KG COLLEGE OF ARTS AND SCIENCE
Autonomous Institution | Affiliated to Bharathiar University
Accredited with A++ Grade by NAAC
ISO 9001:2015 Certified Institution
KGiSL Campus, Saravanampatti, Coimbatore – 641 035

Regulations 2024 -25 for Undergraduate Programme

Learning Outcomes Based Curriculum Framework- (LOCF) model with Choice Based Credit System (CBCS)

Programme: B.Sc. Computer Science (B.Sc. CS)
Programme Code: BCS

(Applicable for the Students Admitted During the Academic Year 2024 - 25 onwards)

Eligibility

The Student should have passed Higher Secondary Examination and wherever the students have not studied mathematics knowledge be imparted through Residential/Bridge Course.
(As per the eligibility condition given Ref. BU/R/B3-B4/Eligibility Condition/2024/9206 dated 24/05/2024).

Program Learning Outcomes (PLOs)

The successful completion of B.Sc. CS Programme shall enable the students to:

PLO1	Develop an ability to analyze a given problem statement, identify and define the computing requirements for finding the appropriate solution.
PLO2	Prepare students to equip themselves involving problem solving skills using computer science and technologies to become software developer.
PLO3	Develop the ability to pursue advanced studies and to excel in research in the field of Computer Science.
PLO4	Inspire the students to become entrepreneurs or technopreneurs to innovate and create.
PLO5	Recognize professional responsibilities and make informed judgments in computing practice based on legal ethical and sustainability principles.

B.Sc. Computer Science
Distribution of Credits and Hours for all the Semesters

Part	Course Category	No. of. Courses	Hrs.		Credits	Total		Semester
I	Language - I	4	4 X 4	16	4 X 3	12	12	1 – 4
II	Language - II	4	4 X 4	16	4 X 3	12	12	1 – 4
III	Core Theory **(6 hrs. /Week)**	4	4 X 6	24	4 X 4	16	100	3,6
	Core Theory **(5 hrs. /Week)**	9	9 X 5	45	9 X 4	36		1,2,4,5
	Core Lab **(5 hrs. /Week)**	3	3 X 5	15	3 X 3	9		5,6
	Core Lab **(4 hrs. /Week)**	4	4 X 4	16	4 X 2	8		1 – 4
	Allied	4	4 X 4	16	4 X 3	12		1 - 4
	Electives	2	2 X 5	10	2 X 3	6		5,6
	Core : Project Work	1	1 X 6	6	1 X 5	5		6
	SEC : Internship	1	-	-	1 X 2	2		5
	Skill Enhancement (SEC)	3	3 X 2	6	3 X 2	6		3, 4, 6
IV	Foundation Course (FC)	2	2 X 2	4	2 X 2	4	14	1 - 2
	Foundation Course (FC)	1	-	-	1 X 2	2		3
	Ability Enhancement Compulsory Course (AECC)	3	3 X 2	6	3 X 2	6		1, 2, 4
	Ability Enhancement Compulsory Course (AECC) – Online Course – MOOC	1	-	-	1 X 2	2		3
V	Liberal Arts (Extra-curricular and Co-curricular)	-	-	-	2	2	2	4
Total		**46**		**180**		**140**	**140**	

Consolidated Semester wise and Component wise Hours and Credits Distribution

Semester	Part I		Part II		Part III		Part IV		Part V		Total	
	Hrs.	Credits	Hrs.	Credits	Hrs.	Credits	Hrs.	Credits	Hrs.	Credits	Hrs.	Credits
1	4	3	4	3	18	13	4	4	-	-	30	23
2	4	3	4	3	18	13	4	4	-	-	30	23
3	4	3	4	3	22	15	-	4	-	-	30	25
4	4	3	4	3	20	15	2	2	-	2	30	25
5	-	-	-	-	30	23	-	-	-	-	30	23
6	-	-	-	-	30	21	-	-	-	-	30	21
Total	**16**	**12**	**16**	**12**	**138**	**100**	**10**	**14**	**-**	**2**	**180**	**140**

Curriculum

B.Sc. Computer Science

Semester – 1									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
24TAM11L	I	Language – I	Tamil – I	4	3	25	75	100	3
24HIN11L	I		Hindi – I						
24MAL11L	I		Malayalam – I						
24FRE11L	I		French – I						
24ENG12L	II	Language – II	English – I	4	3	25	75	100	3
24BCS13C	III	Core – I	Python Programming	5	3	25	75	100	4
24BCS14P	III	Core Lab – I	**Lab:** Python Programming	4	3	40	60	100	2
24BCS15C	III	Core – II	Digital Fundamental Architecture & Microprocessor	5	3	25	75	100	4
24BCS16A	III	Allied – I	Numerical Methods	4	3	25	75	100	3
24ENV1FC	IV	FC – I	Environmental Studies	2	2	50	-	50	2
24QUA1AE	IV	AECC – I	Quantitative Aptitude	2	2	-	50	50	2
Total				**30**				**700**	**23**

Semester – 2									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
24TAM21L	I	Language - I	Tamil – II	4	3	25	75	100	3
24HIN21L	I		Hindi – II						
24MAL21L	I		Malayalam – II						
24FRE21L	I		French – II						
24ENG22L	II	Language – II	English – II	4	3	25	75	100	3
24BCS23C	III	Core – III	Java Programming	5	3	25	75	100	4
24BCS24P	III	Core Lab - II	**Lab:** Java Programming	4	3	40	60	100	2
24BCS25C	III	Core – IV	Operating Systems	5	3	25	75	100	4
24BCS26A	III	Allied – II	Discrete Mathematics	4	3	25	75	100	3
24HUM2FC	IV	FC – II	Human Rights	2	2	50	-	50	2
24SOF2AE	IV	AECC – II	Soft Skills	2	2	-	50	50	2
Total				**30**				**700**	**23**

Semester – 3									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
24TAM31L	I	Language – I	Tamil – III	4	3	25	75	100	3
24HIN31L	I		Hindi – III						
24MAL31L	I		Malayalam – III						
24FRE31L	I		French – III						
24ENG32L	II	Language – II	English – III	4	3	25	75	100	3
24BCS33C	III	Core – V	Data Structures & Algorithms	6	3	25	75	100	4
24BCS34P	III	Core Lab – III	**Lab:**Data Structures & Algorithms	4	3	40	60	100	2
24BCS35C	III	Core – VI	Introduction to Data Science	6	3	25	75	100	4
24BCS36A	III	Allied – III	Operations Research	4	3	25	75	100	3
24BCS37P	III	SEC – I	**Lab:** Interactive JavaScript Programming	2	3	40	60	100	2
24BAT3FC/	IV	FC – III	Basic Tamil /	-	2	50	-	50	2
24ADT3FC/			Advanced Tamil						
24IKS3FC			Indian Knowledge Systems (IKS)*						
24MOO3AE	IV	AECC – III	Online Course – MOOC	-	-	50	-	50	2
Total				**30**				**800**	**25**

Semester – 4									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
24TAM41L	I	Language – I	Tamil – IV	4	3	25	75	100	3
24HIN41L			Hindi – IV						
24MAL41L			Malayalam – IV						
24FRE41L			French – IV						
24ENG42L	II	Language – II	English – IV	4	3	25	75	100	3
24BCS43C	III	Core – VII	Database Management System	5	3	25	75	100	4
24BCS44P	III	Core Lab – IV	**Lab :** Database Management System	4	3	40	60	100	2
24BCS45C	III	Core – VIII	Software Engineering	5	3	25	75	100	4
24BCS46A	III	Allied – IV	Arduino Systems and Applications	4	3	25	75	100	3
24BCS47P	III	SEC Lab – II	**Lab :** ReactJS Development	2	3	40	60	100	2
24IDT4AE/	IV	AECC – IV	Innovation & Design Thinking/	2	2	-	50	50	2
24IPR4AE/			Intellectual Property Rights/						
24END4AE			Entrepreneurship Development						
24EXC4LA	V	Extra-curricular and Co-curricular	Liberal Arts	-	2	50	-	50	2
Total				**30**				**800**	**25**

Semester – 5									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max. Marks**			
						CIA	**ESE**	**Total**	
24BCS51C	III	Core – IX	Artificial Intelligence and Expert Systems	5	3	25	75	100	4
24BCS52P	III	Core Lab – V	**Lab:** Node.js and MongoDB	5	3	40	60	100	3
24BCS53C	III	Core – X	Linux and Shell Programming	5	3	25	75	100	4
24BCS54P	III	Core Lab – VI	**Lab:** Linux and Shell Programming	5	3	40	60	100	3
24BCS55C	III	Core – XI	Visual Basic	5	3	25	75	100	4
24BCS5AE/	III	Elective – I	Cloud Services Management **(Cloud Computing)**	5	3	25	75	100	3
24BCS5BE/			**Computer Networks and Security (Networking & Cyber Security)**						
24BCS5CE/			Data Mining **(Data Mining)**						
24BCS56I	III	SEC	Internship	-	2	50	-	50	2
Total				**30**				**650**	**23**

Semester – 6									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max. Marks**			
						CIA	**ESE**	**Total**	
24BCS61C	III	Core - XII	Graphics and Multimedia	6	3	25	75	100	4
24BCS62P	III	Core Lab – VII	**Lab :** Graphics and Multimedia	5	3	40	60	100	3
24BCS63C	III	Core - XIII	Cyber Security	6	3	25	75	100	4
24BCS6AE/	III	Elective - II	DevOps **(Cloud Computing)**	5	3	25	75	100	3
24BCS6BE/			**Information Security Management (Networking & Cyber Security)**						
24BCS6CE			Big Data Processing and Analytics **(Data Mining)**						
24BCS64P	III	SEC Lab - III	**Lab :** Cyber Security	2	3	40	60	100	2
24BCS6PR	III	Project	**Core :** Project Work	6	3	40	60	100	5
			Total	**30**				**600**	**21**
			Grand Total	**180**				**4250**	**140**

Semester – 1

Part – I : Language I-Tamil-I

(All the Undergraduate Programmes)

Course Code	Course Name	Category	Hours / Week	Credits
24TAM11L	Tamil - I	Language - I	4	3

Course Objectives

The course intends to cover

- இலக்கிய வளர்ச்சியை அறிந்துகொள்ளுதல்
- இலக்கியம் படைக்கும் திறன்
- இலக்கிய இலக்கண உரைசெய்தல்
- திறனாய்வு முறையினைக் கற்றுத்தேர்தல்

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	புதுக்கவிதையின் மூலம் வாழ்வியல் விழுமியங்கள உணர்ந்து கொள்ளுதல்.	K1, K2
CLO2	சிறந்த மற்றும் வாழும் கவிஞர்களை அறிந்துகொள்ளுதல்.	K2, K3
CLO3	சிறந்த படைப்பாளர்களின் சிறுகதையில் வெளிப்படும் சமூகச்சிந்தனைகளை அறிந்து விழிப்புணர்வைப் பெறுதல்.	K3
CLO4	தற்கால இலக்கியங்களான புதுக்கவிதை, சிறுகதை தோன்றி வளர்ந்த பின்புலத்தை அறிதல்.	K1, K3
CLO5	மொழியைப் பிழையின்றி பேச, எழுத, கற்கத் தேவையான தமிழ் இலக்கணத்தின் இன்றியமையாமையை உணர்தல். நடைமுறை வாழ்வியலுக்குத் தேவைப்படும் ஆங்கிலக் கடிதத்தைத் தமிழாக்கம் செய்தலுக்கான பயிற்சி பெறுதல்.	K2, K3
K1 - Remember; **K2** - Understand; **K3** – Apply		

Part – I: Language-I-Tamil – I

Unit	Content	No. of Hours
I	**(நாட்டுப்பற்று)** 1. உலகத்தை நோக்கி வினவுதல் - பாரதியார் 2. பாரதிதாசன் கவிதைகள் - பாரதிதாசன் • தமிழ்ப்பேறு 3. ஒற்றுமையே உயிர்நிலை - கவிமணி 4. தேவதேவன் கவிதைகள் - தேவதேவன் • சாலையும் மரங்களும் செருப்பும் • புதிய வீடு 5. ஆலாபனை - கவிக்கோ அப்துல் ரகுமான் • போட்டி • பாதை 6. புத்தகச் சந்தை - கவிஞர் வாலி	14
II	**(சமூகம்)** 1. எட்டாவது சீர்..... - ஈரோடு தமிழன்பன் 2. தொலைந்து போனேன் - கவிஞர் தாமரை 3. திருநங்கைகள் காகிதப் பூக்கள் - நா. காமராசன் 4. மரங்களைப் பாடுவேன் - வைரமுத்து 5. புள்ளிப் பூக்கள் (ஹைக்கூ) - அமுத பாரதி 6. நாட்டுப்புறப் பாடல்கள் • தாலாட்டுப் பாடல், தெம்மாங்கு பாடல், உழவுத்தொழில்	14
III	**(சிறுகதை)** 1. அகல்யை - புதுமைப்பித்தன் 2. சுமைதாங்கி - ஜெயகாந்தன் 3. அம்மா ஒரு கொலை செய்தாள் - அம்பை 4. சோற்றுக் கணக்கு - ஜெயமோகன் 5. தூரத்து உறவு - வைரமுத்து	12

Unit	Content	No. of Hours
IV	**(இலக்கிய வரலாறு)** 1. மரபுக்கவிதையின் தோற்றமும் வளர்ச்சியும் 2. புதுக்கவிதையின் தோற்றமும் வளர்ச்சியும் 3. ஹைக்கூ கவிதையின் தோற்றமும் வளர்ச்சியும் 4. சிறுகதையின் தோற்றமும் வளர்ச்சியும்	10
V	**(இலக்கணம்)** 1. எழுத்துக்கள் (முதல் எழுத்துக்கள், சார்பெழுத்துக்கள்) 2. எழுத்துக்களின் பிறப்பு 3. மாத்திரைகள் 4. பயிற்சிக்குரியன - மொழிப்பெயர்ப்பு (ஆங்கிலத்திலிருந்து தமிழுக்கு மொழிப்பெயர்த்தல்)	10
	Total Hours	**60**

Reference Books	
1	பாரதி பாடல்கள் ஆய்வுப் பதிப்பு, பேரா. ம ரா போ குருசாமி,(2016) தமிழ்ப் பல்கலைக் கழகம், தஞ்சாவூர்
2	ஆலாபனை, அப்துல் ரகுமான்,(2000) கவிக்கோ பதிப்பகம்
3	தாமரை கவிதைகள், தாமரை, (2012) நியூ செஞ்சுரி புக் ஹவுஸ்
4	தமிழ் இலக்கிய வரலாறு, மு வரதராசனார், (2021) சாகித்திய அகாதெமி பதிப்பு
5	புதிய வெளிச்சத்தில் தமிழ் இலக்கிய வரலாறு, முனைவர் க பஞ்சாங்கம், (2017) அன்னம் வெளியீட்டு
6	தமிழ் இலக்கிய வரலாறு, முனைவர் கா கோ வேங்கடராமன்,(2008) கலையக வெளியீடு
7	நல்ல தமிழ் எழுத வேண்டுமா?, அ கி பரந்தாமனார் எம். ஏ., (2002)அல்லி நிலையம்
8	100 சிறந்த சிறுகதைகள் (தொகுதி 1 & 2) தொகுப்பு: எஸ் ராமகிருஷ்ணன் (2006) பதிப்பகம்: தேசாந்திரி பதிப்பகம்
9	தமிழ் இலக்கணம் எளிய அறிமுகம் , கோ குமரன் (2010) சந்தியா பதிப்பகம்
10	நாட்டுப்புற இயல் ஆய்வு, சு சக்திவேல்,(2012) மணிவாசகர் பதிப்பகம்

Part – II : Language-II-English - I

(All the Undergraduate Programmes)

Course Code	Course Name	Category	Hours / Week	Credits
24ENG12L	English - I	Language - II	4	3

Course Objectives

The course intends to cover

- Various genres of literature.
- Active and passive vocabulary.
- Usage of Grammar and Communication.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify aesthetic sense and appreciate poetry, enhancing creativity and understanding relevant to professional environments.	K1
CLO2	Understand diverse styles of prose, facilitating versatility in writing and inculcating interpersonal skills.	K2
CLO3	Apply the characters and the narrative techniques in creative writing and content creation ethically.	K3
CLO4	Employ vocabulary and grammatical proficiency in communication to enhance clarity in workplace interactions.	K3
CLO5	Enhance overall communication competence. Practicing these skills in combination reinforces learning and provides students with opportunities to use the language in authentic contexts.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply		

Part - II: Language-II-English - I

Unit	Content	No. of Hours
I	**Poetry** : Nature 1. I Wandered Lonely as a Cloud - William Wordsworth 2. The Sparrow - Paul Laurence Dunbar 3. Stopping by woods on a snowy Evening – Robert Frost	12
II	**Prose** : Friendship 1. The Man in Black - Oliver Goldsmith 2. Of Friendship - Francis Bacon 3. The Blessing of Friends - Sir John Lubbock	12
III	**Short Stories:** Morality 1. The Necklace – Guy de Maupassant 2. The Lottery - Shirley Jackson 3. The Monkey's Paw - W. W. Jacobs	12
IV	**Language Competency:** Vocabulary 1. Vocabulary : Synonyms, Antonyms, Word Formation 2. Appropriate use of Articles and Parts of Speech 3. Error correction	12
V	**English for Communication** 1. Listening for General and Specific Information. 2. Self - Introduction, Introducing others, Greetings. 3. Reading a prose passage, Reading a poem and Reading a short story 4. Descriptive writing – writing a short descriptive essay of two to three paragraphs.	12
	Total Hours	**60**

Text Books	
1.	Zama, M. (2004). Poetry Down the Ages. Orient Blackswan.
2.	Goldsmith, O. (1869). The Works of Oliver Goldsmith. J. Dicks
3.	Bacon, F., & Montagu, B. (1857). The Works of Francis Bacon (Vol. 1). Parry & McMillan.
Reference Books	
1.	Kumar,V. T. Bhavani, Durga.K. Srinivas.YL. (2018). English in use - A textbook forCollege Students. (English, Paperback).
2.	Swan, M. (2005). Practical english usage (Vol. 7). Oxford: Oxford university press.
Web Resources (Swayam / NPTEL)	
1.	https://nptel.ac.in/courses/109105205

Course Code	Course Name	Category	Hours/ Week	Credits
24BCS13C	Python Programming	Core – I	5	4

Course Objectives

This Course intends to cover:

- Core syntax and semantics of Python programming language.
- Process of structuring the data using lists, dictionaries, tuples and sets.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Remember the fundamentals of solving problems with computers and execute simple Python programs.	K1
CLO2	Learn the Basic Programming constructs in Python.	K2
CLO3	Understand the basic functions in Python Programming.	K2
CLO4	Apply Software Objects and databases in Python.	K3
CLO5	Apply OOPs concepts in Python programs.	K3
K1- Remember; **K2** - Understand; **K3** – Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	3	1	1	1
CLO2	3	3	1	1	1
CLO3	3	2	1	1	1
CLO4	3	2	2	2	1
CLO5	3	2	2	2	1
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - I: Python Programming

Unit	Content	No. of Hours
I	**Introduction:** The essence of computational problem solving – Limits of computational problem solving-Computer Algorithms-Computer Hardware-Computer Software-The process of computational problem solving-Python programming language - Literals - Variables and Identifiers - Operators - Expressions and Data types, Input / Output.	15
II	**Control Structures:** Boolean Expressions - Selection Control - If Statement-Indentation in Python- Multi-Way Selection- Iterative Control- While Statement- Infinite loops- Definite vs. Indefinite Loops- Boolean Flag. String, List, Tuple and Dictionary, Manipulations Building blocks of python programs, understanding and using ranges-slicing.	15
III	**Functions:** Program Routines- Defining Functions- More on Functions: Calling Value- Returning Functions-Calling Non-Value-Returning Functions-Parameter Passing - Keyword Arguments in Python - Default Arguments in Python-Variable Scope. Recursion: Recursive Functions.	15
IV	**Objects and their use**: Software Objects - Turtle Graphics – Turtle attributes-Modular Design: Modules - Top-Down Design - Python Modules - Text Files: Opening, reading and writing text files – Database Programming: Connecting to a database, Creating Tables, INSERT, UPDATE, DELETE and READ operations, Transaction Control, Disconnecting from a database, String Processing - Exception Handling.	15
V	**Dictionaries and Sets:** Dictionary type in Python-Set Data type. Object Oriented Programming using Python: Encapsulation – Inheritance – Polymorphism. **Python Packages**: Simple programs using the built-in functions of packages matplotlib, numpy, pandas etc.	15
	Total Hours	**75**
Text Books		
1.	Charles Dierbach (2022), Introduction to Computer Science using Python - A computational Problem solving Focus, Wiley India Edition. (Unit – I, II, III, IV)	
2	Wesley J. Chun (2016), Core Python Applications Programming, 3rd Edition, Pearson Education. (Unit – V)	
Reference Books		
1.	Mark Lutz (2018), Learning Python Powerful Object Oriented Programming, O'Reilly Media, 5th Edition.	
2.	Timothy A. Budd (2011), Exploring Python, Tata MCGraw Hill Education Private Limited, 1st Edition.	
3.	John Zelle (2013), Python Programming: An Introduction to Computer Science, 2nd Edition, Course Technology Cengage Learning Publications, ISBN 978- 1590282410	
Web Resources (Swayam / NPTEL)		
1.	https://onlinecourses.swayam2.ac.in/cec24_cs01/course	
2.	https://onlinecourses.nptel.ac.in/noc24_cs57/preview	

Course Code	Course Name	Category	Hours / Week	Credit
24BCS14P	Lab: Python Programming	Core Lab-I	4	2

S. No.	List of Programs
1	Sample programs using Lists, Tuples and Dictionaries.
2	Program to convert the given temperature from Fahrenheit to Celsius and vice versa depending upon user's choice.
3	Program to find the area of rectangle, square, circle and triangle by accepting suitable input parameters from user.
4	Write a Python script that prints prime numbers less than 20.
5	Program to find factorial of the given number using recursive function.
6	Write a Python program to count the number of even and odd numbers from array of N numbers.
7	Write a Python class to reverse a string word by word.
8	Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)
9	Create a Savings Account class that behaves just like a BankAccount, but also has an interest rate and a method that increases the balance by the appropriate amount of interest (Hint: use Inheritance).
10	Write a Python program to construct the following pattern, using a nested loop * ** *** **** ***** **** *** ** *
11	Read a file content and copy only the contents at odd lines into a new file.
12	Create a Turtle graphics window with specific size.
13	Write a Python program for Towers of Hanoi using recursion
14	Create a menu driven Python program with a dictionary for words and their meanings.

S. No.	List of Programs
15	Devise a Python program to implement the Hangman Game.
16	Program to create student database and calculate total marks, percentage and grade of a student. Marks obtained in each of the five subjects are to be input by user. Assign grades according to the following criteria: Grade A: Percentage >=80 Grade B: Percentage >=70 and 80 Grade C: Percentage >=60 and <70 Grade D: Percentage >=40 and <60 Grade E: Percentage < 40
Total Hours	**60**
Text Books	
1.	Charles Dierbach (2022), Introduction to Computer Science using Python – A computational Problem solving Focus, Wiley India Edition.
2.	Wesley J. Chun (2016), Core Python Applications Programming, 3rd Edition, Pearson Education.
Reference Books	
1.	Mark Lutz (2018), Learning Python Powerful Object Oriented Programming,O'Reilly Media, 5th Edition.
2.	Timothy A. Budd (2011), Exploring Python, Tata MCGraw Hill Education Private Limited, 1st Edition.
3.	John Zelle (2013), Python Programming: An Introduction to Computer Science,2nd Edition, Course Technology Cengage Learning Publications, ISBN 978-1590282410
Web Resources (Swayam/NPTEL)	
1.	https://onlinecourses.swayam2.ac.in/cec24_cs01/course
2.	https://onlinecourses.nptel.ac.in/noc24_cs57/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BCS15C	Digital Fundamental Architecture and Microprocessor	Core-II	5	4

Course Objectives

The Course intends to cover:

- Different Number System, Digital Arithmetic and Logic Circuits.
- Various types of Microprocessor Architecture.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the basics of digital systems and computing.	K1, K2
CLO2	Apply the basics in digital circuits.	K3
CLO3	Develop the various electronic circuits.	K3
CLO4	Understand the architecture and functionalities of Integrated Circuits.	K2
CLO5	Demonstrate an application or a working environment with Integrated Circuits and its Peripherals.	K2
K1 - Remember; **K2** - Understand; **K3** – Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	3	1	1	1
CLO2	3	2	1	1	1
CLO3	3	2	2	2	-
CLO4	3	3	3	2	-
CLO5	3	3	3	2	-
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - II: Digital Fundamental Architecture and Microprocessor

Unit	Content	No. of Hours
I	**Number Systems and Logic Gates:** Number systems - Binary, Octal, Decimal, Hexadecimal Number - Binary Arithmetic, Subtraction, Multiplication - One's and Two's Complements Arithmetic. Codes: Grey Code, Error Detecting and Correcting Codes. Logic Gates: AND, OR, NOT, NAND, NOR, and Exclusive - OR operations, Boolean algebra, Basic Laws.	15
II	**Combinational Circuits:** Standard representation for logic functions, K-map representation and simplification of logic functions using K-map, minimization of logical functions- Don't care conditions. Half Adders – Full Adder- Half Subtractors - Full Subtractors – Parallel Binary Adder - 4 Bit Binary Adder/Subtractor - BCD Adder – Multiplexer and Demultiplexer – Priority Encoders and Decoders - Digital comparator.	15
III	**Sequential Circuits:** SR flip flop, Clocked SR Flip Flop – JK Flip Flop – D Flip Flops - T Flip Flop - Applications of Flip Flops. Shift Registers and Its Types - Applications of shift Registers. Ring Counter - Ripple (Asynchronous) counters - Synchronous Counters - Up down Counter – Mod – 3 and Mod - 5 Counter – Decade Counter - Applications of Counters.	15
IV	**8085 Microprocessor:** Introduction – Block Diagram - Pin Diagram - 8085 Architecture, bus organization. Instruction Format – Instruction Set – Addressing Modes. Programming the 8085: Arithmetic and Logical Programs.	15
V	**Parallel and Serial Interfacing:** 8255A Programmable Peripheral Interfacing: Block Diagram, Pin Diagram, Modes of Operation: I/O and BSR. 8085 Interrupts - Architecture of Programmable Interrupt Controller 8259 — Architecture of 8254 Programmable Interval Timer / Counter. Direct Memory Access – 8237 DMA Controller. ADC Interfacing – DAC Interfacing.	15
	Total Hours	**75**
Text Books		
1.	Morris Mano, (2022), Computer System Architecture, 3rd Edition, Pearson Education. (Unit- I, II, III)	
2.	Salivahanan S, Arivazhagan (2012), Digital Circuits and Design, 3rd Edition, McGraw Hill Education.	
3.	Ramesh Gaonkar, (2019), Microprocessor Architecture, Programming and Application with the 8085, 6th Edition, Pearson International Publishing. (UNIT - IV, V)	
Reference Books		
1.	V K Puri (2017), Digital Electronics: Circuits and Systems, McGraw Hill Education.	
2.	Badri Ram (2012), Advanced Microprocessor and Interfacing, McGraw Hill Education.	
Web Resources (Swayam/ NPTEL Courses)		
1.	https://onlinecourses.swayam2.ac.in/cec24_cs09/preview	
2.	https://onlinecourses.nptel.ac.in/noc24_ee46/preview	

Part – III : Allied Courses

(B.Sc. Computer Science / BCA / B.Sc. Information Technology / B.Sc. Computer Technology)

Course Code	Course Name	Category	Hours / Week	Credits
24BCS16A /	Numerical Methods	Allied – I	4	3

Course Objectives

The course intends to cover

- The ability to use algorithms for approximation problems.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Obtain numerical solutions of algebraic and transcendental equations.	K1
CLO2	Determine the numerical solutions of simultaneous linear equations using different methods	K2
CLO3	Compute the numerical solutions of differentiation of functions	K2
CLO4	Evaluate the definite integrals using numerical methods	K3
CLO5	Distinguish methods of Taylor series, Euler's, Modified Euler's and Runge Kutta methods to find solutions of differential equations.	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze;		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	2	2	2	1	2
CLO2	2	2	2	1	2
CLO3	2	2	2	1	2
CLO4	2	2	2	1	2
CLO5	1	2	2	2	1
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Allied – I : Numerical Methods

Unit	Content	No. of Hours
I	**The Solution of Numerical Algebraic and Transcendental Equations:** Bisection method – Iteration Method – Convergence condition – Regula Falsi Method – Newton – Raphson method - Convergence Criteria – Order of Convergence.	12
II	**Solution of Simultaneous Linear Algebraic Equations:** Gauss elimination method – Gauss Jordan method– Gauss Jacobi method – Gauss Seidel method.	12
III	**Numerical Differentiation:** Newton's forward Difference – Newton's Backward Difference – Derivative using Stirling's formula.	12
IV	**Numerical Integration:** Newton – Cote's formula – Trapezoidal rule – Simpson's $1/3^{rd}$ and $3/8^{th}$ rules.	12
V	**Numerical Solution of Ordinary Differential Equation:** Taylor series method – Euler's method –Modified Euler's method – Runge Kutta method (Second &fourth order Runge Kutta method only).	12
	Total Hours	**60**
Text Book		
1.	P. Kandasamy, K.Thilagavathy & K. Gunavathy (2007). Numerical methods, S. Chand and Company Ltd, New Delhi. Unit I : Chapter 3 : Section 3.1 – 3.4 Unit II : Chapter 4 : Section 4.1, 4.2, 4.8, 4.9 Unit III: Chapter 9 : Section 9.1 – 9.4 Unit IV: Chapter 9 : Section 9.7 – 9.9, 9.13, 9.14 Unit V: Chapter 11 : Section 11.5, 11.6, 11.9, 11.11- 11.13	
Reference Books		
1.	M.K. Venkataraman(1999). Numerical Methods in Science and Engineering, National Publishing company.	
2.	K. Sankara Rao(2018), Numerical Methods for Scientists and Engineers, Prentice Hall India	
3.	S.S. Sastry (2006). Introductory Methods of Numerical Analysis (4th ed.), Prentice Hall of India Pvt. Ltd.,	
Web Resources (Swayam / NPTEL)		
1.	https://archive.nptel.ac.in/courses/111/107/111107105/	

Components for Internal Assessment and

Distribution of Marks for CIA and ESE (Theory)

Max Marks	Marks for		Components for CIA									
	CIA	ESE	CIA – I		CIA – II		Best of CIA-I & CIA-II	Model		Attendance	Active Engagement	Total
100	25	75	Actual	Weightage	Actual	Weightage	Weightage	Actual	Weightage	5	5	25
			50	5	50	5	5	75	10			

Question Paper Pattern

Component	Duration in Hrs.	Section A			Section B			Section C			Total
		Type of question	No. of questions	Marks	Type of question	No. of questions	Marks	Type of question	No. of questions	Marks	
CIA – I &II	2	MCQ	8	8x1=8	Either or	3	3x6=18	Either or	3	3x8=24	50
Model Exam /ESE	3	MCQ	10	10x1=10	Either or	5	5x5=25	Either or	5	5x8=40	75

Components for Internal Assessment and Distribution of Marks for CIA (Lab)

Max Marks	Marks for		Components for CIA							
	CIA	ESE	Test – I		Test - II		Model		Observation	Total
100	40	60	Actual	Weightage	Actual	Weightage	Actual	Weightage	5	40
			50	10	50	10	60	15		

Examination Pattern

Component	Duration in Hrs.	Marks			Weightage
		Practical	Record	Total Marks	
Test – I	2	50	-	50	10
Test – II	2	50	-	50	10
Model	3	60	-	60	15
ESE	3	50	10	60	-

Part – IV : Foundation Courses

(All the Undergraduate Programmes)

Course Code	Course Name	Category	Hours / Week	Credits
24ENV1FC	Environmental Studies	FC- I	2	2

Unit	Content
I	The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.
II	**Natural Resources:** Renewable and non-renewable resources: Natural resources and associated problems. - Forest resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. - Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. - Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. - Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. - Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies. - Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources. Equitable use of resources for sustainable lifestyles.
III	**Ecosystems** - Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem. - Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem: - a. Forest ecosystem b. Grassland ecosystem c. Desert ecosystem d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries).

Unit	Content
IV	**Biodiversity and its Conservation** - Introduction-Definition: genetic, species and ecosystem diversity. - Bio geographical classification of India. - Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. - Biodiversity at global, National and local levels. - India as a mega-diversity nation. - Hot-spots of biodiversity. - Threats to biodiversity: habital loss, poaching of wildlife, man-wildlife conflicts. - Endangered and endemic species of India. - Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
V	**Environmental Pollution Definition** - 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. - Disaster management: floods, earthquake, cyclone and landslides.
VI	**Social Issues and the Environment** - From Unsustainable to Sustainable development. - Urban problems related to energy. - Water conservation, rain water harvesting, watershed management. - Resettlement and rehabilitation of people; its problems and concerns. Case studies. - Environmental ethics: Issues and possible solutions. - Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. - Wasteland reclamation. - Consumerism and waste products. - 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.

Unit	Content
VII	**Human Population and the Environment** - Population growth, variation among nations. - Population explosion-Family welfare Programme. - Environment and human health. - Human Rights. - Value Education. - HIV/AIDS. - Women and Child Welfare. - Role of information Technology in Environment and human health. - Case Studies.
VIII	**Field Work (Practical).** - Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain. - Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. - Study of common plants, insects, birds. - Study of simple ecosystems-pond, river, hill slopes, etc.
	Total Hours. 30

Web Resources	
1.	https://www.ugc.gov.in/oldpdf/modelcurriculum/env.pdf

Components for Internal Assessment and Distribution of Marks for CIA (Theory)

Max Marks	Marks for		Components for CIA							
	CIA	ESE	CIA – I		CIA – II		Bestof CIA-I & CIA-II	Model		Total (Best + Model)
			Actual	Weightage	Actual	Weightage	Weightage	Actual	Weightage	
50	50	-	50	**25**	50	**25**	**25**	50	**25**	**50**

Question Paper Pattern

Duration in Hours	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Offline	Open Choice	5 (Out of 8)	5 x 10=50

Part – IV : Ability Enhancement Compulsory Courses

(All the Undergraduate Programmes)

Course Code	Course Name	Category	Hours/Week	Credits
24QUA1AE	Quantitative Aptitude	AECC - I	2	2

Course Objectives

The course intends to cover

- Basic concepts of numbers, time and work, interests, data representation and graphs
- Concepts of permutation, probability, discounts, percentage & profit loss.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Remember and Understand the concepts of numbers and average	K1, K2
CLO2	Understand about percentage and apply profit & loss related processing.	K2, K3
CLO3	To understand the concepts of time and work and interest calculations.	K2
CLO4	To understand about the concepts of permutation, combination and probability.	K2
CLO5	Understand , Apply and analyze the concept of problem solving involved in graphs and age.	K2,,K3,K4
K1 - Remember;**K2** - Understand; **K3** - Apply; **K4** -Analyze		

Ability Enhancement Compulsory Course(AECC) - I: Quantitative Aptitude

Unit	Content	No. of Hours
I	Numbers - Simplification - BODMAS rule - Algebraic formulas - Decimal fractions - Square root and cube roots - Surds and indices - Divisibility rules - HCFand LCM - same remainder - different remainder - application problems – average – equation - mistaken value – replacement - including/excluding.	6
II	Percentage - increase/decrease – netchange – salary – election – marks – consumption - population / machine - profit and loss - profit and loss % - finding cp and sp - profit=loss - same product cp and sp with percentage – discount - ratio and proportion - divided into parts - based on numbers - increase/decrease/ income / expenditure – coins – partnership.	6
III	Time-and-work - individual/combined - alternative days - remaining work - efficiency based - amount split - chain rule - group of male and female or boys - pipes and cistern - finding time - efficiency based – alternative - remaining part - capacity of the tank - simple interest - finding principal - rate of interest – amount -time period - doubles or triples - compound interest - finding rate - finding time, principal - doubles or triples - difference between SI and CI.	6
IV	Permutation - finding value - vowels come together - vowel never comes together -some letters come together - no two vowels come together - vowels in odd/even places - based on repetition - circular permutation – application – combination - finding value and application – probability – coins - dice-cards - balls and miscellaneous problems - odd man out and number series.	6
V	Clock - finding angle - reflex angle - gain or loss – calendars - finding particular day - data interpretation - bar chart - line chart - pie chart – table – combined –ages ratio-twice or thrice - addition /subtraction - family based - problems on numbers - equations.	6
	Total Hours	**30**
Text Book		
1.	R.S. Aggarwal , Quantitative Aptitude, S.Chand & Company Ltd.,	
Reference Book		
1.	Ashish Arora, Quantitative Aptitude.	
Web Resources		
1.	https://www.javatpoint.com/aptitude/quantitative	
2.	https://www.indiabix.com/aptitude/questions-and-answers/	

Components for and Distribution of Marks for ESE (Theory)

Ability Enhancement Compulsory Course(AECC)

Duration in Hrs.	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Online	MCQ	50	50x1=50

Semester 2

Semester – 2									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
24TAM21L	I	Language - I	Tamil – II	4	3	25	75	100	3
24HIN21L	I		Hindi – II						
24MAL21L	I		Malayalam – II						
24FRE21L	I		French – II						
24ENG22L	II	Language – II	English – II	4	3	25	75	100	3
24BCS23C	III	Core – III	Java Programming	5	3	25	75	100	4
24BCS24P	III	Core Lab - II	**Lab:** Java Programming	4	3	40	60	100	2
24BCS25C	III	Core – IV	Operating Systems	5	3	25	75	100	4
24BCS26A	III	Allied – II	Discrete Mathematics	4	3	25	75	100	3
24HUM2FC	IV	FC – II	Human Rights	2	2	50	-	50	2
24SOF2AE	IV	AECC – II	Soft Skills	2	2	-	50	50	2
Total				**30**				**700**	**23**

Part – I : Language-I-Tamil-II

(All the Undergraduate Programmes)

Course Code	Course Name	Category	Hours/ Week	Credits
24TAM21L	Tamil – II	Language - I	4	3

Course Objectives

The course intends to cover

- தமிழ் இலக்கியம் கற்பதன் மூலம் நாகரிகம் மற்றும் பண்பாட்டைப் புரிந்துகொள்ளுதல்.
- தனிப்பட்ட வளர்ச்சி, படைப்பாற்றல் திறனை வளர்த்தல்.
- வாழ்வியல் அறங்களைக் கற்றல் மற்றும் வாழ்வைச் செழுமையாக்க உதவும் நன்னெறிகளை அறிதல்.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	அற இலக்கியங்கள் வழி வாழ்வியல் ஒழுக்கங்களைக் கற்றுத் தருதல்.	K1, K2
CLO2	பக்தி இலக்கியங்கள் வழி பக்தி நெறிகளை உணர்த்துதல்.	K2
CLO3	தமிழில் உரைநடை இலக்கியப் படைப்பாளர்களின் சிந்தனைகளை எடுத்துரைத்தல்.	K3
CLO4	தமிழ் இலக்கிய வரலாற்றில் அற இலக்கியம் மற்றும் உரைநடையின் தாக்கம் குறித்து அறிதல்.	K1, K3
CLO5	பிழையின்றி எழுத இலக்கணங்களைக் கற்றுத் தருதல்.	K2, K3
K1 - Remember; **K2** - Understand; **K3** – Apply		

Part – I: Language-I-Tamil – II

Unit	Content	No. of Hours
I	**(அறம்)** 1. திருக்குறள் • புகழ் • வினை செயல்வகை • நெஞ்சொடு கிளத்தல் 2. திரிகடுகம்(தேர்ந்தெடுக்கப்பட்ட 10 பாடல்கள்) 3. பழமொழி நானூறு(தேர்ந்தெடுக்கப்பட்ட 10 பாடல்கள்)	**14**
II	**(பக்தி)** 1. அபிராமி அந்தாதி(10 பாடல்கள்) - அபிராமி பட்டர் 2. உமர்கயாம் பாடல்கள் (தனிப்பாடல்கள்) - கவிமணி தேசிய விநாயகம் பிள்ளை 3. முத்துக்குமாரசாமி பிள்ளைத்தமிழ்(தாலப் பருவம்) – குமரகுருபரர் 4. இயேசுகாவியம் - மலைப்பொழிவு - கண்ணதாசன் 5. சித்தர் பாடல்கள் - சிவவாக்கியர் பாடல்	**14**
III	**(கலை மற்றும் பண்பாடு)** 1. அறம் எனப்படுவது - அமுதன் 2. ஏட்டில் எழுதா இலக்கியம் - ஔவை துரைச்சாமி 3. கீழடி - தொல்லியல் துறை, வெளியீடு 4. மனம் எனும் சொர்க்கவாசல் - டாக்டர் எம்.எஸ்.உதயமூர்த்தி 5. ஆளுமைத் திறன் - அறிவுக்கதிர் (அரசுப்பணி சிறப்பிதழ்)	**12**
IV	**(இலக்கிய வரலாறு)** 1. பதினெண் கீழ்க்கணக்கு நூல்கள் 2. உரைநடையின் தோற்றமும் வளர்ச்சியும்	**10**
V	**(இலக்கணம்)** 1. சொல்லின் வகைகள் 2. வேற்றுமைத் தொகைகள் 3. பயிற்சிக்குரியன:(விண்ணப்பங்கள், மடல்கள் எழுதச் செய்தல்)	**10**
	Total Hours	**60**

Reference Books

1	முத்துக்குமாரசாமி பிள்ளைத்தமிழ்,(2021) கமலா முருகன், சாரதா பதிப்பகம்
2	இயேசு காவியம், கவிஞர் கண்ணதாசன்,(2006) கலைக்காவிரி பதிப்பகம்

Reference Books	
3	உரைகளும் உரையாசிரியர்களும்,(2013) தி சு நடராசன் நியூ செஞ்சுரி புக் ஹவுஸ்
4	அபிராமி அந்தாதி, முனைவர் சி சேதுராமன்,(2010) நியூ செஞ்சுரி புக் ஹவுஸ்
5	புதிய வெளிச்சத்தில் தமிழ் இலக்கிய வரலாறு, முனைவர் க பஞ்சாங்கம், (2017) அன்னம் வெளியீட்டு
6	தமிழ் இலக்கிய வரலாறு, மு வரதராசனார்,(2021) சாகித்ய அகாடமி பதிப்பு
7	தமிழ் உரைநடை வரலாறு, வி செல்வநாயகம்,(2003) அடையாளம் பதிப்பகம்
8	தமிழ் இலக்கிய வரலாறு, முனைவர் கா கோ வேங்கடராமன்,(2010) கலையக வெளியீடு
9	எண்ணங்கள் - டாக்டர் எம் எஸ் உதயமூர்த்தி,(2016) வெளியீடு: கங்கை புத்தக நிலையம், சென்னை
10	அடோன் தமிழ் இலக்கணம், புலவர் பொன்மணிமாறன்,(2011) அருண் பப்ளிஷிங்

Part – II :Language-II- English - II

(All the Undergraduate Programmes)

Course Code	Course Name	Category	Hours/ Week	Credits
24ENG22L	English-II	Language - II	4	3

Course Objectives

The course intends to cover

- The literary elements in poetry.
- The critical contemplation and writing in styles of prose texts.
- The modernist techniques and ethics in the narratives of short stories.
- The interpersonal skills essential in the work environment.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify the common techniques underlying free verse and traditional forms of poetry for crafting poems.	K1
CLO2	Understand humour in prose texts psychologically to master the oratory skills.	K2
CLO3	Employ empathy and morale in diplomatic Day-to-day circumstances.	K3
CLO4	Strengthen the writing skills for documentation.	K3
CLO5	Persist flexibility and mobility in the sequel LSRW.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply		

Part - II: Language-II-English - II

Unit	Content	No. of Hours
I	**Poetry**: Motherhood 1. My Grand Mother's House – Kamala Das 2. Of mother, among others things – A.K Ramanujam 3. Night of the Scorpion – Nissim Ezekiel	12
II	**Prose**: Humour 1. With The Photographer – Stephen Leacock 2. Travel by Train – J.B.Priestley 3. On Forgetting – Robert Lynd	12
III	**Short Stories:** Integrity 1. The taxi driver – K.S. Duggal 2. A Retrieved Reformation- O Henry 3. Kabuliwala - Rabindranath Tagore	12
IV	**Language Competency:**Vocabulary 1. Homonyms, Homophones, Homographs Portmanteau words 2. Verbs and Tenses, Subject Verb Agreement 3. Error correction Vocabulary : Synonyms, Antonyms, Word Formation	12
V	**English for Communication** 1. Listening with courtesy and adding ideas and giving opinions during themeeting and making concluding remarks 2. Participating in a meeting: face to face and online 3. Reading news and weather reports 4. Preparing first drafts of short assignments	12
	Total Hours	**60**

Text Books	
1.	Ezekiel Nissim, 1989 .Collected Poems 1952-1988. Oxford University Press.
2.	Hewings, M. (2000). Advanced English Grammar. Cambridge. University Press.
Reference Books	
1.	Bakshi, S.P. & Sharma, R. (2019). Descriptive English. Arihant Publications (India) Ltd.
2.	Cameron S & Dempsey L. (2019). The Reading Book: A Complete Guide to TeachingReading. S & L. Publishing.
3.	Sherman B. (2014) Skimming and Scanning Techniques. Liberty University Press.
Web Resources (Swayam / NPTEL)	
1.	https://nptel.ac.in/courses/109103020

Course Code	Course Name	Category	Hours / Week	Credits
24BCS23C	Java Programming	Core-III	5	4

Course Objectives

The Course intends to cover:

- Fundamentals of Object-Oriented Programming in Java.
- AWT controls, Event Handling, Swing and Graphical User Interface (GUI) concepts and Spring Boot.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Remember object-oriented features to build simple applications.	K1
CLO2	Understand the concept of Inheritance, Packages, Interfaces and Exception Handling.	K2
CLO3	Apply multithreaded programming and file handling concepts.	K3
CLO4	Understand the fundamental concepts of AWT controls, layouts and events to demonstrate the user-driven interactive applications.	K2, K3
CLO5	Develop GUI Applications using Swing in Java, develop simple Application using Spring Boot.	K3
K1 - Remember; **K2** - Understand; **K3** – Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	2	2	2	1
CLO2	3	2	2	2	1
CLO3	3	3	3	2	1
CLO4	3	3	3	3	1
CLO5	3	3	3	3	1
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - III: Java Programming

Unit	Content	No. of Hours
I	**Introduction:** Review of Object-Oriented concepts – History of Java - Java buzzwords - JVM architecture - Datatypes – Variables - Scope and lifetime of variables – arrays – operators – control statements – type conversion and casting – Simple Java program – constructors – methods – Static Block - Static Data – Static Method String and String Buffer Classes.	15
II	**Inheritance:** Basic concepts - Types of inheritance - Member access rules - Usage of this and Super keyword - Method Overloading - Method overriding - Abstract classes - Dynamic method dispatch - Usage of final keyword. Packages: Definition - Access Protection - Importing Packages - Interfaces- Definition – Implementation – Extending. Exception Handling**:** try –catch - throw - throws – finally – Built–in exceptions - Creating own Exception classes.	15
III	**Multithreaded Programming:** Thread Class - Runnable interface - Synchronization – Using synchronized methods – Using synchronized statement - Interthread Communication – Deadlock. I/O Streams: Concepts of streams -Stream classes - Byte and Character stream - Reading console Input and Writing Console output - File Handling.	15
IV	**AWT Controls:** The AWT class hierarchy - user interface components - Labels - Button - Text Components - Check Box - Check Box Group - Choice - List Box - Panels – Scroll Pane - Menu - Scroll Bar. Working with Frame class - Color - Fonts and layout managers - Event Handling - Events – Event sources - Event Listeners - Event Delegation Model (EDM) - Handling Mouse and Keyboard Events - Adapter classes - Inner classes.	15
V	**Swing**: Introduction to Swing - Hierarchy of swing components. Containers-Top level containers - JFrame - JWindow - JDialog - JPanel - JButton – JtoggleButton - JCheckBox - JRadioButton - JLabel, JTextField - JTextArea - JList - JComboBox - JScrollPane. Spring Boot: Fundamentals of Spring Boot-Spring vs Spring Boot-Spring Boot Architecture-Develop Spring Boot Application step by step-Run Spring Boot Application-Creating first Spring Boot application.	15
	Total Hours	**75**

Text Books

1.	Herbert Schildt (2017), The Complete Reference, Tata McGraw Hill, New Delhi, 9th Edition. (Unit – I, II, III, IV, V)
2.	E.Balagurusamy (2023), Programming with Java, Tata McGraw Hill, New Delhi, 7th Edition.
3.	Ashish Sarin, J. Sharma (2017), Getting Started with Spring Framework, CreateSpace Independent Publishing Platform.

Reference Books

1.	Y. Daniel Liang (2018), Introduction to Java Programming, Pearson Education, India, 10th Edition.
2.	Kathy Sierra, Bert Bates, Trisha Gee (2022), Head First Java. O.Reilly Publications, 3rd Edition

Web Resources (Swayam / NPTEL)

1.	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2.	https://onlinecourses.nptel.ac.in/noc20_cs84/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BCS24P	Lab: Java Programming	Core Lab-II	4	2

S. No.	List of Programs
1	Basic Java programs.
2	Java program that prompts the user for an integer and then prints out all the prime numbers up to that Integer.
3	Java program to multiply two given matrices.
4	Java program that displays the number of characters, lines, and words in a text.
5	Generate random numbers between two given limits using Random class and print messages according to the range of the value generated.
6	Java program to do String Manipulation using Character Array and perform the following string operations: a) String length b) Finding a character at a particular position c) Concatenating two strings.
7	Java program to perform the following string operations using String class: a) String Concatenation b) Search a substring c) To extract substring from the given
8	Java program to perform string operations using the String Buffer class: a) Length of a string b) Reverse a string c) Delete a substring from the given string.
9	Java program that implements a multi-thread application that has three threads. The first thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
10	Threading program that uses the same method asynchronously to print the numbers 1 to 10 using Thread1 and to print 90 to 100 using Thread2.
11	Java program to demonstrate the use of the following exceptions. a) ArithmeticException b) NumberFormatException c) ArrayIndexOutofBoundException d) NegativeArraySizeException
12	Java program that reads on file name from the user, then displays information about whether the file exists, whether the file is readable, whether the file is writable, the type of file, and the length of the file in bytes.

S. No.	List of Programs
13	Java program to accept a text and change its size and font. Include bold italic options. Use frames and controls.
14	Java program that handles all mouse events and shows the event name at the center of the window when a mouse event is fired. (Use adapter classes).
15	Java program that works as a simple calculator. Use a grid layout to arrange buttons for the digits and for the +, -, *, and % operations. Add a text field to display the result. Handle any possible exceptions like divide by zero.
16	Java program that simulates a traffic light. The program lets the user select one of three lights: red, yellow, or green with radio buttons. On selecting a button, an appropriate message with "stop" or "ready" or "go" should appear above the buttons in a selected color. Initially there is no message shown.
Total Hours	**60**
Text Books	
1.	Herbert Schildt (2017), The Complete Reference, Tata McGraw Hill, New Delhi,9th Edition
2.	E. Balagurusamy (2023), Programming with Java, Tata McGraw Hill, New Delhi,7th Edition.
Reference Books	
1.	Cay S. Horstmann (2007), Gary Cornell, Core Java, Volume I– Fundamentals, Prentice Hall, 8th Edition.
2.	Kathy Sierra, Bert Bates, Trisha Gee (2022), "Head First Java", (Grayscale Indian Edition) O'Reilly Publications, 3rd Edition.
Web Resources (Swayam / NPTEL)	
1.	https://onlinecourses.nptel.ac.in/noc22_cs47/preview
2.	https://onlinecourses.nptel.ac.in/noc20_cs84/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BCS25C	Operating Systems	Core-IV	5	4

Course Objectives

The course intends to cover:

- Basic Operating System concepts.
- Process concepts, Deadlock and Memory management.
- Scheduling algorithms, devices, and information management.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Define the process concepts and its lifecycle in operating system.	K1
CLO2	Understand the Asynchronous concurrent process and algorithms.	K2
CLO3	Understand the deadlock detection, prevention and recovery using algorithms.	K2
CLO4	Apply the knowledge of job Scheduling Algorithms to make the effective utilization of CPU.	K3
CLO5	Apply memory management strategies to enhance system efficiency.	K3
K1 - Remember; K2 - Understand; K**3** – Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	3	2	2	1
CLO2	3	3	2	2	1
CLO3	3	3	3	2	1
CLO4	3	3	3	2	1
CLO5	3	3	3	3	-
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - IV: Operating Systems

Unit	Content	No. of Hours
I	**Introduction:** Operating system, history (1990s to 2000 and beyond), distributed computing, parallel computation- Process concepts- Definition of process, process states- Life cycle of a process, process management- process state transitions, process control block (PCB), process operations, suspend and resume, context switching, Interrupts - Interrupt processing, interrupt classes, inter-process communication - signals, message passing.	15
II	**Asynchronous concurrent processes:** Mutual exclusion - critical section, mutual exclusion primitives, implementing mutual exclusion primitives, Peterson's algorithm- software solutions to the mutual Exclusion Problem- n-thread mutual exclusion- Lamport Bakery Algorithm- Semaphores – Mutual exclusion with Semaphores, thread synchronization with semaphores- counting semaphores- implementing semaphores- Concurrent programming-Monitors, message passing.	15
III	**Deadlock and indefinite postponement:** Resource concepts, four necessary conditions for deadlock- deadlock prevention- deadlock avoidance and Dijkstra's Banker's algorithm- deadlock detection- deadlock recovery.	15
IV	**Job and processor scheduling:** Scheduling levels- scheduling objectives- scheduling criteria- preemptive vs non-preemptive scheduling- interval timer or interrupting clock- priorities- scheduling algorithms - FIFO scheduling- RR scheduling- quantum size- SJF scheduling- SRT scheduling- HRN scheduling- multi-level feedback queues-Fair share scheduling.	15
V	**Real Memory organization and Management:** Memory organization- Memory management- Memory hierarchy- Memory management strategies-contiguous vs non- contiguous memory allocation- single user contiguous memory allocation- fixed partition multiprogramming - variable partition multiprogramming- Memory swapping- Virtual Memory organization - virtual memory basic concepts, multilevel storage organization- block mapping- paging basic concepts- segmentation- paging- segmentation systems- Virtual Memory Management - Demand Paging- Page replacement strategies.	15
	Total Hours	**75**
Text Books		
1.	H.M.Deitel (2011), Operating Systems, 3rd Edition, Pearson Education Asia.(Unit– I, II, III, IV, V)	
2.	Andrew S. Tanenbaum (2010), Modern Operating Systems, Pearson Education.	
Reference Books		
1.	William Stallings (2012), Operating System: Internals and Design Principles, 7th Edition, Prentice-Hall of India.	
2.	Avi Silberschatz, Peter Baer Galvin, Greg Gagne (2012), Operating Systems Concepts, 9th Edition, John Wiley &Sons (ASIA) Pvt. Ltd.	
Web Resources (Swayam / NPTEL)		
1.	https://onlinecourses.nptel.ac.in/noc21_cs88/preview	
2.	https://onlinecourses.nptel.ac.in/noc21_cs72/preview	

Part – III : Allied Courses

(B.Sc. Computer Science / BCA / B.Sc. Information Technology / B.Sc. Computer Technology)

Course Code	Course Name	Category	Hours / Week	Credits
24BCS26A	Discrete Mathematics	Allied – II	4	3

Course Objectives

The course intends to cover

- The fundamental concepts and tools in discrete mathematics with emphasis on their applications to computer science.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Formulate the basic terminology of sets.	K1
CLO2	Design the operations with relations.	K2
CLO3	Apply FSA to find a solution for a computer based system.	K3
CLO4	Apply the concepts of Connectives and tautological implications in data analysis.	K3
CLO5	Evaluate the basic terminology of graph theory.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	3	2	1	3
CLO2	2	1	1	3	3
CLO3	2	3	2	1	2
CLO4	3	3	2	1	3
CLO5	3	1	3	2	2
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Allied – II : Discrete Mathematics

Unit	Content	No. of Hours
I	**Set Theory:** -Set & its Elements-Set Description-Types of sets-Venn- Euler Diagrams- Set operations & Laws of set theory-Fundamental products-partitions of sets-minsets- Algebra of sets and Duality-Inclusion and Exclusion principle.	12
II	**Relations:** Binary Relations – Set operation on relations-Types of Relations – Partial order relation – Equivalence relation – Composition of relations.	12
III	**Languages:** Operations on languages – Regular Expressions and regular languages – Grammar – Types of grammars – Finite state machine – Finite – State automata.	12
IV	**Mathematical Logic:** Propositional calculus –Basic logical operations-Tautologies-Contradiction-Argument-Method of proof- Predicate calculus.	12
V	**Graph Theory:** Basic terminology – paths, cycle & Connectivity – Sub graphs – Types of graphs – Representation of graphs in computer memory - Trees – Properties of trees – Binary trees – traversing Binary trees – Computer Representation of general trees.	12
	Total Hours	**60**
Text Book		
1.	J.K. Sharma, (2022). Discrete Mathematics(Ed.2), Macmillan India Ltd. Unit I : Chapter 1 : Section 1.1 – 1.7, 1.9,1.10,1.12,1.14 Unit II : Chapter 3 : Section 3.3 – 3.7, 3.9, 3.11 Unit III: Chapter 15 : Section 15.3 – 15.7 Unit IV: Chapter 12 : Section 12.1 – 12.3, 12.8 – 12.12, 12.14 Unit V: Chapter 9 : Section 9.1 – 9.5, 9.8 Chapter 10 : Section 10.1 -10.3, 10.6, 10.8	
Reference Books		
1.	J.P. Tremblay, R. Manohar, (2002). Discrete Mathematics Structures with Applications to Computer Science,, McGraw Hill International Edition.	
2.	M.K. Venkataraman., N. Sridharan. & N. Chandarasekaran, (2004). Discrete Mathematics, National Publishing Company, Chennai.	
Web Resources (Swayam / NPTEL)		
1.	https://archive.nptel.ac.in/courses/111/106/111106086/	

Components for Internal Assessment and Distribution of Marks for CIA and ESE (Theory)

Max Marks	Marks for		Components for CIA									
	CIA	ESE	CIA – I		CIA – II		Best of CIA-I & CIA-II	Model		Attendance	Active Engagement	Total
100	25	75	Actual	Weightage	Actual	Weightage	Weightage	Actual	Weightage	5	5	25
			50	5	50	5	5	75	10			

Question Paper Pattern

Component	Duration in Hrs.	Section A			Section B			Section C			Total
		Type of question	No. of questions	Marks	Type of question	No. of questions	Marks	Type of question	No. of questions	Marks	
CIA – I &II	2	MCQ	8	8x1=8	Either or	3	3x6=18	Either or	3	3x8=24	50
Model Exam /ESE	3	MCQ	10	10x1=10	Either or	5	5x5=25	Either or	5	5x8=40	75

Components for Internal Assessment and Distribution of Marks for CIA (Lab)

Max Marks	Marks for		Components for CIA							
	CIA	ESE	Test – I		Test - II		Model		Observation	Total
100	40	60	Actual	Weightage	Actual	Weightage	Actual	Weightage	5	40
			50	10	50	10	60	15		

Examination Pattern

Component	Duration in Hrs.	Marks			Weightage
		Practical	Record	Total Marks	
Test – I	2	50	-	50	10
Test – II	2	50	-	50	10
Model	3	60	-	60	15
ESE	3	50	10	60	-

Part – IV : Foundation Courses

(All the Undergraduate Programmes)

Course Code	Course Name	Category	Hours / Week	Credits
24HUM2FC	Human Rights	FC - II	2	2

Unit	Content
I	**Concept of Human Values, Value Education Towards Personal Development** Aim of Education and Value Education; Evolution of Value Oriented Education; Concept of Human Values; Types of Values; Components of Value Education. **Personal Development:** Self-analysis and Introspection; Sensitization towards Gender Equality, Physically Challenged, Intellectually Challenged. Respect to - Age, Experience, Maturity, Family Members, Neighbors, Co-workers. Character Formation towards Positive Personality: Truthfulness, Constructively, Sacrifice, Sincerity, Self-Control, Altruism, Tolerance, Scientific Vision.
II	**Value Education Towards National and Global Development** **National and International Values:** Constitutional or National Values - Democracy, Socialism, Secularism, Equality, Justice, Liberty, Freedom, and Fraternity. Social Values - Pity and Probity, Self-Control, Universal Brotherhood. Professional Values - Knowledge Thirst, Sincerity in Profession, Regularity, Punctuality, and Faith. Religious Values - Tolerance, Wisdom, Character. Aesthetic Values - Love and Appreciation of Literature and Fine Arts and Respect for the Same. National Integration and International Understanding.
III	**Impact of Global Development on Ethics and Values** Conflict of Cross-Cultural Influences, Mass Media, Cross-Border Education, Materialistic Values, Professional Challenges, and Compromise. Modern Challenges of Adolescent Emotions and Behavior; Sex and Spirituality: Comparison and Competition; Positive and Negative Thoughts. Adolescent Emotions, Arrogance, Anger, Sexual Instability, Selfishness, Defiance
IV	**Therapeutic Measures** Control of the Mind through a. Simplified Physical Exercise b. Meditation – Objectives, Types, Effect on Body, Mind and Soul c. Yoga – Objectives, Types, Asanas d. Activities: (i) Moralisation of Desires (ii) Neutralisation of Anger (iii) Eradication of Worries (iv) Benefits of Blessings

Unit	Content
V	**Human Rights** 1. Concept of Human Rights – Indian and International Perspectives a. Evolution of Human Rights b. Definitions under Indian and International Documents 2. Broad Classification of Human Rights and Relevant Constitutional Provisions. a. Right to Life, Liberty and Dignity b. Right to Equality c. Right against Exploitation d. Cultural and Educational Rights e. Economic Rights f. Political Rights g. Social Rights 3. Human Rights of Women and Children a. Social Practice and Constitutional Safeguards (i) Female Feticide and Infanticide (ii) Physical Assault and harassment (iii) Domestic Violence (iv) Conditions of Working Women 4. Institutions for Implementation a. Human Rights Commission b. Judiciary 5. Violations and Redressal a. Violation by State b. Violation by Individuals c. Nuclear Weapons and terrorism d. Safeguards

Web Resources	
1.	https://syllabus.b-u.ac.in/syl_college/ug_ve.pdf

Components for Internal Assessment and Distribution of Marks for CIA (Theory)

Max Marks	Marks for		Components for CIA							
	CIA	ESE	CIA – I		CIA – II		Best of CIA-I & CIA-II	Model		Total (Best + Model)
50	50	-	Actual	Weightage	Actual	Weightage	Weightage	Actual	Weightage	50
			50	**25**	50	**25**	**25**	50	**25**	

Question Paper Pattern

Duration in Hrs.	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Offline	Open Choice	5 (Out of 8)	5 x 10=50

Course Code	Course Name	Category	Hours / Week	Credits
24SOF2AE	Soft Skills	AECC - II	2	2

Course Objectives

The course intends to cover

- The essential soft skills that is crucial for success in today's dynamic and interconnected workplace.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the comprehensive skills to participate actively in conversation, writing short texts with expression	K1, K2, K3
CLO2	Infer the cohesive devices to describe and discuss any objects, pictures using compound, complex sentence forms.	K2, K3
CLO3	Comprehend the logic in the given situation to organize the ideas to write formal and informal letters.	K2, K3
CLO4	Understand the given material to organize it in a logical sequence to present a paragraph with main and supporting ideas with concluding sentences.	K3
CLO5	Present valuable ideas in conversation to emulate the main ideas and key points in short essays.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply;		

Ability Enhancement Compulsory Course - II : Soft Skills

Unit	Details	No. of Hours
I	**Presentation Skills : Getting to Know You:** Grammar: Introduction to Tenses; Listening: Fill in the blanks; Speaking: Self Introduction, Everyday English, Role-Play; Reading: Different ways of communication. **My Day:** Grammar: Present simple positive & negative / Adverbs of Frequency; Vocabulary & Speaking: Daily Activities; Listening: Observe and Answer / Telling the time; Reading & Writing: Describe where you live. **Your World:** Grammar: Possessive determiners; Vocabulary & Speaking: Talk about countries, nationalities; Listening: Positive & negative contractions; Reading & Writing: Personal profile. **The World Of Work:** Grammar: Yes/No & Wh Questions; Vocabulary & Speaking: Jobs; Listening: Recognize the schwa sound; Reading & Writing: Opening and closing an email. .**Places And Things:** Grammar: There is / there are, articles; Vocabulary & Speaking: Talk about rooms & furniture; Listening: Directions; Reading & Writing: Imperatives.**24 Hours:** Grammar: Likes & Dislikes; Vocabulary & Speaking: Speak about hobbies and interests; Listening: Observe & answer; Reading: Match the photos with descriptions; Writing: Write complete sentence using prompts;	6
II	**Confidence : Clothes and Shopping:** Grammar: Modal verbs / Adverbs of Frequency / Adjectives and Adverbs; Vocabulary & Speaking: Shopping; Listening: Observe and Answer; Reading & Writing: Product Review. **Travel & Transport:** Grammar: Past simple questions; Vocabulary & Speaking: Talk about holidays; Listening: At the train station; Reading & Writing: Email - A perfect holiday. **Health & Fitness:** Grammar: Past simple irregular verbs; Vocabulary & Speaking: Talk about a healthy lifestyle; Listening: Listen & Answer; Reading & Writing: Time sequencers. **Music:** Grammar: Present perfect simple; Vocabulary & Speaking: Survey about music; Listening: Listen two people talk about music; Reading: Use adjectives and create sentences. **Let's go shopping:** Grammar: Countable & Uncountable; Vocabulary & Speaking: Town Survey; Listening: Listen and answer; Reading & Writing: Read and match	6
III	**Creativity :Cooking & Eating:** Grammar: Some & Any, Quantifiers; Vocabulary & Speaking: Food & Drink; Listening: Kitchen conversation; Reading & Writing: Article reading & answering. **Survival:** Grammar: Comparison of adjectives; Vocabulary & Speaking: Describing people; Listening: Listen & Answer; Reading & Writing: Read and Answer. **Working Together:** Grammar: Verb + Noun phrases; Vocabulary & Speaking: Talk about technology; Listening: Listen & Answer; Reading & Writing: Notice. **Music:** Grammar: Present perfect simple; Vocabulary & Speaking: Survey about music; Listening: Listen two people talk about music; Reading: Use adjectives and create sentences. **Culture and Arts:** Grammar: Present perfect; Vocabulary & Speaking: Speak on the phone; Listening: Listen and answer; Reading & Writing: Review	6

Unit	Content	No. of Hours
IV	**Problem-Solving :Do's and Don'ts:** Grammar: Modal verbs; Vocabulary & Speaking: Role play; Listening: Holidays in January; Reading & Writing: Article reading & answering. **Body:** Grammar: First conditional; Vocabulary & Speaking: Personality & Appearance; Listening: Listen to conversations about personality; Reading & Writing: Read and Answer about your skills. **Speed:** Grammar: Present simple passive; Vocabulary & Speaking: Talk about relationships; Listening: Listen & Answer; Reading & Writing: Error spotting. **Work:** Grammar: Adverbs of manner; Vocabulary & Speaking: Talk about work advice; Listening: Observe & Answer; Reading: Read & check your ideas	6
V	**Critical Thinking : Influence:** Grammar: would / past habits; Listening: Sentence Correction; Speaking & Vocabulary: Your inspiration; Reading: Picture description; Writing: Rewrite the sentences. **Money:** Grammar: Second conditional; Listening: radio programme; Speaking & Vocabulary: Talk about games; Reading & Writing: Fill in the blanks. **Things that changed the world:** Grammar: articles; Speaking & Listening: Talk about chewing gum; Reading & Writing: Read and write a book review	6
	Total Hours	**30**

Components for and Distribution of Marks for ESE (Theory) Ability Enhancement Compulsory Course(AECC)

Duration in Hours	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Online	MCQ	50	50x1=50

Semester - 3

Curriculum

B.Sc. Computer Science

Semester – 3									
Course Code	Part	Course Category	Course Name	Hours / Week	Examination				Credits
					Duration in Hours	Max Marks			
						CIA	ESE	Total	
24TAM31L	I	Language – I	Tamil – III	4	3	25	75	100	3
24HIN31L	I		Hindi – III						
24MAL31L	I		Malayalam – III						
24FRE31L	I		French – III						
24ENG32L	II	Language – II	English – III	4	3	25	75	100	3
24BCS33C	III	Core – V	Data Structures & Algorithms	6	3	25	75	100	4
24BCS34P	III	Core Lab – III	**Lab:**Data Structures & Algorithms	4	3	40	60	100	2
24BCS35C	III	Core – VI	Introduction to Data Science	6	3	25	75	100	4
24BCS36A	III	Allied – III	Operations Research	4	3	25	75	100	3
24BCS37P	III	SEC – I	**Lab :** Interactive JavaScript Programming	2	3	40	60	100	2
24BAT3FC/	IV	FC – III	Basic Tamil /	-	2	50	-	50	2
24ADT3FC/			Advanced Tamil						
24IKS3FC			Indian Knowledge Systems (IKS)*						
24MOO3AE	IV	AECC – III	Online Course – MOOC	-	-	-		-	2
Total				**30**				**750**	**25**

Part –I : Language-I-Tamil –III
(All the Undergraduate Programmes)

Course Code	Course Name	Category	Hours / Week	Credits
24TAM31L	Tamil - III	Language - I	4	3

Course Objectives
The course intends to cover

- தமிழரின் பிற துறை சார்ந்த சிந்தனைகளைக் கற்றுத் தேர்தல்
- இன்றைய அறிவியல் வளர்ச்சி மற்றும் கணினியின் பயன்பாட்டுத் தேவையை உணர்த்துதல்
- இயற்கை பாதுகாப்பு குறித்த விழிப்புணர்வை வளர்த்தல்

Course Learning Outcomes
On the successful completion of the course, students will be able to

CLO	CLO Statements	Knowledge Level
CLO1	வணிகத் தமிழ் - கணினித் தமிழின் நுட்பங்கள் மற்றும் பயன்பாடுகளை அறிதல்.	K1, K2
CLO2	ஊடகம் மற்றும் உளவியல் தன்மை குறித்த சிந்தனைகளை வளர்த்தல்.	K2
CLO3	சுற்றுலா - சுற்றுச்சூழலியல் தேவை மற்றும் மீட்டுருவாக்கம் குறித்து உணர்த்துதல்.	K3
CLO4	மேலாண்மை பற்றி அறிதல் மற்றும் சுயக்கற்றல் திறனை வளர்த்தல்.	K1, K3
CLO5	கொங்கு ஆளுமைகள் குறித்து அறியச் செய்தல்.	K2, K3
K1 - Remember; **K2** - Understand; **K3** – Apply		

Part – I: Language-I-Tamil – III

பயன்பாட்டுத் தமிழ்

Unit	Content	No. of Hours
I	**வணிகம் மற்றும் கணினித் தமிழ்** தமிழரின் வணிகம் - வணிகக் கடிதங்கள் – உலகமயமாக்கல் - செயற்கை நுண்ணறிவு கற்றல் - இணைய நூலகம் - இணையத் தமிழ் பயன்பாடு	12
II	**ஊடகம் மற்றும் உளவியல் தமிழ்** ஊடகத்தின் இன்றியமையாமை - நிகழ்வுகளைச் செய்திகளாக வடிவமைத்தல் - ஊடகத் துறையில் மொழியின் பங்கு - உளவியல் வரையறை - உளவியல் பிரிவுகள் - வகுப்பறை உளவியல் (ஆசிரியர், மாணவர்)	12
III	**சுற்றுச்சூழலியல் மற்றும் சுற்றுலாவியல்** தமிழரின் சூழலியல் அறிவு - சுற்றுச்சூழல் மாசுபாடு - சுற்றுச்சூழல் பாதுகாப்பு - சுற்றுலா வகைகள் - உலகப் புகழ்பெற்ற சுற்றுலாத் தலங்கள் - சுற்றுலா வளர்ச்சி மற்றும் பயன்கள்	12
IV	**மேலாண்மைத் தமிழ் மற்றும் மொழிப்பயிற்சி** மேலாண்மையும் அணுகுமுறைகளும் - மேலாண்மை செயல்பாடுகள் மற்றும் வகைகள் - வகுப்பறை மேலாண்மை – நேர்காணல் - நூல் திறனாய்வு மற்றும் மதிப்பீடு - படிவங்கள் பூர்த்தி செய்தல் மற்றும் விண்ணப்பங்கள்	12
V	**பன்முக ஆளுமைகள்** ஜி.டி.நாயுடு(அறிவியல்) – பத்மஸ்ரீ டாக்டர் பக்தவத்சலம்(மருத்துவம்) - நா மகாலிங்கம்(தொழில்) - மயில்சாமி அண்ணாதுரை(விஞ்ஞானம்) - என் ஜி ராமசாமி(சமூகம்) - நம்மாழ்வார்(விவசாயம்)	12
	Total Hours	**60**

Reference Books

1	சுந்தரம்.இல, (2022) கணினித் தமிழ், விகடன் பிரசுரம்
2	மணியரசன்.துரை, (2019), இணையமும் இனியத் தமிழும், இசை பதிப்பகம்
3	பொன்னவைக்கோ.மு, (2015) இணையத் தமிழ் வரலாறு, பாரதிதாசன் பல்கலைக் கழகம்.
4	தங்கமணி இரா.ம, (2018) சுற்றுலாவியல், கொங்கு பதிப்பகம்
5	இலக்கியா க.வி, நந்தினி சா.சு,(2022), விடியல் பதிப்பகம்
6	சின்னத்தம்பி முருகேசன்.பொன்(2016) சுற்றுச் சூழலியல்(உலகம் தழுவிய வரலாறு), எதிர் வெளியீடு
7	இறையன்பு.வெ (2018) இலக்கியத்தில் மேலாண்மை, நியூ செஞ்சுரி புக் ஹவுஸ்
8	ஸ்ரீனிவாசன்.வி, (2009), திருக்குறளில் மேலாண்மை, விகடன் பிரசுரம்

Reference Books	
9	பட்டனத்தி மைந்தன், (2018), ஜி.டி நாயுடு, ராமையா பதிப்பகம்
10	டாக்டர் பக்தவத்சலம்.ஜி (2009) இதயம் ஒரு கோவில், விஜயா பதிப்பகம்

Question Pattern	
காலம் : 3 மணி நேரம்	மொத்த மதிப்பெண்கள் : 75
பிரிவு – அ 10x1=10	
• சரியான விடையைத் தேர்ந்தெடுத்து எழுதுக.	
பிரிவு – ஆ 5x5=25	
• வணிகம் மற்றும் கணினித் தமிழ்	- 1 வினா
• ஊடகம் மற்றும் உளவியல் தமிழ்	- 1 வினா
• சுற்றுலாவியல் மற்றும் சுற்றுச்சூழலியல்	- 1 வினா
• மேலாண்மைத் தமிழ் மற்றும் மொழிப்பயிற்சி	- 1 வினா
• கொங்கு ஆளுமைகள்	- 1 வினா
பிரிவு – இ 5x8=40	
• வணிகம் மற்றும் கணினித் தமிழ்	- 1 வினா
• ஊடகம் மற்றும் உளவியல் தமிழ்	- 1 வினா
• சுற்றுலாவியல் மற்றும் சுற்றுச்சூழலியல்	- 1 வினா
• மேலாண்மைத் தமிழ் மற்றும் மொழிப்பயிற்சி	- 1 வினா
• கொங்கு ஆளுமைகள்	- 1 வினா

குறிப்பு : ஆ, இ பிரிவுகளில் வினாக்கள் "இது" அல்லது "அது" என்ற வகையில் அந்தந்த அலகுகளிலிருந்து அமைத்தல் வேண்டும்.

Course Code	Course Name	Category	Hours / Week	Credits
24HIN31L	Hindi - III	Language - I	4	3

Course Objectives

The course intends to

- Have knowledge of the contents of primitive poetry
- Learn about contemporary poetry and its techniques.
- Interest in reading poetry and the ability to express social thoughts will improve
- Understand the basics of Hindi literature and to understand Hindi literature properly
- Have Knowledge of the elements of poetry and the knowledge of subtle translation will improve

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	May have knowledge of the contents of primitive poetry	K1, K2
CLO2	Learn about contemporary poetry and its techniques.	K2
CLO3	Interest in reading poetry and the ability to express social thoughts will improve	K3
CLO4	This will help you to understand the basics of Hindi literature and to understand Hindi literature properly	K1, K3
CLO5	Knowledge of the elements of poetry and the knowledge of subtle translation will improve.	K2, K3
K1 - Remember; **K2** - Understand; **K3** - Apply		

Part – I: Hindi – III

Unit	Content	No. of Hours
I	**Poetry: Kavya Lehar – By Dr. V. Baskhar Pracheen Kavitha** 1. Mahatma Kaber – Saki 2. Goswamy Tulasidas – Ram-Van-Aman 3. Mahatma Soordas – Baal – Leela 4. Kavivar Rahim – Dohe	14
II	**Poetry: Kavya Lehar – By Dr. V. Baskhar Aadhunik Kavitha** 1. Mythili Sharn Gupth – Vikaral Bijali 2. Sumithranandan Panth – Parivarthan 3. Suryakanth Thripati Nirala – Sandhayasundarai 4. Ramdhari Sing Dinkar – Bhagavan Ke Dakkiya 5. Harivansray Bachchan – Kota Sikka 6. Agyeya – Anubhav Paripakva 7. Naresh Mehtha – Ullangan 8. Dharmaveer Bharathi – Tum Mere Koun Ho	14
III	**History of Hindi Literature:** (Sahithyik Tippanian) 1. Ammer Kusro 2. Vidhyapathi 3. Chandbardhayi 4. Pruthiviraj Raso 5. Ramacharitha Manas 6. Vinaya Patrika	12
IV	**Alankar:** 1. Anupras 2. Yamak 3. Slesh 4.Vakrokthi 5.Upama, 6. Roopak 7. Virodhabas	10
V	**Translation**: **English - Hindi only** Anuvadh abhyas – III (16-30 Lessons Only)	10
	Total Hours	**60**

Text Books	
1	Dr Baskhar V., (2006), Kavya lehar –Jawahar Pusthakalay, Sadar Bazaar,Mathura-U.P.281001.
2	Anuvadh Abyas-III,Dakshin Bharath Hindi Prachar Sabha Chennai – 17.
Reference Books	
1	Rajnath sharma,(2010) Hindi sahithya ka saral ithihaas, Vinod Pustak Mandir, Agra-282
2	Kavya pradeep rambadri shukla,(2008) hindi bhavan, 36, tagore town, allahabad – 211 002.

Course Code	Course Name	Category	Hours/Week	Credits
24MAL31L	Malayalam - III	Language - I	4	3

Course Objectives

The course intends to

- Have knowledge of the contents of primitive poetry
- Learn about contemporary poetry and its techniques.
- Interest in reading poetry and the ability to express social thoughts will improve
- Understand the basics of Malayalam Poetry and to understand Malayalam literature properly
- It will provide knowledge of the elements of poetry.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Get a basic knowledge of the history of Malayalam literature.	K1
CLO2	Enhances the art and taste of Malayalam literary works	K1
CLO3	Literary genres can be learned	K2
CLO4	Create more to read and enjoy Malayalam poetry	K3
CLO5	Get the basic Knowledge of poetry techniques	K4

Part – I: Malayalam – III

Unit	Content	No. of Hours
I	Poetry – Chinthavishtayaya Seetha	14
II	Poetry – Chinthavishtayaya Seetha	14
III	Poetry – Mrugasikshakan - (Murgasikshakan, Kausalya, Varavu, Vittupoku Ekalavyan, Mazha) 6 poetries	12
IV	Poetry – Mrugasikshakan - (Kayal, Karkkadakam, Bhagavatham, Vazhivakkile naikutty, Edavelayil oru nimisham, Verumoru kathu) 6 Poetries	10
V	Poetry – Aayisha	10
Total Hours		**60**

Text Books	
1	Kumaranasan, (2012), Chinthavishtayaya Seetha, Kerala Book Store Publishers.
2	Vijayalakshmi, (2010), Mrugasikshakan, DC Books, Kottayam.
3	VayalarRamavarma,(2014), Aayisha, Kerala Book Store Publishers.
Reference Books	
1	Dr.Leelavathi M, (2015) Kavitha SahithyaCharitram, Kerala Sahithya Academy, Trichur.
2	Dr.Leelavathi M, (2015) Kavitha Dwani, D.C.Books, Kottayam.
3	Dr.George K.M, (2014) Aadhunika Sahithyacharithram Prasthanangalilude, D.C.Books, Kottayam.
4	Chummar T.M. (2009) Padya Sahithya Charithram, Kerala Sahithya Academy, Trichur.

Course Code	Course Name	Category	Hours/Week	Credits
24FRE31L	French - III	Language - I	4	3

Course Objectives

The course intends

To interact in a simple way, ask and answer simple questions about themselves, where they live, people they know, and things they have, initiate and respond to simple statements in areas of immediate need or on very familiar topics, rather than relying purely on a very finite rehearsed, lexically-organized repertoire of situation-specific phrases.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Comprehend a repertoire of vocabulary	K1
CLO2	Understand tenses and intermediary level of grammar	K2
CLO3	Try to converse in unknown situation	K3
CLO4	Translate unknown texts on familiar topics	K4

Part – I : French – III

Unit	Content	No. of Hours
I	Etape 1 (Lecons 1 - 3)	14
II	Etape2 (Lecons 1 - 3)	14
III	Etape 3 - Leçons 1 – 2	12
IV	Etape 3 – Leçon 3	10
V	Etape 4 – Leçon 1	10
	Total Hours	**60**

Text Book	
1.	Céline Himber, Corina Brillant, Sophie Erlich, (2014), Adomania2 – Methode Defrancais, Publisher : Hachette Fle
Reference Book	
1.	Yves Loiseau, Régine Merieux (2009), Latitudes 1, Publisher: French and European Publications Inc.

Course Code	Course Name	Category	Hours/ Week	Credits
24ENG32L	English-III	Language- II	4	3

Course Objectives

The course intends to cover

- Various genres of literature
- Inter personal skills essential at work environment

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	List out the connotations and denotations to pen poems.	K1
CLO2	Identify complex characters to navigate philosophical and intellectual learning and employ it in work place.	K2
CLO3	Interpret various prose styles to enhance creative writing	K3
CLO4	Compute vocabulary and grammatical proficiency in communication to enhance clarity in content creation.	K3
CLO5	Practice communication skills to be effective in lifelong learning.	K3
K1 – Remember; **K2**-Understand; **K3**- Apply		

Part-II: Language-II-English-III

Unit	Content	No. of Hours
I	**Poetry** 1. Nothing Will Die – Alfred Lord Tennyson 2. Porphyria's Lover – Robert Browning 3. Obituary – A K Ramanujan	12
II	**Scenes from William Shakespeare's Plays** 1. Romeo and Juliet – The Balcony Scene 2. Merchant of Venice - Court Scene 3. Julius Caesar - Murder Scene	12
III	**Famous Speeches** 1. You've Got to Find What You Love-Steve Jobs 2. You Will Prevail -Sundar Pichai 3. I am Malala – Malala Yousafzai	12
IV	**Language Competency** 1. Identifying types of Sentences 2. Sentence Structure 3. Active Voice and Passive Voice 4. Direct and Indirect Speech	12
V	**English for Communication Listening and Speaking** Participating in a Group Discussion 1. Group discussion as a selection process 2. Different kinds of Group Discussion 3. Structure of Group Discussion 4. Successful Group Discussion Techniques 5. Group Discussion – Do's and Don'ts **Reading and Writing** 1. Reading diagrammatic information-interpretations maps, graphs and pie charts 2. Narrative writing– Two to three paragraphs 3. Dramatizing everyday situations/social issues through skits. (Writing scripts and performing)	12
	Total Hours	**60**
Reference Book		
1.	Wren, P.C. (1973). High school English grammar and composition.	
Web Resources (Swayam/NPTEL)		
1.	https://nptel.ac.in/courses/109106129	
2.	https://nptel.ac.in/courses/109104031	

Course Code	Course Name	Category	Hours / Week	Credits
24BCS33C	Data Structures and Algorithms	Core – V	6	4

Course Objectives

This course intends to cover

- Basic Concepts of Data Structures and Applications
- Algorithm Analysis and Design Techniques

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Learn the basic concepts of Stack and Queues Data Structures and its application	K1
CLO2	Understand the representation of Linked List and its implementation	K2
CLO3	Organize and manage hierarchical data with non-linear Data structures	K2
CLO4	Understand various Sorting Algorithms and to manage the data efficiently	K3
CLO5	Apply algorithmic design paradigms like Dynamic Programming, Backtracking, Divide and Conquer	K3
K1 - Remember; **K2 -** Understand; **K3 -** Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	1	3	2	2
CLO2	3	1	2	3	2
CLO3	2	2	3	2	2
CLO4	2	2	2	2	1
CLO5	2	3	2	3	1
3 - Substantial (high)		**2 - Moderate (medium)**		**1 - Slight (low)**	

Core -V: Data Structures and Algorithms

Unit	Content	No. of Hours
I	**Basic Concepts:** Overview: System Life Cycle-Algorithm Specification: Introduction-Performance Analysis: Space Complexity-Time Complexity-Asymptotic Notation - **Arrays:** The Abstract Data Type - Sparse Matrix - The Abstract Data Type - Sparse Matrix Representation - Transposing a Matrix. The Representation of Multidimensional Arrays - S**tacks and Queues:** Stacks - Queues - Evaluation of Expression - Multiple Stacks and Queues	**18**
II	**Linked List:** Singly Linked Lists and Chains - Linked Stacks and Queues-Polynomials-Polynomial Representation-Adding Polynomial - Circular List Representation of Polynomial-Sparse Matrices-Sparse Matrix Representation - Doubly Linked List	**18**
III	**Trees: Terminology –** Representation of Trees – Binary Trees: The Abstract Data Type – Properties of Binary Tree – Binary Tree Traversal. Binary Search Tree-Searching, Inserting and Deleting in Binary Search Tree. Introduction: Threaded Binary Trees. **Graphs** - The Graph Abstract Data Type – Elementary Graph Operations: Depth First Search - Breadth First Search - Minimum Cost Spanning Tree - Kruskal's Algorithm – Shortest Path and Transitive Closure	**18**
IV	**Searching:** Sequential Search - Binary Search - **Sorting:** Definitions - Insertion sort - Quick sort - Merge sort - Heap sort - **Hashing:** The Symbol Table, Abstract Data Type - Static Hashing - Dynamic Hashing using Directories	**18**
V	**Algorithm Analysis Techniques**: Efficiency of Algorithms - Analysis of Recursive Programs - **Algorithm Design Techniques**: Divide and Conquer Algorithms - Dynamic Programming - 0/1 Knapsack Problem - Matrix Chain Multiplication - Greedy Algorithms -Case study on Job Sequencing Algorithm - Huffman Coding - K- Job Sequencing with Deadlines	**18**
	Total Hours	**90**

Text Books

1.	Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed (2014),"Fundamentals of Data Structures in C", 2nd Edition, Universities Press.
2.	Aho V, John E. Hopcroft, Jeffrey D. Ullman, (2008), "Data Structures and Algorithms",3rd Edition, Pearson Education Alfred Asia

Reference Books

1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia.
2.	Ellis Horowitz, Sartaj Sahani and Dinesh Mehta (2008), "Fundamentals of Data Structures in C++", 2nd Edition, University Press.

Web Resources (Swayam / NPTEL)

1.	https://onlinecourses.nptel.ac.in/noc23_cs85/preview
2.	https://onlinecourses.nptel.ac.in/noc24_cs78/preview

Core Lab - III: Data Structures and Algorithms

Course Code	Course Name	Category	Hours / Week	Credits
24BCS34P	Lab: Data Structures & Algorithms	Core Lab - III	4	2

S. No.	List of Programs	
1	Sample Programs	
	Implementation of Array Operations	
2	Implementation of Stack using Arrays	
3	Implementation of Queue using Arrays	
4	Conversion of Infix to Postfix Expression	
5	Evaluation of Postfix Expression	
6	Implementation of Singly Linked List	
7	Implementation of Tree Traversal	
8	Implementation of Depth First Search	
9	Implementation of Breadth First Search	
10	Implementation of Linear Search	
11	Implementation of Binary Search	
12	Implementation of Quick Sort	
13	Implementation of Merge Sort	
14	Greedy Algorithms - Activity Selection Problem	
15	0-1 Knapsack Problem	
	Total Hours	**60**
Text Books		
1.	Ellis Horowitz, Sartaj Sahni, Susan Anderson Freed (2014), "Fundamentals of Data Structures in C", 2nd Edition, Universities Press.	
2.	Aho V, John E. Hopcroft, Jeffrey D. Ullman, (2008), "Data Structures and Algorithms", 3rd Edition, Pearson Education Alfred Asia	
Reference Books		
1.	Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", 2nd Edition, Pearson Education Asia.	
2.	Ellis Horowitz, Sartaj Sahani and Dinesh Mehta (2008), "Fundamentals of Data Structures in C++", 2nd Edition, University Press.	
Web Resources (Swayam / NPTEL)		
1.	https://onlinecourses.nptel.ac.in/noc23_cs85/preview	
2.	https://onlinecourses.nptel.ac.in/noc24_cs78/preview	

Course Code	Course Name	Category	Hours / Week	Credits
24BCS35C	Introduction to Data Science	Core – VI	6	4

Course Objectives

The course intends to cover

- To introduce the concepts, techniques, and tools in Data Science.
- To understand the various facets of data science practice, including data collection and integration, exploratory data analysis, predictive modeling, descriptive modeling and effective communication.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	To understand the basics in Data Science and Big Data.	K1
CLO2	To understand the overview and building process in Data Science.	K2
CLO3	To incorporate basic Data Pre-Processing procedures.	K3
CLO4	To understand various algorithms in Data Science.	K3
CLO5	To understand Data Science in different domains.	K3
K1 - Remember; **K2** - Understand; **K3** – Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	1	1	3	2	1
CLO2	1	2	2	1	2
CLO3	1	2	1	3	1
CLO4	2	1	1	1	2
CLO5	2	1	1	2	2
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - VI: Introduction to Data Science

Unit	Content	No. of Hours
I	**Introduction to Data Science** – Evolution of Data Science – Data Science Roles - Benefits and uses – Facets of Data – Data Science Process – Big Data ecosystem and Data Science.	18
II	**Overview of the Data Science Process** – Research Goals – Retrieving Data – Data Integration and Transformation – Exploratory Data Analysis – Data Reduction – Model Building.	18
III	**Data Preprocessing-Feature Engineering:** Creating New Features – Feature Selection Techniques – Automating Data Preparation with Scikit.	18
IV	**Machine Learning algorithms** – Modeling Process and Types –Predictive models - Classification – SVM- Supervised – Unsupervised - Semi-supervised.	18
V	**Data Science in different domains:** Healthcare, Retail, Finance and Social Media – Introduction to Hadoop – Spark – Text Analytics and NLP – Introduction to Tableau and Power BI.	18
	Total Hours	**90**

Text Books

1.	Davy Cielen(2016), Arno D. B. Meysman, Mohamed Ali, Introducing Data Science, manning publications
2.	Tom White(2012), "Hadoop: The definitive Guide
3.	Davy Cielen(2016), Arno D.B. Meysman, Mohamed Ali,Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Dreamtech Press

Reference Books

1.	Dipanjan Sarkar(2019), Text Analytics with Python: A Practitioner's guide to NLP
2.	Cathy O'Neil, Rachel Schutt(2013), Doing Data Science Straight Talk from the Frontline, O'Reilly Media

Web Resources (Swayam / NPTEL)

1.	https://nptel.ac.in/courses/10610617

Part – III: Allied Courses

(B.Sc. Computer Science / BCA / B.Sc. CS (AI & DS))

Course Code	Course Name	Category	Hours / Week	Credits
24BCS36A/ 24BCA36A/ 24BAI36A	Operations Research	Allied III	4	3

Course Objectives

The course intends to cover

- Optimization methods such as linear programming, transportation problems, and game theory to address complex decision-making challenges in real-world scenarios.
- Employ analytical and computational techniques like PERT/CPM and replacement models to effectively manage resources and optimize project scheduling.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Recall the concepts of linear programming, including mathematical formulation, graphical method, and simplex method.	K1
CLO2	Explain Transportation and Assignment Problems, feasible solutions and the Traveling Salesman Problem.	K2
CLO3	Solve Two-Person Zero-Sum Games using the Maximin and Minimax Principles.	K3
CLO4	Apply the models of queuing theory in the real-world applications	K3
CLO5	Analyze the knowledge of drawing project networks for quantitative analysis of projects	K4
K1 - Remember; K2 –Understand, **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	2	2	2	2	3
CLO2	2	1	2	3	2
CLO3	2	2	2	3	2
CLO4	1	1	3	2	3
CLO5	3	2	3	3	2
3 - Substantial (high)		**2 - Moderate (medium)**		**1 - Slight (low)**	

Allied III: Operations Research

Unit	Details	No. of Hours
I	**Linear Programming Problems:** Introduction to Linear Programming - Mathematical Formulation of Linear Programming Problem – Graphical method - Simplex method.	12
II	**Transportation Problems:** Introduction to transportation problem – The transportation table – Solution of transportation problem – Finding an initial basic feasible solution**.** **Assignment Problems:** Introduction – Mathematical Formulation – Solution Methods – Special case – The Traveling Salesman Problem.	12
III	**Game Theory:** Introduction – Two Person Zero – Sum Games – Some basic terms – The Maximin – Minimax Principle – Games without Saddle Points - Mixed Strategies – Graphical Solution of 2 x n and m x 2 Games - Dominance Property.	12
IV	**Queuing Theory:** Introduction – Queuing System- Elements of Queuing System- Operating Characteristics of Queuing System- Classification of Queuing Models- Model I (M/M/1):(∞/FIFO), Model II (M/M/1):(N/FIFO).	12
V	**Network Scheduling by PERT / CPM:** Introduction – Network -Basic Components – Logical Sequencing – Rules of Network Construction – Critical Path Analysis – Probability Consideration in PERT – Distinction between PERT and CPM – Applications of Network Techniques.	12
	Total Hours	**60**

Text Book

1.	Manmohan, P.K. Gupta, Kanthiswarup (1997), "Operations Research", S. Chand & Sons. Unit I : Chapter 2 : Section 2.1 – 2.4 Chapter 3 : Section 3.2 Chapter 4 : Section 4.3 Unit II : Chapter 10 : Section 10.5, 10.8, 10.9 Chapter 11 : Section 11.1 – 11.4, 11.7 Unit III: Chapter 17 : Section 17.1 – 17.7 Unit IV: Chapter 21 : Section 21.1 – 21.9 Unit V: Chapter 25 : Section 25.1 – 25.9

Reference Books

1.	Hamdy A Taha(2002), "Operations Research" Pearson Education, 7th edition.
2.	P.K. Gupta, D.S. Hira, "Problems in Operations Research", S. Chand Publishers.

Web Resources (Swayam / NPTEL)

1.	https://archive.nptel.ac.in/courses/111/107/111107128/

SEC-I: Interactive JavaScript Programming

Course Code	Course Name	Category	Hours / Week	Credits
24BCS37P	Lab: Interactive JavaScript Programming	SEC – Lab I	2	2

S.No.	List of Programs	No. of Hours
	Level 1: Basics of JavaScript & User Interaction	
1.	Create a basic calculator based on user input for addition, subtraction, multiplication, and division.	2
2.	Create a simple game where the user guesses a random number, and the program provides hints (higher/lower).	4
3.	Create a JavaScript Program to Manipulate Strings and Arrays.	4
	Level 2: DOM Manipulation & Form Handling	
4.	Using JavaScript, validate a registration form with fields like name, email, password, and phone number.	2
5.	Build a word and character counter for a textarea input field.	2
6.	Build a dynamic to-do list where users can add, remove, and mark tasks as completed.	4
	Level 3: Timers & Real-Time Interaction	
7.	Implement a stopwatch with start, stop, and reset functionalities using JavaScript's `setInterval()`.	2
8.	Display a real-time digital clock using a `Date` object and update it every second.	4
	Level 4: Dynamic Content & UI Effects	
9.	Implement an image slider that changes images automatically or using next/previous buttons.	2
	Level 5: Working with APIs	
10.	Use the Fetch API to get JSON data from an external source and display it on a webpage.	4
	Capstone Project	
	Productivity Hub – A Multi-Utility JavaScript Web App (An Interactive Collection of Everyday Tools Built Using HTML, CSS, and Vanilla JavaScript)	
	Total Hours	**30**

Text Books

1. Kyle Simpson (2015-2020), "You Don't Know JS" (Book Series), O'Reilly Media.
2. Marijn Haverbeke (2018), "Eloquent JavaScript" (3rd Edition), No Starch Press.

Reference Books

1. David Flanagan (2020), "JavaScript: The Definitive Guide" (7th Edition), O'Reilly Media.
2. Jon Duckett (2014), "JavaScript & JQuery: Interactive Front-End Web Development", Wiley.

Web Resources (Swayam / NPTEL):

1. https://onlinecourses.swayam2.ac.in/nou24_cs09/preview

Part – IV – Foundation Course

(All the Undergraduate Programmes)

Course Code	Course Name	Course Category	Hours/Week	Credits
24IKS3FC	Indian Knowledge Systems(IKS)	FC-III	-	2

Unit	Content
1	**Indian Knowledge System (IKS) Basic Concepts** - Introduction - Journey of Indian Culture and Civilization - Hindu Philosophical System - Contribution of Indian Knowledge System in Science and Arts - Indian Knowledge System and Way of Life - The Implicit Concepts in Indian Knowledge System - Social Viewpoint in Indian Knowledge system - Idea of Vasudhaiva Kutumbakam.
2	**Indian Culture, Art & Architecture** - Introduction - Concept of Culture - Culture and Heritage - General Characteristics of Culture - Indian Culture - Indian Culture during the Modern and Contemporary Period -The Factors of Unity in Diversity - Aspects of Indian culture - Indian Architecture - Architecture of Tamil Nadu
3	**Vedic Mathematics** - Introduction - History of Vedic Mathematics - Addition - Subtraction - Base Method - Sub Base Method - Multiplication by numbers consisting of all 9s - Division - Special Methods of Division - Straight Division.
4	**Science and Technology in Indian Knowledge System(IKS)-** Introduction - The Indian S & T Heritage - Metals and Metalworking Technology - Lost wax casting of Idols and Artefacts - Literary sources for Science and Technology - Technology in Ancient India - Significant Science and Technology Discovery in Ancient India - Council of Scientific and Industrial Research - Animal Science in Ancient India - Biodiversity and folk traditions.
5	**History of Trade and Commerce in Ancient India** - Introduction - Indigenous Banking System - Rise of Intermediaries - Transport - Major Trade Centres - Major Exports and Imports - Position of Indian Subcontinent in World Economy.
6	**Indigenous Agriculture and IKS** - Introduction - History of Indian Agriculture - Indigenous Knowledge - Organic Farming and Natural Fertilization - Mixed Cropping and Crop Rotation - Ecological and Socioeconomic Impacts of Indigenous Farming - Challenges and Future Directions.

Unit	Content
7	**Traditional Water Management Systems of India** - Introduction - Methodology - Traditional Water Management Systems - Northern Region - North Western Region - North Eastern Region - Central Indian Region - Southern Indian Region.
8	**Traditional Foods and Festival of India** - History - Introduction - Foods Consumed in Different Regions of India - Eating Styles of India - Traditional Equipment's used for Cooking - Changes in Consumption of Traditional Foods - Traditional Foods/Modern Functions - The Future of Traditional Foods - Traditional Festivals of India.
9	**Sports in India-From Ancient Period to Modern Period** - Introduction - Indus Valley Civilization - Early Hindu Period/ Epic Period - Traditional Indoor and Outdoor Games - British Period - Post Independence - Modern period.
10	**Nobel Laureates of Indian Origin & Inspiring Scientists of India and their Contributions** - History of the Nobel Prize - Nobel Prize Insignia - Indian Nobel Prize winners and their Biography - Inspiring Scientists and their Contributions.

Reference Resources	
1.	https://www.education.gov.in/shikshakparv/docs/background_note_Stimulating_Indian_Knowledge_Systems_Arts_Culture.pdf
2.	Singh, R. K., King, C. A., & Barrett, D. A. (2010). Traditional ecological knowledge and agricultural sustainability in India. Indian Journal of Traditional Knowledge, 9(2), 231- 243

Components for Internal Assessment and Distribution of Marks for CIA and ESE (Theory)

Max Marks	Marks for		Components for CIA						
	CIA	ESE	CIA		Model		Attendance	Active Engagement	Total
100	25	75	Actual	Weightage	Actual	Weightage	5	5	25
			50	**5**	75	**10**			

Question Paper Pattern

Component	Duration in Hours	Section A			Section B			Section C			Total
		Type of Question	No. of Questions	Marks	Type of Question	No. of Questions	Marks	Type of Question	No. of Questions	Marks	
CIA	2	MCQ	8	8x1=8	Either or	3	3x6=18	Either or	3	3x8=24	50
Model Exam / **ESE**	3	MCQ	10	10x1=10	Either or	5	5x5=25	Either or	5	5x8=40	75

Components for Internal Assessment and Distribution of Marks for CIA (Lab)

Max Marks	Marks for		Components for CIA						
	CIA	ESE	Test		Model		Experiments / Programs	Observation	Total
100	40	60	Actual	Weightage	Actual	Weightage	Marks	5	40
			50	**10**	60	**15**	**10**		

Examination Pattern

Component	Duration in Hours	Marks			Total Marks
		Practical Exam	Record	Weightage	
Test	2	50	-	**10**	50
Model	3	60	-	**15**	60
Experiments	-	-	-	**10**	10
Observation	-	-	-	**05**	05
Total Marks - CIA				**40**	**40**
ESE	3	50	10	-	**60**

Components for Internal Assessment and Distribution of Marks for CIA (Foundation Course -Theory)*

Max Marks	Marks for		Components for CIA				
50	CIA	ESE	CIA		Model		Total
	50	-	Actual	Weightage	Actual	Weightage	
			50	25	50	25	50

*FC-III – Indian Knowledge System is a self-study course with open book assessment

Question Paper Pattern

Duration in Hours	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Offline	Open Choice	5 (Out of 8)	5 x 10=50

Components for and Distribution of Marks for ESE (Theory) Ability Enhancement Compulsory Courses (AECC) & Question Paper Pattern

Duration in Hours	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Online	MCQ	50	50x1=50

Semester 4

Semester – 4									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
24TAM41L	I	Language – I	Tamil – IV	4	3	25	75	100	3
24HIN41L			Hindi – IV						
24MAL41L			Malayalam – IV						
24FRE41L			French – IV						
24ENG42L	II	Language – II	English – IV	4	3	25	75	100	3
24BCS43C	III	Core – VII	Database Management System	5	3	25	75	100	4
24BCS44P	III	Core Lab – IV	**Lab :**Database Management System	4	3	40	60	100	2
24BCS45C	III	Core – VIII	Software Engineering	5	3	25	75	100	4
24BCS46A	III	Allied – IV	Arduino Systems and Applications	4	3	25	75	100	3
24BCS47P	III	SEC Lab – II	**Lab :** ReactJS Development	2	3	40	60	100	2
24IDT4AE/	IV	AECC – IV	Innovation & Design Thinking/	2	2	-	50	50	2
24IPR4AE/			Intellectual Property Rights/						
24END4AE			Entrepreneurship Development						
24EXC4LA	V	Extra-curricular and Co-curricular	Liberal Arts	-	2	50	-	50	2
Total				**30**				**800**	**25**

Part – I: Language – I

தமிழ் – IV

(All the UG Programmes)

Course Code	Course Name	Category	Hours / Week	Credits
24TAM41L	Tamil - IV	Language - I	4	3

Course Objectives

The Course intends to cover

- தமிழ் இலக்கிய வளர்ச்சிப் போக்குகள் மற்றும் நுட்பங்களை அறியச்செய்தல்.
- தமிழ்நாடு அரசுப் பணியாளர் தேர்வாணையம் நடத்தும் போட்டித்தேர்வுகளை எதிர்கொண்டு வேலைவாய்ப்பினைப் பெறும் வகையில் மாணவர்களைத் தயார்படுத்துதல்.
- கேட்டல், பேசுதல், படித்தல் மற்றும் எழுதுதல் முதலான திறன்களை(LSRW Skills) அறியச்செய்தல்.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	இலக்கியங்கள் மூலம் பண்டைய தமிழக மக்களின் வாழ்க்கை முறை, சமூக மதிப்பீடுகள், கலை, கலாச்சாரம் போன்றவற்றை ஆழமாகப் புரிந்துகொள்ளுதல்.	K1- K3
CLO2	தமிழறிஞர்களின் தமிழ்த்தொண்டை அறிவதன் மூலம் தமிழ் மொழியின் செழுமை, அதன் இலக்கிய வளம் மற்றும் பண்பாட்டு அடையாளம் ஆகியவற்றை அறிந்துகொள்ளுதல்.	K1- K3
CLO3	பிழையின்றி பேசுவதற்கும் எழுதுவதற்கும் இலக்கணத்தை பயன்படுத்துதல்.	K1 - K3
CLO4	தமிழ்நாடு அரசு நடத்தும் அனைத்து தேர்வுகளுக்கும் கல்வி மற்றும் மொழி வளர்ச்சிக்கும் கலைச்சொற்கள் ஒரு முக்கியத் தேவையாக உள்ளன என்பதனை உணர்தல்.	K1- K3
CLO5	உரைநடை பத்தியை வாசித்து கேட்கப்படும் வினாக்களுக்கு ஏற்ற பதில்களைத் தேடுவதன் மூலம் ஆழமான புரிதல் ஏற்படும் என்பதை உணர்தல்.	K2, K3
K1 - Remember; **K2** - Understand; **K3** – Apply		

Unit	Content	No. of Hours
I	**(இலக்கிய வரலாறு)** • திருக்குறள் • நாலடியார் • நான்மணிக்கடிகை • பழமொழி நானூறு • முதுமொழிக்காஞ்சி • திரிகடுகம் • இன்னா நாற்பது • சிறுபஞ்சமூலம் • ஏலாதி • ஔவையார் பாடல்கள்	12
II	**(தமிழ் அறிஞர்களும், தமிழ்த்தொண்டும்)** **திராவிட மொழிகள் தொடர்பான செய்திகள்:** • உ.வே.சாமிநாத ஐயர் • தெ.பொ.மீனாட்சி சுந்தரம் • சி.இலக்குவனார். **தமிழ்ப்பணி தொடர்பான செய்திகள்:** • தேவநேய பாவாணர் • பெருஞ்சித்திரனார் • ஜி.யு.போப் • வீரமாமுனிவர். **தமிழ்த்தொண்டு மற்றும் சான்றோர் தொடர்பான செய்திகள்:** • பாவேந்தர் • டி.கே.சிதம்பரனாதர் • தவத்திரு குன்றக்குடி அடிகளார் • கண்ணதாசன் • வேலுநாச்சியார் • முடியரசன் • தமிழ் ஒளி • கி.வா.ஜகந்நாதர் • நாமக்கல் கவிஞர்	12

Unit	Content	No. of Hours
III	**(இலக்கணம்)** • குறில், நெடில் வேறுபாடு • லகர, ளகர, ழகர வேறுபாடு • னகர, ணகர வேறுபாடு • ரகர, றகர வேறுபாடு • சுட்டெழுத்துக்கள் • வினா எழுத்துக்கள் • இனவெழுத்துக்கள் • ஒருமைப் பன்மை அறிதல் • எழுத்துப்பிழை, ஒற்றுப்பிழை அறிதல் • ஓரெழுத்து ஒருமொழி • ஒருபொருள் பன்மொழி • இருபொருள் குறிக்கும் சொற்கள்	12
IV	**(எழுத்துத்திறன் மற்றும் கலைச்சொற்கள்)** • சொற்றொடர் அமைத்தல் • தொடர் வகைகள் • செய்வினை, செயப்பாட்டு வினை • தன்வினை, பிறவினை. **திணைமரபு:** • உயர்திணை, • அஃறிணை. **பால் மரபு:** • ஆண்பால், • பெண்பால், • பலர்பால். • வினைமரபு • தொகை மரபு • நிறுத்தல் குறியீடுகள். **பல்துறை சார்ந்த கலைச்சொல்லுக்கு நேரான தமிழ்ச்சொல் அறிதல்:** • அறிவியல், கல்வி, மருத்துவம், மேலாண்மை, சட்டம், புவியியல், தொழில்நுட்பம், ஊடகம், தகவல் தொழில்நுட்பம்.	12

Unit	Content	No. of Hours
V	**வாசித்தல், புரிந்து கொள்ளும் திறன் மற்றும் எளிய மொழி பெயர்ப்பு** **வாசித்தல்** : கொடுக்கப்பட்ட பத்தியை வாசித்து கேட்கப்பட்ட வினாக்களுக்கு சரியான விடையைத் தேர்ந்தெடுத்தல். **புரிந்துகொள்ளும் திறன்:** உவமைத் தொடரின் பொருளறிதல், மரபுத்தொடரின் பொருளறிதல், பழமொழிகள் பொருளறிதல். **எளிய மொழி பெயர்ப்பு:** ஆங்கிலம் மற்றும் பிறமொழிச் சொற்களுக்கு இணையான தமிழ்ச் சொற்கள் அறிதல், பயன்பாட்டில் உள்ள ஆங்கிலச் சொற்களை மொழிபெயர்த்தல்.	12
	Total Hours	**60**

Reference Books

1	வரதராசன் மு. (2021, 34-வது பதிப்பு), தமிழ் இலக்கிய வரலாறு, சாகித்திய அகாதமி பதிப்பு.
2	டாக்டர் தமிழண்ணல், (2010, 26-ம் பதிப்பு), புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு, மீனாட்சி புத்தக நிலையம்.
3	பேரா. முனைவர் பாக்கியமேரி, (2022, 6-ம் பதிப்பு), வகைமை நோக்கில் தமிழ் இலக்கிய வரலாறு, நியூசெஞ்சுரி புக் ஹவுஸ்(பி). லிட்.
4	பாலசுப்பிரமணியம் சி. (2016, 27-ம் பதிப்பு), தமிழ் இலக்கிய வரலாறு, சாரதா பதிப்பகம்.
5	டாக்டர் பூவண்ணன், (2019, முதல் பதிப்பு), தமிழ் இலக்கிய வரலாறு, வர்த்தமான் பதிப்பகம்
6	பேராசிரியர்.விமலானந்தம் மது.ச. (2017, முதல் பதிப்பு), தமிழ் இலக்கிய வரலாறு, பாரி நிலையம்
7	விஜயராகவன், முனைவர் கண்ணன் கு. (2018, முதல் பதிப்பு), தமிழ் இலக்கியம் இலக்கணம் வரலாறு, பாவை பப்ளிக்கேஷன்.
8	முனைவர் இராசா கி. (2019, 4-ம் பதிப்பு), தமிழ் இலக்கிய வரலாறு, நியூ செஞ்சுரி புக் ஹவுஸ் (பி). லிட்.
9	முனைவர் அருணாச்சலம் மு. (2017 6-ம் பதிப்பு), தமிழ் இலக்கிய வரலாறு, அருண் பதிப்பகம்.
10	குமரன் கோ (2010, முதல் பதிப்பு), தமிழ் இலக்கணம் எளிய அறிமுகம், சந்தியா பதிப்பகம்.

Part – I: Language – I-Hindi – IV

Course Code	Course Name	Category	Hours / Week	Credits
24HIN41L	Hindi – IV	Language - I	4	3

Course Objectives

The Course intends to cover

- Knowledge of contemporary drama contents of Hindi literature.
- Novels and its techniques. The ability to read novels and express criticism about it and the ability to express social thoughts will improve.
- Litigation messages in Hindi and news on speech techniques.
- The Ability to write articles on their own and improve their sophisticated translation skills.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the text styles and grammatical elements.	K1
CLO2	Discuss the content of a reading passage.	K2
CLO3	Develop an interest in the appreciation of short stories.	K3
CLO4	Comprehend the grammatical structures and sentence making.	K4
CLO5	Understand the language and developing English to Hindi translation skill.	K4
K1 - Remember; **K2** - Understand; **K3** – Apply; **K4**-Analyse.		

Unit	Contents	No. of Hours
I	Drama: Dhuvasaminy By Jayashankar Prasad	12
II	Novel - Nirmala – Premchand	12
III	Lokkothi & Muhavare - Naveen Hindi Vyakaran (Selected Lokkokthi -10 & Muhavare-10)	12
IV	General Essay :Aadarsh Nibandh	12
V	Translation : Hindi-English Only Anuvadh Abhyas – III (16-30 Lessons Only)	12
	Total Hours	**60**

Text Books

1.	Jayashankar Prasad (2015), Dhuvasaminy, Drama, , Publisher : Dakshin Bharath Hindi Prachar Sabha, Chennai-17.
2	Premchand(2015),Nirmala,Novel , Rajkamal Prakashan,1B Nethaji Subash Marg,New Delhi

Reference Books

1.	Rajnath Sharma , Hindi Sahithya Ka Saral Ithihaas, , Vinod Pustak Mandir,Agra-282
2.	Kavya Pradeep Rambadri Shukla, Hindi Bhavan, 36, Tagore Town, Allahabad – 211 002.

Part – I: Language – I-Malayalam – IV

Course Code	Course Name	Category	Hours / Week	Credits
24MAL41L	Malayalam - IV	Language - I	4	3

Course Objectives

The Course intends to cover

- Knowledge of contemporary drama contents of Malayalam literature.
- Screen play and its techniques. The ability to read drama and express criticism about it and the ability to express social thoughts will improve.
- Litigation messages in Malayalam and news on speech techniques.
- Ability to write articles on their own and improve their creative skills.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Get a basic knowledge of drama	K1
CLO2	Can read and critique Screenplay	K1
CLO3	Create interest in art literature courses	K2
CLO4	The hope of writing a Drama or a Screen Play.	K3
CLO5	The idea of creating new works and critique knowledge will improve.	K4
K1 - Remember; **K2** - Understand; **K3** – Apply; **K4**-Analyse.		

Unit	Content	No. of Hours
I	Screen Play – Perumthachan	12
II	Screenplay – Perumthachan	12
III	Drama – Saketham	12
IV	Drama – Saketham	12
V	Drama – Saaketham	12
	Total Hours	**60**

Text Books

1. Perumthachan – M.T.Vasudevan Nair, DC Books
2. Saketham – C.N.Sreekandan Nair, DC Books.

Reference Books

1. Malayala Nataka Sahithya Charithram. G Sankara Pillai (Kerala SahithyaAkademi, Trissur)
2. Malayala NatakaSahithya Charithram, Vayala Vasudevan Pillai (Kerala SahithyaAkademi Thrissur).
3. Natakam- Oru Patanam (C.J. SmarakaPrasanga Samithi, Koothattukulam)
4. Natakaroopacharcha, Kattumadam Narayanan (NBS, Kottayam)
5. Chalachithra sameeksha – Vijayakrishanan.
6. Cinemayude Paadangal Visakalanavum Veekshanavum – Jose-K.Manual

Part – I: Language – I-French – IV

Course Code	Course Name	Category	Hours / Week	Credits
24FRE41L	French – IV	Language - I	4	3

Course Objective

The Course intends

To communicate during easy or habitual tasks requiring a basic and direct information exchange on familiar subjects to use simple words to describe his or her surroundings and communicate immediate needs

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Comprehend the grammatical structures in various genres.	K1
CLO2	Understand the text styles and poetical elements.	K2
CLO3	Develop an interest in the appreciation of literature.	K3
CLO4	Discuss and respond to content of a reading passage.	K4
K1 - Remember; **K2 -** Understand; **K3** – Apply; **K4 -** Analyse		

Unit	Contents	No. of Hours
I	Etape 5 (Lecons 1 - 3)	12
II	Etape 6 (Lecons 1 - 3)	12
III	Etape 7 - Leçons 1 – 2	12
IV	Etape 7 – Leçon 3, Etape 8 – Leçon 1	12
V	Etape 8 – Leçons 2 – 3	12
Etapes 5 to 8, Pages 63 to 114		
	Total Hours	**60**
Text Book		
1	Adomania 2 , Methode de francais , Céline Himber, Corina Brillant, Sophie Erlich Publisher: HACHETTE FLE, Goyal Publishers and Distributors Pvt Ltd, New Delhi (9810322459)	
Reference Book		
1	Latitudes 1 , Yves Loiseau, Régine Merieux Publisher: French and European Publications Inc, Goyal publishers and distributors Pvt Ltd, New Delhi (9810322459).	

Part – II: English –IV

(All the Undergraduate Programmes)

English for Competitive Examinations

Course Code	Course Name	Category	Hours / Week	Credits
24ENG42L	English-IV	Language-II	4	3

Course Objectives

The course intends to cover

- Essential Language Skills for Competitive Exams.
- Grammatical Mastery and Writing Skills for confident formal communication.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify grammatical errors with precision and write with clarity and accuracy.	K1
CLO2	Identify, comprehend and use a wide range of vocabulary to enhance verbal expression.	K2, K3
CLO3	Construct structured essays, reports, and formal letters with clarity and coherence.	K3
CLO4	Interpret diverse texts using strategic reading techniques to analyze content and answer comprehension questions effectively	K3
CLO5	Understand and employ the technical and administrative terms to excel in the career.	K2, K3
K1 - Remember; **K2** - Understand; **K3** - Apply		

Part-II: English-IV

Unit	Content	No. of Hours
I	**Grammar** Parts of Speech, Concord, Tenses, Active Voice and Passive Voice, Types of Sentences – Statement, Interrogative, Imperative, Exclamatory, Transformation of Statements into imperatives, Interrogatives into Statements, Assertive into Negatives, Exclamatory Sentences into Statements, Imperatives into Inquisitive Interrogatives, Imperatives into Appreciative Statements, Verbs, Main Verbs and Auxiliary Verbs, Regular and Irregular Verbs	12
II	**Grammar** Infinitives, Gerunds, Participles, Question Tags, Sentence Patterns, Types of Sentences – Simple, Compound and Complex, Phrases and Clauses, Degrees of Comparison – Positive, Comparative & Superlative, Direct into Indirect and Indirect to Direct, Synthesis of Sentences, Punctuations,	12
III	**Vocabulary and Writing Skills** Synonyms, Antonyms, Homonyms, Homophones, Collocations, Idioms & Phrases, Phrasal verbs, Spelling of words, Correct usage of words, One word substitution, Word Creation, Singular and plural (including Zero plural), Derivatives, Abbreviations, British and American English, Compound words and Figures of speech. Letter writing (formal and informal) – Types of Letters, Precis Writing, Jumbled sentences, Finding out the right order of sentences, Making queries, Inferences, Blanks, Substitutions.	12
IV	**Reading Comprehension** Types of Passages (Narrative, Argumentative, Factual, Descriptive),Unseen passages (News Paper, Headlines, Editorials, Government related News), Question Types - Strong question, Weak question, Match the following, Sentence Completion, Ascertainment of facts	12
V	**Administrative Vocabulary & Translation** Marketing and Sales, Human Resource, Finance and Operation, Organization and Management, Office Procedures and Document Word Translation, Sentence Translation, Tense related translation tasks, Tense / Voice related tasks. (**Simple words - Basic Level**)	12
	Total Hours	**60**

Reference Books

1.	Bhatnagar, R. P., & Bhargava, R. (2017). English for Competitive Examinations (3rd ed.). New Delhi: Laxmi Publications.
2.	Wren, P. C., & Martin, H. (2007). High School English Grammar & Composition (11th ed.). New Delhi: S. Chand & Company
3.	Gupta, S. C. (2014). English Grammar & Composition (2nd ed.). Meerut: Arihant Publications
4.	Aggarwal, R. S., & Aggarwal, V. (2022). Quick Learning Objective General English (Revised ed.) New Delhi, S. Chand Publishing.

Web Resources (Swayam/NPTEL)

1.	https://onlinecourses.nptel.ac.in/noc24_hs73/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BCS43C	Database Management System	Core – VII	5	4

Course Objectives

The Course intends to

- Learn the designing of database systems, foundation on the relational model of data and normal forms.
- Understand the concepts of database management system, design simple Database models.
- Apply SQL & PL/SQL to write queries.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the basic concepts of database system and its data models.	K1,K2
CLO2	Develop relational databases using keys, integrity rules, ER diagrams and normalization techniques.	K3
CLO3	Apply SQL commands for data definition, manipulation, joins and advanced query operations.	K3
CLO4	Implement subqueries, SQL functions, PL/SQL fundamentals and differentiate between SQL and NoSQL databases.	K3
CLO5	Develop PL/SQL programs using control structures, cursors, exceptions, procedures, functions, packages and triggers.	K3
K1 - Remember; **K2 –** Understand**; K3-**Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	2	1	1	1
CLO2	2	3	2	1	1
CLO3	1	2	3	2	1
CLO4	1	1	2	3	2
CLO5	1	1	2	2	3
3 - Substantial (high)		**2 - Moderate (medium)**		**1 - Slight (low)**	

Core Theory –VII: Database Management System

Unit	Content	No. of Hours
I	**Database Concepts:** Database Systems - Data vs Information - Introducing the database - File system - Problems with file system. **Data Models:** Importance - Basic Building Blocks - Business rules - Evolution of Data models - Degrees of Data Abstraction.	**15**
II	**Design Concepts:** Relational database model - logical view of data-keys -Integrity rules - relational set operators - data dictionary and the system catalog - relationships - data redundancy revisited -indexes - Codd's rules. Entity relationship model - ER diagram. **Normalization of Database Tables:** Database tables and Normalization – The Need for Normalization –The Normalization Process – Higher level Normal Form.	**15**
III	**Introduction to SQL:** Data Definition Commands – Data Manipulation Commands – SELECT Queries – Additional Data Definition Commands – Additional SELECT Query Keywords – Joining Database Tables. **Advanced SQL:** Relational SET Operators: UNION – UNION ALL – INTERSECT - MINUS.SQL Join Operators: Cross Join – Natural Join – Join USING Clause – JOIN ON Clause – Outer Join.	**15**
IV	**Sub Queries and Correlated Queries:** WHERE – IN – HAVING – ANY and ALL – FROM. **SQL Functions:** Date and Time Function – Numeric Function – String Function – Conversion Function. **NoSQL:** Overview of NoSQL-Difference between SQL and NoSQL. **PL/SQL:** A Programming Language: History – Fundamentals – Block Structure – Comments – Data Types – Other Data Types – Variable Declaration – Assignment operation –Arithmetic operators.	**15**
V	**Control Structures and Embedded SQL:** Control Structures – Nested Blocks – SQL in PL/SQL – Data Manipulation – Transaction Control statements. PL/SQL **Cursors and Exceptions:** Cursors – Implicit Cursors, Explicit Cursors and Attributes – Cursor FOR loops – SELECT…FOR UPDATE – WHERE CURRENT OF clause – Cursor with Parameters – Cursor Variables – Exceptions – Types of Exceptions. **Named Blocks:** Procedures –Functions – Packages –Triggers.	**15**
	Total Hours	**75**
Text Books		
1.	Coronel C & Morris S (2009), Database Systems: Design, Implementation and Management, 9th edition, Cengage Learning.	
2.	Shah N (2016), Database Systems using Oracle, 2nd edition, Pearson Education India.	
Reference Books		
1.	Silberschatz A, Korth H. F & Sudarshan S (2011), Database System Concepts, 6th edition, McGraw-Hill International.	
2.	Singh S K (2011), Database Systems, 2nd edition, Pearson Education.	
Web Resources (Swayam / NPTEL)		
1.	https://onlinecourses.nptel.ac.in/noc22_cs91/preview	

Core Lab - IV: Database Management System

Course Code	Course Name	Category	Hours / Week	Credits
24BCS44P	Lab : Database Management System	Core Lab - IV	4	2

S. No.	List of Programs	
	Sample programs	
1.	***SQL*** 1. DDL Commands 2. DML Commands 3. TCL Commands	
2	***PL/SQL*** (i) Fibonacci Series (ii) Factorial (iii) String Reverse (iv) Sum of Series (v) Trigger	
3	***Cursor*** Student Mark Analysis Using Cursor	
4	***Application*** (i) Library Management System (ii) Student Mark Analysis	
	Total Hours	**60**
Text Books		
1.	Coronel C & Morris S (2009), Database Systems: Design, Implementation and Management, 9th edition, Cengage Learning.	
2.	Shah N (2016), Database Systems using Oracle, 2nd edition, Pearson Education India.	
Reference Books		
1.	Silberschatz A, Korth H. F & Sudarshan S (2011), Database System Concepts, 6th edition, McGraw-Hill International.	
2.	Singh S K (2011), Database Systems, 2nd edition, Pearson Education.	
Web Resources (Swayam / NPTEL)		
1.	https://onlinecourses.nptel.ac.in/noc22_cs91/preview	

Course Code	Course Name	Category	Hours / Week	Credits
24BCS45C	Software Engineering	Core - VIII	5	4

Course Objectives

The Course intends to

- Learn about the various phases and models (waterfall, evolutionary, agile, etc.) used in building software.
- Elicit user requirements, build use cases, and develop software requirements specifications.
- Apply design principles to create models and develop robust software solutions.
- Understand testing strategies, debugging, and quality assurance concepts to ensure reliable software.
- Gain knowledge of project planning, scheduling, and risk management in software development.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand Software Engineering process models.	K1,K2
CLO2	Understand software requirements, create SRS documents, and use UML modeling to design systems.	K2, K3
CLO3	Apply the knowledge of different software architectural styles and design patterns.	K3
CLO4	Identify and apply software testing approaches, verification, validation and quality control strategies.	K3
CLO5	Understand the CASE tools and Software Maintenance.	K2
K1 - Remember; **K2 -** Understand; **K3 –** Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	2	2	2	2
CLO2	2	2	1	2	1
CLO3	2	1	1	2	1
CLO4	2	1	1	1	2
CLO5	2	1	1	1	1
3 - Substantial (high)		**2 - Moderate (medium)**		**1 - Slight (low)**	

Core Theory –VIII: Software Engineering

Unit	Content	No. of Hours
I	**Introduction:** The software engineering discipline, programs vs. software products, why study software engineering, emergence of software engineering, Notable changes in software development practices, computer systems engineering. **Software Life Cycle Models:** Why use a life cycle model, Classical waterfall model, iterative waterfall model, prototyping model, evolutionary model, spiral model, Agile model, comparison of different life cycle models.	**15**
II	**Requirements Analysis and Specification:** Requirements gathering and analysis, Software Requirements Specification (SRS). **Software Design:** Good software design, cohesion and coupling, neat arrangement, software design approaches, object- oriented vs function-oriented design	**15**
III	**Function-Oriented Software Design:** Overview of SA/SD methodology, structured analysis, data flow diagrams (DFD's), structured design, detailed design. **User-Interface design:** Characteristics of a good interface, basic concepts, types of user interfaces, component-based GUI development, a user interface methodology.	**15**
IV	**Coding and Testing:** Coding, code review, testing, testing in the large vs testing in the small, unit testing, black-box testing, white-box testing, debugging, program analysis tools, integration testing, system testing, some general issues associated with testing. **Software Reliability and Quality Management:** Software reliability, statistical testing, software quality, software quality management system, SEI capability maturity model, personal software process.	**15**
V	**Computer Aided Software Engineering (CASE)**: Scope, CASE environment, CASE support in software life cycle, other characteristics of CASE tools, towards second generation CASE tool, Architecture of a CASE environment. **Software Maintenance:** Characteristics of software maintenance, software reverse engineering, software maintenance process models, estimation of maintenance cost.	**15**
	Total Hours	**75**

Text Book	
1.	Rajib Mall (2018), Fundamentals of Software Engineering, 5th Edition, Prentice-Hall of India.
Reference Books	
1.	Richard Fairley (2017), Software Engineering Concepts, Tata McGraw-Hill publishing company Ltd.
2.	Roger S Pressman, Software Engineering, 7th Edition, McGraw-Hill.
3.	James A Senn, Analysis & Design of Information Systems, 2nd Edition, McGraw-Hill International Editions.
Web Resources (Swayam / NPTEL)	
1.	https://onlinecourses.nptel.ac.in/noc25_cs108/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BCS46A	Arduino Systems and Applications	Allied - IV	4	3

Course Objectives

The course intends to

- Understand the fundamental concepts of embedded systems, Arduino MCU blocks, and board pinouts.
- Set up the Arduino toolchain, upload sketches, and verify using Serial Monitor/Plotter.
- Write simple Arduino code to handle digital and analog inputs with basic adjustments.
- Implement millis based timing and communicate with peripherals using UART/I²C.
- Develop a precise way to connect sensors and actuators to produce reliable serial outputs.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand embedded system concepts and the Arduino architecture.	K1, K2
CLO2	Set up the IDE, develop and debug sketches, and use the Serial Monitor/Plotter effectively.	K3
CLO3	Apply digital and analog I/O with debouncing, ADC scaling/calibration, PWM/tone generation and timing.	K3
CLO4	Integrate two sensors to output formatted data on the Serial console and communicate via UART/I²C.	K4
CLO5	Analyze and demonstrate a multi-sensor prototype with safe actuation and concise documentation.	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	2	1	2	2
CLO2	2	3	1	2	1
CLO3	2	3	2	2	1
CLO4	3	3	2	3	1
CLO5	3	3	3	3	2
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Allied IV - Arduino Systems and Applications

Unit	Content	No. of Hours
I	**Basics of Arduino:** Embedded systems overview and characteristics - Microcontroller Vs Microprocessor - MCU blocks - Arduino board families - Pin mapping - Arduino IDE setup - First upload - Serial Monitor and Plotter - Sketch anatomy.	12
II	**Arduino C:** Variables, data types, literals, overflow - Operators and expressions - Control flow - short practice exercises- - Scope - Qualifiers - Arrays and strings - Safe serial printing - Modular sketches.	12
III	**I/O, Timing and Core Communications:** Digital I/O - Internal pull-ups - Analog input - ADC resolution - Scaling - Simple calibration examples - PWM for dimming - Basic servo preview. **Timing Models:** delay Vs millis - UART/Serial fundamentals - I²C fundamentals	12
IV	**Sensor–Actuator Basics & Serial I/O:** Sensor categories: temperature, humidity, light, distance, motion/IMU basics, gas - Signal types (analog, digital, I²C/SPI). **Actuators:** relays, DC motors, buzzers/indicators - Interface a TMP36/LM35 temperature sensor and print the reading on the Serial Monitor - Interfacing an ultrasonic sensor and printing distance on Serial Monitor.	12
V	**Multi-Sensor Interfacing:** Interfacing a PIR sensor and logging motion events on Serial Monitor and Plotter - Interfacing an accelerometer and streaming X/Y/Z on Serial Monitor and Plotter - Interfacing a GPS sensor and printing latitude/longitude on Serial Monitor.	12
	Total Hours	**60**

Text Books

1.	Simon Monk (2016), Programming Arduino: Getting Started with Sketches, 2nd Edition, McGraw- Hill.
2.	Michael Margolis, Brian Jepson and Nicholas Robert Weldin (2020), Arduino Cookbook, 3rd Edition, O'Reilly.

Reference Books

1.	Jeremy Blum (2013), Exploring Arduino: Tools and Techniques for Engineering Wizardry, 2nd Edition, Wiley.
2.	John Boxall (2013), Arduino Workshop: A Hands-On Introduction with 65 Projects, 2nd Edition, No Starch Press.
3.	J. M. Hughes (2016), Arduino: A Technical Reference, 1st Edition, O'Reilly.

Web Resources (Swayam / NPTEL)

1.	https://onlinecourses.swayam2.ac.in/aic20_sp04/preview
2.	https://nptel.ac.in/courses/106105166

SEC Lab – II: ReactJS Development

Course Code	Course Name	Category	Hours / Week	Credits
24BCS47P	Lab : ReactJS Development	SEC – Lab II	2	2

S. No.	List of Programs
	Level 1: React Basics (Getting Started)
1.	Create a counter with increment, decrement, and reset buttons.
2.	Build a to-do list that allows users to add, delete, and mark tasks as complete.
	Level 2: Forms & User Interaction
3.	Create a form with name, email, and password fields. Display entered data below the form after submission.
4.	Create a color picker with multiple buttons (Red, Blue, Green). When clicked, change the background color of a box.
	Level 3: Conditional Rendering & Logic
5.	Display a dynamic greeting message based on the current system time. Use conditional rendering in React to update the message according to the hour of the day.
6.	Develop a React application that accepts two numeric inputs and dynamically performs addition, subtraction, multiplication, and division. Display the computed result in real time as the user interacts with the inputs.
	Level 4: Data & Component Navigation
7.	Fetch and display a list of users from JSON Placeholder API. Show name and email.
8.	Create a component with 3 tabs (Home, About, Contact). Clicking each tab shows different content.
	Level 5: Theming & Routing
9.	Add a Dark Mode / Light Mode toggle. The theme should change the background and text colors.
10.	Create a mini blog with 2 pages: Home page shows a list of posts, Post page shows full content when clicked.
	Capstone Project
Develop a React-Based Task Management System with User Authentication, Database Integration, API Connectivity, Theme Toggle, and Dynamic Routing.	
Total Hours	**30**
Text Books	
1.	Banks A. & Porcello, E. (2020), Learning React: Modern Patterns for Developing React Apps (2nd edition.), O'Reilly Media.
2.	Wieruch R. (2022), The Road to React: Your Journey to Master Plain Yet Pragmatic React.js (5th edition.), Self-published.
Reference Books	
1.	Mardan A (2019), React Quickly: Painless Web Apps with React, JSX, Redux, and GraphQL, Manning Publications.
2.	Roy A (2021), Full-Stack React Projects: Build real-world modern web apps with React 18, TypeScript, Next.js, React Native, and GraphQL (2nd edition.), Packt Publishing.
Web Resources (Swayam/NPTEL)	
1.	https://nptel.ac.in/courses/106106222

Ability Enhancement Compulsory Courses - IV (AECC – IV)

Course Code	Course Name	Category	Hours / Week	Credits
24IDT4AE	**Innovation & Design Thinking**	**AECC - IV**	**2**	2

Course Objectives

The Course intends to cover

- The principles and practices of innovation and design thinking.
- Creative problem-solving skills, and impactful solutions across diverse contexts.
- The user-centered research techniques, and practical tools to generate, prototype.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the design thinking methodology for solving real-world problems.	K2
CLO2	Generate, prototype, and test innovative ideas.	K3
CLO3	Frame human-centered solutions and present them effectively.	K3
CLO4	Enhance their confidence in collaborative approaches to problem solving.	K3
CLO5	Integrate innovation strategies into business, social, and creative contexts to drive sustainable impact.	K4
K2 - Understand; **K3** – Apply ; **K4** - Evaluate		

Ability Enhancement Compulsory Courses (AECC)-IV : Innovation & Design Thinking

Unit	Content	No. of Hours
I	**Principles of Design Thinking:** Usability, Human-centeredness, Empathy, Iteration. **Types of Innovation:** Product, Process, Business Model, Social Innovation.	6
II	**Empathy & Defining The Problem:** Understanding users - observation - ethnographic research - interviews - Empathy maps and personas - Identifying user pain points - Problem framing vs. problem solving.	6
III	**Ideation & Creativity Tools:** Divergent vs. Convergent Thinking - Brainstorming and mind mapping techniques – SCAMPER. Idea selection and prioritization frameworks.	6
IV	**Prototyping & Experimentation:** Low-fidelity vs. High-fidelity prototyping - Storyboarding, sketching, mock-ups, and role-playing - Rapid prototyping with simple materials.	6
V	**Testing & Feedback:** Testing prototypes with users - Iteration and learning from feedback. **Innovation Strategy & Implementation :**Scaling ideas into innovations - Measuring innovation impact - Barriers - Design Thinking for social change and sustainability.	6
	Total Hours	**30**
Text Books		
1	Kelley T & Kelley D (2013), Creative Confidence: Unleashing the creative potential within us all. Crown Business.	
2	Dan Saffer, Designing for Interaction, New Riders Publications, 2010.	
Reference Books		
1	Plattner H ,Meinel C & Leifer L (Eds.) (2018), Design Thinking Research: Making Distinctions: Collaboration versus Cooperation. Springer.	
2	Liedtka J & Ogilvie T (2011), Designing for Growth: A Design Thinking Tool Kit for Managers. Columbia University Press.	
3	Martin R (2009), The Design of Business: Why Design Thinking is the Next Competitive Advantage. Harvard Business Press.	
Web Resources (Swayam / NPTEL)		
1	https://onlinecourses.nptel.ac.in/noc22_mg32/preview	
2	https://onlinecourses.swayam2.ac.in/imb23_mg65/preview	
3	https://onlinecourses.nptel.ac.in/noc20_hs08/preview	

Course Code	Course Name	Category	Hours/Week	Credits
24IPR4AE	Intellectual Property Rights	AECC - IV	2	2

Course Objectives

The course intends to

- Identify the objectives, forms, duration, and scope of protection for different types of intellectual property.
- Understand the global IP framework and India's compliance challenges.
- Recognize the role of IP as a policy tool for national, economic, social, and cultural growth.
- Gain knowledge of substantive laws and procedural mechanisms of IP in India.
- Analyze recent national and global trends in intellectual property rights.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the core principles of intellectual property protection.	K2
CLO2	Identify the key concepts and principles of trademarks.	K2
CLO3	Comprehend the legal implications and rights under copyright law.	K3
CLO4	Understand the legal consequences of patents and trade secrets.	K2
CLO5	Comprehend IP rights for plant varieties and farmers, along with their legal and social aspects.	K4
K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** – Analyze		

Ability Enhancement Compulsory Courses(AECC)-IV
Intellectual Property Rights

Unit	Content	No. of Hours
I	**Introduction to Intellectual Property:** Introduction, types of intellectual property, international organizations, agencies and treaties, importance of intellectual property rights.	6
II	**Trade Marks:** Purpose and function of trademarks, acquisition of trade mark rights, protectable matter, selecting, and evaluating trade mark, trade mark registration processes.	6
III	**Law of Copy Rights:** Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law**.**	6
IV	**Law of Patents, Trade Secrets:** Foundation of patent law, patent searching process, ownership rights and transfer. Trade Secrets: Trade secrete law, determination of trade secrete status, liability for misappropriations of trade secrets, protection for submission, trade secrete litigation.	6
V	**Protection of Plant Varieties and Farmers' Rights:** Introduction -Meaning and Definition - Registrable Varieties of Plants - Procedure for Registration - Plant Varieties Protection.	6
	Total Hours	**30**
Text Books		
1	V K Ahuja - Law Relating To Intellectual Property Rights - Lexis Nexis; Third edition , 2017.	
2	Elizabeth Verkey - Intellectual Property Law and Practice – Eastern Book Company – 2018.	
3	S R Myneni - Law of Intellectual Property - Asia Law House – 2021.	
Reference Books		
1	B.L. Wadehra - Law Relating To Intellectual Property – Universal Law Publishing House, New Delhi , 2011.	
2	Avtar Singh - Intellectual Property Law - Eastern Book Company – 2015.	
Web Resources (Swayam/NPTEL)		
1	https://onlinecourses.nptel.ac.in/noc22_hs59/preview	

Course Code	Course Name	Category	Hours / Week	Credits
24END4AE	Entrepreneurship Development	AECC – IV	2	2

Course Objectives

The course intends to cover

- The Basics of starting and managing entrepreneurial ventures.
- Tools for planning, funding, and entrepreneurial growth.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the concept of entrepreneurship.	K2
CLO2	Gain knowledge on entrepreneurial motivation	K2
CLO3	Apply business idea evaluation	K3
CLO4	Create systematic Business plan	K3
CLO5	Analyse business finance and support	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyse		

Ability Enhancement Compulsory Course – IV : Entrepreneurship Development

Unit	Content	No. of Hours
I	**Entrepreneurship:** Meaning of Entrepreneurship - Characteristics, Functions and Types of entrepreneurs - Intrapreneur vs. Entrepreneur - Need for Entrepreneurship in economic development - Contribution to GDP, Employment, Innovation.	5
II	**Entrepreneurial Motivation:** Meaning - Need for Achievement Theory - Risk-taking Behaviour - Innovation and Entrepreneur – Economic & non-economic factors affecting entrepreneurial growth.	5
III	**Business Ideas:** Sources of Business Ideas & Opportunity Identification – Idea generation techniques (Brainstorming, Design Thinking). Business incubation - Technical Assistance for small business – Preparation of Feasibility Reports, Legal Formalities and Documentation	7
IV	**Business Plan:** Meaning and importance of Business Plan – Structure and components – Market Study.	7
V	**Entrepreneurial finance:** Sources of finance (Bank, Angel investors, Venture Capital, Crowdfunding, Mudra Loans) - Institutional support to entrepreneurs (DIC, KVIC, EDII and MSME).	6
	Total Hours	**30**
Text Books		
1	C.B. Gupta and N.P. Srinivasan (2020), Entrepreneurship Development, Sultan Chand and Sons.	
2	Dr. Vasant Desai and Dr. Kulveer Kaur (2021), Entrepreneurship Development and Management, Himalaya Publications.	
Reference Books		
1	Dr. Jayashree Suresh (2021), Entrepreneurial Publications, Margham Publications	
2	S S Khanka (2020), Entrepreneurial Development, Sultan Chand and Sons, New Delhi.	
Web Resources (Swayam/NPTEL)		
1	https://onlinecourses.nptel.ac.in/noc25_mg95/preview	

Components for Internal Assessment and Distribution of Marks for CIA and ESE (Theory)

Max Marks	Marks for		Components for CIA						
	CIA	ESE	CIA		Model		Attendance	Active Engagement	Total
			Actual	Weightage	Actual	Weightage			
100	25	75	50	5	75	10	5	5	25

Question Paper Pattern

Component	Duration in Hours	Section A			Section B			Section C			Total
		Type of Question	No. of Questions	Marks	Type of Question	No. of Questions	Marks	Type of Question	No. of Questions	Marks	
CIA	2	MCQ	8	8x1=8	Either or	3	3x6=18	Either or	3	3x8=24	50
Model Exam / **ESE**	3	MCQ	10	10x1=10	Either or	5	5x5=25	Either or	5	5x8=40	75

Components for Internal Assessment and Distribution of Marks for CIA (Lab)

Max Marks	Marks for		Components for CIA						
	CIA	ESE	Test		Model		Experiments / Programs	Observation	Total
			Actual	Weightage	Actual	Weightage	Marks		
100	40	60	50	10	60	15	10	5	40

Examination Pattern

Component	Duration in Hours	Marks			Total Marks
		Practical Exam	Record	Weightage	
Test	2	50	-	**10**	50
Model	3	60	-	**15**	60
Experiments	-	-	-	**10**	10
Observation	-	-	-	**05**	05
			Total Marks - CIA	**40**	**40**
ESE	3	50	10	-	**60**

Components for and Distribution of Marks for ESE (Theory) Ability Enhancement Compulsory Courses (AECC) & Question Paper Pattern

Duration in Hours	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Online	MCQ	50	50x1=50

Semester 5

Semester – 5									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max. Marks**			
						CIA	**ESE**	**Total**	
24BCS51C	III	Core – IX	Artificial Intelligence and Expert Systems	5	3	25	75	100	4
24BCS52P	III	Core Lab – V	**Lab:** Node.js and MongoDB	5	3	40	60	100	3
24BCS53C	III	Core – X	Linux and Shell Programming	5	3	25	75	100	4
24BCS54P	III	Core Lab – VI	**Lab:** Linux and Shell Programming	5	3	40	60	100	3
24BCS55C	III	Core – XI	Visual Basic	5	3	25	75	100	4
24BCS5AE/	III	Elective – I	Cloud Services Management **(Cloud Computing)**	5	3	25	75	100	3
24BCS5BE/			Computer Networks and Security **(Networking & Cyber Security)**						
24BCS5CE/			Data Mining **(Data Mining)**						
24BCS56I	III	SEC - III	Internship	-	2	50	-	50	2
Total				**30**				**650**	**23**

Course Code	Course Name	Category	Hours/ Week	Credits
24BCS51C	Artificial Intelligence and Expert Systems	Core-IX	5	4

Course Objectives

The Course intends to cover

- The basic concepts and real time applications of Artificial Intelligence.
- Search techniques to solve the problems.
- Knowledge Representation and Expert Systems.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the nature of AI problems and techniques.	K1, K2
CLO2	Apply the appropriate algorithms to solve the problems.	K3
CLO3	Analyze and select the suitable knowledge representation method.	K4
CLO4	Infer new knowledge by acquiring knowledge of predicate logic.	K3
CLO5	Apply the rules to uncover knowledge in expert systems.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	3	3	3	3
CLO2	3	3	3	2	3
CLO3	3	3	3	2	3
CLO4	3	2	3	1	3
CLO5	3	3	3	1	3
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - IX: Artificial Intelligence and Expert Systems

Unit	Content	No. of Hours
I	**Introduction:** AI Problems - AI techniques - Criteria for Success. Problems- Problem Spaces. **Search:** State Space Search - Production Systems - Problem Characteristics - Issues in Design of Search.	15
II	**Heuristic Search Techniques:** Generate and Test-Hill Climbing - Best-First - Problem Reduction - Constraint Satisfaction - Means - End Analysis. **Game Playing:** The Minimax Search procedure – Adding Alpha – Beta Cutoffs – Iterative Deepening.	15
III	**Knowledge Representation**: Representations and Mappings - Approaches to Knowledge Representations - Issues in Knowledge Representations - Frame Problem.	15
IV	**Predicate Logic:** Representing Simple Facts in Logic - Representing Instance and Is a Relationships - Computable Functions and Predicates - Resolution - Natural deduction.	15
V	**Representing Knowledge Using Rules:** Procedural Vs Declarative Knowledge - Logic Programming - Forward Vs Backward Reasoning - Matching - Control Knowledge - Brief Explanation of Expert Systems - Definition - Characteristics - Architecture - Knowledge Engineering - Expert System Life Cycle - Knowledge Acquisition Strategies - Expert System Tools.	15
	Total Hours	**75**

Text Books

1.	Elaine Rich and Kelvin Knight (2017), Artificial Intelligence, TMH, 3rd Edition.
2.	Stuart Russell & Peter Norvig (2009), Artificial Intelligence A Modern Approach, Pearson Education 3rd Edition.

Reference Books

1.	Janaki Raman V S, K Sarukesi, Gopalakrishnan P (2016), Foundations of Artificial Intelligent and Expert Systems, Mac Millan India limited.
2.	George F Luger (2005), Artificial Intelligence, Pearson Education, 4th Edition.

Web Resources (Swayam / NPTEL)

1.	https://nptel.ac.in/courses/106102220
2.	https://nptel.ac.in/courses/106105077

Course Code	Course Name	Category	Hours / Week	Credits
24BCS52P	Lab: Node.js and MongoDB	Core Lab - V	5	3

S. No.	List of Programs
1	Sample programs To create a basic HTTP server using Node.js and analyze how client-server communication works using request and response objects.
2	To implement routing in Express.js for handling multiple endpoints and simplify server- side development.
3	To implement custom middleware for logging and request handling.
4	To simulate database operations using in-memory data structures.
5	To establish a connection between application and database.
6	a. To define the structure of documents and enforce data consistency within the database. b. To create a model that acts as an interface for interacting with the database collection.
7	To understand how to insert documents into MongoDB and retrieve them using Mongoose methods.
8	To understand how to update and delete documents in MongoDB using Mongoose methods.
9	a. To study validation techniques in Mongoose and implement error handling mechanisms. b. To ensure only valid data is stored in the database.
10	a. To understand modular routing in Express.js and organize application structure. b. To separate route handling logic into different files for better maintainability.
11	To implement querying and filtering of data using MongoDB query operators.
12	a. To implement pagination in API responses to handle large datasets efficiently. b. To control the number of records returned per request.
13	a. To understand authentication mechanisms and implement JWT-based authentication. b. To secure APIs and allow access only to authenticated users.
14	a. To understand password security and implement hashing using bcrypt. b. To securely store user passwords in the database.
15	a. To integrate all concepts learned throughout the course and develop a complete backend application. b. To build a Student Management System with CRUD operations, authentication, and advanced features
	Total Hours 75
Text Books	
1	Prashant Mondkar (2025), Node.js for Beginners: A Practical Introduction to Backend Development, Kindle Edition.
2	Ranjeet Jha (2025), MongoDB Essentials: Build Faster, Perform Better, Store Smarter,Scale Bigger, and Master Document Database, Kindle Edition.
Reference Books	
1.	Dhruti Shah (2018), Node.JS Guidebook, BPB Publications.
2.	Manu Sharma (2021), MongoDB Complete Guide, BPB Publication, Kindle Edition.
Web Resources	
1.	https://www.mongodb.com/docs/
2.	https://nodejs.org/docs/latest/api/

Course Code	Course Name	Category	Hours / Week	Credits
24BCS53C	Linux and Shell Programming	Core – X	5	4

Course Objectives

The course intends to cover

- The fundamentals of the Linux operating system.
- Concepts related to user & system administration and Process.
- Automation of Shell Scripting.
- Linux networking and security practices.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the fundamentals of Linux operating system and system administration concepts.	K1, K2
CLO2	Apply Linux commands to manage files, directories, users and file systems.	K3
CLO3	Demonstrate process management and command line operations in the Linux environment.	K2
CLO4	Implement shell scripts using variables, conditional statements and loops for automation.	K3
CLO5	Analyze Linux networking, security mechanisms and system logs to detect issues.	K4
K1 – Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	3	1	2	1
CLO2	3	2	1	2	1
CLO3	3	2	2	2	2
CLO4	3	3	3	2	2
CLO5	3	3	3	2	2
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - X: Linux and Shell Programming

Unit	Content	No. of Hours
I	**Introduction to Linux Operating System:** Introduction – The Linux Operating System - Basic Commands in Linux. **Types of Linux Distributions:** Debian, Ubuntu, Red Hat, Fedora, CentOS, Kali Linux, Arch Linux, SUSE Linux. **Linux System Administration:** Introduction to Linux System Administration - Role of system administrator - Responsibilities of Linux system administration - Managing system resources - Complementarity of AI and Linux in Building Development Environments.	15
II	**Managing Files and Directories:** Introduction - Directory Commands in Linux - File Commands in Linux. **User and Group Management:** Creating and managing user accounts - Group management - Password policies - Switching users - Administrative privileges. **Process Management:** Process concept - Foreground and background processes - Process monitoring - Process priority management - Terminating processes.	15
III	**Creating files using the vi editor**: Text editors - The vi editor. **Managing Documents:** Locating files in Linux - Standard files - Redirection – Filters - Pipes. **Disk and File System Management:** Linux file system hierarchy - Disk space management - Mounting and unmounting file systems - Checking disk usage. **Backup and Compression Utilities:** Backup techniques - File compression and archiving.	15
IV	**Securing files in Linux:** File access permissions - viewing File access permissions - Changing File access permissions. **Automating Tasks using Shell Scripts:** Introduction - Variables - Local and Global Shell variables - Command Substitution. **Linux Networking and Security:** Introduction to Linux Networking- Basic networking concepts - Network configuration - IP addressing - Network troubleshooting. **Network Monitoring and Diagnostics:** Monitoring network connections - Checking active ports and services.	15
V	**Using Conditional Execution in Shell Scripts:** Conditional Execution – The case…esac Construct. **Managing repetitive tasks using Shell Scripts:** Using Iteration in Shell Scripts– The while construct – until construct – for construct – break and continue Commands – Simple Programs using Shell Scripts.**Remote Access and File Transfer:** Secure remote login - File transfer between Linux systems. **Firewall and Network Protection:** Linux firewall concepts - Packet filtering - Managing firewall rules. **System Logs and Security Monitoring:** Importance of log files - Monitoring system activity - Detecting suspicious activity.	15
	Total Hours	**75**

Text Books	
1.	NIIT. (2006), Operating System Linux, Eastern Economy Edition, PHI Learning.
2.	Venkateswarlu N.B(2008), Introduction to Linux: Installation and Programming, Edition, BS Publications.
3.	Christopher Negus C. (2025), Linux Bible, 10th Edition, Wiley publishers.
Reference Books	
1.	Petersen R. (2008), Linux: The Complete Reference, 6th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2.	Soyinka W. (2015), Linux Administration: A Beginner's Guide, McGraw-Hill Education.
3.	Jones M. T. (2009), Linux System Programming and Administration, Jones & Bartlett Learning.
Web Resources(Swayam/NPTEL/Others)	
1.	https://www.classcentral.com/course/swayam-linux-applications-in-engineering-education-503682?
2.	https://nptel.ac.in/courses/117106113
3.	https://www.redhat.com/en/services/training/getting-started-with-linux-fundamentals?
4.	https://developers.redhat.com/
5.	https://grokipedia.com/page/AI_Development_on_Linux

Course Code	Course Name	Category	Hours / Week	Credits
24BCS54P	Lab: Linux and Shell Programming	Core Lab - VI	5	3

S. No.	List of Programs
1	Sample programs
	Write a shell script to stimulate the file commands: rm, cp, cat, mv, cmp, wc, split, diff.
2	Write a shell script to show the following system configuration: a. Currently logged user and his log name b. Current shell, home directory, operating system type, current path setting, current working directory c. Show currently logged number of users, show all available shells d. Show CPU information like processor type, speed e. Show memory information.
3	Write a shell script to implement the following: pipes, Redirection and tee commands.
4	Write a shell script for displaying current date, user name, file listing and directories by getting user choice.
5	Write a shell script to implement the filter commands.
6	Write a shell script to remove the files which has file size as zero bytes.
7	Write a shell script to find the sum of the individual digits of a given number.
8	Write a shell script to find the greatest among the given set of numbers using command line arguments.
9	Write a shell script for palindrome checking.
10	Write a shell script to print the multiplication table of the given argument using for loop.
11	Write a shell script to display and analyze group information. a. Display all groups available in the system. b. Display the group ID of a specified group. c. List users belonging to a particular group. d. Count the total number of groups available. e. Display groups assigned to the current user.
12	Write a shell script to monitor process activities. a. Display all running processes. b. Display processes belonging to the current user. c. Show top five CPU consuming processes. d. Display process ID and parent process ID. e. Display the total number of running processes.
13	Write a shell script to display network configuration information. a. Display system hostname. b. Display IP address of all network interfaces. c. Display routing table information. d. Display DNS server configuration. e. Test network connectivity with a remote host.

S. No.	List of Programs
14	Write a shell script to monitor system logs and detect suspicious activity. a. Display recent system log entries. b. Display login history of users. c. Display failed login attempts. d. Search for specific keywords in log files. e. Display the last 10 security related log messages.
15	Write a shell script to analyze disk usage. a. Display disk usage of all directories in the home folder. b. Display the top 5 largest directories in the system. c. Display the number of files in each directory. d. Display the file system type of each partition. e. Display free disk space available.
	Total Hours **75**
Text Books	
1.	NIIT. (2006), Operating System Linux, Eastern Economy Edition, PHI Learning.
2.	Venkateswarlu N.B. (2008), Introduction to Linux: Installation and Programming,1st Edition, BS Publications.
3	Christopher Negus C. (2025), Linux Bible, 10th Edition, Wiley publishers.
Reference Books	
1.	Petersen R. (2008), Linux: The Complete Reference, 6th Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2.	Soyinka W. (2015), Linux Administration: A Beginner's Guide, McGraw-Hill Education.
3.	Jones M. T. (2009), Linux System Programming and Administration, Jones & Bartlett Learning.
Web Resources(Swayam/NPTEL/Others)	
1.	https://www.classcentral.com/course/swayam-linux-applications-in-engineering-education-503682?
2.	https://nptel.ac.in/courses/117106113
3.	https://www.redhat.com/en/services/training/getting-started-with-linux-fundamentals?
4.	https://developers.redhat.com/
5.	https://grokipedia.com/page/AI_Development_on_Linux

Course Code	Course Name	Category	Hours/ Week	Credits
24BCS55C	Visual Basic	Core – XI	5	4

Course Objectives

The course intends to cover

- Visual Basic programming skills required for application development.
- The controls available in Visual Basic.
- Database and management using data controls.
- Tools available in VB for developing projects.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand Visual Basic environment including Forms, Procedures and Controls.	K1, K2
CLO2	Implement MDI applications using forms, dialog boxes and MSFlex Grid.	K3
CLO3	Understand the connectivity between VB with MS-ACCESS database.	K2
CLO4	Apply OLE drag-and-drop operations in applications.	K3
CLO5	Build user-friendly VB applications.	K3
K1- Remember**; K2** - Understand; **K3 –** Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	3	3	2	3
CLO2	3	3	3	2	3
CLO3	3	3	2	2	3
CLO4	3	3	2	1	3
CLO5	3	3	2	1	3
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core – XI: Visual Basic

Unit	Content	No. of Hours
I	**Introduction to VB:** Getting Started with VB6 - Programming Environment - Working with Forms - Developing an application – Variables - Data types and Modules - Procedures and Control structures - Arrays. **Working with Controls:** Creating and using controls- Working with Control Arrays.	15
II	**Menus in VB:** Menus - Mouse events - Dialog boxes. **MDI and Flexgrid:** MDI - Using the Flex Grid control.	15
III	**ODBC and Data Access Objects:** Data Access Options - ODBC - Remote data objects. **ActiveX EXE and ActiveX DLL:** Introduction - Creating an ActiveX EXE Component - Creating ActiveX DLL Component.	15
IV	**Object Linking and Embedding:** OLE fundamentals - Using OLE Container Control - Using OLE Automation objects - OLE Drag and Drop. **File and File System Control:** File System Controls - Accessing Files- Visual Basic for AI Driven Neural Network Modelling.	15
V	**Controls in VB:** Additional controls in VB: sstab control - Setting properties at runtime, Adding controls to tab - List control - tabstrip control - MSFlex Grid control - Why ADO - Establishing a reference - Crystal and Data Reports. **VB.Net:** Introduction - CLR - CTS - CLS.	15
	Total Hours	**75**

Text Books

1.	Content Development Group (2007), Visual Basic 6.0 Programming, TMH, 8th reprint.
2.	Mohammed Azam, Vikas (2006), Programming with Visual Basic 6.0, Publishing House, 4th reprint.

Reference Books

1.	Gray Cornell (2003), Visual Basic 6 from ground up TMH, New Delhi,1st Edition,
2.	Deitel and Deitel, Nieto T R (1998), Visual Basic 6-How to Program, Pearson Education. 1st Edition.

Web Resources

1.	https://learn.microsoft.com/en-us/shows/visual-basic-fundamentals-for-absolute-beginners/
2.	https://learn.microsoft.com/en-us/dotnet/visual-basic/
3.	https://www.codeguru.com/visual-basic/setting-up-a-neural-network-using-visual-basic-and-ai/

Course Code	Course Name	Category	Hours / Week	Credits
24BCS5AE	Cloud Services Management	Elective-I	5	3

Course Objectives

The course intends to cover

- Cloud Services Management terminology, definition & concepts.
- Cloud services management with traditional IT Service management.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the Cloud Ecosystem and the essential characteristics of cloud computing.	K1, K2
CLO2	Understand the Cloud Strategy Management Framework and its role in managing cloud services effectively.	K2
CLO3	Analyze different benchmarking techniques for evaluating cloud services.	K4
CLO4	Apply different pricing models for cloud services.	K3
CLO5	Analyze the value of cloud services using methods.	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	1	2	1	1
CLO2	2	1	2	1	1
CLO3	3	2	2	2	1
CLO4	2	1	1	1	1
CLO5	3	2	3	2	1
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Elective- I: Cloud Services Management

Unit	Content	No. of Hours
I	**Cloud Service Management:** Fundamentals**,** Cloud Ecosystem - The Essential Characteristics. Basics of Information Technology - Service Management and Cloud Service Management - Service Perspectives - Cloud Service Models - Cloud Service Deployment Models.	15
II	**Cloud Services Strategy:** Fundamentals, Management Framework of Cloud Strategy - Cloud Policy - Key Drive for Adoption, Risk Management –AI Applications in Risk Management - IT Capacity and Utilization - Demand and Capacity Matching - Demand Queuing - Change Management - Cloud Service Architecture.	15
III	**Cloud Service Reference Model:** Cloud Service Life Cycle - Basics of Cloud Service Design - Dealing with Legacy Systems and Services - Benchmarking of Cloud Services - Cloud Services Capacity Planning - Cloud Service Deployment and Migration - Cloud Marketplace - Cloud Service Operations Management.	15
IV	**Cloud Service Economics:** Pricing models for Cloud Services - Freemium - Pay Per Reservation, Pay Per User - Subscription based Charging - Procurement of Cloud-based Services - Capex Vs Opex Shift - Cloud Service Charging - Cloud Cost Models.	15
V	**Cloud Service Governance & Value:** IT Governance - Definition. **Cloud Governance:** Definition, Framework, Structure and Considerations. **Cloud Service:** Model Risk Matrix, Understanding and Measuring the value of Cloud Services - Balanced Scorecard - Total Cost of Ownership.	15
	Total Hours	**75**
Text Books		
1.	Haque Enamul(2020), Cloud Service Management and Governance: Smart Service Management in Cloud Era, Enel Publications.	
2.	Erl, Thomas, Puttini, Ricardo, Mohammad, Zaigham (2013), Cloud Computing: Concepts, Technology & Architecture, 1st Edition, Pearson.	
Reference Books		
1.	Erl, Thomas, Puttini, Ricardo, Mahmood, Zaigham (2023), Cloud Computing: Concepts, Technology, Security & Architecture, 2nd Edition, Pearson.	
2.	Buyya, Rajkumar, Vecchiola, Christia, Selvi, Thamarai S et al. (2026), Mastering Cloud Computing: Foundations and Applications Programming, 2nd Edition, Elsevier.	
Web Resources(NPTEL/Swayam/Others)		
1.	https://onlinecourses.nptel.ac.in/noc24_cs118/preview?	
2.	https://thedigitalprojectmanager.com/project-management/ai-in-project-risk-management/	

Course Code	Course Name	Category	Hours/ Week	Credits
24BCS5BE	Computer Networks and Security	Elective -I	5	3

Course Objectives

The course intends to cover

- Basic concepts of networks and reference models.
- Layers of OSI model and network security.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the basics of computer networks and OSI models.	K1, K2
CLO2	Understand physical layer and transmission media.	K2
CLO3	Apply the techniques to detect the errors.	K3
CLO4	Identify the various algorithms in the network layer and transport layer.	K2
CLO5	Analyze the methods of network security.	K4
K1 - Remember**; K2 –** Understand**; K3 -** Apply; **K4 -** Analyze		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	2	1	1	3
CLO2	2	3	2	1	2
CLO3	3	2	3	2	2
CLO4	3	2	2	3	2
CLO5	3	2	2	2	3
3 - Substantial (high)		**2 -** Moderate (medium)		**1 -** Slight (low)	

Elective-I: Computer Networks and Security

Unit	Content	No. of Hours
I	**Basics of Networks and OSI Model: Network Hardware**: LAN - WAN - MAN - Wireless - Home Networks. **Network Software**: Protocol Hierarchies - Design Issues for the Layers - Connection-oriented and connectionless services - Service Primitives - The Relationship of services to Protocols. **Reference Models**: OSI Reference Model - TCP/IP reference Model - Comparison of OSI and TCP/IP - Critique of OSI and protocols - Critique of the TCP/IP Reference model.	15
II	**Physical Layer: Guided Transmission Media**: Magnetic Media - Twisted Pair - Coaxial Cable - Fiber Optics. **Wireless Transmission**: Electromagnetic Spectrum - Radio Transmission - Microwave Transmission - Infrared and Millimeter Waves - Light Waves. **Communication Satellites**: Geostationary, Medium-Earth Orbit, Low Earth-orbit Satellites - Satellites versus Fiber.	15
III	**Data-Link Layer:** Error Detection and correction - Elementary Data-link Protocols - Sliding Window Protocols. **Medium-Access Control Sub Layer**: Multiple Access Protocols - Ethernet - Wireless LANs - Broadband Wireless - Bluetooth.	15
IV	**Network Layer**: Routing algorithms - Congestion Control Algorithms. **Transport Layer**: Elements of Transport Protocols - Internet Transport Protocols - TCP - Introduction to Intelligent Routing.	15
V	**Application Layer**: DNS - E-mail. **Network Security**: Cryptography - Symmetric Key Algorithms - Public Key Algorithms - Digital Signatures - Symmetric Key Signatures - Public Key Signatures - Crypto Currency.	15
	Total Hours	**75**

Text Books

1.	Andrew S. Tanenbaum(2018), Computer Networks, Pearson publications, 4th Edition.
2.	Dr.Sanjay Sharma, Kataria S K & Sons (2009), A Textbook of Computer Network, 1st Edition.

Reference Books

1.	Achyut Godbole(2007), Data Communication and Networks, TMH.
2.	Uyless Black(1996), Computer Networks: Protocols, Standards, and Interfaces, PHI, 2nd Edition.

Web Resources(NPTEL/Swayam/Others)

1.	https://nptel.ac.in/courses/106105080
2.	https://nptel.ac.in/courses/106105081
3.	https://docs.pega.com/bundle/platform/ app-dev/intelligent-routing.html

Course Code	Course Name	Category	Hours/ Week	Credits
24BCS5CE	Data Mining	Elective-I	5	3

Course Objectives

The course intends to cover

- Tasks and technology of Data mining for enterprise data management.
- Techniques and algorithms of Data mining for applications.
- Data mining process using Large Item Sets.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand basic data mining tasks, issues and metrics.	K1, K2
CLO2	Apply data mining algorithms in real-time applications.	K3
CLO3	Analyze the data by comparing the classification algorithms.	K4
CLO4	Apply the clustering algorithms on transactional databases.	K3
CLO5	Develop appropriate data mining models.	K3
K1 - Remember**; K2**-Understand; **K3**-Apply; **K4**-Analyze		

CLO - PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	2	2	3	2	3
CLO2	2	3	3	2	3
CLO3	2	3	3	1	2
CLO4	2	2	2	2	2
CLO5	2	3	3	1	3
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Elective-I: Data Mining

Unit	Content	No. of Hours
I	**Basic Data Mining Tasks:** Data Mining Versus Knowledge Discovery in Data Bases - Data Mining Issues - Data Mining Matrices - Social Implications of Data Mining - Data Mining from Data Base Perspective.	15
II	**Data Mining Techniques:** A Statistical Perspective on data mining - Similarity Measures - Decision Trees - Neural Networks - Genetic Algorithms. **Web Mining:** Web Content Mining – Web Usage Mining.	15
III	**Classification:** Introduction - Statistical Based Algorithms - Distance Based Algorithms - Decision Tree - Based Algorithms - Neural Network Based Algorithms- Rule Based Algorithms - Combining Techniques.	15
IV	**Clustering:** Introduction - Similarity and Distance Measures - Outliers - Hierarchical Algorithms - Partitional Algorithms.	15
V	**Association Rules:** Introduction - Large Item Sets - Basic Algorithms - Parallel & Distributed Algorithms and its Comparison - Incremental Rules - Measuring the Quality of Rules - Incremental Learning in AI systems.	15
	Total Hours	**75**
Text Books		
1.	Margaret H.Dunbam(2006), Data Mining Introductory and Advanced Topics, Pearson Education.	
2.	Arun K. Pujari (2013), Data Mining Techniques, Universities Press.	
Reference Books		
1.	JiaweiHan & Micheline Kamber (2001), Data Mining Concepts &Techniques, Academic Press.	
2.	Soman K.P, Shyam Diwakar, Ajay V (2009), Insight into Data Mining – Theory and Practice, Prentice Hall of India.	
Web Resources(NPTEL/Swayam/Others)		
1.	https://nptel.ac.in/courses/106105174	
2.	https://nptel.ac.in/courses/106106853	
3.	https://www.datacamp.com/blog/what-is-incremental-learning	

Components for Internal Assessment and Distribution of Marks for CIA and ESE (Theory)

Max Marks	Marks for		Components for CIA						
	CIA	ESE	CIA		Model		Attendance	Active Engagement	Total
100	25	75	Actual	Weightage	Actual	Weightage	5	5	25
			50	**5**	75	**10**			

Question Paper Pattern

Component	Duration in Hours	Section A			Section B			Section C			Total
		Type of Question	No. of Questions	Marks	Type of Question	No. of Questions	Marks	Type of Question	No. of Questions	Marks	
CIA	2	MCQ	8	8x1=8	Either or	3	3x6=18	Either or	3	3x8=24	50
Model Exam / **ESE**	3	MCQ	10	10x1=10	Either or	5	5x5=25	Either or	5	5x8=40	75

Components for Internal Assessment and Distribution of Marks for CIA (Lab)

Max Marks	Marks for		Components for CIA						
	CIA	ESE	Test		Model		Experiments / Programs	Observation	Total
100	40	60	Actual	Weightage	Actual	Weightage	Marks	5	40
			50	**10**	60	**15**	**10**		

Examination Pattern

Component	Duration in Hours	Marks			Weightage
		Practical Exam	Record	Total Marks	
Test	2	50	-	**50**	10
Model	3	60	-	**60**	15
Experiments Completed	-	-	-	**10**	10
Observation Note	-	-	-	**05**	05
				Total Marks - CIA	**40**
ESE	3	50	10	-	**60**

Components for Internal Assessment and Distribution of Marks for CIA (Foundation Course -Theory)

Max Marks	Marks for		Components for CIA				
	CIA	ESE	CIA		Model		Total
			Actual	Weightage	Actual	Weightage	
50	50	-	50	25	50	25	50

Question Paper Pattern

Duration in Hours	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Offline	Open Choice	5 (Out of 8)	5 x 10=50

Components for and Distribution of Marks for ESE (Theory) Ability Enhancement Compulsory Courses (AECC) & Question Paper Pattern

Duration in Hours	Mode of Exam	Type of Questions	No. of Questions	Marks
2	Online	MCQ	50	50x1=50

Components of Internship (Internal Assessment Only)

Components	Marks
Submission of Internship Report	20
Performance in viva-voce	30
Total Marks	**50**

***Certification of Completion is Mandatory for the award of Internal Marks and to avail the credits**



Semester 6

Semester – 6									
Course Code	Part	Course Category	Course Name	Hours/ Week	Examination				Credits
					Duration in Hours	Max. Marks			
						CIA	ESE	Total	
24BCS61C	III	Core - XII	Graphics and Multimedia	6	3	25	75	100	4
24BCS62P	III	Core Lab – VII	**Lab :** Graphics and Multimedia	5	3	40	60	100	3
24BCS63C	III	Core - XIII	Cyber Security	6	3	25	75	100	4
24BCS6AE/	III	Elective - II	DevOps **(Cloud Computing)**	5	3	25	75	100	3
24BCS6BE/			**Information Security Management (Networking & Cyber Security)**						
24BCS6CE			Big Data Processing and Analytics **(Data Mining)**						
24BCS64P	III	SEC Lab - III	**Lab :** Cyber Security	2	3	40	60	100	2
24BCS6PR	III	Project	**Core :** Project Work	6	3	40	60	100	5
			Total	**30**				**600**	**21**
			Grand Total	**180**				**4250**	**140**

Course Code	Course Name	Category	Hours/Week	Credits
24BCS61C	Graphics and Multimedia	Core - XII	6	4

Course Objectives

The Course intends to cover

- Line, circle, ellipse algorithms and output primitive attributes for innovative digital application design
- 2D transformations, viewing and clipping operations.
- Types of text, image, color models and audio formats.
- Various operations in video, animation, audio and video file compression.

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Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the digital and technological applications using output primitive attributes.	K1, K2
CLO2	Use 2D geometric transformations, matrix representations, clipping operations and AI-based image segmentation techniques to solve computer graphics and image-processing problems.	K3
CLO3	Apply image enhancement techniques to improve image quality in multimedia applications.	K3
CLO4	Implement audio recording and processing techniques to improve sound quality in multimedia content.	K3
CLO5	Apply video editing and animation techniques to develop multimedia content.	K3
K1 - Remember; **K2 -** Understand; **K3 -** Use, Apply, Implement		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	2	2	1	1
CLO2	3	3	2	2	1
CLO3	2	3	2	1	1
CLO4	2	3	2	1	2
CLO5	3	3	2	2	2
3 - Substantial (high)		**2 -** Moderate (medium)		**1 -** Slight (low)	

Core – XII : Graphics and Multimedia

Unit	Content	No. of Hours
I	**Output Primitives**: Points and Lines – Line-Drawing algorithms – Loading frame Buffer – Line function – Circle-Generating algorithms – Ellipse-generating algorithms. **Attributes of Output Primitives:** Line Attributes – Curve attributes – Color and Grayscale Levels – Area-fill attributes – Character Attributes. Basic applications of AI in image recognition.	18
II	**2D Geometric Transformations**: Basic Transformations – Matrix Representations – Composite Transformations – Other Transformations. **2D Viewing:** The Viewing Pipeline – Viewing Co-ordinate Reference Frame – Window-to-Viewport Co-ordinate Transformation - 2D Viewing Functions – Clipping Operations . AI Based Image Segmentation.	18
III	**Text**: Types of Text – Unicode Standard – Font – Insertion of Text – Text compression – File formats. **Image:** Image Types – Seeing Color – Color Models – Basic Steps for Image Processing – Scanner – Digital Camera – Interface Standards – Specification of Digital Images – CMS – Device Independent Color Models – Image Processing software – File Formats – Image Output on Monitor and Printer. Image Enhancement.	18
IV	**Audio:** Introduction – Acoustics – Nature of Sound Waves – Fundamental Characteristics of Sound – Microphone – Amplifier – Loudspeaker – Audio Mixer – Digital Audio – Synthesizers – MIDI – Basics of Staff Notation – Sound Card – Audio Transmission – Audio File formats and CODECs – Audio Recording Systems – Audio and Multimedia – Voice Recognition and Response - Audio Processing Software – Speech to Text and Text to Speech. AI Music Generator.	18
V	**Video:** Analog Video Camera – Transmission of Video Signals – Video Signal Formats – Television Broadcasting Standards – PC Video – Video File Formats and CODECs – Video Editing – Video Editing Software. **Animation:** Types of Animation – Computer Assisted Animation – Creating Movement – Principles of Animation – Some Techniques of Animation – Animation on the Web – Special Effects – Rendering Algorithms. **Compression:** MPEG-1 Audio – MPEG-1 Video - MPEG-2Audio – MPEG-2 Video. AI-Powered Video Editing.	18
	Total Hours	**90**

Text Books	
1.	Donald Hearn, M. Pauline Baker,(2018) Computer Graphics, 2nd Edition, PHI.
2.	Ranjan Parekh,(2007) , Principles of Multimedia, 3rd Edition , TMH.
Reference Books	
1.	Amarendra N Sinha, Arun D Udai, (2008) Computer Graphics, TMH
2.	Tay Vaughan, Multimedia: Making it Work, 7th Edition, TMH.
Web Resources (Swayam/ NPTEL/Others)	
1.	https://nptel.ac.in/courses/106103224
2.	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs104
3.	https://mindtitan.com/resources/blog/ai-image-recognition-applications-and-benefits/
4.	https://cloudinary.com/guides/ai/ai-image-segmentation
5.	https://www.soundverse.ai/blog/article/how-ai-music-generators-work
6.	https://bitbaroda.com/blog/ai-powered-video-editing-modern-tools-professional-video

Course Code	Course Name	Category	Hours / Week	Credits
24BCS62P	Lab: Graphics and Multimedia	Core Lab - VII	5	3

S. No.	List of Programs
Graphics :	
1.	Write a program to rotate an image.
2.	Write a program to drop each word of a sentence one by one from the top.
3.	Write a program to drop a line using DDA Algorithm.
4.	Write a program to move a car with sound effect.
5.	Write a program to bounce a ball and move it with sound effect.
6.	Write a program to test whether a given pixel is inside or outside or on a polygon.
Multimedia	
7.	Create Sunflower using Photoshop.
8.	Animate Plane flying in the Clouds using Photoshop.
9.	Create Plastic Surgery for the Nose using Photoshop.
10.	Create See-through text using Photoshop.
11.	Create a Web Page using Photoshop.
12.	Convert Black and White Photo to Color Photo using Photoshop.
	Total Hours **75**

Text Books

1. Donald Hearn, M, Pauline Baker, Computer Graphics, ,2nd edition, PHI.
2. Ranjan Parekh (2007), Principles of Multimedia, TMH.

Reference Books

1. Amarendra N Sinha, Arun D Udai Computer Graphics, TMH.
2. Tay Vaughan Multimedia: Making it Work, ,7th edition, TMH.

Web Resources (NPTEL/Swayam)

1. https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs178
2. https://onlinecourses.swayam2.ac.in/e-learning/preview/nou26_cs21

Course Code	Course Name	Category	Hours/Week	Credits
24BCS63C	Cyber Security	Core – XIII	6	4

Course Objectives

The Course intends to cover

- Cybersecurity concepts and security threats.
- Operating system and network security for protecting systems and networks.
- Cryptography and data security for protecting information.
- Privacy and data protection in cyberspace.
- Security Planning and Risk Analysis.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the fundamental concepts of cyber security and cyber-attacks.	K1, K2
CLO2	Understand security concepts in Operating Systems and computer networks.	K2
CLO3	Apply cryptography and security techniques to protect system and data.	K3
CLO4	Apply privacy concepts for providing security in cyberspace.	K3
CLO5	Analyze security planning, risks, incidents, cybercrime, cyber law and ethical issues in computer security.	K4
K1 - Remember**; K2 –** Understand**; K3 -** Apply; **K4 –** Analyze		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	2	1	1	3
CLO2	2	3	2	1	2
CLO3	3	2	3	2	2
CLO4	3	2	2	3	2
CLO5	3	2	2	2	3
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core – XIII : Cyber Security

Unit	Content	No. of Hours
I	**Cyber Security**: Introduction - Computer Security - Threats - Harm - Vulnerabilities - Controls - Authenticate Access Control and Cryptography - Web User Side - Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks-Types.	18
II	**Security in Operating System & Networks**: Security in Operating Systems - Security in the Design of Operating Systems - Rootkit - Network Security Attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service-Attack Types.	18
III	**Cryptography in Network Security:** Cryptography in Network Security - Firewalls - Intrusion Detection and Prevention Systems -Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.	18
IV	**Privacy in Cyber Space:** Privacy Concepts - Privacy Principles and Policies - Authentication and Privacy - Data Mining Privacy on the Web - Email Security- Privacy Impacts of Emerging Technologies - Where the Field is Headed - AI Tools for Cyber.	18
V	**Management and Incidents**: Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster. **Emerging Topics:** Internet of Things and security issues - Economics of Cyber Security - Electronic Voting and Vulnerabilities and Solutions - Cyber Warfare and critical issues. **Cyberspace and the Law**: International Laws - Cybercrime – Ethical issues in Cyber Security.	18
	Total Hours	**90**

Text Books	
1	Charles P. Pfleeger, Shari Lawrence Pfleeger , Jonathan Margulies, (2015), Security in Computing, 5th Edition, Pearson Education.
2	George K. Kostopoulos, (2013), Cyberspace and Cybersecurity, CRC Press.
Reference Books	
1.	Martti Lehto, Pekka Neittaanmaki, (2015), Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland.
2.	Nelson Phillips and Enfinger Steuart, (2009), Computer Forensics and Investigations, Cengage Learning, NewDelhi.
Web Resources (NPTEL / Swayam / Others)	
1.	https://nptel.ac.in/courses/106106248
2.	https://nptel.ac.in/courses/129106894
3.	https://link.springer.com/book/10.1007/978-3-030-29053-5?utm_source
4.	https://sbbsuniversity.ac.in/Digital%20Literatcy%20App/chapter8.html

Course Code	Course Name	Category	Hours / Week	Credits
24BCS6AE	DevOps	Elective - II	5	3

Course Objectives

The Course intends to cover

- Fundamental concepts, principles, culture and lifecycle of DevOps.
- The usage of version control, Git and GitHub.
- DevOps practices such as Continuous Integration, Continuous Delivery and application deployment.
- Monitoring DevOps Practices.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify the basic concepts, principles and stages of DevOps.	K1, K2
CLO2	Use Git, GitHub and Jenkins for version control and continuous integration.	K3
CLO3	Build CI/CD pipelines for application delivery and deployment.	K3
CLO4	Use Docker and Kubernetes for container-based application deployment.	K3
CLO5	Apply monitoring, automation, security and DevSecOps practices in DevOps.	K3
K1, K2-Identify; K**3** – Use, Build, Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	2	2	1	1	1
CLO2	3	3	1	2	1
CLO3	3	3	2	2	2
CLO4	3	3	2	2	1
CLO5	2	3	2	2	3
3 - Substantial (high)		**2 -** Moderate (medium)		**1 -** Slight (low)	

Elective – II : DevOps

Unit	Content	No. of Hours
I	**Introduction:** Evolution of Software Development - Traditional Software Development and Agile - Need for DevOps - Definition and Principles of DevOps - DevOps Culture and Collaboration - DevOps Lifecycle - DevOps and Agile - Benefits and Challenges of DevOps .	15
II	**Version Control and Continuous Integration:** Version Control Systems - Git and GitHub - Git Repository - Basic Git Operations - Branching and Merging - Continuous Integration - Build Automation - Introduction to Jenkins - Automated Testing.	15
III	**Continuous Delivery Introduction:** Continuous Deployment - CI/CD Pipeline - Application Deployment - Deployment Automation - Release Management - Deployment Strategies - Configuration Management.	15
IV	**Containers and Cloud Deployment:** Virtualization and Containerization - Introduction to Docker - Docker Images and Containers - Dockerfile -Docker Hub - Container-based Application Deployment - Introduction to Kubernetes - Pods and Services - Basic Container Orchestration - Jenkins.	15
V	**Monitoring and DevOps Practices:** DevOps Monitoring - Logging and Alerting - Application Performance Monitoring DevOps Metrics - Continuous Feedback - Infrastructure Automation - Security in DevOps - DevSecOps - Scalability and Reliability - Case Studies in DevOps- Optimize DevOps with AI agents.	15
	Total Hours	**75**

Text Books	
1.	Aruna Ravichandran, Kieran Taylor, Peter Waterhouse (2016), DevOps for Digital Leaders-Reignite Business with a Modern DevOps-Enabled Software Factory.
2.	Alex Williams, (2018), CI/CD with Kubernetes.
Reference Book	
1.	Mike Loukides, (2015) What is DevOps, Kindle Edition, O'Reilly Media.
Web Resources (Swayam / NPTEL/Others)	
1.	https://learn.microsoft.com/en-us/training/courses/az-2008?
2.	https://learn.microsoft.com/en-us/training/paths/az-400-work-git-for-enterprise-devops/
3.	https://learn.microsoft.com/en-us/training/paths/optimize-devops-ai-agents-azure/

Course Code	Course Name	Category	Hours / Week	Credits
24BCS6BE	Information Security Management	Elective - II	5	3

Course Objectives

The Course intends to cover

- The Fundamentals of Information Security, CNSS security model, information system, Security SDLC and needs of security.
- Laws, Ethics in Information Security and the steps involved in Risk Management.
- Access control, firewall and VPN technologies, Intrusion Detection and Prevention Systems and other Security Tools.
- Physical security concepts along with the technical aspects of Information Security implementation and project management.
- Security personnel management, employment security practices, Information Security maintenance models and digital forensics.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify different approaches to implementing Information Security and needs of security.	K1
CLO2	Identify relevant laws and legal bodies related to Information Security and illustrate recommended risk management practices for basic information security scenarios.	K1, K2
CLO3	Apply appropriate security technologies to basic network security scenarios.	K3
CLO4	Use suitable security controls to address security needs.	K3
CLO5	Implement suitable employment security policies for Information Security personnel.	K3
K1, K2 – Identify**; K3 –** Apply, Use, Implement		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	3	2	1	1	2
CLO2	3	2	1	1	2
CLO3	3	3	1	2	2
CLO4	3	3	2	2	3
CLO5	2	3	2	2	3
3 - Substantial (high)		**2 -** Moderate (medium)		**1 -** Slight (low)	

Elective - II: Information Security Management

Unit	Content	No. of Hours
I	**Introduction to Information Security:** The History of Information Security - CNSS Security Model - Components of an Information System - Balancing information security and Access - Approaches to Information Security Implementation - The Security Systems Development Life Cycle. **The Need for Security:** Business Needs - Threats - Attacks - Secure Software Development. AI-based Threat Detection.	15
II	**Legal, Ethical, and Professional Issues in information Security:** Introduction - Law and Ethics in Information Security - International Laws and Legal Bodies - Ethics and Information Security - Codes of Ethics and Professional Organizations. **Risk Management:** Introduction - Risk Identification, Assessment & Control Strategies - Selecting a Risk Control Strategy - Quantitative Versus Qualitative Risk Control Practices.	15
III	**Security Technology: Firewalls and VPNs:** Introduction - Access Control - Firewalls - Protecting Remote Connection. **Intrusion Detection and Prevention systems:** Honeypots, Honeynets and Padded Cell Systems - Scanning and Analysis Tools.	15
IV	**Physical Security:** Introduction - Physical Access Control - Fire Security and Safety - Failure of Supporting Utilities and Structural Collapse - Interception of Data - Mobile and Portable Systems - Special Considerations for Physical Security. **Implementing Information Security:** Information Security Project Management - Technical Aspects of Implementation.	15
V	**Security and Personnel:** Introduction - positioning and Staffing the Security Function - Credentials of Information Security Professionals - Employment Policies and Practices. **Information Security Maintenance**: Introduction - Security Management Maintenance Models - Digital Forensics.	15
	Total Hours	**75**

Text Books

1.	Whitman, M. E., & Mattord, H. J. (2012). Principles of Information Security (4th ed.). Vikas Publishing House.
2.	Charles P. Pfleeger , Shari Lawrence Pfleeger, Jonathan Margulies (2015), Security in Computing, 5th Edition, Pearson Education.

Reference Books

1.	Stallings, W., & Brown, L. (2012). Computer Security: Principles and Practice (2nd ed.). Pearson.
2.	Nieles, M., Dempsey, K., & Pillitteri, V. Y. (2017), An introduction to Information Security (NIST Special Publication 800-12, Revision 1).
3.	Stallings, W., & Brown, L. (2012). Computer Security: Principles and Practice (2nd ed.). Pearson.

Web Resources (NPTEL/Swayam/Others)

1.	https://nptel.ac.in/courses/106106157
2.	https://www.zscaler.com/blogs/product-insights/ai-driven-threat-detection-revolutionizing-cyber-defense

Course Code	Course Name	Category	Hours / Week	Credits
24BCS6CE	Big Data Processing and Analytics	Elective - II	5	3

Course Objectives

The Course intends to cover

- Big Data, Sources, Quality Data Storage and Analysis.
- Hadoop, Map Reduce concepts and Hadoop Eco System.
- NoSQL Big Data Management, MongoDB, Casandra Databases.
- Map Reduce, Hive and Pig.
- Machine Learning Algorithms.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand Big Data and processing of large datasets.	K1, K2
CLO2	Apply Hadoop Ecosystem tools to create, store, retrieve and manage distributed datasets.	K3
CLO3	Apply NoSQL data architecture patterns and shared-nothing architecture for distributed Big Data applications.	K3
CLO4	Apply Pig and Hive tools for large-scale data processing and analysis.	K3
CLO5	Apply Machine Learning Algorithms for Big Data Analytics.	K3
K1 - Remember**; K2 –** Understand**; K3 -** Apply		

CLO – PLO Mapping

CLOs/PLOs	PLO1	PLO2	PLO3	PLO4	PLO5
CLO1	2	3	1	2	1
CLO2	3	3	3	2	1
CLO3	2	3	3	2	1
CLO4	2	3	3	2	1
CLO5	2	3	3	3	2
3 - Substantial (high)		**2 -** Moderate (medium)		**1 -** Slight (low)	

Elective - II: Big Data Processing and Analytics

Unit	Content	No. of Hours
I	**Big Data Analytics:** Introduction – Big Data – Scalability and Parallel Processing - Designing Data Architecture – **Data:** Sources - Quality - Pre-Processing and Storing – Data Storage and Analysis – Big Data Analytics Applications and Case Studies - AI-enabled Data Collection and Preprocessing.	15
II	**Hadoop:** Introduction - Hadoop and its Ecosystem **- HDFS** (Hadoop Distributed File System) – MapReduce Framework and Programming Model – Hadoop Yarn – **Hadoop Ecosystem Tools**: Hadoop Ecosystem – Ambari – Hbase – Hive – Pig – Mahout.	15
III	**NoSQL Big Data Management, MongoDB and Cassandra:** Introduction – NoSQL Data Store – NoSQL Data Architecture Patterns – NoSQL to Manage Big Data – Shared-Nothing Architecture for Big Data Tasks – MongoDB Database – Casandra Databases.	15
IV	**MapReduce, Hive and Pig:** Introduction – MapReduce Tasks – Composing MapReduce for Calculations and Algorithms – Hive – HiveQL – Pig.	15
V	**Machine Learning Algorithms for Big Data Analytics –** Correlation – Regression Analysis - Finding Similar Items – Similarity of Sets and Collaborative Filtering – Frequent Item Sets and Association Rule Mining – Clustering - Classification – Recommendation System.	15
	Total Hours	**75**

Text Books

1.	Raj Kamal, Preeti Saxena (2025), Big Data Analytics – Introduction to Hadoop, Spark and Machine Learning, McGraw Hill Education (India) Private Limited.
2.	Rajaraman, A., & Ullman, J. D. (2012), Mining of massive datasets, Cambridge University Press.
3.	Liebowitz, J. (2013), Big data and business analytics, Auerbach Publications, CRC Press.
4.	Plunkett, T., & Hornick, M. (2013), Using R to unlock the value of big data: Big data analytics with Oracle R Enterprise and Oracle R Connector for Hadoop, McGraw-Hill/Osborne Media.

Reference Books

1.	Franks, B. (2012), Taming the big data tidal wave: Finding opportunities in huge data streams with advanced analytics, John Wiley & Sons.
2.	Minelli, M., Chambers, M., & Dhiraj, A. (2013), Big data, big analytics: Emerging business intelligence and analytic trends for today's businesses, Wiley.
3.	Sathi, A. (2012), Big data analytics: Disruptive technologies for changing the game, MC Press.

Web Resources (NPTEL/Swayam/Others)

1.	https://nptel.ac.in/courses/106104189
2.	https://www.crystalhues.com/blog/ai-data-processing-explained-why-it-matters-and-how-it-works

Course Code	Course Name	Category	Hours/Week	Credits
24BCS64P	Lab: Cyber Security	SEC Lab III	2	2

S. No.	List of Programs
1.	Develop a Java program to check the strength of a password based on length, uppercase letters, lowercase letters, digits, and special characters.
2.	Develop a Java program to implement a secure login system with a limited number of login attempts and account lockout.
3.	Develop a Java program to validate and sanitize user input to prevent invalid and potentially harmful input.
4.	Develop a Java program to detect common SQL Injection patterns in user input.
5.	Develop a Java program to identify suspicious or potentially phishing URLs based on URL characteristics.
6.	Develop a Java program to calculate and compare the SHA-256 hash of a file to verify file integrity.
7.	Develop a Java program to detect potentially malicious files based on their file extensions.
8.	Develop a Java program to validate an IPv4 address and identify whether it is valid or invalid address.
9.	Develop a Java program to simulate a simple firewall using predefined rules to allow or block network traffic based on IP address and port number.
10.	Develop a Java program to analyze login records and detect suspicious activities such as repeated failed login attempts.
	Total Hours **30**

Text Books

1.	Herbert Schildt, (2021), Java: The Complete Reference, 12th Edition, McGraw Hill.
2.	William Stallings, (2018), Computer Security: Principles and Practice, 4th Edition, Pearson.

Reference Books

1.	Behrouz A. Forouzan, (2013), Cryptography and Network Security, 2nd Edition, McGraw Hill.
2.	Charles P. Pfleeger, Shari Lawrence Pfleeger and Jonathan Margulies, (2015), Security in Computing, 5th Edition, Pearson.

Web Resources (NPTEL/Swayam/Others)

1.	https://nptel.ac.in/courses/106106248
2.	https://cheatsheetseries.owasp.org/cheatsheets/Password_Storage_Cheat_Sheet.html?utm_source

Course Code	Course Name	Category	Hours/Week	Credits
24BCS6PR	Core : Project Work	Project	6	5

Evaluation Pattern:

1. Viva-Voce will be conducted at the end of the year by both Internal (Respective Guides) and External Examiners for a total of 100 marks
2. Out of 100 marks,
   CIA – **40 marks** (15 Marks - Review I + 15 marks - Review II + 10 marks - Internal Viva Voce)
   ESE – **60 marks** (15 marks – Project Report + 30 marks – Implementation/ Execution / Presentation + 15 marks - Viva Voce).

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Components of Assessment (CIA & ESE)

Components for Internal Assessment and Distribution of Marks for CIA and ESE (Theory)

Max Marks	Marks for		Components for CIA						
100	CIA	ESE	CIA		Model		Attendance	Active Engagement	Total
	25	75	Actual	Weightage	Actual	Weightage	5	5	25
			50	**5**	75	**10**			

Question Paper Pattern (CIA & ESE)

Component	Duration in Hours	Section A			Section B			Section C			Total
		Type of Question	No. of Questions	Marks	Type of Question	No. of Questions	Marks	Type of Question	No. of Questions	Marks	
CIA	2	MCQ	8	8x1=8	Either or	3	3x6=18	Either or	3	3x8=24	50
Model Exam / **ESE**	3	MCQ	10	10x1=10	Either or	5	5x5=25	Either or	5	5x8=40	75

Components for Internal Assessment and Distribution of Marks for CIA (Lab)

Max Marks	Marks for		Components for CIA						
	CIA	ESE	Test		Model		Experiments / Programs	Observation	Total
100	40	60	Actual	Weightage	Actual	Weightage	Marks	5	40
			50	**10**	60	**15**	**10**		

Examination Pattern

Component	Duration in Hours	Marks			Weightage
		Practical Exam	Record	Total Marks	
Test	2	50	-	**50**	10
Model	3	60	-	**60**	15
Experiments	-	-	-	**10**	10
Observation	-	-	-	**05**	05
				Total Marks - CIA	**40**
ESE	3	50	10	-	**60**

Components of Project Work*

Components	Marks	
Review - 1	15	
Review - 2	15	
Internal Viva-Voce	10	
Total Marks - CIA		**40**
Project Report	15	
Implementation/Execution/Presentation	30	
Viva-Voce	15	
Total Marks - ESE		60
Total Marks		**100**

***Certification of Completion is Mandatory for the award of Marks and to avail the credits.**