application layer security standards.

CO5:Apply security practices for real time applications.

24DBAL41 DATA COMMUNICATION AND NETWORKING

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

This course introduces the basic concepts of Data Communication and Networking , OSI Model, Layers of OSI Model, Parallel and serial transmission, Analog and digital network.

UNIT I PROTOCOLS & MEDIA 12

Introduction to data communication – Network protocols & standards – Line configuration – Topology – Transmission mode – Categories of networks – OSI model – Layers of OSI model – Transmission media – Guided media – Unguided media.

UNIT II SIGNALS & ERRORS 12

Analog and digital signals – Encoding and modulation – Parallel and serial transmission – DTE/DCE – Types of errors – Error detection and correction – Data link control – Line discipline – Flow control – Error control.

UNIT III MULTIPLEXING & SWITCHING 12

Multiplexing – Types of multiplexing – LAN – Project 802 – Ethernet – Token bus – Token ring – FDDI – MAN – IEEE 802.6 – Circuit switching – Packet switching.

UNIT IV ISDN & ATM 12 History of analog and digital network – Access to ISDN – ISDN layers – Broadband ISDN – Packet layer protocol – ATM – ATM architecture – ATM layers – Congestion control – Leaky bucket algorithm.

UNIT V NETWORK & APPLICATION LAYER 12

Repeaters – Bridges – Routers – Gateway – Routing algorithms – TCP/IP – Overview – Network layer – Transport and application layers of TCP/IP – DNS – SMTP – HTTP – WWW.

TOTAL: 60 Hours

TEXT BOOKS:

1. Andrew S. Tanenbaum, "Computer Networks", 5th Edition, Pearson Education, 2011.

2. James F. Kurose and Keith W. Ross, "Computer Networking: A Top-Down Approach", 8th Edition, Pearson, 2021.

REFERENCE BOOKS:

1. Behrouz A. Forouzan, "Data Communications and Networking", 5th Edition, McGraw-Hill Education, 2012.

2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", 6th Edition, Morgan Kaufmann, 2019.

3. Bhavneet Sidhu, An Integrated Approach to Computer Networks, Khanna Publishing House, 2023.

4. Mastering PC Hardware & Networking, Khanna Publishing House, 2024.

WEB RESOURCES:

1. Cisco Networking Academy - Online Courses and Resources

2. NetworkLessons.com - Tutorials on Various Networking Topics

COURSE OUTCOMES:

CO-1: Analyze the features and operations of various application layer protocols such as Http, DNS, and SMTP.

CO-2: Analyze the various types of transmission media and services.

CO-3: Understand the fundamental concepts of data communications and networking and able to intelligently compare and contrast local area networks and wide area networks in terms of characteristics and functionalities.

CO-4: Understand the purpose of network layered models, network communication using the layered concept, and able to compare and contrast Open System Interconnect (OSI) and the Internet Model.

CO-5: Understand the basic difference between data logical link control and media access control and realize the features of SMDS, switching techniques, ISDN, and ATM.

24DBAL42 **ETHICAL HACKING**

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

This course covers the theory and practices of finding the vulnerabilities through forming the different attacks and then defining the appropriate security policy including the action to detect or prevent the attacks and thus reduce the damages.

UNIT I INTRODUCTION TO ETHICAL HACKING 12

Security Fundamental - Security Testing - Hacker and Cracker – Descriptions - Test Plans keeping it legal - Ethical and Legality-Technical Foundations of Hacking: The Attacker's

Process - The Ethical Hacker's Process- Security and the Stack.

UNIT II FOOTPRINTING AND SCANNING 12

Information Gathering - Determining the Network Range - Identifying Active Machines Finding Open Ports and Access Points - OS Fingerprinting Services - Mapping the Network

Attack Surface - Enumeration and System Hacking: Enumeration - System Hacking.

UNIT III MALWARE THREATS AND SESSION HIJACKING 12

Viruses and Worms- Trojans - Covert Communication - Keystroke Logging and Spyware -

Malware Counter Measures- Sniffers - Session Hijacking - Denial of Service - Distributed

Denial of Service.

UNIT IV WEB SERVER HACKING AND ATTACKS 12

Web Server Hacking - Web Application Hacking - Database Hacking - Wireless Technologies

- Mobile Security and Attacks: Wireless Technologies - Mobile Device Operation and Security

– Wireless LANs.

UNIT V CASE STUDY 12

Intrusion Detection Systems - Firewalls - Honeypots - Physical Security - Social Engineering –

Case Studies: Intrusion detection Real Secure Tripwire Dragon Snort ,Packet sniffing Leave the

sniffer running, Passwords in procedures & documents.

Total: 45 Hours

REFERENCE BOOKS:

1. Michael Gregg,"Certified Ethical Hacker", Version 10, Third Edition, Pearson IT Certification, 2019.

2. Roger Grimes ,"Hacking the Hacker" , 1st Edition, Wiley, 2017.

3. Ankit Fadia, " The Unofficial Guide to Ethical Hacking", Laxmi Publications, 2ns Edition, 2006.

COURSE OUTCOMES:

At the end of this course students will be able to,

CO-1: To Describe and understand the basics of the ethical hacking

CO-2: Able to perform the foot printing and scanning

CO-3: Characterize the malware and their attacks and detect and prevent them.

CO-4: To understand the basic concepts of sniffers and session hijacking.

CO-5: Able to learn Intrusion Detection Systems and physical security.

24DBAL51 **INTERNET OF THINGS**

L	T	P	O	C
3	1	0	2	4

COURSE OBJECTIVES

To understand the fundamentals of Internet of Things and to apply the conceptin Real World Scenario.

UNIT I OVERVIEW 12

IoT-An Architectural Overview- Building an architecture - Main design principles and needed capabilities - An IoT architecture outline - Standards considerations.

UNIT II M2M AND IOT TECHNOLOGY FUNDAMENTALS 12

Devices and gateways- Local and wide area networking- Data management- Business processes in IoT-EverythingasaService(XaaS)-M2MandIoTAnalytics-KnowledgeManagement.

UNIT III REFERENCE ARCHITECTURE 12

Introduction - IoT reference Model - IoT Reference Architecture-Functional View- Information View- Deployment and Operational View- Other Relevant architectural views.

UNIT IV REAL-WORLD DESIGN CONSTRAINT 12

Introduction- Technical Design constraints - Data representation and visualization, Interaction and remote control. IoT systems management - IoT Design Methodology - specifications - Integration and ApplicationDevelopment.

UNIT V CASESTUDY 12

Case Study - Various Real time applications of IoT- Connecting IoT to cloud - Cloud StorageforIot-DataAnalyticsforIoT-Software&ManagementToolsforIoT.

Total Hours: 60 hours

TEXT BOOKS:

1. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Aves and, Stamatis

2.Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things:IntroductiontoaNewAgeofIntelligence",1stEdition,AcademicPress,2014.

REFERENCE BOOKS:

1. Peter Waher, "Learning Internet of Things", PACKT publishing, Birmingham, Mumbai,2005.

2. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press,2012.

COURSE OUTCOMES:

CO-1: To assess the vision and introduction of IoT and to understand IoT Market perspective

CO-2: To Implement Data and Knowledge Management and use of Devices in IoT technology.

CO-3: To understand where the IoT concept fits within the broader ICT industry and possible future Trends

CO-4: To Understand and be able to explain the role of big data, cloud computing and data analytics in a typical IoTsystem.

CO-5: Apply effective techniques to create IoT based projects.

24DBAL52 BUSINESS INTELLIGENCE AND ANALYTICS

L	T	P	O	C
3	1	0	2	4

Course Objective

- Explain the Business Intelligence, Analytics and Decision Support system
- List the technologies for Decision making, Automated decision systems
- Explain sentiment analysis techniques
- Illustrate Multi-criteria Decision making systems, predictive modelling techniques

UNIT I : An Overview of Business Intelligence, Analytics, and Decision Support 12

Information Systems Support for Decision Making - An Early Framework for Computerized Decision Support- The Concept of Decision Support Systems - A Framework for Business Intelligence - Business Analytics Overview - Brief Introduction to Big Data Analytics.

UNIT II Decision Making 12

Introduction and Definitions- Phases of the Decision - Making Process -The Intelligence Phase- Design Phase, Choice Phase, Implementation Phase - Decision Support Systems Capabilities, Decision Support Systems Classification - Decision Support Systems Components.

UNIT III Neural Networks and Sentiment Analysis 12

Basic Concepts of Neural Networks - Developing Neural Network-Based Systems, Illuminating the Black Box of ANN with Sensitivity - Support Vector Machines - A Process Based Approach to the Use of SVM - Nearest Neighbor Method for Prediction - Sentiment Analysis Overview -Sentiment Analysis Applications - Sentiment Analysis Process - Sentiment Analysis -Speech Analytics.

UNIT IV :Model-Based Decision Making 12

Decision Support Systems modeling -Structure of mathematical models for decision support, Certainty, Uncertainty, and Risk - Decision modeling with spreadsheets - Mathematical programming optimization - Decision Analysis with Decision Tables and Decision Trees -Multi-Criteria Decision Making With Pairwise Comparisons.

UNIT V Automated Decision Systems and Expert System 12

Automated Decision Systems - The Artificial Intelligence field - Basic concepts of Expert Systems - Applications of Expert System - Structure of Expert Systems -Knowledge Engineering, Development of Expert System

TOTAL 60 HOURS

TEXT BOOKS:

1. "Data Analytics" by V.K. Jain, Khanna Book Publishing Company, 2024.
2. Ramesh Sharda, Dursun Delen, EfraimTurban, J.E.Aronson,Ting-Peng Liang, David King, "Business Intelligence and Analytics: System for Decision Support", 10th Edition, Pearson Global Edition, 2013

REFERENCE BOOKS:

1. Data Analytics: The Ultimate Beginner's Guide to Data Analytics Paperback – 12 November 2017 by Edward Mize

COURSE OUTCOMES:

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

CO1: Able to analyze Business Intelligence, Analytics and Decision Support

CO2: Explain the technologies for Decision making

CO3 Apply predictive modelling techniques

CO4: Apply sentiment analysis techniques(

24DBAL61 **CLOUD COMPUTING**

L	T	P	O	C
4	0	0	2	4

Course Objective

This course introduces the fundamental concepts of cloud computing, its services and Tools. Analyze the comparative advantages and disadvantages of cloud computing.

UNIT I CLOUD COMPUTING 12

History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT II WEB-BASED APPLICATION 12

Pros and Cons of Cloud Service Development – Types of Cloud Service Development– Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud ServicesDevelopmentServicesandTools–AmazonEc2–GoogleAppEngine–IBMClouds.

UNIT III CENTRALIZING EMAIL COMMUNICATIONS 12

Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud ComputingfortheCommunity–CollaboratingonGroupProjectsandEventsfortheCorporation

UNIT IV COLLABORATING ON CALENDARS SCHEDULES AND TASK MANAGEMENT 12

Exploring Online Scheduling Applications – Exploring Online Planning and Task Management – Collaborating on Event Management – Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Databases– Storing and Sharing Files.

UNIT V COLLABORATING VIA WEB-BASED COMMUNICATION TOOLS 12

Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis.

Total: 60 Hours

REFERENCE BOOKS:

1. Michael Miller, "Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online", Que Publishing, August2008.

2. Haley Beard, "Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs", Emereo Pty Limited, July2008.

COURSE OUTCOMES:

CO-1: Understand the importance of virtualization in distributed computing and how this has enabled the development of Cloud Computing.

CO-2: Analyze Cloud infrastructure including Google Cloud and Amazon Cloud.

CO-3: Analyze authentication, confidentiality and privacy issues in cloud computing environment.

CO-4: Access the cloud database, analyze how to store and share data with privacy.

CO-5: Determine financial and technological implications for selecting cloud computing platforms.

24DBAL62 CLIENT RELATIONSHIP MANAGEMENT

L	T	P	O	C
4	0	0	2	4

COURSE OBJECTIVES:

Acquire knowledge about Service Now platform. To get comprehensive knowledge in ITSM principles and architecture. To acquire various features of Service Now platform and tool.

UNIT I: Service Now Intermediate Level 12 Administrator-Service Now Introduction-Service Now Platform UI Service Now ITSM overview-Managing Users, Groups and Roles, departments, companies and Assignment Rules-Tables, Columns, Attributes, Dictionary Entries, Schema Map-Managing Forms, Layouts and Lists - Dictionary Overrides and Simple Reference Qualifiers.

UNIT II: System Properties 12

Incident management - - Problem management- - Change management- Overview of other ITSM Modules - Overview of other ITSM Modules- SLA Basics-Introduction to Client and Server Side Scripting-server-side scripting - Server Side Glide API -server-side scripting - Server Side Glide API - Server Side script Debugging-Server Side Scripting Best Practices-Business Rules-Client Side APIs-UI Policies and Data Policies-Client Scripts -Client Side script Debugging.

UNIT III: Client Scripts & Client Glide Apis-Best Practices 12

Client-side scripting & policies (UI and Data)-Modularize programming using UI Actions (both Server and Client Side)-Script Include-Glide AJAX-UI Pages and UI Macros-Managing Update Sets-Custom Applications Automated Test Framework –Events-Inbound/Out Bound notifications-Mail Templates and Scripts.

UNIT IV: Manage Workflows 12

Managing Stage Sets -Manage Workflows -Manage Workflows -Flow Designer (Over view)- Service Catalogs, Categories, Items and variables-Manage Execution Plans and workflows-Cart Layouts-Client scripts and UI policies-Record Producers-Order Guides & Scriptable Order GuidesScheduled Jobs. VTB Agent Intelligence (Over View)-Restrict access to applications and application modules-Automatically create application Access Controls -Manually create, test, and debug Access Controls-Managing ServiceNow imports and exports-Managing Import Sets and Transform MapConfigure and run Reports and Dashboards Security Controls-Database Views.

UNIT V: Service now Service Portals Overview 12

Service Now Service portals core components -Scripting in Service Portal-ITSM Virtual Agent – Overview-Performance Analytics Overview-Service Now on Mobile-Service Now Integration Overview.

TOTAL HOURS:60

REFERENCE BOOKS

- Tim Woodruff, “Learning ServiceNow: Administration and development on the Now platform, for powerful IT automation”, 2nd Edition, Packt Publishing Ltd., 2018.
- AshishRudraSrivastava “ServiceNow Cook Book” Packt Publishing Ltd, 2017.
- Andrew Kindred , “Mastering ServiceNow Scripting” Packt Publishing2018.

WEBSITES

1. https://www.servicenow.com/products/it-service-management.html
2. https://www.servicenow.com/content/dam/servicenow-assets/public/en-us/doctype/resource-center/data-sheet/ds-itsm.pdf
3. https://www.guru99.com/servicenow-tutorial.html

COURSE OUTCOMES

CO1: To understand about Service Now Intermediate Level

CO2: To understand System Properties

CO3: To practice Client Scripts & Client Glide Apis

CO4: Using Flows and Workflows for process automation

CO5: Various script types used throughout the platform

24DBAL72 SECURITY ISSUES IN MACHINE LEARNING

L	T	P	O	C
4	0	0	2	4

Course Objective:

This course introduces the basic concept of machine learning, types of machine learning, security issues and possible solutions to ensure machine learning security, advanced learning techniques and case study on machine learning.

UNIT I INTRODUCTION TO MACHINE LEARNING 12

Overview of Machine learning concepts – Over fitting and train/test splits, Types of Machine learning – Supervised, Unsupervised, Reinforced learning, Introduction to Bayes Theorem, Linear Regression- model assumptions, regularization (lasso, ridge, elastic net)

UNIT II CLASSIFICATION AND REGRESSION ALGORITHMS 12

Classification and Regression algorithms- Naïve Bayes, K-Nearest Neighbors, logistic regression, support vector machines (SVM), decision trees, and random forest, Classification Errors, Analysis of Time Series- Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks Learning And Generalization, Overview of Deep Learning.

UNIT III SECURITYIN MACHINE LEARNING 12

Security Vulnerabilities in Machine Learning Algorithms, Evasion Attacks (Adversarial Inputs), Data Poisoning Attacks, Model Stealing Techniques, Possible Solutions to Ensure Machine Learning Security

UNIT IV ADVANCED LEARNING 12

Sampling-Basic Sampling methods, Monte Carlo, Gibbs Sampling – Computational Learning Theory – Mistake Bound Analysis – Reinforcement learning – Markov Decision processes, Deterministic and Non- deterministic Rewards and Actions, Temporal Difference Learning Exploration.

UNIT V CASE STUDY 12

Possible case studies: Machine learning for intrusion detection, Machine learning for side

channel analysis, Privacy preserving machine learning, Adversarial machine learning.

Total: 60 Hours

REFERENCE BOOKS:

1. Rajiv Chopra, Machine Learning and Machine Intelligence, Khanna Book Publishing Company, 2024.
2. Christopher Bishop, “Pattern Recognition and Machine Learning” Springer,2007.
3. KevinP.Murphy,“MachineLearning:AProbabilisticPerspective”,MITPress,2012.
4. EthemAlpaydin,“Introduction to MachineLearning”,MITPress,ThirdEdition,2014.
5. Tom Mitchell, "Machine Learning", McGraw-Hill,1997.
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer, Second Edition,2011.
7. Stephen Marsland, “Machine Learning - An Algorithmic Perspective”, Chapman and Hall/CRC Press, Second Edition,2014.

COURSE OUTCOMES:

CO-1: To appreciate supervised and unsupervised learning and their applications

CO-2: To understand the classification and regression algorithm techniques.

CO-3: To appreciate the concepts and algorithms of reinforcement learning.

CO-4: To understand the possible solutions to ensure machine learning security.

CO-5: To appreciate the concepts and algorithms of reinforcement learning.

24DBAL81 BLOCK CHAIN TECHNOLOGY

L	T	P	O	C
3	1	0	2	4

Course Objective:

This course covers the technical aspects of public distributed ledgers, blockchain systems, crypto currencies, and smart contracts. Students will learn how these systems are built, how to interact with them, how to design and build secure distributed applications.

UNIT-I BLOCK CHAIN BASICS 12

Distributed Database, Two General Problem, Byzantine General problem and Fault Tolerance, Hadoop Distributed File System, Distributed Hash Table, ASIC resistance, Turing Complete. Cryptography: Hash function, Digital Signature - ECDSA, Memory Hard Algorithm, Zero Knowledge Proof positions.

UNIT-II INTRODUCTION TO BLOCKCHAIN 12

Introduction, Advantage over conventional distributed database, Block chain Network, Mining Mechanism, Distributed Consensus, Merkle Patricia Tree, Gas Limit, Transactions and Fee, Anonymity, Reward, Chain Policy, Life of Block chain application, Soft & Hard Fork, Private and Public block chain.

UNIT-III DISTRIBUTED CONSENSUS AND CRYPTO CURRENCY 12

Nakamoto consensus, Proof of Work, Proof of Stake, Proof of Burn, Difficulty Level, Sybil Attack, Energy utilization and alternate. History, Distributed Ledger, Bitcoin protocols - Mining strategy and rewards, Ethereum - Construction, DAO, Smart Contract, GHOST, Vulnerability, Attacks, Sidechain, Namecoin.

UNIT-IV CRYPTO CURRENCY REGULATION 12

Stakeholders, Roots of Bit coin, Legal Aspects-Crypto currency Exchange, Black Market and Global Economy. Applications: Internet of Things, Medical Record Management System, Domain Name Service and future of Block chain.

UNIT V CASE STUDY ON BLOCKCHAIN 12

Case study on Naive Blockchain construction, Memory Hard algorithm – Hash cash implementation, Direct Acyclic Graph, Play with Go-ethereum, Smart Contract Construction, Toy application using Blockchain, Mining puzzles

Total: 60 Hours

REFERENCE BOOKS:

1. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction, Princeton

University Press (July 19,2016).

2. Draft version of "S. Shukla, M. Dhawan, S. Sharma, S. Venkatesan, 'Blockchain Technology: Cryptocurrency and Applications', Oxford University Press,2019.
3. Josh Thompson, 'Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming', Create Space Independent Publishing Platform,2017.

WEB RESOURCES:

1. https://www.blockchainexpert.uk/book/blockchain-book.pdf
2. https://users.cs.fiu.edu/~prabakar/cen5079/Common/textbooks/Mastering_Blockchain_2nd _Edition. pdf
3. https://www.gsb.stanford.edu/sites/gsb/files/publication-pdf/study-blockchain-impact-moving-beyond-hype_0.pdf
4. https://www.lopp.net/pdf/princeton_bitcoin_book.pdf
5. https://bitcoinbook.cs.princeton.edu/
6. https://www.icaew.com/technical/technology/blockchain/blockchain-articles/blockchain-case- studies#asset
7. https://consensys.net/blockchain-use-cases/
8. https://medium.com/@dejanjovanovic_24152/blockchain-case-studies-2271d37d3ed

COURSE OUTCOMES:

CO-1: Stating block chain technologies basics are made possible through learning Distributed Database and various types of database

CO-2: Stating the Mining strategies followed in block chain teach the basic architecture behind the perfect building of block chain for industries.

CO-3: Describing the history behind the block chain and learning about Vulnerability, Attacks and Side chain gives an additional support for creating a secured block chain.

CO-4: Recognizing some of latest crypto currency aspects leads students to understand some of basic concepts of Black Market and Global Economy.

CO-5: Develop the acquired knowledge in solving the problem in existing case studies.

24DBAL82 **DESIGN THINKING**

L	T	P	O	C
3	1	0	2	4

UNIT-1 : DESIGN THINKING PROCESS

Design Thinking Process: Types of the thinking process, Common methods to change the human thinking process, Design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs Design thinking, Problem solving, the need of design thinking; An approach to design thinking**,** Design thinking Process model, Design thinking tools.

Case Studies: General, Engineering and Service applications

Activities: Identify an Opportunity and Scope of the Project

Explore the possibilities and prepare a design brief

UNIT II: EMPATHIZE AND DEFINE

Design thinking phases, how to empathize, Role of empathy in design thinking, the purpose of empathy maps, Things to be done prior to empathy mapping, Activities during and after the session, Understanding empathy tools: Customer Journey Map, Personas.

Define- Methods of Define Phase: Storytelling, Critical items diagrams, Define success

Activities: Apply the methods of empathizing and Define Phases Finalize the problem statement

UNIT III: IDEATION

Challenges in idea generation, Visualize, Empathize, and Ideate method, Importance of visualizing and empathizing before ideating, Applying the method**,**

Create Thinking**,** Generating Design Ideas**,** Lateral Thinking**,** Analogies**,** Brainstorming**,** Mind mapping**,** National Group Technique**,** Synectic's**,** Development of work**,** Analytical Thinking**,** Group Activities. Ideation Tools: How Might We? (HMW), Storyboard, Brainstorming. What is design innovation? A mindset for innovation**,** and asking "What if?" asking "What wows?" and "What works?"

Activities- Apply the methods of Ideate Phase: Generate Lots of Ideas

UNIT I V: PROTOTYPING

What is a prototype? - Prototyping as a mindset, prototype examples, prototyping for products; Why we prototype? Fidelity for prototypes, Process of prototyping- Minimum Viable prototype.

Activities: Apply the Methods of the Prototype Phase: Create prototypes for selected ideas

UNIT V: TESTING PROTOTYPES

Prototyping for digital products: What's unique for digital products, Preparation; Prototyping for hysical products: What's unique for physical products, Preparation; Testing prototypes with users. Create a Pitch-

Plan for scaling up-Road map for Implementation, Fine-tuning and Submission of the project report

Activities: Collect feedback; iterate and improve the ideas

Present your solution using the Storytelling method

TEXT BOOKS:

1. Tim Brown, Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation, HarperCollins Publishers Ltd.

2. Idris Mootee, Design Thinking for Strategic Innovation,2013, John Wiley & Sons Inc.

MULTIDISCIPLINARY ELECTIVE

24EMDE31 INDIAN KNOWLEDGE SYSTEM

L	T	P	O	C
2	0	0	0	2

COURSE OBJECTIVES

- To Gain an understanding of Indian Knowledge System.
- To Develop an ability to apply the Indian Knowledge System to societal challenges faced today in areas such asholistic health, governance, public administration and sustainable living.
- To Promote the youths to do research in the various fields of Indian knowledge system.

Unit1: An Overview of Indian Knowledge System 6

Introduction- Organization of Indian Knowledge System- The IKS corpus- A Classification framework- Historicity of Indian Knowledge System -Some salient aspects of Indian Knowledge System

Unit 2: Philosophical system 6

Introduction to Philosophy- Development of Indian Philosophical system - Unique features of Indian Philosophical system- Introduction to Yoga.

Unit 3 : Governance and Public Administration 6

Introduction - Understanding Governance from ancient to modern times- Relevance of Arthashastra- Glimpses of Nitishastra- Vidura Niti.

Unit 4 : Wisdom through the Ages 6

Gateways of ancestral wisdoms-Introduction to Purāṇa- The Purāṇic repository- Issues of interest in Purāṇas- Introduction to Itihāsas- Key messages in Itihāsa-Wisdom through Nīti-śāstra.

Unit 5 Mathematics 6

Introduction to Indian Mathematics- Unique aspects of Indian Mathematics- Indian Mathematicians and their Contributions.

Total 30 hours

COURSE OUTCOMES:

CO1 : Classify the key concepts of Indian Knowledge System and discuss the multi-faceted nature of knowledge contained in the Traditional Systems of India.

CO2 : Identify the rich heritage of governance in Indian Knowledge System.

CO3 : Recognize the relevance of Arthash astra in public administration.

CO4 :Identify the Wisdom through Ages through Ithihasas.

CO5 : Knowledge of Indian Mathematicians and their contributions.

Text Books:

1. Mahadevan B., Bhat V R, Nagendra Pavana R.N., Indian Knowledge System Concepts andApplication, PHI Learning Pvt. Ltd., 2022.
2. Kapoor Kapil, and Singh Avadesh Kumar, Indian Knowledge System Vol.1, DK Print World,Ltd., 2005.

Reference Books

1. Textbook on The Knowledge System of Bhārata by Bhag Chand Chauhan.

2. Histrory of Science in India Volume-1, Part-I, Part-II, Volume VIII, by Sibaji Raha, et al. National Academy of Sciences, India and The Ramkrishan Mission Institute of Culture, Kolkata

Weblink:

1. https://onlinecourses.swayam2.ac.in/imb23_mg54/preview
2. https://digest.iimb.ac.in/2022/04/book-indian-knowledge-systems-co-authored-dr-b-mahadevan/
3. https://www.summarize.tech/www.youtube.com/watch?v=jcV0LIp570A

VALUE ADDED COURSES

24DVAC11 UNIVERSAL HUMAN VALUES

L	T	P	O	C
1	0	0	1	1

COURSE OBJECTIVES:

The candidates will be able to appreciate the complementarity between the values and skills for sustained happiness and prosperity. To influence the students to approach the life and profession with a holistic perspective towards a value-based living in a natural way. To highlight plausible implications of holistic understanding of ethical human conduct.

UNIT- I INTRODUCTION TO VALUE EDUCATION 5

Living a fulfilling life. Value education. Skill education. Complementarity of Values and Skills. Development of a holistic perspective. Right understanding, relationship and physical facility. Understanding the happiness and prosperity.

UNIT-II HARMONY AT MULTIPLE LEVELS 5

Human being as co-existence of the self and the human body. Understanding harmony in the self. Harmony in the family and understanding values in human-human relationships. Harmony in the society and understanding universal human order. Harmony in nature and understanding the interconnectedness, self-regulation and mutual fulfillment. Harmony in existencedot and understanding co-existence at various levels.

UNIT-III IMPLICATIONS OF THE RIGHT UNDERSTANDING 5

Ethical human conduct. Implications of value-based living. Right understanding of professional ethics. Humanistic education. Holistic technologies, production systems and management models. Strategies for transition towards value-based life and profession.

Total: 15 Hours

COURSE OUTCOMES:

At the end of the course learners will be able to:

CO1: Develop qualities like responsibility and the ability to handle problems with sustainable solutions.

CO2: Appraise human values and the harmony at various levels.

CO3: Perceive a better critical ability.

CO4: Develop qualities pertaining to value-based living.

CO5: Apply what they have learnt to their own self in real life settings.

Text Books:

1. R.R. Gaur, R. Asthana, G.P. Bagaria. (2023). A Foundation Course in Human Values and Professional Ethics. 3rd Revised Edition. Excel Books, New Delhi.

Reference Books:

1. A. Nagaraj, Jeevan Vidya Prakashan, Amar Kantak. Jeevan Vidya (1999), Ek Parichaya
2. Rakesh Gupta. Jeevan Vidya (2008), An Introduction (Introductory Book to Madhyasth Darshan-Coexistentialism). English Version.
3. A. N. Tripathi (2004), Human Values. First Edition. New Age International Publishers, New Delhi.

24DVAC41 YOGA EDUCATION

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The students will be able to:

- Understand the philosophy, aims, and health benefits of Yoga.
- Gain practical knowledge of yogic postures, breathing techniques, and relaxation practices.
- Apply yogic methods for stress reduction, emotional balance, and focus enhancement.
- Incorporate Yoga as a tool for lifestyle improvement, well-being, and inner awareness.

UNIT-I INTRODUCTION TO YOGA 5

Definition and meaning of Yoga – Classical and modern perspectives. -Philosophy and objectives of Yoga-Benefits of Yoga for physical, mental, and emotional health -Relevance of Yoga in daily life, especially for students and professionals - Guidelines for safe and mindful Yoga practice

UNIT II YOGA PRACTICES – ASANAS AND BREATHING 5

Loosening and warm-up exercises Neck, shoulder, spine, and joint movements - Standing AsanasTadasana, Trikonasana, Vrikshasana - Sitting AsanasVajrasana, Ardha Matsyendrasana, Bhadrasana - Prone and Supine AsanasBhujangasana, Shalabhasana, Pavanamuktasana - Breathing Practices (Pranayama)Anulom Vilom, Bhramari, Sheetali, Sheetkari - Relaxation TechniquesDeep Relaxation Technique (DRT)

UNIT-III YOGA FOR MENTAL WELL-BEING & LIFESTYLE MANAGEMENT 5

Ecosystems and ecosystem services: Major ecosystem types in India and their basic Role of Yoga in managing stress, anxiety, and fatigue - Importance of meditation and breath regulation - Basics of meditation: breath-based and mindfulness - Yogic lifestyle guidelines – diet, discipline, sleep, and conduct - Integrating Yoga into student routine for balance and productivity

Total: 15 hours

Text Books & Reference Books

1. Ministry of AYUSH. (2023). Common Yoga Protocol. Government of India
2. Swami Satyananda Saraswati. Asana, Pranayama, Mudra, Bandha. Bihar School of Yoga
3. Dr. R. Nagarathna & Dr. H. R. Nagendra. Yoga for Students. SVYASA
4. NCERT. (2020). Yoga – A Healthy Way of Living (Upper Primary and Secondary)

Course Outcomes (CO):

At the end of this course, learners will be able to:

CO1: Explain the meaning and relevance of Yoga for overall well-being.

CO2: Demonstrate basic asanas and breathing techniques with proper alignment.

CO3: Practice guided relaxation and introductory meditation.

24SNSS41 NATIONAL SERVICE SCHEME

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The students will be able to understand the concept of youth and the importance of youth population in Nation Building. The course also enable the students to appraise the nature and growth of national service scheme in India. The course enable the students to perceive the aims, objectives, logo, emblem and organizational structure of NSS.

UNIT-I INTRODUCTION 5

Introduction to National Service Scheme. Philosophy of NSS. Basic concepts of NSS-Motto, Symbol, Badge, NSS Day. NSS programs and activities; NSS Components-Programme Officer, Volunteer, Community. Classification of NSS Programme.

UNIT-II ACTIVITIES OF NSS 5

Regular activities of NSS – Adoption of villages, slums etc., Coordination with Voluntary Organizations, National Service Volunteer Scheme (NSVS), Day Camps, Special Camping Program-objectives, contributions and activities.

UNIT-III ADMINISTRATION, PLANNING & IMPLEMENTATION OF NSS PROGRAMS 5

Administrative structure of NSS at National, State and University levels. NSS advisory committees. Planning and Implementation of NSS Programs-Off campus activities- Rally, Swatchatha Programme, Visit to heritage sites, conserving ancient monuments, Women empowerment program, Blood donation, Water conservation program etc.

Total : 15 Hours

COURSE OUTCOMES:

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

CO1: To explain the philosophy and basic concepts of NSS. CO2:

To appraise the activities of NSS.

CO3: To discuss the concepts of Special Camping Program.

Textbooks:

1. National Service Scheme Manual (Revised), (2006), Government of India, Ministry of

Youth Affairs and Sports, New Delhi.

2. Afsal Mohammad B, (2020), An introduction to volunteerism in India.

24DVAC51 VALUE EDUCATION

L	T	P	O	C
2	0	0	1	2

COURSE OBJECTIVES:

The course aims to nurture ethical principles, holistic living, and moral values, fostering responsible and balanced individuals. It equips students with essential life skills like decision- making, teamwork, and time management while promoting awareness of human rights and environmental conservation. Additionally, it sensitizes learners to social issues and prepares them to address societal challenges effectively.

Unit I 6

Value education-its purpose and significance in the present world – Value system – The role of culture and civilization-Holistic living – Balancing the outer and inner – Body, Mind and Intellectual level- Duties and responsibilities.

Unit II 6

Salient values for life- Truth, commitment, honesty and integrity, forgiveness and love, empathy and ability to sacrifice, care, unity , and inclusiveness, Self esteem and self confidence, punctuality

– Time, task and resource management -Problem solving and decision making skills- Interpersonal and Intra personal relationship – Team work – Positive and creative thinking

Unit III 6

Human Rights – Universal Declaration of Human Rights – Human Rights violations – National Integration – Peace and non-violence – Dr. A P J Kalam's ten points for englightened citizenship

– Social Values and Welfare of the citizen – The role of media in value building.

Unit IV 6

Environment and Ecological balance – interdependence of all beings – living and non-living. The binding of man and nature – Environment conservation and enrichment.

Unit V 6

Social Evils – Corruption, Cyber crime, Terrorism – Alcoholism, Drug addiction – Dowry – Domestic violence – untouchability – female infanticide – atrocities against women- How to tackle them

Total: 30 Hours

COURSE OUTCOMES

CO1: Understand the significance of value systems, holistic living, and individual responsibilities to achieve personal and societal balance.

CO2: Develop core values such as integrity, empathy, and time management skills, along with problem-solving and effective decision-making abilities.

CO3: Gain awareness of human rights, social welfare, and the role of media in fostering peace, unity, and enlightened citizenship.

CO4: Comprehend the importance of environmental conservation, ecological balance, and the interconnectedness of all living and non-living beings.

CO5: Identify and analyze social evils like corruption, cybercrime, and domestic violence, and explore strategies to combat these issues.

Text Books:

1. Roger Packham, Margaret Taplin, Kevin Francis - How Values Education Can Improve Student and Teacher Wellbeing - 2024

2. Various Authors - Value-Creating Education: Teachers' Perceptions and Practice - 2021

Reference Books:

1. Nucci, Larry, and Ilten-Gee, Robyn. Moral Education for Social Justice. 2021

2. John Chi-Kin Lee, *Spiritual, Life and Values Education for Children*, 2023

24SBAL61 MINI PROJECT

L	T	P	O	C
2	0	0	2	2

COURSE OBJECTIVES:

The objective of the mini project is to help the student develop the ability to apply theoretical and practical tools / techniques to solve real life problems related to industry academic institutions.

Students are to take up sample project development activities with the guidelines given below:

1. Preparing a project - brief proposal including:
   - Problem Identification
   - Developing a model for solving the problem
   - A statement of system / process specifications proposed to be developed (Data
   - FlowDiagram)
   - List of possible solutions including alternatives and constraints
   - Cost benefit analysis
   - Time line activities
2. A report highlighting the design finalization [based on functional requirements & standards(if any)]
3. A presentation including the following:
   - Implementation phase (Hardware / Software / both)
   - Testing & Validation of the developed system

- Learning in the Project Consolidated report preparation.

Total: 30 Hours

COURSE OUTCOMES:

At the End of this Course, the Student will be able to:

CO-1: Create new project with Report:

CO-2: Evaluate project scope and Objectives.

CO-3: Analyze Software, Hardware and tools needed for the Project.

CO-4: Apply technical knowledge to solve project problem.

CO-5: Understand the implementation of Project

SUMMER INTERNSHIP

24IBAL31 INTERNSHIP-I

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The internship aims to:

1. Provide hands-on experience with software development, programming, and problem-solving.
2. Expose participants to real-world IT workflows, software life cycles, and project management.
3. Enhance understanding of core computer science domains such as data structures, algorithms, and system design.
4. Develop skills in emerging technologies like cloud computing, machine learning, and cybersecurity.
5. Build teamwork, communication, and technical documentation abilities.

COURSE MODULES

Module 1: Introduction to Software Development

- Overview of SDLC
- Tools for Software Development (e.g., Git, JIRA, IDEs)
- Agile and Scrum Methodologies

Module 2: Programming Fundamentals and Development

- Review of Core Programming Languages (C++, Java, Python, etc.)
- Hands-on: Developing Algorithms and Solving Problems
- Working with APIs and Libraries

Module 3: Web and Mobile Application Development

- Basics of Web Technologies (HTML, CSS, JavaScript)
- Backend Development (Node.js, Django, or Flask)
- Mobile App Development (Flutter or React Native)
- Hands-on: Developing a Full-Stack Application

Module 4: Data Structures and Algorithms

- Problem Solving with Data Structures (Arrays, Trees, Graphs, etc.)
- Algorithmic Techniques (Sorting, Searching, Dynamic Programming)

- Competitive Programming Exercises

Module 5: Database Design and Management

- Relational Databases (SQL) and NoSQL Databases (MongoDB)
- Database Modeling and Normalization
- Hands-on: Building and Querying Databases

Module 6: Emerging Technologies

- Basics of Cloud Computing (Azure, AWS, or Google Cloud)
- Introduction to Machine Learning and AI
- Cybersecurity Essentials
- Hands-on: Implementing Cloud or ML Features in a Project

Module 7: Final Project

- Selection of a Domain-Specific Problem (E.g., E-Commerce, IoT Integration)
- Team Collaboration and Milestone Planning
- Project Development, Testing, and Deployment
- Final Presentation and Documentation

Total: 15 Hours

COURSE OUTCOMES:

Upon completion of this internship, participants will be able to: CO1:Apply computer science concepts to real-world problems effectively. CO2: Develop, test, and deploy software applications.

CO3: Demonstrate proficiency in programming languages and frameworks used in the internship. CO4: Understand and contribute to software development lifecycle (SDLC) processes.

CO5: Work collaboratively on team projects, using agile or other methodologies. CO6: Present technical findings and document project outcomes effectively.

24IBAL51 INTERNSHIP-II

L	T	P	O	C
0	0	2	1	1

COURSE OBJECTIVES:

The internship aims to:

1. Provide hands-on experience with software development, programming, and problem-solving.
2. Expose participants to real-world IT workflows, software life cycles, and project management.
3. Enhance understanding of core computer science domains such as data structures, algorithms, and system design.
4. Develop skills in emerging technologies like cloud computing, machine learning, and cybersecurity.
5. Build teamwork, communication, and technical documentation abilities.

COURSE MODULES

Module 1: Introduction to Software Development

- Overview of SDLC
- Tools for Software Development (e.g., Git, JIRA, IDEs)
- Agile and Scrum Methodologies

Module 2: Programming Fundamentals and Development

- Review of Core Programming Languages (C++, Java, Python, etc.)
- Hands-on: Developing Algorithms and Solving Problems
- Working with APIs and Libraries

Module 3: Web and Mobile Application Development

- Basics of Web Technologies (HTML, CSS, JavaScript)
- Backend Development (Node.js, Django, or Flask)
- Mobile App Development (Flutter or React Native)
- Hands-on: Developing a Full-Stack Application

Module 4: Data Structures and Algorithms

- Problem Solving with Data Structures (Arrays, Trees, Graphs, etc.)

- Algorithmic Techniques (Sorting, Searching, Dynamic Programming)
- Competitive Programming Exercises

Module 5: Database Design and Management

- Relational Databases (SQL) and NoSQL Databases (MongoDB)
- Database Modeling and Normalization
- Hands-on: Building and Querying Databases

Module 6: Emerging Technologies

- Basics of Cloud Computing (Azure, AWS, or Google Cloud)
- Introduction to Machine Learning and AI
- Cybersecurity Essentials
- Hands-on: Implementing Cloud or ML Features in a Project

Module 7: Final Project

- Selection of a Domain-Specific Problem (E.g., E-Commerce, IoT Integration)
- Team Collaboration and Milestone Planning
- Project Development, Testing, and Deployment
- Final Presentation and Documentation

Total: 15 Hours

COURSE OUTCOMES:

Upon completion of this internship, participants will be able to: CO1:Apply computer science concepts to real-world problems effectively. CO2: Develop, test, and deploy software applications.

CO3: Demonstrate proficiency in programming languages and frameworks used in the internship. CO4: Understand and contribute to software development lifecycle (SDLC) processes.

CO5: Work collaboratively on team projects, using agile or other methodologies. CO6: Present technical findings and document project outcomes effectively.

RESEARCH PROJECT

24RBAL71 RESEARCH PROJECT -I

L	T	P	O	C
0	0	12	2	6

COURSE OBJECTIVES

The research projects program aims to:

1. Equip students with the ability to conduct independent and team-based research.
2. Develop skills in identifying, formulating, and solving complex research problems.
3. Enhance proficiency in research methodologies, tools, and techniques.
4. Foster critical thinking, innovation, and analytical reasoning.
5. Prepare students to publish and present their findings in academic or industrial forums.

COURSE MODULES

Module 1: Introduction to Research

- Understanding Research in Computer Science
- Types of Research: Exploratory, Descriptive, and Experimental
- Importance of Problem Identification and Research Questions

Module 2: Literature Review and Gap Analysis

- Techniques for Conducting a Literature Review
- Tools for Reference Management (e.g., Zotero, Mendeley)
- Identifying Gaps and Formulating Objectives

Module 3: Research Methodology

- Qualitative vs. Quantitative Research
- Data Collection Techniques (Surveys, Experiments, Simulations)
- Research Tools and Platforms (MATLAB, R, Python)

Module 4: Proposal Development

- Writing a Research Proposal
- Setting Goals, Deliverables, and Milestones
- Ethical Guidelines and Considerations

Module 5: Implementation and Experimentation

- Designing and Conducting Experiments
- Data Analysis and Interpretation
- Tools for Data Visualization (Tableau, matplotlib, Power BI)

Module 6: Documentation and Reporting

- Structuring Research Papers (Abstract, Introduction, Methods, Results, Conclusion)

- Writing Technical Reports and Presentations
- Formatting and Publishing in Journals/Conferences

Module 7: Final Project Presentation

- Developing Final Deliverables (Prototype, Model, or Software)
- Presentation to Peers and Evaluators
- Peer Reviews and Feedback Integration

Total: 180 Hours

COURSE OUTCOMES

Upon completing the research project course, students will be able to:

1. Identify and define research problems within a domain of interest.
2. Conduct thorough literature reviews and gap analyses.
3. Apply appropriate research methodologies and tools to explore solutions.
4. Develop and test hypotheses or prototypes based on research objectives.
5. Analyze and interpret research data effectively.
6. Present findings through well-structured reports, presentations, or publications.
7. Understand ethical considerations in research and intellectual property rights.
8. Collaborate effectively with peers and mentors to achieve research objectives.

24RBAL81 RESEARCH PROJECT-II

L	T	P	O	C
0	0	12	2	6

COURSE OBJECTIVES

The research projects program aims to:

6. Equip students with the ability to conduct independent and team-based research.
7. Develop skills in identifying, formulating, and solving complex research problems.
8. Enhance proficiency in research methodologies, tools, and techniques.
9. Foster critical thinking, innovation, and analytical reasoning.
10. Prepare students to publish and present their findings in academic or industrial forums.

COURSE MODULES

Module 1: Introduction to Research

- Understanding Research in Computer Science
- Types of Research: Exploratory, Descriptive, and Experimental
- Importance of Problem Identification and Research Questions

Module 2: Literature Review and Gap Analysis

- Techniques for Conducting a Literature Review
- Tools for Reference Management (e.g., Zotero, Mendeley)
- Identifying Gaps and Formulating Objectives

Module 3: Research Methodology

- Qualitative vs. Quantitative Research
- Data Collection Techniques (Surveys, Experiments, Simulations)
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Module 6: Documentation and Reporting

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- Writing Technical Reports and Presentations
- Formatting and Publishing in Journals/Conferences

Module 7: Final Project Presentation

- Developing Final Deliverables (Prototype, Model, or Software)
- Presentation to Peers and Evaluators
- Peer Reviews and Feedback Integration

Total: 180 Hours

COURSE OUTCOMES

Upon completing the research project course, students will be able to:

9. Identify and define research problems within a domain of interest.
10. Conduct thorough literature reviews and gap analyses.
11. Apply appropriate research methodologies and tools to explore solutions.
12. Develop and test hypotheses or prototypes based on research objectives.
13. Analyze and interpret research data effectively.
14. Present findings through well-structured reports, presentations, or publications.
15. Understand ethical considerations in research and intellectual property rights.
16. Collaborate effectively with peers and mentors to achieve research objectives.