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. Electronics and Communication Systems (B.Sc. ECS)
Programme Code: BEC

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

Eligibility

Students should have passed Higher Secondary Examination and wherever the students have not studied Mathematics knowledge be imparted through Residential / Bridge Course to be conducted. (As per the eligibility condition given by Bharathiar University Ref. BU / R / B3 – B4 / Eligibility Condition / 2024 / 9206 dated 24/05/2024).

Program Learning Outcomes (PLOs)

The successful completion of the B.Sc. Electronics and Communication Systems programme shall enable the students to:

PLO1	Develop a strong foundation in electronics and communication, preparing graduates to become technical engineers in the ever-evolving technological landscape.
PLO2	Demonstrate proficiency in software development methodologies, tools, and languages relevant to the IT field, enabling them to pursue career as software developers.
PLO3	Innovate novel solutions to existing problems in areas like Healthcare, R & D and Industrial settings applying wireless communication systems and embedded systems.
PLO4	Gain knowledge with digital fluency to integrate with the related disciplines.
PLO5	Promote lifelong learning, uphold ethical and professional responsibilities to ensure sustainability in society and the environment.

B.Sc. Electronics and Communication Systems
Distribution of Credits and Hours for all the Semesters

Part	Course Category	No. of Courses	Hours		Credits		Total Credits	Semester
I	Language – I	4	4 X 4	16	4 X 3	12	12	1,2,3,4
II	Language – II	4	4 X 4	16	4 X 3	12	12	1,2,3,4
III	Core Theory (4 hrs.. / week)	2	2 X 4	8	2 X 4	8	100	1
	Core Theory (5 hrs. / week)	5	5 X 5	25	5 X 4	20		2,5
	Core Theory (6 hrs. / week)	5	5 X 6	30	5 X 4	20		3,4,6
	Core Lab (3 hrs. / week)	2	2 X 3	6	2 X 2	4		1
	Core Lab (4 hrs. / week)	1	1 X 4	4	1 X 3	3		2
	Core Lab (4 hrs. / week)	2	2 X 4	8	2 X 2	4		3,4
	Core Lab (5 hrs. / week)	3	3 X 5	15	3 X 3	9		5,6
	Allied (4 hrs. / week)	4	4 X 4	16	4 X 3	12		1,2,3,4
	Allied Lab (4 hrs. / week)	1	1 X 4	4	1 X 2	2		4
	Electives (5 hrs. / week)	2	2 X 5	10	2 X 3	6		5,6
	Project	1	1 X 6	6	1 X 4	4		6
	Internship (IT)	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 & Co-Curricular)	1	-	-	1 X 2	2	2	4
Total		**48**		**180**			**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	15	4	4	-	-	**30**	**25**
2	4	3	4	3	18	14	4	4	-	-	**30**	**24**
3	4	3	4	3	22	15	-	4	-	-	**30**	**25**
4	4	3	4	3	20	13	2	2	-	2	**30**	**23**
5	-	-	-	-	30	23	-	-	-	-	**30**	**23**
6	-	-	-	-	30	20	-	-	-	-	**30**	**20**
Total	**16**	**12**	**16**	**12**	**138**	**100**	**10**	**14**	**-**	**2**	**180**	**140**

Curriculum

B.Sc. Electronics and Communication Systems

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
24BEC13C	III	Core - I	Basic Electronics	4	3	25	75	100	4
24BEC14C	III	Core - II	Semiconductor Devices	4	3	25	75	100	4
24BEC15P	III	Core Lab - I	**Lab:** Basic Electronics	3	3	40	60	100	2
24BEC16P	III	Core Lab - II	**Lab:** Semiconductor Devices	3	3	40	60	100	2
24BEC17A	III	Allied - I	Mathematics – I	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**				**800**	**25**

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
24BEC23C	III	Core – III	Digital Principles and Applications	5	3	25	75	100	4
24BEC24C	III	Core – IV	Electronic Circuits	5	3	25	75	100	4
24BEC25P	III	Core Lab– III	**Lab:** Digital Electronics	4	3	40	60	100	3
24BEC26A	III	Allied – II	Mathematics - II	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**	**24**

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			Hindi – III						
24MAL31L			Malayalam – III						
24FRE31L			French – III						
24ENG32L	II	Language - II	English – III	4	3	25	75	100	3
24BEC33C	III	Core – V	Analog and Digital Communication	6	3	25	75	100	4
24BEC34C	III	Core - VI	IC's and Instrumentation	6	3	25	75	100	4
24BEC35P	III	Core Lab – IV	**Lab:** Electronic Communication Lab	4	3	40	60	100	2
24BEC36A	III	Allied - III	Programming in C	4	3	25	75	100	3
24BEC37P	III	SEC – I	Arduino Programming Essentials	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
24BEC43C	III	Core – VII	Microprocessor and Embedded Systems	6	3	25	75	100	4
24BEC44P	III	Core Lab – V	**Lab:**Microprocessor and Embedded Systems Lab	4	3	40	60	100	2
24BEC45A	III	Allied – IV	Python Programming	4	3	25	75	100	3
24BEC46P	III	Allied Lab – I	**Lab:**Python Programming Lab	4	3	40	60	100	2
24BEC47P	III	SEC – II	IC's and Instrumentation Lab	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	-	-	50	-	50	2
Total				**30**				**800**	**23**

Semester – 5									
Course Code	**Part**	**Course Category**	**Course Name**	**Hours/ Week**	**Examination**				**Credits**
					Duration in Hours	**Max Marks**			
						CIA	**ESE**	**Total**	
24BEC51C	III	Core – IX	Industrial and Power Electronics	5	3	25	75	100	4
24BEC52C	III	Core – X	Internet of Things and Applications	5	3	25	75	100	4
24BEC53C	III	Core – XI	Programmable Logic Control	5	3	25	75	100	4
24BEC54P	III	Core Lab – VI	**Lab:**Industrial and Power Electronics Lab	5	3	40	60	100	3
24BEC55P	III	Core Lab - VII	**Lab:** Internet of Things and Applications Lab	5	3	40	60	100	3
24BEC5AE/	III	Elective I	Satellite and Network Communication **(Communication Systems)**	5	3	25	75	100	3
24BEC5BE/			Automotive Electronics **(Embedded Systems)**						
24BEC5CE			Virtual Instrumentation **(Electronic Systems)**						
24BEC56I	III	SEC	**SEC :** Internship	-	-	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**	
24BEC61C	III	Core – XII	Robotics and Automation	6	3	25	75	100	4
24BEC62C	III	Core - XIII	Embedded IoT Applications with Cloud	6	3	25	75	100	4
24BEC63P	III	Core Lab - VIII	Embedded IoT Applications with Cloud Lab	5	3	40	60	100	3
24BEC6AE/	III	Elective II:	Mobile Computing **(Communication Systems)**	5	3	25	75	100	3
24BEC6BE/			Medical Electronics **(Embedded Systems)**						
24BEC6CE			VLSI Design **(Electronic Systems)**						
24BEC64P	III	SEC Lab - III	Raspberry Pi Essentials Lab	2	3	40	60	100	2
24BEC6PR	III	Core	Project Work	6	3	40	60	100	4
Total				**30**				**600**	**20**

Semester 1

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
24BEC13C	III	Core - I	Basic Electronics	4	3	25	75	100	4
24BEC14C	III	Core - II	Semiconductor Devices	4	3	25	75	100	4
24BEC15P	III	Core Lab - I	**Lab:** Basic Electronics	3	3	40	60	100	2
24BEC16P	III	Core Lab - II	**Lab:** Semiconductor Devices	3	3	40	60	100	2
24BEC17A	III	Allied - I	Mathematics – I	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**				**800**	**25**

Part – I : Language 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 விழுமியங்களை 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 டிதத்தைத் தமிழாக்கம் செய்தலுக்கான பயிற்சி பெறுதல்.	K2, K3
K1 - Remember; **K2** - Understand; **K3** – Apply		

Part – 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: 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 for College 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
24BEC13C	Basic Electronics	Core - I	4	4

Course Objectives

The course intends to cover

- Fundamentals of electronic components.
- Handling of common electronic components.
- Construction of electronic circuits to perform realistic tasks.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Recall the classification and characteristics of resistors and inductors.	K1
CLO2	Apply the knowledge to explain capacitor behavior and predict circuit effects.	K3
CLO3	Explore Kirchhoff's Current and Voltage Laws to analyze resistor behavior in series, parallel, and combined circuits.	K3, K4
CLO4	Summarize various network theorems for simplifying complex DC circuits and solving for voltages and currents.	K2
CLO5	Apply the understanding of sinusoidal waves (RMS and average values) to analyze AC circuits containing resistors, inductors, and capacitors in series, parallel, and combined configurations, and calculate real power.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

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

Core - I: Basic Electronics

Unit	Content	No. of Hours
I	**Resistors & Inductors:** Types of Resistors: Fixed, Variable - Brief mention of their Construction and Characteristics - Color Coding of Resistors - Connecting Resistors in Series and Parallel. Types of Inductors: Fixed, Variable-Self and Mutual Inductance-Faraday's Law and Lenz's Law of Electromagnetic Induction-Inductance in Series and Parallel - Testing of Resistance and Inductance using Multimeter.	12
II	**Capacitors**: Principles of Capacitance-Parallel Plate Capacitor-Permittivity-Definition of Dielectric Constant - Dielectric Strength-Energy Stored in a Capacitor-Types of Capacitors: Air, Paper, Mica, Teflon, Ceramic, Plastic and Electrolytic- Construction and Application- Connecting Capacitors in Series and Parallel.	12
III	**Electrical Elements and Circuits:** Potential Difference- Electric Current-Electromotive Force-Ohms Law- Kirchoff's Voltage Law- Kirchoff's Current Law-Analysis of Resistance in Series Circuits, Parallel Circuits and Series Parallel Circuits-Concept of Voltage Source and Current Source-Voltage Source in Series and Current Source in Parallel-Simple Problems in DC Circuits.	12
IV	**Network Theorems:** Superposition Theorem - Thevenin Theorem-Thevenizing a Circuit with Two Voltage Sources - Bridge Circuit - Norton's Theorem - Thevenin Norton Conversion - Conversion of Voltage and Current Sources-Millman's Theorem-Maximum Power Transfer Theorem - Simple Problems in DC Circuits.	12
V	**AC Circuits:** Introduction to Sinusoidal Wave - RMS Value - Average Value - AC Circuits with Resistance-Circuits with XL Alone–Circuits with XC Alone-Series Reactance and Resistance - Parallel Reactance and Resistance - Series Parallel Reactance and Resistance - Real Power.	12
	Total Hours	**60**

Text Books

1.	Sedha, R. S (2012) A Text Book of Applied Electronics. S. Chand & Company Ltd.
2.	Mehta, V. K., Rohit Mehta (2012) Principles of Electronics. S. Chand Publishing.
3.	Chakrabarti A (2008) Circuit Theory and Networks: Analysis and Synthesis. Hodder & Stoughton Publication.

Reference Books

1.	Bernard Grob (2009) Basic Electronics -Tata McGraw-Hill Publishing Company Limited.
2.	Theraja, B. L (2009) Basic Electronics-Solid State Devices, S. Chand Company Ltd.

Web Resources (Swayam / NPTEL)

1.	https://nptel.ac.in/courses/108/104/108104139/
2.	https://nptel.ac.in/courses/108/101/108101091/

Course Code	Course Name	Category	Hours/ Week	Credits
24BEC14C	Semiconductor Devices	Core - II	4	4

Course Objectives

The course intends to cover

- Operating principles, characteristics and applications of semiconductor devices such as diodes, bipolar junction transistors (BJTs) and field-effect transistors (FETs).
- Construction of electronic circuits incorporating semiconductor devices.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Define semiconductor material, energy band theory and diode.	K1
CLO2	Summarize various types of special-purpose diodes based on their characteristics and applications.	K2
CLO3	Apply the understanding of transistor construction and biasing to analyze the operation of Bipolar Junction Transistors (BJTs) and Field-Effect Transistors (FETs) in different configurations.	K3, K4
CLO4	Experiment the operation and applications of various thyristor devices based on their construction and electrical characteristics.	K3
CLO5	Apply the knowledge of optoelectronic devices to explain their operating principles and functions in various applications.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

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

Core - II: Semiconductor Devices

Unit	Content	No. of Hours
I	**Semiconductor Theory:** Introduction - Structure of Semiconductor Materials – Energy Band Theory – Types of Semiconductor: Intrinsic and Extrinsic Semiconductor – Formation of PN Junction diode and characteristics - Application: Clipping and clamping circuit.	12
II	**Special Diodes:** Zener Diode - VI Characteristics – Zener diode as a voltage regulator - Backward Diode – Varactor Diode - Step Recovery Diode - Point Contact Diode – Schottky Diode - Tunnel Diode - Gunn Diode - PIN Diode.	12
III	**Transistor and FET Operation:** Introduction – Transistor Construction and Operation – CB, CE & CC Configurations –Transistor Comparison - Transistor Biasing: Self bias- feedback bias and voltage divider bias- FET: N – Channel JFET Construction, Operation and Characteristics - FET as a Voltage Variable Resistor – MOSFET: Depletion Type MOSFET - Enhancement Type MOSFET.	12
IV	**Power Electronics:** Silicon Controlled Rectifier (SCR) – construction – SCR operation – VI characteristics of SCR – DIAC: construction – VI characteristics of DIAC. TRIAC: construction – VI characteristics of TRIAC – Applications of SCR, DIAC, TRIAC. Unijunction Transistor (UJT): construction – operation – VI characteristics of UJT – UJT Relaxation Oscillator.	12
V	**Optoelectronic Devices:** LDR – Photo Diode - Photo Transistor – Solar Cell – Photo Multiplexer – LED – LCD - Seven Segment Display - IR Emitter – Optocouplers.	12
	Total Hours	**60**

Text Books	
1.	Mehta, V. K., Rohit Mehta (2012) Principles of Electronics. S. Chand Publishing.
2.	Salivahanan. S, Suresh Kumar. N, Vallavaraj. A (2012) Electronic devices and circuits, TMH publishing company Ltd.
Reference Books	
1.	Sedha, R. S. (2012) A Text Book of Applied Electronics. S. Chand & Company Ltd.
2.	Robert L. Boylestad, Louis Nashelsky (2023) Electronic Devices and Circuit Theory, Pearson Prentice Hall.
Web Resources (Swayam / NPTEL)	
1.	https://onlinecourses.nptel.ac.in/noc24_ee02/preview
2.	https://onlinecourses.nptel.ac.in/noc24_ee27/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BEC15P	Lab : Basic Electronics Lab	Core Lab - I	3	2

Basic Electronics Lab (Any 10 Practicals)

1. Introduction to Basic Electronics Lab
2. Measurement of Amplitude, Frequency & Phase Difference using CRO
3. Resistance in Series, Parallel and Series –Parallel
4. Capacitance in Series, Parallel and Series –Parallel
5. Voltage Sources in Series, Parallel and Series –Parallel
6. Voltage and Current Dividers
7. Verification of Ohm's Law
8. Verification of Kirchoff's Voltage Law and Current Law
9. Verification of Norton's Theorem
10. Verification of Thevenin's Theorem
11. Verification of Millman's Theorem
12. Verification of Superposition Theorem
13. Verification of Maximum Power Transfer Theorem
14. Filter Circuits

Total Hours	**45**

Text Books

1.	Sedha, R. S. (2012) A Text Book of Applied Electronics. S. Chand & Company Ltd.
2.	Mehta, V. K., Rohit Mehta (2012) Principles of Electronics. S. Chand Publishing.
3.	Chakrabarti A (2008) Circuit Theory and Networks: Analysis and Synthesis. Hodder & Stoughton Publication.

Reference Books

1.	Bernard Grob (2009) Basic Electronics -Tata McGraw-Hill Publishing Company Limited.
2.	Theraja, B. L (2009) Basic Electronics-Solid State Devices, S. Chand Company Ltd.

Web Resources (Swayam / NPTEL)

1.	https://nptel.ac.in/courses/108/104/108104139/
2.	https://nptel.ac.in/courses/108/101/108101091/

Course Code	Course Name	Category	Hours / Week	Credits
24BEC16P	Semiconductor Devices Lab	Core Lab - II	3	2

Semiconductor Devices Lab (Any 10 Practicals)

1. Introduction to Semiconductor Devices Lab
2. V-I Characteristics of Junction Diode
3. Clipping Circuits
4. Clamping Circuits
5. V-I Characteristics of Zener Diode
6. Zener diode as a Voltage regulator
7. Transistor Characteristics of CE Configuration
8. Transistor Characteristics of CB Configuration
9. Stability Factor of Fixed Bias and Self bias
10. V-I Characteristics of JFET
11. V-I Characteristics of UJT
12. UJT as Relaxation Oscillator
13. Characteristics of LDR
14. Study of LED and 7 Segment display

Total Hours	**45**

Text Books

1.	Mehta V. K., Rohit Mehta (2012) Principles of Electronics. S. Chand Publishing.
2.	Salivahanan. S, Suresh Kumar. N, Vallavaraj. A (2012) Electronic devices and circuits, TMH publishing company Ltd.

Reference Books

1.	Sedha, R. S (2012) A Text Book of Applied Electronics. S. Chand & Company Ltd.
2.	Robert L. Boylestad, Louis Nashelsky (2023) Electronic Devices and Circuit Theory, Pearson Prentice Hall.

Web Resources (Swayam / NPTEL)

1.	https://onlinecourses.nptel.ac.in/noc24_ee02/preview
2.	https://onlinecourses.nptel.ac.in/noc24_ee27/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BEC17A	Mathematics - I	Allied - I	4	3

Course Objectives

The course intends to cover

- The fundamental concepts of Mathematics by exploration.
- The Mathematical ideas in Electronic circuits by acquainting knowledge.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Remember the concepts of Matrix and its types.	K1
CLO2	Distinguish Gradient, Solenoidal, Curl.	K2
CLO3	Relate Laplace transforms in circuit problems.	K3
CLO4	Analyse Fourier Series in real time problems.	K4
CLO5	Correlate the ideas learnt in the complex numbers.	K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze		

CLO – PLO Mapping

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

Allied - I: Mathematics – I

Unit	Content	No. of Hours
I	**Matrices:** Different types of matrices- Inverse of matrix- solution of simultaneous equation of matrix method- properties of unitary and orthogonal matrices - Characteristics equation and Characteristics roots.	12
II	**Vector Calculus:** Concepts of vector and scalar fields-the Del operator-Divergence of a vector-curl of a vector- Laplacian operator-Gauss's theorem, Green theorem, Stoke's theorem.	12
III	**Laplace Transforms:** Definition of Laplace transform-properties of Laplace Transform, Inverse Laplace transform - Convolution theorem.	12
IV	**Fourier Series:** General Fourier series - change of length of Interval - Fourier cosine and sine series- Half range Series - Fourier series in complex form.	12
V	**Fourier Transforms:** Definition of Fourier Transform- Properties of Fourier Transform- Inverse Fourier Transform - Convolution Theorem.	12
	Total Hours	**60**
Text Books		
1.	Dr.G. Balaji (2021). Matrices and Calculus, Balaji Publishers. Unit I: Chapter 1: Section: 1.1 – 1.146	
2.	Dr. M.K. Venkatraman.(2012). Engineering Mathematics, Vol II. Unit II: Chapter 2: Section: 1.1 – 1.12 Chapter 2 Section: 3.1-3.7, 3.9 Chapter:2 Section: 4.3, 4.9, 4.13	
3.	Dr. Venkatraman. M.K..(2000) Engineering Mathematics, III A. Unit III: Chapter 1: Section: 1 - 23	
4.	Dr.Balaji.G, (2021). Transforms and Partial Differential Equations, Balaji Publishers. Unit IV: Chapter 2: Section: 2.1 – 2.185 Unit V: Chapter 4: Section: 4.1 – 1.139	
Reference Books		
1.	Dr.G. Balaji (2019). Vector Calculus, Balaji Publishers, 2019.	
2.	Dr.M.K.Venkatraman (2010). Higher Mathematics for Engineering & Science.	
Web Resources (Swayam / NPTEL)		
1.	https://archive.nptel.ac.in/courses/111/105/111105122/	
2.	https://archive.nptel.ac.in/courses/111/101/111101164/	

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 Course

(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		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

Part – IV : Ability Enhancement Compulsory Course

(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 - 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 - HCF and 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 particularday - 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
24BEC23C	III	Core – III	Digital Principles and Applications	5	3	25	75	100	4
24BEC24C	III	Core – IV	Electronic Circuits	5	3	25	75	100	4
24BEC25P	III	Core Lab– III	**Lab:** Digital Electronics	4	3	40	60	100	3
24BEC26A	III	Allied – II	Mathematics – II	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**	**24**

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: 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
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 : 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: 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
24BEC23C	Digital Principles and Applications	Core - III	5	4

Course Objectives

The course intends to cover

- Fundamental principles of digital electronics, including binary numbers, boolean algebra,logic gates and truth tables.
- Implementation of boolean functions using logic gates and create complex logic circuits such as adders, multiplexers and decoders.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify the different number systems used in digital electronics and basic conversion methods.	K1
CLO2	Classify the basic building blocks of digital logic and their symbolic representations.	K2
CLO3	Apply the understanding of binary arithmetic and digital circuits to perform addition, subtraction, and data manipulation using various combinational logic circuits.	K3
CLO4	Analyze and construct sequential circuits using various flip-flops and apply them to construct counters and registers for digital systems.	K3, K4
CLO5	Illustrate the functionalities of various analog-to-digital converter (ADC) architectures and identify the key factors to consider when selecting an ADC for a specific application.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

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

Core - III: Digital Principles and Applications

Unit	Content	No. of Hours
I	**Number Systems and Codes: Introduction -** Digital Vs Analog- Number Systems: Binary, Octal, Decimal and Hexa Decimal Numbers – Conversion – Binary Coded Decimal (BCD) – Excess Three – Grey Code – ASCII Codes.	15
II	**Logic Gates and Boolean Algebra:** AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR gates – Boolean Algebra – Commutative, Associative and Distributive Laws – Duality Theorem – De-Morgans Theorem – Sum of Products and Products of Sums – Karnaugh map.	15
III	**Combinational Logic Circuits:** Binary Addition, Subtraction– Addition of 1's and 2's Complements - Half Adder – Full Adder – Half Subtractor – Full Subtractor – 4-bit Binary Adder / Subtractor – BCD adder – Multiplexer – Demultiplexer – Decoders – Encoders – Magnitude Comparators.	15
IV	**Sequential Logic Circuits:** Flip Flops – RS, Clocked RS, JK, JK Master Slave, D and T Flip Flops – Shift Registers–Ring Counters–Synchronous Counter–Asynchronous Counter - Up Down counter – Mod-3, Mod-5 Counters – Decade Counter.	15
V	**Digital to Analog Converters:** Resistive Divider Type - Ladder Type – Analog to Digital Converters: Counter – Ramp Type – simultaneous Conversion – Dual Slope Type – Successive Approximation Type – Accuracy and Resolution.	15
	Total Hours	**75**
Text Books		
1.	Morris Mano (2022) Computer System Architecture, Pearson Education.	
2.	Albert Paul Malvino and Donald P. Leech (2019) Digital Principles and Applications, McGraw Hill Company.	
Reference Books		
1.	Puri V K (2017) Digital Electronics: Circuits and Systems, McGraw Hill Education.	
2.	Salivahanan S (2012) Digital Circuits and Design, McGraw Hill Education.	
Web Resources (Swayam / NPTEL)		
1.	https://nptel.ac.in/courses/108105132	
2.	https://onlinecourses.swayam2.ac.in/cec24_cs09/preview	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC24C	Electronic Circuits	Core - IV	5	4

Course Objectives

The course intends to cover

- Construction of analog electronic circuits, including amplifiers, filters, oscillators, and power supplies.
- Fundamentals of different transistor amplifier configurations and their characteristics.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify the different types of rectifiers and basic filter circuits used in DC power supplies, along with their key functions.	K1
CLO2	Compare and contrast the characteristics of different single-stage transistor amplifier configurations (CE, CB, CC).	K2
CLO3	Apply the understanding of amplifier class operation (A, B, AB, C) to analyze their efficiency, distortion characteristics, and suitability for different power amplifier applications.	K3, K4
CLO4	Explain the effects of negative feedback on amplifier performance, including gain, bandwidth, distortion and noise.	K3
CLO5	Illustrate the understanding of oscillator design principles and analyze the functionalities of various oscillator circuits and multivibrator circuits.	K3, K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

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

Core - IV: Electronic Circuits

Unit	Content	No. of Hours
I	**Rectifiers and Regulators:** Half-wave, Full-wave and Bridge Rectifiers – Calculation of RMS Value – Average Value - Ripple Factor – Efficiency – Transformer Utility Factor – Peak Inverse Voltage - Inductor Filter, Capacitor Filter, LC Filter and Pi Filter – Voltage Doubler – Voltage Regulator – Zener Diode Shunt Regulator – Transistor Shunt and Series Regulator – Overload Protection - Construction of DC Power Supply.	15
II	**Small Signal Amplifiers:** CE, CB, CC Amplifiers – Calculation of I/P Resistance, O/P Resistance – Current Gain – Voltage Gain – Power Gain - Single Stage Transistor Amplifier – DC and AC Load Line - RC Coupled Amplifier – Gain Frequency Response – Bandwidth - Transformer Coupled Amplifier – Impedance Matching - FET Amplifier.	15
III	**Power Amplifiers:** Operation and Graphical Representation of Class A, Class B, Class C and Class AB Amplifiers – Maximum Collector Efficiency of Class A Power Amplifier – Collector Dissipation Curve – Harmonic Distortion – Class B Push Pull Amplifier – Crossover Distortion - Complementary Symmetry Push Pull Amplifier.	15
IV	**Feedback Amplifiers:** Basic concepts of Feedback – Positive feedback – Negative feedback – Effects of Negative feedback on Gain – Bandwidth – Distortion – Noise. Voltage Series Feedback – Voltage Shunt Feedback – Current Series Feedback – Current Shunt Feedback.	15
V	**Oscillators and Multivibrators:** Barkhausen Criterion – Hartley oscillator – Colpitt's Oscillator– Phase Shift Oscillator – Wien Bridge Oscillator – Piezo Electric Crystal and its Effects - Crystal Oscillator. Multivibrators: Astable Multivibrator – Monostable Multivibrator – Bistable Multivibrator – Schmitt Trigger.	15
	Total Hours	**75**
Text Books		
1.	Mehta, V. K., Rohit Mehta (2012) Principles of Electronics. S. Chand Publishing.	
2.	Salivahanan. S, Suresh Kumar. N, Vallavaraj. A (2012) Electronic devices and circuits, TMH publishing company Ltd.	
Reference Books		
1.	Theraja, B. L (2009) Basic Electronics-Solid State Devices, S. Chand Company Ltd.	
Web Resources (Swayam / NPTEL)		
1.	https://onlinecourses.nptel.ac.in/noc24_ee12/preview	
2.	https://onlinecourses.swayam2.ac.in/nou24_ec04/preview	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC25P	Digital Electronics Lab	Core Lab - III	3	2

Digital Electronics Lab (Any 10 Practicals)

1. Introduction to Digital Electronics Lab
2. Verification of Basic Gates and Realize Basic gates from universal gates
3. Verification of Demorgan's Theorem
4. 2-bit Comparator using Gates
5. Half Adder and Full Adder
6. Half Subtractor and Full Subtractor
7. 4-bit Binary Adder
8. Multiplexer and Demultiplexers
9. Encoder and Decoder
10. Study of Flip flops
11. Binary to Gray and Gray to Binary Conversion
12. Shift Registers and Ring Counter
13. Analog to Digital Converter
14. Digital to Analog Converter

Total Hours	**45**

Text Books

1.	Morris Mano (2022) Computer System Architecture, Pearson Education.
2.	Albert Paul Malvino and Donald P. Leech. (2019) Digital Principles and Applications, McGraw Hill Company.

Reference Books

1.	Puri V K (2017) Digital Electronics: Circuits and Systems, McGraw Hill Education.
2	Salivahanan S (2012) Digital Circuits and Design, McGraw Hill Education.

Web Resources (Swayam/NPTEL)

1.	https://nptel.ac.in/courses/108105132
2.	https://onlinecourses.swayam2.ac.in/cec24_cs09/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BEC26A	Mathematics - II	Allied - II	4	3

Course Objectives

The course intends to cover

- The fundamental concepts of Mathematics by exploration.
- The Mathematical ideas in Electronic circuits by acquainting knowledge.
- Z transforms which is applied in discrete time signals.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand and apply solving equations in electronic circuits.	K2, K4
CLO2	Demonstrate the process of numerical integration.	K3
CLO3	Apply Z- transforms in solving problems for discrete time signals.	K3
CLO4	Explain about Beta and Gamma functions.	K4
CLO5	Illustrate the ideas learnt in the complex numbers.	K4
K2 - Understand; **K3** - Apply; **K4** - Analyze		

CLO – PLO Mapping

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

Allied - II: Mathematics – II

Unit	Content	No. of Hours
I	**Differential Equations:** Second order linear differential equation with constant coefficients- Laplace Equations - Application to electronic circuits RL, RC, RLC.	12
II	**Numerical Methods:** Solving simultaneous equation process—Gauss Jorden method-Numerical Integration - Trapezoidal Rule- Simpson's Rule.	12
III	**Z- Transforms:** Elementary properties - Inverse Z - transform (using partial fraction and residues) - Convolution theorem - Formation of difference equations - Solution of difference equations Using Z - transform.	12
IV	**Special Functions:** Beta and Gamma Functions- Definitions- Relationship between Beta and Gamma Functions - (only statements) - Properties of Gamma and Beta Functions.	12
V	**Complex Numbers:** Definition of Complex numbers- Argand Diagram- Rectangular form- polar form- Conversion of rectangular form to polar and vice versa- addition, Subtraction- Multiplication and Division by using polar and rectangular forms-Demoivre's Theorem.	12
	Total Hours	**60**
Text Books		
1.	Dr.M.K. Venkatraman (2012), Engineering Mathematics, Vol II. Unit I: Chapter 24: Section: 24.1 – 24.22 Unit IV: Chapter 21: Section: 21.1 – 21.11	
2.	M.K.Dr. Venkatraman, Numerical Methods In Science and Engineering Unit II: Chapter 4: Section: 1 – 6	
3.	Dr. G. Balaji., (2021). Transforms and Partial Differential Equations, Balaji Publishers. Unit III: Chapter 2: Section: 2.1 – 2.185	
4.	S. Narayanan, T.K. Manicavachagam Pillay, Trigonometry Unit V: Chapter 2: Section: 1-4.	
Reference Book		
1.	A.V. Oppenheim and Schafer,(1989), Discrete Time Signal Processing, Prentice Hall	
Web Resources (Swayam / NPTEL)		
1.	https://archive.nptel.ac.in/courses/111/105/111105122/	
2.	https://archive.nptel.ac.in/courses/111/101/111101164/	

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	
	Total Hours	**30**

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

Part – IV : Ability Enhancement Compulsory Course

(All the Undergraduate Programmes)

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

Semester 3

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			Hindi – III						
24MAL31L			Malayalam – III						
24FRE31L			French – III						
24ENG32L	II	Language - II	English – III	4	3	25	75	100	3
24BEC33C	III	Core – V	Analog and Digital Communication	6	3	25	75	100	4
24BEC34C	III	Core - VI	IC's and Instrumentation	6	3	25	75	100	4
24BEC35P	III	Core Lab - IV	**Lab:** Electronic Communication	4	3	40	60	100	2
24BEC36A	III	Allied - III	Programming in C	4	3	25	75	100	3
24BEC37P	III	SEC – I	Arduino Programming Essentials	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**

Part –I : Tamil –III

(All the Undergraduate Programmes)

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

Course Objectives

- 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: 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

Reference Books	
8	ஸ்ரீனிவாசன்.வி, (2009), திருக்குறளில் மேலாண்மை, விகடன் பிரசுரம்
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** (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
- 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
K1 – Remember; **K2**-Understand; **K3**- Apply; **K4**-Analyse		

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 Objective

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
K1 – Remember; **K2**-Understand; **K3**- Apply; **K4 -** Analyse		

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: 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** **P**articipating 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
24BEC33C	Analog and Digital Communication	Core - V	6	4

Course Objectives

The course intends to cover

- The fundamental concepts of wave propagation, analog communication systems, and their applications, focusing on the effects of environmental factors and different modulation techniques such as AM, FM, and PM.
- The principles and advancements in digital communication, including data transmission methods, digital modulation techniques, pulse modulation, and quantization processes, emphasizing system design and performance analysis.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Define the effects of environmental factors such as reflection, refraction, interference, diffraction, absorption, and attenuation on wave propagation.	K1
CLO2	Explain the principles of amplitude, frequency, and phase modulation, and describe the functioning of AM and FM receivers.	K2
CLO3	Apply the principles of digital communication to design basic communication systems, including the use of encoders, decoders, modulators, demodulators, and repeaters.	K3
CLO4	Demonstrate the implementation of digital modulation techniques such as ASK, FSK, PSK, and their variants.	K3
CLO5	Apply pulse modulation techniques such as PAM, PWM, and PPM, and analyze the operation and applications of PCM, Delta Modulation, and Adaptive Delta Modulation systems.	K3, K4
K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

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

Core - V: Analog and Digital Communication

Unit	Content	No. of Hours
I	**Propagation of Waves:** Effects of environments such as reflection, refraction, interference, diffraction, absorption and attenuation (Definition only) - Propagation of waves - Ground waves - space waves – Tropospheric wave - Tropospheric scatter - Sky wave propagation - The Ionospheric Layer – Special Ionospheric Phenomena: Spread Echoes, Scattering, Fading, Echoes, Cosmic and Solar noise.	18
II	**Analog Communication Systems:** Modulation - Types of modulation – AM – FM – PM - Amplitude modulation - Modulation factor - Analysis of amplitude modulated wave - Sideband frequencies in AM wave -Transistor AM modulator - Power in AM wave - Frequency modulation - Theory of frequency modulation - Demodulation - Essentials in demodulation - AM diode detector - AM radio receivers -Types of AM radio receivers - Stages of superhetrodyne radio receiver - Advantages of superhetrodyne circuit - FM receiver - Difference between FM and AM receivers.	18
III	**Digital Communication Systems:** Representation of Data Signal – Serial and Parallel Data Transmission - Model of Digital Communication System – Elements of Digital Communication System: Information Source, Source Encoder / Decoder, Communication Channel, Modulator, Demodulator, Channel Encoder / Decoder, Other Functional Blocks – Analysis of Communication System – Design of Communication System – Repeaters.	18
IV	**Pulse Modulation and Quantization:** Electrical Representation of Binary Digits - Pulse Amplitude Modulation – Pulse Width Modulation – Pulse Position Modulation – Quantization of Signals – Quantization Error – Pulse Code Modulation – Companding – Advantages and Applications of PCM - Differential PCM – Delta Modulation – Adaptive Delta Modulation – Comparison of PCM and DM systems.	18
V	**Digital Data Communication:** Amplitude Shift Keying – Power Spectral Density for ASK – Amplitude Shift Keying Modulator – Coherent Amplitude Shift Keying (ASK) Detector – Non coherent ASK Detector – Frequency Shift Keying – Bandwidth and Spectrum Frequency of FSK – Demodulation of Binary FSK Wave – Detection of FSK using PLL – Phase Shift Keying – Generation of Binary PSK Waves – Detection of Binary PSK Waves – Differential Phase Shift Keying – Quadrature Phase Shift Keying.	18
	Total Hours	**90**
Text Books		
1.	Sam K. Shanmugam (2017), Digital and Analog Communication Systems,Wiley Publications.	
2.	George Kennedy, Bernard Davis (2018), Electronic Communication Systems. Tata McGraw-Hill Publishing Company Limited.	
Reference Books		
1.	Anokh Singh, Chhabra, A.K., (2013), Principles of Communication Engineering, S. Chand Publishing.	
2.	Mehta, V. K., Rohit Mehta (2015), Principles of Electronics. S. Chand Publishing.	
Web Resources (Swayam / NPTEL)		
1.	https://onlinecourses.nptel.ac.in/noc26_ee03/preview	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC34C	IC's and Instrumentation	Core – VI	6	4

Course Objectives

The course intends to cover

- Fundamentals and working of operational amplifiers.
- Principles and types of waveform generators.
- The internal structure and applications of timer ICs.
- The concepts and types of transducers.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Learn the various IC fabrication techniques.	K2
CLO2	Acquire the knowledge of basic application using op-amp	K3
CLO3	Analyze and design various operational amplifier applications including summing amplifiers, subtractors, instrumentation amplifiers, waveform generators, and signal converters.	K4
CLO4	Understand the working of Timer and PLL	K2
CLO5	Understand the principle of various types of transducers	K2
K2 - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

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

Core - VI: IC's and Instrumentation

Unit	Content	No. of Hours
I	**Integrated Circuits Fabrication:** Fundamentals of Monolithic IC Technology – Basic Planar Processes: Silicon Wafer Preparation – Epitaxial Growth – Oxidation – Photolithography – Diffusion of Impurities – Ion Implantation - Isolation Techniques – Metallization - Assembly Processing and Packaging – Monolithic Transistor – Integrated Resistors – Fabrication of FET, MOSFET and CMOS	18
II	**Operational Amplifier and Characteristics:** Basic information of Op-Amp - Ideal Characteristics of Op-Amp - Inverting Amplifier and Non-Inverting Amplifier - Voltage Follower – Differential Amplifier - Common Mode Rejection Ratio – **DC Characteristics:** Input Bias Current - Input Offset Current – Input Offset Voltage – Thermal Drift – **AC Characteristics:** Frequency Response – Slew Rate	18
III	**Operational Amplifier Applications:** Summing Amplifier – Inverting summing amplifier and Non Inverting Summing Amplifier – Adder - Subtractor – Instrumentation Amplifier - Voltage to Current Converter – Current to Voltage Converter – Precision half Wave Rectifiers – Precision Full Wave Rectifiers - Differentiator - Integrator - **Comparator and Waveform Generators:** Op-amp as Comparator – Zero Crossing Detector – Time Marker Generator – Regenerative Comparator – Astable Multivibrator – Monostable Multivibrator – Triangular Wave Generator	18
IV	**Timer:** Functional Block Diagram of 555 timer – Monostable Operation– Applications: Missing Pulse Detector – Linear Ramp Generator –Frequency Divider - Pulse Width Modulation – Astable Operation – Applications: FSK Generator - Schmitt Trigger – **Phase Locked Loop:** Functional Block Diagram – Phase Detector / Comparator –Voltage Controlled Oscillator – Low Pass Filter – Applications: Frequency Multiplier / Division – AM Detection	18
V	**Transducers:** Introduction – Electrical Transducer – Basic Requirements of Transducer – Classification of Transducers – Selection of Transducers – Resistive Transducers – Potentiometers – Thermistors – Thermocouple – LVDT – RVDT – Piezoelectric Transducers – Hall Effect Transducers – Photoelectric Transducers – Digital Displacement Transducers.	18
	Total Hours	**90**

Text Books

1.	Roy Choudhury.D, Shail B. Jain, (2017) Linear Integrated Circuits, New Age International Publishers, Sixth Edition.
2.	A.K.Sawhney, (2016) A course in Electrical and Electronic Measurements and Instrumentationts, Dhanpat Rai & Co. Publishers, 18th Edition.

Reference Books

1.	Sudhakar.A, (2012) Linear and Digital Integrated Circuits Design, Laxmi Publications; First Edition, ISBN 9789380386515.
2.	Ramakant A Gayakwad, (2004) Op-Amps and Linear Integrated Circuits, PHI, 4th edition.

Web Resources (Swayam / NPTEL)

1.	https://nptel.ac.in/courses/108/108/108108111/

Course Code	Course Name	Category	Hours / Week	Credits
24BEC35P	Electronic Communication Lab	Core Lab - IV	4	2

Electronic Communication Lab (Any 10 Practical's)

1. Introduction to Electronic Communication Lab
2. AM Generation and Detection
3. FM Generation and Detection
4. Signal Sampling and Reconstruction
5. PAM Generation and Detection
6. PWM & PPM Generation and Detection
7. Generation and Detection of PCM
8. Amplitude Shift Keying
9. Frequency Shift Keying
10. Phase Shift Keying
11. Differential Phase Shift Keying
12. Quadrature Phase Shift Keying
13. Generation of Delta Modulation
14. Generation of Adaptive Delta Modulation

Total Hours	**60**

Text Books

1.	George Kennedy, Bernard Davis, Prasanna. S. R. M (2018) Electronic Communication Systems. McGraw-Hill Publishing.
2.	John Proakis, G, Masoud Salehi (2018) Digital Communications. McGraw-Hill Publishing.
3.	Sam Shanmugam, K. (2017) Digital and Analog Communication Systems. Wiley Publications.

Reference Books

1.	Andreas Molosch, F (2013) Wireless Communications, Wiley-India Edition Ltd.
2.	Kennedy. Davis (2018) Electronic Communication Systems -Tata McGraw-Hill Publishing Company Limited.

Web Resources (Swayam / NPTEL)

1.	https://archive.nptel.ac.in/courses/117/105/117105144/

Course Code	Course Name	Category	Hours / Week	Credits
24BEC36A	Programming in C	Allied - III	4	3

Course Objectives

The course intends to cover

- Imparting knowledge about Computer fundamentals
- Understanding the concepts and techniques in C Programming
- Indulging them in problem solving using C.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Learn about the Computer fundamentals and the Problem solving.	K2
CLO2	Understand the basic concepts of C programming.	K2
CLO3	Describe the reason why different decision making and loop constructs are available for iteration in C.	K3
CLO4	Demonstrate the concept of User defined functions, Recursions, Scope and Lifetime of Variables, Structures and Unions.	K4
CLO5	Develop C programs using pointers Arrays and file management.	K3
K2 - Understand; **K3** - Apply; **K4** – Analyze		

CLO – PLO Mapping

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

Allied - III: Programming in C

Unit	Content	No. of Hours
I	**Fundamentals of Computers:** Introduction – History of Computers-Generations of Computers- Classification of Computers-Basic Anatomy of a Computer System-Input Devices-Processor- Output Devices-Memory Management – Types of Software- Overview of Operating System- Programming Languages-Translator Programs-Problem Solving Techniques - Overview of C.	12
II	**Overview of C**: Introduction - Character set - C tokens - keyword & Identifiers - Constants - Variables - Data types - Declaration of variables - Assigning values to variables - Defining Symbolic Constants - Arithmetic, Relational, Logical, Assignment, Conditional, Bitwise, Special, Increment and Decrement operators - Arithmetic Expressions - Evaluation of expression - precedence of arithmetic operators - Type conversion.	12
III	**Decision Making and Branching:** Introduction – if, if…. else, nesting of if …else statements- else if ladder – The switch statement, The?: Operator – The goto Statement. **Decision Making and Looping:** Introduction- The while statement- the do statement – the for statement-jumps in loops. Arrays – Character Arrays and Strings.	12
IV	**User-Defined Functions:** Introduction – Need and Elements of User-Defined Functions- Definition-Return Values and their types - Function Calls – Declarations – Category of Functions- Nesting of Functions – Recursion.	12
V	**Pointers:** Introduction-Understanding pointers -Accessing the address of a variable Declaration and Initialization of pointer Variable – Accessing a variable through its pointer Chain of pointers- Pointer Expressions – Pointer Increments and Scale factor. Pointers and Arrays. Basics of file management.	12
	Total Hours	**60**
Text Books		
1.	Balagurusamy, E (2023) Computing Fundamentals & C Programming. S. Tata McGraw-Hill Publishing Company Limited.	
2.	Rajaraman, V (2009) Computer Programming in C.Prentice Hall of India Private Limited.	
Reference Books		
1.	Ashok N Kamthane (2023) Programming in C-Pearson India Education Services Private Limited.	
2.	Mullish Cooper (2004) The Sprit of C- Jaico Publishing House.	
3.	Uma Maheswari, P (2007) Fundamentals of Programming in C- Umayam Publications.	
Web Resources (Swayam / NPTEL)		
1.	https://nptel.ac.in/courses/106105171	
2.	https://nptel.ac.in/courses/106104128	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC37P	Arduino Programming Essentials	SEC - I	2	2

Arduino Programming Essentials Lab

1. Write an Arduino program to calculate the sum, average, and standard deviation of a given set of numbers and display the results on the Serial Monitor.
2. Write an Arduino program to generate and display the first 'n' prime numbers on the Serial Monitor.
3. Write an Arduino program to generate and display the Fibonacci series up to 'n' terms on the Serial Monitor.
4. Write an Arduino program to print a magic square of order 'n' (where n > 3 and n is odd) on the Serial Monitor.
5. Write an Arduino program to read temperature data from a DHT11 sensor and plot real-time temperature variations using the Serial Plotter.
6. Write an Arduino program to measure distance using an Ultrasonic sensor (HC-SR04) and display distance readings on the Serial Monitor.
7. Write an Arduino program to read light intensity using an LDR sensor and display the light level values on the Serial Monitor.
8. Write an Arduino program to read soil moisture sensor data and display the moisture percentage on the Serial Monitor.
9. Write an Arduino program to read heart rate data from a Pulse Sensor and display BPM on Serial Monitor
10. Write an Arduino program to detect motion using PIR Sensor and display motion alert on Serial Monitor

Total Hours	**30**

Text Books

1.	Massimo Banzi, Michael Shiloh., (2014) Getting Started with Arduino, Maker Media Publications.
2.	Jeremy Blum., (2019) Exploring Arduino: Tools and Techniques for Engineering Wizardry, Wiley Publications.

Reference Books

1.	Michael Margolis, (2011) Arduino Cookbook, O'Reilly Media.
2.	Jonathan Oxer, Hugh Blemings., (2010) Practical Arduino: Cool Projects for Open Source Hardware, Apress Publications.

Web Resources (Swayam/NPTEL)

1.	https://onlinecourses.swayam2.ac.in/aic20_sp04/preview

Indian Knowledge Systems (IKS)

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

Unit	Content
1	**Indian Knowledge Systems (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** - 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 in 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.
7	**Traditional Water Management Systems of India** - Introduction - Traditional Water Management Systems - Northern Region - North Western Region - North Eastern Region - Central Indian Region - Southern Indian Region.

Unit	Content
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						
100	CIA	ESE	CIA		Model		Attendance	Active Engagement	Total
			Actual	Weightage	Actual	Weightage			
	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 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 Systems(IKS)-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
24BEC43C	III	Core – VII	Microprocessor and Embedded Systems	6	3	25	75	100	4
24BEC44P	III	Core Lab – V	**Lab:** Microprocessor and Embedded Systems Lab	4	3	40	60	100	2
24BEC45A	III	Allied – IV	Python Programming	4	3	25	75	100	3
24BEC46P	III	Allied Lab – I	**Lab:** Python Programming Lab	4	3	40	60	100	2
24BEC47P	III	SEC – II	**Lab :** IC's and Instrumentation Lab	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**	**23**

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
24BEC43C	Microprocessor and Embedded Systems	Core – VII	6	4

Course Objectives

The course intends to

- Understand the basics of Microprocessor and Microcontroller.
- Learn programming skills using the 8085 Microprocessors.
- Understand how peripherals are connected and used with the 8085.
- Study the architecture and programming of the 8051 Microcontrollers.
- Apply the 8051 Microcontrollers in simple embedded system projects.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Define the 8085 Microprocessor architecture, its instruction set and arithmetic programs.	K1
CLO2	Understand the interfacing concepts of the 8085 Microprocessor with various peripheral devices.	K2
CLO3	Apply the architecture, instruction set and addressing modes of the 8051 Microcontroller.	K2
CLO4	Develop embedded C programs for the 8051 Microcontroller.	K3
CLO5	Design and implement interfacing concepts in real-world embedded applications.	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	1	1	2	1
CLO3	3	2	1	1	1
CLO4	2	1	2	3	1
CLO5	1	3	2	1	3
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - VII: Microprocessor and Embedded Systems

Unit	Content	No. of Hours
I	**Introduction to 8085 Microprocessor:** Introduction – Block diagram, Pin Diagram - Architecture - Bus Structure. **Instruction Set and Addressing Modes:** Instruction Set – Addressing Modes – Instruction Format and Word Size – Simple Programs (8/16 bit addition, subtraction and 8 bit multiplication and division)	18
II	**Interfacing Concepts:** Peripheral I/O Instructions – Device Selection and Data Transfer – Interfacing I/O's using decoders, Interfacing Output Displays - LED and 7-Segment. **Parallel and Serial Interface:** Introduction to Programmable Peripheral Interface 8255 – Pin Diagram – Architecture. **Modes of Operation**: I/O and BSR.	18
III	**Overview and Instruction Set of 8051 Microcontroller:** Microcontrollers and Embedded Processors – Microcontrollers for Embedded systems – Overview of 8051 families – 8051 Instruction set and registers. **Assembly Programming & Addressing Modes:** Introduction to 8051 assembly programming – The program counter and ROM – Data types and directives – flag bits and PSW register – Register Banks and Stack — I/O Port Programming – addressing modes – Arithmetic programs.	18
IV	**8051 Programming in C:** Programming with C: Data types – time delay programming – I/O programming – logic operations in C. **8051 Peripherals (Timer, Serial Communication and Interrupt):** Basic registers of timer – counter programming – Programming Timer 0 and 1 in C – Basics of serial communication – 8051 connections to RS 232 – Serial Port Programming in C – 8051 interrupts – programming external hardware interrupts - Interrupt Programming in C.	18
V	**8051 Interfacing:** Interfacing ADC / DAC Interfacing with 8051 - Interfacing sensor with 8051 - Interfacing LCD to the 8051 – Interfacing Stepper motor – 8051 interfacing to the keyboard. **Real World Applications:** Water level controller - Traffic Light Controller – Smart Irrigation Systems.	18
	Total Hours	**90**

Text Books

1.	R.S.Gaonkar (2013), Microprocessor Architecture, Program and Its Application With 8085, New Age International (P) Ltd, 5th Edition.
2.	Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay (2015), The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson Education Publication, 2nd Edition.

Reference Books

1.	Aditya P Mathur (2002), Introduction to Microprocessors, Tata Mcgraw - Hill Publication, 3rd Edition.
2.	R.S.Kaler (2011), A Textbook of Microprocessors and Microcontrollers, I.K. International Publishing House Pvt. Ltd.

Web Resources (Swayam / NPTEL)

1.	https://onlinecourses.nptel.ac.in/noc24_ee46/preview
2.	https://onlinecourses.swayam2.ac.in/ntr25_ed92/preview?

Course Code	Course Name	Category	Hours / Week	Credits
24BEC44P	Lab: Microprocessor and Embedded Systems Lab	Core Lab – V	4	2

Microprocessor and Embedded Systems Lab (Any 10 Practical's)

1. Introduction to Microprocessor and Embedded Systems Lab
2. Addition and Subtraction of 8 bit Data using 8085 Microprocessor.
3. Multiplication and Division of 8 bit Data using 8085 Microprocessor.
4. Block of data transfer using 8085 Microprocessor.
5. Smallest and Largest of N-8 bit numbers using 8085 Microprocessor.
6. Sum of N-8 bit numbers using 8085 Microprocessor.
7. Encryption and Decryption of N-8 bit data using 8085 Microprocessor.
8. 1's and 2's complement of an Array using 8085 Microprocessor.
9. LED Interfacing with 8051 Microcontroller.
10. 7-Segment Display Interfacing with 8051 Microcontroller.
11. ADC Interfacing with 8051 Microcontroller.
12. DAC Interfacing with 8051 Microcontroller.
13. Keyboard Interfacing with 8051 Microcontroller.
14. DC Motor interfacing with 8051 Microcontroller.
15. Relay Interfacing with 8051 Microcontroller.

Total Hours	**60**

Text Books

1.	R.S.Gaonkar (2013), Microprocessor Architecture, Program and Its Application With 8085, New Age International (P) Ltd, 5th Edition.
2.	Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinlay (2015), The 8051 Microcontroller and Embedded Systems Using Assembly and C, Pearson Education Publication, 2nd Edition.

Reference Books

1.	Aditya P Mathur (2002), Introduction to Microprocessors, Tata Mcgraw - Hill Publication, 3rd Edition.
2.	R.S.Kaler (2011), A Textbook of Microprocessors and Microcontrollers, I.K. International Publishing House Pvt. Ltd.

Web Resources (Swayam / NPTEL)

1.	https://onlinecourses.nptel.ac.in/noc24_ee46/preview
2.	https://onlinecourses.swayam2.ac.in/ntr25_ed92/preview?

Course Code	Course Name	Category	Hours / Week	Credits
24BEC45A	Python Programming	Allied - IV	4	3

Course Objectives

The course intends to

- Introduce the fundamental concepts of Python Programming.
- Instruct the basics of Functions in Python.
- Impart the knowledge of Lists, Tuples, Files and Directories.
- Learn about dictionaries in python.
- Explore the object-oriented programming with Graphical programming and to gain the knowledge about the powerful tools for text processing.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Remember the concept of operators, data types, looping statements in Python programming.	K1
CLO2	Understand the concepts of Input / Output operations in file.	K2
CLO3	Apply the concept of functions and exception handling.	K3
CLO4	Analyze the structures of list, tuples and maintaining dictionaries.	K4
CLO5	Demonstrate the python programming development environment	K4
K1 - Remember; **K2** - Understand; **K3** – Apply; **K4** – Analyze		

CLO – PLO Mapping

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

Allied – IV: Python Programming

Unit	Content	No. of Hours
I	**Basics:** Python - Variables - Executing Python from the Command Line - Editing Python Files - Python Reserved Words - Basic Syntax-Comments - Standard Data Types – Relational Operators - Logical Operators - Bit Wise Operators - Simple Input and Output.	12
II	**Control Statements:** Control Flow and Syntax - Indenting - if Statement - statements and expressions- string operations- Boolean Expressions -while Loop - break and continue - for Loop. **LISTS:** List-list slices - list methods - list loop – mutability – aliasing - cloning lists – list parameters. **TUPLES:** Tuple assignment, tuple as return value -Sets – Dictionaries	12
III	**Functions:** Definition - Passing parameters to a Function - Built-in functions-Variable Number of Arguments - Scope – Type Conversion-Type Coercion-Passing Functions to a Function - Mapping Functions in a Dictionary – Lambda - Modules - Standard Modules– sys – math – time - dir - help Function.	12
IV	**Error Handling:** Run Time Errors - Exception Model - Exception Hierarchy – Handling Multiple Exceptions - Data Streams - Access Modes Writing - Data to a File Reading - Data from a File - Additional File Methods - Using Pipes as Data Streams - Handling IO Exceptions - Working with Directories.	12
V	**Object Oriented Features:** Principles of Object Orientation - Creating Classes - Instance Methods - File Organization - Special Methods - Class Variables – Inheritance – Polymorphism - Type Identification - Simple Character Matches - Special Characters - Character Classes – Quantifiers - Dot Character - Greedy Matches – Grouping - Matching at Beginning or End - Match Objects – Substituting - Splitting a String - Compiling Regular Expressions.	12
	Total Hours	**60**
Text Books		
1.	Mark Summerfield, (2018) Programming in Python 3: A Complete Introduction to the Python Language India / Pearson Education: Second edition.	
2.	Martin C. Brown, (2018) PYTHON: The Complete Reference, McGraw-Hill.	
3.	E. Balagurusamy, (2017) “Problem Solving and Python Programming”, McGraw-Hill, First Edition.	
Reference Book		
1.	Allen B. Downey, (2024) Think Python: How to Think Like a Computer Scientist, Updated for Python 3, Shroff/ O ‘Reilly Publishers, 3rd Edition,	
2.	Guido van Rossum and Fred L. Drake Jr, (2022) An Introduction to Python Tutorial and What’s New - Version 3.11”.	
3.	Wesley J Chun, (2012) Core Python Applications Programming, Prentice Hall.	
Web Resources (Swayam / NPTEL)		
1.	https://onlinecourses.swayam2.ac.in/cec22_cs20/preview	
2.	https://onlinecourses.nptel.ac.in/noc21_cs32/preview	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC46P	Lab: Python Programming Lab	Allied Lab - I	4	2

S. No.	List of Experiments
1	Basics in Python Programming To compute GCD of two numbers.
2	To find the square root of a number (Newton's method).
3	To display the multiplication table.
4	To find the sum of number digits in list.
5	To perform linear search and binary search.
6	Using lists to store student marks, calculate the average, find the highest and lowest scorer, and display results.
7	Using dictionary to count the frequency of words in a sentence.
8	To make a simple calculator.
9	To multiply matrices.
10	Using command line arguments (word count).
	Total Hours **60**

Text Books

1.	Mark Summerfield, (2018) Programming in Python 3: A Complete Introduction to the Python Language India / Pearson Education: Second edition.
2.	Martin C. Brown, (2018) PYTHON: The Complete Reference, McGraw-Hill.
3.	E. Balagurusamy, (2017),Problem Solving and Python Programming, McGraw-Hill,First Edition.

Reference Books

1.	Allen B. Downey, (2024) Think Python: How to Think Like a Computer Scientist, Updated for Python 3, Shroff/ O'Reilly Publishers, 3rd Edition,
2.	Guido van Rossum and Fred L. Drake Jr, (2022) An Introduction to Python Tutorial and What's New - Version 3.11".

Web Resources (Swayam / NPTEL)

1.	https://onlinecourses.swayam2.ac.in/cec22_cs20/preview

Course Code	Course Name	Category	Hours / Week	Credits
24BEC47P	Lab : IC's and Instrumentation Lab	SEC Lab – III	2	2

IC's and Instrumentation Lab

1. Introduction to IC's and Instrumentation Lab
2. Adder and Subtractor using Op-amp
3. Inverting and Non-inverting amplifier using Op-amp
4. Current to Voltage converter using Op-amp
5. Voltage to Current converter using Op-amp
6. Zero crossing detector using Op-amp
7. Integrator using Op-amp
8. Differentiator using Op-amp
9. Monostable multivibrator using IC555
10. Astable multivibrator using IC555
11. VCO using IC 555
12. Schmitt Trigger using IC 555.

Total Hours	**30**

Text Books

1.	Roy Choudhury.D, Shail B. Jain, (2017) Linear Integrated Circuits, New Age International Publishers, 6th Edition.
2.	Botkar K.R, (2015) Integrated Circuits, Khanna Publishers, 10th Edition.

Reference Books

1.	Sudhakar.A, (2012) Linear and Digital Integrated Circuits Design, Laxmi Publications; 1st Edition, ISBN 9789380386515.
2.	Ramakant A Gayakwad, (2004) Op-Amps and Linear Integrated Circuits, PHI, 4th Edition.

Web Resources (Swayam / NPTEL)

1.	https://nptel.ac.in/courses/108/108/108108111/

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

This course intends to cover

- 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.	K1,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

This course intends to cover

- 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						
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

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 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**	
24BEC51C	III	Core – IX	Industrial and Power Electronics	5	3	25	75	100	4
24BEC52C	III	Core – X	Internet of Things and Applications	5	3	25	75	100	4
24BEC53C	III	Core – XI	Programmable Logic Control	5	3	25	75	100	4
24BEC54P	III	Core Lab – VI	**Lab:** Industrial and Power Electronics	5	3	40	60	100	3
24BEC55P	III	Core Lab - VII	**Lab:** Internet of Things and Applications	5	3	40	60	100	3
24BEC5AE	III	Elective I	Satellite and Network Communication **(Communication Systems)**	5	3	25	75	100	3
24BEC5BE			Automotive Electronics **(Embedded Systems)**						
24BEC5CE			Virtual Instrumentation **(Electronic Systems)**						
24BEC56I	III	SEC	**SEC :** Internship	-	2	50	-	50	2
Total				**30**				**650**	**23**

Course Code	Course Name	Category	Hours / Week	Credits
24BEC51C	Industrial and Power Electronics	Core - IX	5	4

Course Objectives

The course intends to cover

- Principles and operation of power electronic devices and circuits such as SCR, TRIAC, choppers, and converters.
- Techniques of welding, heating and their industrial applications.
- Metrics related to non-electrical quantities using various sensors and transducers.
- Industrial automation systems including control systems, robotics, and microprocessor-based applications.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the working principles of power electronic devices such as SCR, TRIAC, choppers, and converters.	K1, K2
CLO2	Apply the techniques of welding and heating in industrial applications.	K3
CLO3	Process, display and control the electrical and non - electrical signals.	K3
CLO4	Apply control techniques in industrial systems for various process parameters.	K3
CLO5	Apply robotic system principles and microprocessor control in industrial processes.	K3
K1 - Remember; **K2** - Understand; **K3** - Apply;		

CLO – PLO Mapping

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

Core - IX: Industrial and Power Electronics

Unit	Content	No. of Hours
I	**Power Electronic Circuits and Applications:** Principles of Single Phase Inverter, Converter, DC Chopper - Cyclo Converter – UPS– HVDC Static Circuit Breaker – Battery Charging Circuit – SCR Current Limiting Circuit Breaker – Static AC and DC Switches–Flasher Circuits-Time Delay Circuits–Fan Regulator using TRIAC - **Thyristor Protection Circuits:** Over Current Protection – Over Voltage Protection – Gate Protection.	15
II	**Welding and Heating:** Resistance Welding – Types of Resistance Welding – Electronic Control in Resistance Welding: Ignitron Contractor – Heat Control – Non Synchronous Timer - Synchronous Weld Timer – Sequence Timer –Energy Storage Welding Systems – Induction Heating – Applications of Induction Heating – Dielectric Heating –Application of Dielectric Heating.	15
III	**Waves and Measurement:** Generation of Ultrasonic Waves – Applications of Ultrasonic – Production of X Rays – Applications. **Measurement of Non-Electrical Quantities:** Pressure Measurements – Displacement Measurements - Level Measurements – Flow Measurements – Measurement of Thickness.	15
IV	**Application in Industrial Systems:** Thermistor Control of Quench Oil Temperature - Proportional Mode Pressure Control System - Strip Tension Controller - Automatic Weighing System - Control of Relative Humidity in a Textile Moistening Process - Warehouse Humidity Controller - Industry 4.0: AI for Predictive Maintenance in Industrial Power Electronics Systems.	15
V	**Industrial Robotic Systems:** Parts of Robotic Systems – Classifications of Robotic Systems – Robotic System Configurations Degrees of Freedom of Robotic System – Programming Robotic Systems – Motions of Robotic Systems– Sensor for Robotic Systems – Mechanical Parts – Control Systems. **Microprocessor Based Industrial Applications:** Speed Control of DC Motor–Measurement of Physical Quantities Water Level Indicator – Firing Angle Control of Thyristor.	15
	Total Hours	**75**

Text Books	
1.	Harish C. Rai, (2018) Power Electronics and Industrial Applications, Umesh publications.
2.	Shailendra Kumar Mittal, (2024) Power Electronics, Khanna Publishers.
Reference Books	
1.	P S Bimbhra, (2022) Power Electronics, Khanna Publishers.
2.	Harish C. Rai, (2003) Power Electronics Devices, Circuits, Systems & Applications, Galgotia Publications Pvt. Ltd.
Web Resources (Swayam / NPTEL / Others)	
1.	https://onlinecourses.nptel.ac.in/noc26_ee15/preview
2.	https://onlinecourses.nptel.ac.in/noc25_ee183/preview
3.	https://www.geeksforgeeks.org/artificial-intelligence/ai-for-predictive-maintenance-applications-in-industry/

Course Code	Course Name	Category	Hours / Week	Credits
24BEC52C	Internet of Things and Applications	Core – X	5	4

Course Objectives

The course intends to cover

- Fundamentals, architecture and technologies of Internet of Things (IoT).
- Design principles of connected devices including communication and data management.
- Concepts in embedded programming for IoT applications using microcontrollers.
- Interfacing of sensors and actuators with IoT hardware platforms.
- Implementation of IoT systems for real-time data acquisition and cloud integration.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the architecture, characteristics, and applications of IoT systems.	K1, K2
CLO2	Apply design principles for connected devices including communication technologies and data management.	K3
CLO3	Apply embedded programming for IoT-based data acquisition and communication.	K3
CLO4	Analyze the interfacing of sensors and actuators with IoT platforms.	K4
CLO5	Apply NodeMCU and Wi-Fi to transmit sensor data to IoT platforms.	K3
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	3	2	2	3	1
CLO3	2	2	3	2	2
CLO4	2	2	3	3	2
CLO5	1	3	3	2	2
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core X: Internet of Things and Applications

Unit	Content	No. of Hours
I	**Introduction to IoT:** Evolution of IoT - Definition and Characteristics of IoT - Architecture of IoT - Technologies for IoT - Developing IoT Applications - **Applications of IoT**: Industrial IoT and Security in IoT.	15
II	**Design Principles for Connected Devices:** Introduction to IoT/M2M Systems - Communication Technologies - Data Management - Data Consolidation and Device Management - Ease of Designing and Affordability.	15
III	**Embedded Programming for IoT Applications:** Introduction to Embedded Programming for IoT - Microcontroller Programming Concepts - Digital Input and Output Control - Serial Communication - Timing Functions - Interfacing External Devices through GPIO - Basic Sensor Data Acquisition - Data Formatting and Transmission.	15
IV	**Sensors and Actuators:** Analog and Digital Sensors - Interfacing Temperature Sensor - Ultrasound Sensor - Infrared (IR) Sensor with ESP8266 - Interfacing LED and Buzzer with ESP8266 - Interfacing BP Sensor with ESP8266 - Interfacing LED EMG Sensor with ESP8266.	15
V	**Sending Sensor Data over Internet:** Introduction to ESP8266 - NodeMCU Wi-Fi Module - Programming NodeMCU using Arduino IDE - Using Wi-Fi and NodeMCU to transmit data from temperature sensor to Open Source IoT cloud platform - AI-Based Data Analytics in IoT (Edge and Cloud Intelligence).	15
	Total Hours	**75**

Text Books	
1.	Qusay F. Hassan (Ed.), (2025) Internet of Things A to Z: Technologies and Applications, 2nd Edition, Wiley-IEEE Press
2.	Agus Kurniawan,(2024) Internet of Things Programming Projects, 2nd Edition, Packt,
Reference Books	
1.	Tarun Kumar Sharma, Sumit Singh Dhanda, Deepak Panwar, Brahmjit Singh, and Poonam Jindal, (2025) Understanding Internet of Things: Evolution, Enabling Technologies and Challenges, Springer.
2.	Sébastien Ziegler, Renáta Radócz, Adrian Quesada Rodriguez, and Sara Nieves Matheu Garcia (Eds.), (2024) Springer Handbook of Internet of Things, Springer.
3.	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, and Jerome Henry,(2024) Hands-On Industrial Internet of Things, 2nd Edition, Packt.
Web Resources (Swayam / NPTEL / Others)	
1.	https://onlinecourses.swayam2.ac.in/aic20_sp04/preview
2.	https://nptel.ac.in/courses/106105166
3.	https://article.murata.com/en-global/article/what-is-edge-ai

Course Code	Course Name	Category	Hours / Week	Credits
24BEC53C	Programmable Logic Control	Core – XI	5	4

Course Objectives

The course intends to cover

- Fundamentals of Programmable Logic Controllers (PLC) and programmable logic devices.
- Components of PLC Hardware and Software including I/O modules, processor, and memory organization.
- Concepts of PLC programming using ladder diagrams, relay logic, and instruction sets.
- Timer, counter, and data handling instructions for industrial automation.
- Industrial applications of PLC in process control and automation systems.

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 PLC, PLDs and their role in industrial automation.	K1, K2
CLO2	Understand the hardware components and working principles of PLC systems.	K2
CLO3	Apply PLC programming concepts using ladder diagrams and instruction sets for control applications.	K3
CLO4	Analyze timer, counter, and data handling instructions in PLC-based systems.	K4
CLO5	Analyze and develop PLC-based automation solutions for industrial applications such as motor control, conveyor systems, and process control.	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	1	1	2	1
CLO3	3	2	1	1	1
CLO4	2	1	2	3	1
CLO5	1	3	2	1	3
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Core - XI: Programmable Logic Control

Unit	Content	No. of Hours
I	**Introduction to PLC:** Programmable Logic – Introduction - Programmable Logic Structures - Programmable Logic Arrays (PLAS), Programmable Array Logic (Pals), Programmable Gate Arrays (PGAS), Field Programmable Gate Arrays (FPGAS) - Sequential Network Design with Programmable Logic Devices (PLDs) - Design of Sequential Networks Using ROMs and Flash -Traffic Light Controller Using PAL	15
II	**Hardware and Software Components:** Programmable Logic Controllers (PLC) - Introduction - Parts of PLC - Principles of Operation - PLC Sizes - PLC Hardware Components - I/O Section - Analog I/O Section - Analog I/O Modules, Digital I/O Modules CPU - Processor Memory Module - Programming Devices - Diagnostics of PLCS with Computers - AI Integration in PLC Systems.	15
III	**Instructions and Relays:** PLC Programming -Simple Instructions - Programming EXAMINE ON and EXAMINE OFF Instructions -Electromagnetic Control Relays -Motor Starters -Manually Operated Switches - Mechanically Operated and Proximity Switches - Output Control Devices - Latching Relays - PLC Ladder Diagram - Converting Simple Relay Ladder Diagram into PLC Relay Ladder Diagram	15
IV	**Counter and Timer:** Timer Instructions ON DELAY Timer and OFF DELAY Timer - Counter Instructions - Up/Down Counters -Timer and Counter Applications - Program Control Instructions - Data Manipulating Instructions - Math Instructions	15
V	**PLC Applications:** Applications of PLC - Simple Materials Handling Applications - Automatic Control of Warehouse Door - Automatic Lubricating Oil Supplier Conveyor Belt - Motor Control Automatic Car Washing Machine - Bottle Label Detection - Process Control Application.	15
	Total Hours	**75**
Text Books		
1.	Frank D. Petruzella (2014), Programmable Logic Controllers, McGraw- Hill book, company, 9th Edition.	
2.	Charles H. Roth, Jr (2020), Fundamentals of Logic Design, Jaico Publishing house, 4th Edition.	
Reference Books		
1.	William I. Fletcher (2004), An Engineering Approach to Digital Design, Prentice, Hall of India Ltd., New Delhi.	
Web Resources (Swayam / NPTEL / Others)		
1.	https://nptel.ac.in/courses/117108040	
2.	https://www.plctable.com/ai-integration-in-plc-systems/	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC54P	Industrial and Power Electronics Lab	Core Lab - VI	5	3

Industrial and Power Electronics Lab (Any 15 Practical's)		
1.	Introduction to Power Electronics Lab	
2.	Dual Regulated Power Supply	
3.	Automatic street light controller	
4.	Burglar Alarm	
5.	Fan regulator using TRIAC	
6.	Speed control of DC motor using SCR	
7.	Study of SCR as a Static Switch	
8.	Triggering of SCR by R, C and UJT	
9.	Sequencer Circuit	
10.	Switching Regulators	
11.	Linear Voltage Regulator	
12.	Automatic Battery Charger	
13.	Fire alarm	
14.	Commutation Techniques	
15.	Single Phase Invertor	
16.	Protection of SCR using RC Snubber Circuit	
17.	Protection of Load using SCR Crowbar Circuit	
18.	Phase Control Circuit	
	Total Hours	**75**
Text Books		
1.	Harish C. Rai, (2018) Power Electronics and Industrial Applications. Umesh publications.	
2.	Shailendra Kumar Mittal, (2024) Power Electronics. Khanna Publishers.	
Reference Books		
1.	P S Bimbhra, (2022) Power Electronics. Khanna Publishers.	
2.	Harish C. Rai, (2003) Power Electronics Devices, Circuits, Systems & Applications, Galgotia Publications Pvt. Ltd.	
Web Resources (Swayam / NPTEL / Others)		
1.	https://onlinecourses.nptel.ac.in/noc26_ee15/preview	
2.	https://onlinecourses.nptel.ac.in/noc25_ee183/preview	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC55P	Internet of Things and Applications Lab	Core Lab - VII	5	3

Internet of Things and Applications Lab (Any 15 Practical's)	
1.	Real-Time Temperature and Humidity Monitoring Using an ESP8266 Web Server
2.	Human Motion Detection System Using a PIR Sensor and ESP8266 Web Server
3.	Soil Moisture Monitoring System Using an ESP8266 IoT Web Server
4.	Distance Measurement System Using an Ultrasonic Sensor and ESP8266 Web Server
5.	Heart Rate Monitoring System Using an ESP8266 Web Server
6.	Light Intensity Monitoring System Using an LDR and ESP8266 Web Server
7.	Wi-Fi Connectivity Testing Using an ESP8266 Web Server
8.	Push-Button Interface Monitoring Using an ESP8266 Web Server
9.	Serial Data Communication Monitoring Using an ESP8266 Web Server
10.	Real-Time Gas Leakage Monitoring Using ESP8266 and MQ135 Web Server
11.	Fire Detection and Alert System using Flame Sensor and ESP8266 Web Server
12.	Smart LED Control System using ESP8266 Web Server
13.	Water Level Monitoring System using ESP8266 Web Server
14.	IR Sensor-Based Object Detection System using ESP8266 Web Server
15.	Smart Door Lock System using ESP8266 Web Server
16.	Rainfall Detection System using ESP8266 Web Server
17.	Automatic Irrigation System using ESP8266 Web Server
18.	Voltage and Current Monitoring System using ESP8266 Web Server
Total Hours	**75**
Text Books	
1.	Qusay F. Hassan (Ed.) (2025) Internet of Things A to Z: Technologies and Applications, 2nd Edition, Wiley-IEEE Press
2.	Agus Kurniawan,(2024) Internet of Things Programming Projects, 2nd Edition, Packt,
Reference Books	
1.	Tarun Kumar Sharma, Sumit Singh Dhanda, Deepak Panwar, Brahmjit Singh, and Poonam Jindal, (2025) Understanding Internet of Things: Evolution, Enabling Technologies and Challenges, Springer.
2.	Sébastien Ziegler, Renáta Radócz, Adrian Quesada Rodriguez, and Sara Nieves Matheu Garcia (Eds.), (2024) Springer Handbook of Internet of Things, Springer.
Web Resources (Swayam / NPTEL / Others)	
1.	https://onlinecourses.swayam2.ac.in/aic20_sp04/preview
2.	https://nptel.ac.in/courses/106105166

Course Code	Course Name	Category	Hours / Week	Credits
24BEC5AE	Satellite and Network Communication	Elective– I	5	3

Course Objectives

The course intends to cover

- Fundamental concepts and evolution of satellite communication systems and their applications.
- Orbital mechanics and operational aspects of satellite systems.
- Space segment components including spacecraft subsystems and satellite communication equipment.
- Network architecture, layered models, and communication protocols used in data communication.
- LAN, ISDN technologies, and standards used in modern communication networks.

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, frequency bands, and applications of satellite communication systems.	K1, K2
CLO2	Apply orbital mechanics concepts to analyze satellite orbits and parameters	K3
CLO3	Apply knowledge of spacecraft subsystems in satellite communication systems.	K3
CLO4	Summarize network models and communication protocols.	K2
CLO5	Apply LAN standards, ISDN technologies for data communications.	K3
K1 – Remember; **K2 –** Understand; **K3 –** Apply;		

CLO – PLO Mapping

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

Elective: I -Satellite and Network Communication

Unit	Content	No. of Hours
I	**Satellite Systems - Overview**: Introduction – Basic Concepts of Satellite Communication - History of Satellite Communication - Satellite Frequency Bands and Allocations - Satellite Systems and Applications - Advantages of Satellite Communication.	15
II	**Orbital Aspects of Satellite Systems:** Orbital Mechanics - Orbital Period and Velocity - Effects of Orbital Inclination - Azimuth and Elevation - Coverage Angle and Slant Range - Eclipse - Orbital Perturbations - Geostationary Orbit - Launches and Launch Vehicles.	15
III	**Space Segment:** Spacecraft subsystems - Attitude and Orbit Control System - Telemetry, Tracking and Command (TTC&M) – Power Systems - Communication Subsystems - Satellite Antenna Equipment.	15
IV	**Network Architecture and Protocols:** Layered Architecture – OSI Model – Functions of Layers – Data Link Control Protocols – ARQ – Stop and Wait – Sliding Window – Go back N and Selective Repeat – Asynchronous Protocol: X Modem – Y Modem– Kermit – Synchronous Protocol: BSC– SDLC – HDLC – SMTP – HTTP – FTP – AI in Network Traffic Management and Intelligent Routing.	15
V	**LAN and ISDN:** LAN: Standard, Protocol – IEEE 802 Standards: ETHERNET – LLC – MAC – CSMA/CD – Token Ring – Token Bus – FDDI –ALOHA– SONET – ISDN: IDN – Channels – User Interfaces – ISDN Layers – Broad Band ISDN – Frame Relay – ATM: Concept and Architecture – ISDN Protocol– Physical Layer Protocol – D-channel Data Link Layer–Layer 3 Protocols.	15
	Total Hours	**75**
Text Books		
1.	Timothy Pratt, Charles Bostian,Jeremy Allnutt,(2014), Satellite Communications, 2nd edition, John willey.	
2.	Behrous. A.Forouzan, (2000) “Data Communication and Networking”, Tata McGraw Hill, 4th Edition.	
Reference Books		
1.	Dennis Roddy, (2001) Satellite Communications, 3rd edition, Mc Graw Hill, International.	
2.	Ulysess Black, (2012),Data Communications and Distributed Networks, 3rd Edition.	
Web Resources (Swayam / NPTEL / Others)		
1.	https://nptel.ac.in/courses/108104113	
2.	https://nptel.ac.in/courses/106105183	
3.	https://www.ibm.com/think/topics/ai-networking	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC5BE	Automotive Electronics	Elective – I	5	3

Course Objectives

The course intends to cover

- Fundamentals of automotive electrical systems including wiring, charging, and starting systems.
- Principles and operation of ignition systems, fuel control, and combustion processes.
- Instrumentation systems and sensors used for vehicle monitoring and display.
- Electronic control systems for braking, traction, and transmission.
- Engine management systems and modern automotive electronics including safety and security systems.

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 automotive electrical systems including wiring, charging and starting systems.	K1, K2
CLO2	Understand the principles of ignition systems, fuel control and combustion processes in automobiles.	K2
CLO3	Apply knowledge of sensors and instrumentation systems for vehicle condition monitoring and display systems.	K3
CLO4	Apply electronic control systems for braking, transmission and steering in vehicles.	K3
CLO5	Analyze engine management systems and modern automotive electronics including safety and security applications.	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	1	1	2	1
CLO3	3	2	1	1	1
CLO4	2	1	2	3	1
CLO5	1	3	2	1	3
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Elective– I - Automotive Electronics

Unit	Content	No. of Hours
I	**Introduction:** Automotive Component, Operation, Electrical Wiring Terminals and Switching, Multiplexed Wiring Systems, Circuit Diagrams and Symbols. **Charging Systems and Starting Systems:** Charging Systems Principles, Alternations and Charging Circuits, Basic Starting Circuit.	15
II	**Ignition Systems:** Ignition fundamentals – Electronic Ignition – Programmed Ignition – Distributor less Ignition – Direct Ignition – Spark Plugs. **Electronic Fuel Control:** Basics of Combustion – Engine Fueling and Exhaust Emissions– Electronic Control of Carburation – Petrol Fuel Injection – Diesel Fuel Injection.	15
III	**Instrumentation Systems:** Introduction to Instrumentation Systems – Various Sensors used for Different Parameters – Sensing Driver Instrumentation Systems– Vehicle Condition Monitoring Trip Computer – Different Types of Visual Display - Industry 5.0: AI-Based Driver Behavior Monitoring and Predictive Safety Systems.	15
IV	**Electronic Control of Braking and Traction:** Description Control Elements and Control Methodology - **Electronic Control of Automatic Transmission:** Introduction and Description - Control of Gear Shift and Torque Converter - Lockup – Electric Power Steering – Electronic Clutch.	15
V	**Engine Management Systems:** Engine Combined Ignition and Fuel Management Systems – Exhaust Emission Control – Digital Control Techniques – Artificial Intelligence in Engine Management – Automotive Microprocessor Applications – Complete Vehicle Control Systems – Introduction to Electric Vehicles – Battery Management System (BMS). **Lighting and Security Systems:** Vehicle Lighting Circuits – Signaling Circuits.	15
	Total Hours	**75**
Text Books		
1.	Tom Denton, (2017), Automotive Electrical and Electronic Systems, Published Routledge / Butterworth-Heinemann, 5th Edition.	
2.	James D. Halderman, (2012) Automotive Electricity and Electronics, Pearson Education, 6th Edition.	
Reference Books		
1.	William, T.M., (2000), Automotive Mechanics, McGraw Hill Book Co.	
2.	Don Knowles, (1988) Automotive Electronic and Computer controlled Ignition Systems, Don Knowles, Prentice Hall, Englewood Cliffs, New Jersey.	
Web Resources (Swayam / NPTEL / Others)		
1.	https://onlinecourses.nptel.ac.in/noc25_ee108/preview	
2.	https://onlinecourses.nptel.ac.in/noc23_de01/preview	
3.	https://piembsystech.com/ai-driver-monitoring-system	

Course Code	Course Name	Category	Hours / Week	Credits
24BEC5CE	Virtual Instrumentation	Elective– I	5	3

Course Objectives

The course intends to cover

- Fundamentals of Graphical System Design (GSD) and its design flow.
- Concepts of Virtual Instrumentation (VI) and comparison with traditional instruments.
- Hardware and software aspects involved in virtual instrumentation systems.
- Principles of data acquisition, control, and interfacing using LabVIEW.
- Basics of graphical programming and LabVIEW environment for system development.

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 graphical system design and virtual instrumentation concepts.	K1, K2
CLO2	Architect the components of virtual instruments including hardware and software.	K3
CLO3	Apply LabVIEW programming concepts to develop simple virtual instruments and graphical programs.	K3
CLO4	Analyze data acquisition and control systems using LabVIEW and virtual instrumentation techniques.	K4
CLO5	Design and implement basic measurement and automation systems using graphical programming tools.	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	1	1	2	1
CLO3	3	2	1	1	1
CLO4	2	1	2	3	1
CLO5	1	3	2	1	3
3 - Substantial (high)		**2** - Moderate (medium)		**1** - Slight (low)	

Elective – I - Virtual Instrumentation

Unit	Content	No. of Hours
I	**Virtual Instrumentation Basics:** General Functional Description of a Digital Instrument – Block Diagram of a Virtual Instrument – Physical Quantities and Analog Interfaces – Hardware and Software – User Interfaces – Advantages of Virtual Instruments Over Conventional Instruments – Architecture of a Virtual Instrument and its Relation to the Operating System.	15
II	**Software Overview:** LabVIEW – Graphical User Interfaces – Controls and Indicators – 'G' Programming – Labels and Text – Shape, Size and Color – Owned and Free Labels – Data Type, Format, Precision and Representation – Data Types – Data Flow Programming – Editing – Debugging and Running a Virtual Instrument – Graphical Programming Palettes and Tools – Front Panel Objects – Functions and Libraries.	15
III	**Programming Structure:** FOR Loops – WHILE Loops – CASE Structure – Formula Nodes – Sequence Structures – Arrays and Clusters – Array Operations – Bundle – Bundle/Unbundle by Name – Graphs and Charts – String and File I/O – High-Level and Low-Level File I/O – Attribute Modes – Local and Global Variables.	15
IV	**Hardware Aspects:** Installing Hardware – Installing Drivers – Configuring the Hardware – Addressing the Hardware in LabVIEW – Digital and Analog I/O Function – Data Acquisition – Buffered I/O – Real-Time Data Acquisition.	15
V	**Labview Applications:** IMAQ – Motion Control: General Applications – Feedback Devices, Motor Drives – Instrument Connectivity – GPIB, Serial Communication – General – GPIB Hardware & Software Specifications – **PXI / PCI:** Controller and Chassis Configuration and Installation – AI and ML in Virtual Instrumentation Systems.	15
	Total Hours	**75**
Text Books		
1.	Jovitha Jerome, (2010) Virtual Instrumentation Using Labview, PHI.	
2.	Sanjay Gupta, Joseph John (2022) Virtual Instrumentation using Labview, McGraw Hill, 2nd Edition.	
Reference Books		
1.	Robert H.Bishop, (2003) Learning with Labview" Prentice Hall.	
2.	Barry Paron, (2000) Sensor, Transducers and Labview, Prentice Hall, New Delhi.	
Web Resources (Swayam / NPTEL / Others)		
1.	https://nptel.ac.in/courses/108102191	
2.	https://nptel.ac.in/courses/103105064	
3.	https://www.next.gr/tutorials/sensors-and-transducers/virtual-instrumentation-in-electronics-tutorial	

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

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**	
24BEC61C	III	Core – XII	Robotics and Automation	6	3	25	75	100	4
24BEC62C	III	Core - XIII	Embedded IoT Applications with Cloud	6	3	25	75	100	4
24BEC63P	III	Core Lab - VIII	Embedded IoT Applications with Cloud Lab	5	3	40	60	100	3
24BEC6AE/	III	Elective II:	Mobile Computing **(Communication Systems)**	5	3	25	75	100	3
24BEC6BE/			Medical Electronics **(Embedded Systems)**						
24BEC6CE			VLSI Design **(Electronic Systems)**						
24BEC64P	III	SEC Lab - III	Raspberry Pi Essentials Lab	2	3	40	60	100	2
24BEC6PR	III	Core	Project Work	6	3	40	60	100	4
Total				**30**				**600**	**20**

Course Code	Course Name	Category	Hours / Week	Credits
24BEC61C	Robotics and Automation	Core – XII	6	4

Course Objectives

The course intends to cover

- Fundamental concepts, structure, classification and applications of robotic systems.
- Sensors, vision systems, drives, control systems and end effectors used in robotics.
- Robot programming, industrial automation, material handling and intelligent automation.
- PLC architecture, programming, networking, HMI and SCADA concepts.
- CNC control systems, feedback devices, CNC–PLC interfacing and Flexible Manufacturing Systems (FMS).

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify and classify robot structures, applications, drive systems and end Effectors.	K1, K2
CLO2	Select appropriate sensors and vision techniques in robotic systems.	K2
CLO3	Execute industrial automation techniques through robot programming.	K3
CLO4	Implement a PLC network for industrial automation.	K3
CLO5	Analyze CNC systems and FMS for machining accuracy and production efficiency.	K4
K1 - Identify; **K2 –** Classify**,** Select; **K3 –** Execute, Implement; **K4 –** Analyze		

CLO – PLO Mapping

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

Core – XII : Robotics and Automation

Unit	Content	No. of Hours
I	**Robotic Systems:** Basic Structure of a Robot.**Classification of Robots:** Cartesian, Cylindrical, Spherical, Articulated - Accuracy, Resolution and Repeatability of Robots. **Robot Application in Manufacturing:** Material Transfers - Machine Loading and Unloading – Processing Operations – Assembly and Inspection. **Drives and Control Systems:** Hydraulic and Pneumatic Systems: Cylinders, Control Valves, Hydro Moto - Robot End Effectors.	18
II	**Sensors and Vision Systems:** Types of Sensors - Tactile Sensors- Proximity Sensors - Speed Sensors – Encoder, Resolvers. **Vision Systems:** Image Processing and Analysis – Segmentation - Feature Extraction - Object Recognition.	18
III	**Robot Programming & Automation:** Lead through Programming - Textual Programming - Programming Examples – Social and Economic Aspects of Robots - Typical Layouts of Robots in Industries. **Automation:** Advantages of Automation – Building Blocks of Automation. Automatic Feeding Lines - Material-Handling Devices – ASRS - Transfer Lines - Automatic Inspection - Intelligent Automation. Introduction to Artificial Intelligence - Robotics and Artificial Intelligence: From Smart Robots to Intelligent Machines	18
IV	**Programmable Logic Controllers (PLC):** Basics of PLC - Architecture of PLC – Advantages - Types of PLC - Types of Programming Simple Process Control Program's Using Relay Ladder Logic. Introduction to PLC Networking - Introduction to HMI – DC's and SCADA Systems**.**	18
V	**Computer Numerical Control (CNC):** Block Diagram of a CNC Control System – Advantages - Power Supply – CPU - CNC and PLC Interfacing - Control Loops - Feedback Devices in CNC Machine - Analog and Digital CNC Systems - FMS Architecture.	18
	Total Hours	**90**
Text Books		
1.	Mikell P. Groover (2021), Automation, Production Systems and Computer-Integrated Manufacturing, Pearson Education, 5th Edition.	
2.	K. S. Fu, R. C. Gonzalez and C. S. G. Lee (2014), Robotics: Control, Sensing, Vision and Intelligence, McGraw-Hill Education, 1st Edition.	
Reference Books		
1.	W. Bolton (2019), Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, Pearson Education Limited, 7th Edition.	
2.	Mikell P. Groover, Mitchell Weiss, Roger N. Nagel, and Nicholas G. Odrey (2018), Industrial Robotics – Technology, Programming and Applications, McGraw Hill Education, 2nd Edition.	
Web Resources (Swayam / NPTELs / Others)		
1.	https://onlinecourses.nptel.ac.in/noc24_ee46/preview	
2.	https://onlinecourses.nptel.ac.in/e-learning/preview/noc24_ge31	
3.	https://www.matrisrobotic.com/robotics-and-artificial-intelligence-from/	

Course Code	Course Name	Category	Hours/ Week	Credits
24BEC62C	Embedded IoT Applications with Cloud	Core – XIII	6	4

Course Objectives

The course intends to cover

- Principles and architecture of Embedded IoT systems integrated with cloud platforms.
- Device-to-cloud communication using MQTT, HTTP/HTTPS and REST APIs.
- Cloud-based IoT data acquisition, storage, processing and visualization.
- Device management, authentication, security and Over-the-Air (OTA) firmware updates.
- Integration of edge computing, cloud computing and intelligent IoT applications for real-world systems.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Interpret embedded-cloud architecture by identifying cloud computing concepts.	K1, K2
CLO2	Perform real-time analysis through cloud data engineering pipelines.	K3
CLO3	Examine device provisioning and fleet-management approaches for cloud-connected devices.	K4
CLO4	Assess security mechanisms for cloud-connected embedded systems.	K5
CLO5	Evaluate embedded IoT architectures using cloud, digital twin technologies and edge AI/ML.	K5
K1 - Remember; **K2** – Interpret; **K3** – Perform; **K4** – Examine; K**5** – Assess, Evaluate		

CLO – PLO Mapping

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

Core – VIII : Embedded IoT Applications with Cloud

Unit	Content	No. of Hours
I	**Cloud Computing for Embedded Applications:** Cloud Computing for Embedded Systems – Cloud Service Models – Cloud-Native Architecture – Virtualization and Containers – Serverless Computing – Cloud Application Deployment – Resource Management – Cloud Service Orchestration. **Case Study:** Cloud-Based Embedded Application.	18
II	**Cloud Data Engineering:** Cloud Data Ingestion – Cloud Storage – Time-Series Data – Data Pipelines – Batch and Stream Processing – Event-Driven Processing – Data Transformation – Real-Time Processing – Cloud Analytics. **Case Study:** Real-Time Cloud Data Processing.	18
III	**Embedded Device Cloud Management:** Device Provisioning – Device Registration – Device Identity – Device State Management – Remote Configuration – Device Fleet Management – Remote Diagnostics – Device Health Monitoring – Firmware Management – OTA Updates – Device Lifecycle Management. **Case Study:** Cloud Device Fleet.	18
IV	**Cloud Security and Trust:** Cloud Security – Hardware Root of Trust – Public Key Infrastructure – Digital Certificates – Secure Device Onboarding – Key Management – Access Control – Firmware Integrity – Secure Software Updates – Security Monitoring. **Case Study:** Secure Cloud-Connected Embedded System.	18
V	**Edge-Cloud Intelligence and Digital Twins:** Edge-Cloud Computing – Workload Placement – Edge-Cloud Coordination – Resource-Aware Computing – Edge Services – Cloud Machine Learning – Model Deployment – Edge Inference – Digital Twin Architecture – State Synchronization – Predictive Maintenance – Industrial Applications. **Case Study:** Digital Twin – Amazon AWS – AI/ML at the Edge for IoT Applications.	18
	Total Hours	**90**

Text Books	
1.	Colin Dow (2024), Internet of Things Programming Projects, Packt, 2nd Edition.
2.	Brendan Burns (2018), Designing Distributed Systems, O'Reilly Media, 1st Edition.
3.	Raj, V. et al. (2020), The Digital Twin Paradigm for Smarter Systems and Environments: The Industry Use Cases, Elsevier, 1st Edition.
Reference Books	
1.	Samuel Greengard (2015), The Internet of Things, MIT Press, 1st Edition.
2.	Olivier Hersent, David Boswarthick, Omar Elloumi (2012), The Internet of Things: Key Applications and Protocols, Wiley, 2nd Edition.
3.	Raj Kamal (2017), Internet of Things: Architecture and Design Principles, McGraw Hill Education, 1st Edition.
4.	Dieter Uckelmann, Mark Harrison, Florian Michahelles (2011), Architecting the Internet of Things, Springer, 1st Edition.
Web Resources (Swayam / NPTELs / Others)	
1.	https://docs.aws.amazon.com/iot/
2.	https://learn.microsoft.com/azure/iot/
3.	https://mqtt.org/
4.	https://aws.amazon.com/blogs/machine-learning/demystifying-machine-learning-at-the-edge-through-real-use-cases/

Course Code	Course Name	Category	Hours / Week	Credits
24BEC63P	Embedded IoT Applications with Cloud Lab	Core Lab - VII	5	3

Embedded IoT Applications with Cloud Lab (Any 15 Experiments)

1. Interface DHT11 with ESP8266 and monitor temperature and humidity on a cloud dashboard
2. Interface Ultrasonic Sensor with ESP8266 and visualize distance measurements using cloud services
3. Interface PIR Sensor with ESP8266 and implement cloud-based motion event monitoring
4. Interface LDR with ESP8266 and develop a cloud-based light intensity monitoring system
5. Interface Soil Moisture Sensor with ESP8266 and implement cloud-based soil condition monitoring
6. Interface Rain Sensor with ESP8266 and develop a cloud-based rainfall detection system
7. Interface Proximity Sensor with ESP8266 and implement cloud-based object detection monitoring
8. Interface MQ-135 with ESP8266 and visualize air-quality data using cloud services
9. Develop a Multi-Sensor Embedded System using DHT11, LDR and PIR with cloud data visualization
10. Develop a Smart Agriculture Monitoring System using DHT11, Soil Moisture and Rain Sensor with cloud dashboard
11. Develop an Environmental Monitoring System using DHT11 and MQ-135 with real-time cloud data processing
12. Implement Event-Based Cloud Alerts using PIR, Rain and Proximity Sensors
13. Implement Cloud-Based Data Storage and Time-Series Visualization for Multiple Sensors
14. Cloud-Based Temperature and Humidity Alert System using DHT11 and ESP8266
15. Distance-Based Object Detection and Cloud Logging using Ultrasonic Sensor
16. Cloud-Based Intrusion Detection using PIR Sensor and ESP8266
17. Rainfall Detection and Cloud-Based Weather Monitoring using Rain Sensor
18. Smart Agriculture System using Soil Moisture, Rain Sensor, DHT11 and Cloud Services

Total Hours	**75**

Text Books

1.	Andy King (2021), Programming the Internet of Things, O'Reilly Media, 1st Edition.
2.	Vlasios Tsiatsis, Stamatis Karnouskos, Jan Holler, David Boyle, Catherine Mulligan, et al. (2018), Internet of Things: Technologies and Applications for a New Age of Intelligence, Elsevier, 2nd Edition.

Reference Books

1.	Brendan Burns (2024), Designing Distributed Systems, O'Reilly Media, 2nd Edition.
2.	Pethuru Raj and Preetha Evangeline David (2020), The Digital Twin Paradigm for Smarter Systems and Environments: The Industry Use Cases, Elsevier, 1st Edition.

Web Resources (Swayam / NPTELs / Others)

1.	https://docs.aws.amazon.com/iot/
2.	https://onlinecourses.nptel.ac.in/noc25_cs75/preview

Course Code	Course Name	Category	Hours/ Week	Credits
24BEC6AE	Mobile Computing	Elective - II	5	3

Course Objectives

The course intends to cover

- Basic concepts of mobile computing and wireless communication.
- Types and working of wireless networks.
- Concepts and applications of Mobile IP and mobile network layer.
- Mobile transport protocols and their performance in wireless networks.
- Architecture and protocols of Wireless Application Protocol (WAP).

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Identify mobile computing concepts and interpret wireless transmission and access mechanisms.	K1, K2
CLO2	Interpret AI-based mobile network operations using wireless networks.	K2
CLO3	Support mobility in mobile networks using Mobile IP mechanisms.	K3
CLO4	Enhance TCP protocol for mobile communication.	K3
CLO5	Examine the protocol layers and services of WAP architecture.	K4
K1 - Identify; **K2** – Interpret; **K3** – Support, Enhance; **K4** – Examine		

CLO – PLO Mapping

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

Elective - II: Mobile Computing

Unit	Content	No. of Hours
I	**Introduction:** Mobile and Wireless Devices – Simplified Reference Model – Need for Mobile Computing – Wireless Transmissions – Multiplexing – Spread Spectrum and Cellular Systems – Medium Access Control – SDMA – FDMA – TDMA – CDMA - Comparison of Access Mechanisms.	15
II	**Wireless Networks: Wireless LAN:** Infrared Vs Radio Transmission – Infrastructure Networks - Ad hoc Networks - IEEE 802.11– HIPERLAN – Bluetooth - **Wireless ATM:** Working Group – Services - Reference Model – Functions – Radio Access Layer – Handover - Location Management - Addressing Mobile Quality of Service - Access Point Control Protocol - AI-Based Mobile Network Operations.	15
III	**Mobile Network Layer: Mobile IP:** Goals – Assumptions and Requirement – Entities – IP Packet Delivery - Agent Advertisement and Discovery – Registration – Tunneling and Encapsulation – Optimization – Reverse Tunneling – IPv6 – DHCP- Ad Hoc Networks.	15
IV	**Mobile Transport Layer:** Traditional TCP - Indirect TCP - Snooping TCP - Mobile TCP - Fast Retransmit / Fast Recovery - Transmission/Timeout Freezing – Selective Retransmission - Transaction Oriented TCP.	15
V	**WAP:** Architecture – Datagram Protocol- Transport Layer Security - Transaction Protocol - Session Protocol - Application Environment - Wireless Telephony - Application.	15
	Total Hours	**75**

Text Books

1.	J.Schiller, (2025) Mobile Communication, Addison Wesley.
2.	William Stallings, (2013) Wireless Communication Networks, Pearson Education.

Reference Books

1.	William C.Y.Lee, (2013) Mobile Communication Design Fundamentals , John Wilsey.
2.	Rappaport, (2019), Wireless Communications: Principles and Practice, Pearson Education.

Web Resources (Swayam / NPTELs / Others)

1.	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee146
2.	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee159
3.	https://www.ericsson.com/en/blog/2020/10/ai-by-design---to-provide-data-driven-operations-of-networks?

Course Code	Course Name	Category	Hours/ Week	Credits
24BEC6BE	Medical Electronics	Elective - II	5	3

Course Objectives

The course intends to cover

- Fundamental principles of human physiology and bio potentials.
- Electrodes, transducers, and signal conditioning techniques for physiological signal acquisition.
- Working principles and applications of major biomedical diagnostic equipment.
- Biotelemetry, patient safety, and physiological assist devices.
- Computer-based biomedical signal analysis, AI-based ECG analysis, and medical imaging systems.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand cell structure and physiology of the nervous system.	K1, K2
CLO2	Select suitable biomedical electrodes and transducers for measuring physiological and chemical parameters.	K2
CLO3	Apply medical signal-conditioning in diagnostic systems.	K3
CLO4	Implement biotelemetry systems for patient safety through diagnostic imaging.	K3
CLO5	Examine physiological assist devices and computer-based diagnostic systems.	K4
K1 - Remember; **K2** – Understand, Select; **K3** – Apply, Implement; **K4**- Examine		

CLO – PLO Mapping

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

Elective - II: Medical Electronics

Unit	Content	No. of Hours
I	**Basic Physiology:** Cells and their Structures - Transport of Ions through Cell Membrane - Resting and Excited State Transmembrane Potential - Nervous System - Physiology of Muscles - Heart and Blood Circulation.	15
II	**Electrodes and Transducers:** Basic Electrode Theory - Micro Electrodes - Skin Surface Electrodes - Needle Electrodes - Equivalent Circuit - Electrode Materials - Chemical Electrodes - Reference Electrodes - The pH Electrode - Blood Gas Electrode – Thermistor.	15
III	**Signal Conditioners and Diagnostic Equipment:** Instrumentation Amplifiers - Current Amplifiers - Isolation Amplifier - Need for Filters - Low Pass, High Pass and Band Pass Active Filters - Notch Filters - Heated Stylus and Ink Pen Recorders. **Diagnostic Equipment:** Typical Electrocardiogram (ECG)- Electrocardiograph - Electroencephalogram (EEG) - Muscle Response - Electromyography (EMG) - Application of AI/ML in ECG Analysis.	15
IV	**Diagnostic Equipment and Biotelemetry:** X-ray Imaging - Radio Fluoroscopy - Image Intensifiers - Angiography - Endoscopy – Diathermy. **Biotelemetry and Patient Safety:** Need for Biotelemetry - Elements of Telemetry System - Radio Telemetry System - Physiological Signals used in Telemetry.	15
V	**Physiological Assist Devices:** Need for Pacemakers - Pacemaker Parameters and Circuits - Different Modes of Operation - DC Defibrillator - Artificial Heart Valves - Heart Lung Machines - Artificial Lung Machines - Artificial Kidney Machine - Nerve and Muscle Stimulator - Multi-Sensor Fusion. **Computer Applications:** Data Acquisition Systems - Analysis of ECG signals - Computerized Axial Tomography (CAT) Scanner - Ultrasonic Scanner.	15
	Total Hours	**75**

Text Books	
1.	Sudip Paul, Angana Saikia, Vinayak Majhi and Vinay Kumar Pandey (2022), Introduction to Biomedical Instrumentation and Its Applications, Academic Press, 1st Edition.
2.	Webster, J. G. and Nimunkar, A. J. (2020), Medical Instrumentation: Application and Design. 5th Edition.
3	Khandpur, R. S. (2020), Handbook of Biomedical Instrumentation. McGraw Hill Education, 4th Edition.
Reference Books	
1.	Reddy, D. V. (2021), Biomedical Instrumentation. Tata McGraw Hill Education, 2nd Edition.
2.	Arumugam, M. (2016). Biomedical Instrumentation. Anuradha Publications. 2nd Edition.
Web Resources (Swayam / NPTELs / Others)	
1.	https://onlinecourses.nptel.ac.in/e-learning/preview/noc25_bt49
2.	https://www.powerfulmedical.com/blog/how-is-ai-transforming-ecg-interpretation/

Course Code	Course Name	Category	Hours/ Week	Credits
24BEC6CE	VLSI Design	Elective - II	5	3

Course Objectives

The course intends to cover

- Principles and fabrication processes of VLSI technologies and integrated passive components.
- Electrical characteristics and performance parameters of MOS transistors.
- Impact of AI on VLSI design processes and scaling of MOS circuits.
- VLSI design techniques and design styles.
- VLSI circuit testing principles and techniques.

Course Learning Outcomes

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

CLO	CLO Statements	Knowledge Level
CLO1	Understand the VLSI fabrication sequence and NMOS, PMOS, CMOS and BiCMOS processes.	K1, K2
CLO2	Determine circuit performance by calculating MOS transistor parameters and electrical characteristics.	K3
CLO3	Implement VLSI design processes, including design flow, stick diagrams, design rules, and scaling.	K3
CLO4	Examine circuit performance through VLSI physical design, routing, power-delay estimation, and design styles.	K4
CLO5	Assess VLSI circuit quality using BIST, test benches and circuit testing techniques.	K4
K1 - Remember; **K2** – Understand; **K3** – Determine, Implement; **K4**- Examine, Assess		

CLO – PLO Mapping

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

Elective - II: VLSI Design

Unit	Content	No. of Hours
I	**VLSI Technology :** Fabrication sequence – process flow – Testing – Super integration concepts – Integrated Passive components – MOS Resistors and capacitors – Crossovers – NMOS – PMOS – CMOS – BiCMOS fabrication processes – comparison.	15
II	**Electrical Properties of MOS Devices :** Drain to source current (I_{DS}) versus Drain to source voltage (V_{DS}) relationships – MOS transistor threshold voltage (Vt) – MOS transistor trans-conductance g_m and output conductance g_{ds} – Figure of merit (ω0) – pass transistor- pull – up to pull – down ratio.	15
III	**Design Processes :** VLSI design flow – stick diagram design rules with examples - Design rules for Layout diagrams of digital circuits – sheet resistance Rs – standard unit of capacitance – Inverter delays – Propagation delays – scaling of MOS circuits – limitations of scaling- Impact of AI on VLSI Design.	15
IV	**VLSI Physical Design and Styles :** Floor Planning – Placement – Routing – Power Delay Estimation – Clock Routing – Power Routing. **VLSI Design Styles:** Full Custom – Semi custom – Standard Cells – Gate Arrays – FPGAs – CPLDs.	15
V	**Testing of VLSI Circuits :** Test Principles – BIST – Test Bench - Combinational Circuit Testing, Sequential Circuit Testing, Test Bench Techniques.	15
	Total Hours	**75**

Text Books

1.	Douglas. A. Pucknell, Kamran Eshraghian (2011), Basic VLSI Design, ,3rd Edition, PHI Learning Private Limited, New Delhi
2.	Wayne Wolf (2008) Modern VLSI design, 3rd Edition, Pearson Education, New Delhi

Reference Books

1.	John .P. Uyemura, John Wiley (2006), Introduction to VLSI Circuits and Systems, Student Edition, New Delhi.
2.	N.H.E Weste , K.Eshraghian (2012), Principles of CMOS VLSI Design, 2nd Edition, Adisson Wesley, NewDelhi.
3.	Michel John Sebastian Smith (2001), Application Specific Integrated Circuits, Addison Wesley, Indian Edition, New Delhi.

Web Resources (Swayam / NPTELs / Others)

1	https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ee85
2.	https://www.tessolve.com/blogs/impact-of-ai-on-vlsi-design/

Course Code	Course Name	Category	Hours / Week	Credits
24BEC64P	Raspberry Pi Essentials Lab	SEC Lab– III	2	2

Raspberry Pi Essentials Lab (Any 12 Experiments)

1. Interface DHT11 with Raspberry Pi and monitor temperature and humidity using Python
2. Interface Ultrasonic Sensor with Raspberry Pi and measure distance using GPIO
3. Interface PIR Sensor with Raspberry Pi and implement real-time motion detection
4. Interface LDR with Raspberry Pi and measure light intensity using an ADC
5. Interface Soil Moisture Sensor with Raspberry Pi and monitor soil moisture levels using an ADC
6. Interface Rain Sensor with Raspberry Pi and implement real-time rainfall detection
7. Interface Proximity Sensor with Raspberry Pi and implement object detection
8. Interface MQ-135 with Raspberry Pi and monitor air-quality parameters using an ADC
9. Develop a Multi-Sensor Monitoring System using DHT11, LDR and PIR with Raspberry Pi
10. Develop a Smart Agriculture Monitoring System using DHT11, Soil Moisture and Rain Sensor with Raspberry Pi
11. Develop an Environmental Monitoring System using DHT11 and MQ-135 with Raspberry Pi
12. Implement Event-Based Alerts using PIR, Rain and Proximity Sensors with Raspberry Pi
13. Implement Local Data Logging and Time-Series Visualization for Multiple Sensors using Raspberry Pi
14. Develop a Temperature and Humidity Alert System using DHT11 and Raspberry Pi
15. Implement Distance-Based Object Detection and Local Data Logging using an Ultrasonic Sensor
16. Develop a Real-Time Intrusion Detection System using PIR Sensor and Raspberry Pi
17. Develop a Rainfall Detection and Local Weather Monitoring System using Raspberry Pi
    Develop a Smart Agriculture System using Soil Moisture, Rain Sensor, DHT11 and Raspberry Pi

Total Hours	**30**

Text Books

1.	Simon Monk (2024), Raspberry Pi Cookbook, O'Reilly Media, 4th Edition.
2.	Sean McManus and Mike Cook (2023), Raspberry Pi For Dummies, Wiley,5th Edition.

Reference Books

1.	Derek Molloy (2016), Exploring Raspberry Pi: Interfacing to the Real World with Embedded Linux, Wiley.
2.	Sai Yamanoor and Srihari Yamanoor (2017), Python Programming for Raspberry Pi — Packt Publishing.

Web Resources (Swayam / NPTELs / Others)

1.	https://www.raspberrypi.com/documentation
2.	https://onlinecourses.nptel.ac.in/noc25_cs75/preview

Course Code	Course Name	Category	Hours/Week	Credits
24BEC6PR	**Project Work**	**Core**	**6**	4

Guidelines:

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).

CONTENTS

DECLARATION

CERTIFICATE

ACKNOWLEDGEMENT

ABSTRACT

1. INTRODUCTION

2. REVIEW OF LITERATURE

2.1 General Survey

2.2 Journals and Paper Survey

2.3 Review Conclusion

3. SYSTEM DESIGN

3.1 Block Diagram

3.2 Block Diagram Description

4. CIRCUIT DIAGRAM

4.1 Circuit Diagram Description

5. HARDWARE DESCRIPTION

6. SOFTWARE DESCRIPTION

7. RESULTS AND DISCUSSION

7.1 Discussion of the results of the project work

7.2 Screenshots of the Results

7.3 Prototype of the Model

8. CONCLUSION AND SCOPE FOR FUTURE ENHANCEMENT

BIBLIOGRAPHY

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.**