B.SC.,
ELECTRONICS AND COMMUNICATION

SYLLABUS

FROM THE ACADEMIC YEAR 2023-2024

TAMILNADU STATE COUNCIL FOR HIGHER EDUCATION, CHENNAI – 600 005

Preamble for B.Sc. Electronics and Communication Program

In this era Electronics and Communication is one of the foundational science that is essential for understanding the world around us. B.Sc., Electronics and Communication Programme is designed to provide students with a strong foundation in the theoretical and practical aspects of Electronics and Communication.

The undergraduate curriculum has been revised to align with the UGC's Learning Outcome-based Course Framework, which focuses on student learning outcomes. This learner-centred approach allows students to develop a deep understanding of the subject by progressively building on their knowledge and skills. The program also emphasizes the development of problem-solving and analytical skills, as well as the ability to apply theoretical knowledge to real-world problems. The program emphasizes hands-on learning through laboratory work and projects. This allows students to apply the theoretical concepts they learn in the classroom to real-world problems. The program covers a wide range of topics, from the fundamentals of electronics and communications to more specialized areas such as Optical Communication, Microprocessor and Microcontroller, Antenna and Wave Propagation, Internet of Things. This gives students a broad understanding of the field and prepares them for a variety of careers. To impart Industry-relevant skills, the program is designed to give students the skills they need to succeed in the workforce. Students learn how to design, develop, and test electronic circuits and systems. They also learn how to work with software tools and programming languages.

The elective modules of the framework offer students choice to gain knowledge and expertise in specialized domains of electronics and communication. The elective modules in the framework also give students the opportunity to gain knowledge and expertise in specialized fields. The revised syllabus includes new courses on Artificial Intelligence, Optoelectronic Devises, Nanoelectronics, Internet of Things, which is a rapidly growing field with many potential applications in electronics and communication. It is more aligned with the industry needs and trends. This industry-aligned focus equips students for diverse career paths and empowers them to shape their future. This will prepare students for a wider range of careers in the electronics and communication industry and help them to make a significant contribution to the development of new technologies and applications.

Programme Educational Objective (PEOs)

PEO1	Provide student graduates with solid foundation and practical skillsets for eventual success in any of the broad array of careers.
PEO2	Impart analytic and thinking skills to develop initiatives and innovative ideas according to the industry and societal requirements.
PEO3	Provide sound theoretical and practical knowledge in Electronics & Communication and entrepreneurial skills to enable students to contribute to the welfare of society with a global approach.
PEO4	Motivate graduates to become good human beings and responsible citizens for the overall welfare of the society.

Programme Outcome (POs)

PO1	Critical Thinking: Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO2	**Effective Communication:** Excellent communication skills to transfer multifaceted technical information related to Physics in a clear and concise manner.
PO3	**Social Interaction:** Elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO4	**Effective Citizenship:** Imbibed moral and social values in personal and social life leading to highly cultured and civilized temperament.
PO5	**Ethics:** Recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO6	**Environment and Sustainability:** Understand the issues of environmental contexts and sustainable development.
PO7	**Self-directed and Life-long Learning:** Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

Programme Specific Outcomes (PSOs)

On the successful completion of B.Sc., Electronics and Communication

PSO1	Graduates will attain the core knowledge in (theory as well as practical) subjects of Electronics and Communication.
PSO2	Graduates will be able to apply the fundamental concepts of Electronics and Communication to design a variety of components and systems for applications.
PSO3	Graduates will be able to choose and adopt cutting-edge technologies (hardware and software) in the fields of Microcontroller, Analog communication, Digital Communication, Optical Communication (Li – Fi) etc.
PSO4	Graduates will succeed in using the available electronic and communication resources skilfully, effectively and Efficiently for the betterment of the society.
PSO5	Graduates will get jobs in telephone industries, electricity boards, media ad film industry, software companies, Railways, Hardware manufacturing firms, etc., very easily.

ALAGAPPA UNIVERSITY, KARAIKUDI

NEW SYLLABUS UNDER CBCS PATTERN (w.e.f.2023-24)

UG– ELECTRONICS AND COMMUNICATION-PROGRAMME STRUCTURE

Sem.	Part	Course Code	Courses	Title of the Paper	T/P	Cr.	Hrs./ Week	Max. Marks		
								Int.	Ext.	Total
I	I	2311T	T/OL	தமிழ் இலக்கிய வரலாறு-I / Other Languages	T	3	6	25	75	100
	II	2312E	E	General English-I	T	3	6	25	75	100
	III	23BEC1C1	CC-I	Electronic Devices and Circuit Theory	T	4	5	25	75	100
		23BEC1P1	CC-II	Electronic Devices and Circuit Theory Lab	P	4	4	25	75	100
		--	Generic Elective (Allied)	Allied – I (Mathematics/ Physics/ Computer Science/ Electronics)	T	3	3	25	75	100
				Allied Lab – Lab part of the respective Allied Course	P	2	2	25	75	100
	IV	23BEC1S1	SEC –I	Consumer Electronics	T	2	2	25	75	100
		23BEC1FC	Foundation Course-	Electronic Instrumentation	T	2	2	25	75	100
				Total		**23**	**30**	**200**	**600**	**800**
II	I	2321T	T/OL	தமிழ் இலக்கிய வரலாறு-2 / Other Languages	T	3	6	25	75	100
	II	2322E	E	General English – II	T	3	6	25	75	100
	III	23BEC2C1	CC-III	Digital Electronics	T	4	5	25	75	100
		23BEC2P1	CC-IV	Digital Electronics Lab	P	4	4	25	75	100
		--	Generic Elective (Allied)	Allied - II (Mathematics/ Physics/ Computer Science/ Electronics)	T	3	3	25	75	100
				Allied Lab - Lab part of the respective Allied Course	P	2	2	25	75	100
	IV	23BEC2S1	SEC –II	C Programming	T	2	2	25	75	100
		23BEC2S2	SEC-III	Fundamentals of Nanoelectronics	T	2	2	25	75	100
			NMC							
				Total		**23**	**30**	**200**	**600**	**800**
III	I	2331T	T/OL	**தமிழக வரலாறும் பண்பாடும்**/ Other Languages	T	3	6	25	75	100
	II	2332E	E	General English – III	T	3	6	25	75	100
	III	23BEC3C1	CC-V	Linear Integrated Circuits	T	4	5	25	75	100
		23BEC3P1	CC-VI	Linear Integrated Circuits Lab	P	4	4	25	75	100
		--	Generic Elective (Allied)	Allied - III (Mathematics/ Physics/ Computer Science/ Electronics)	T	3	3	25	75	100
				Allied Lab - Lab part of the respective Allied Course	P	2	2	25	75	100
		23BEC3S1	SEC-IV	Entreprenuership	T	2	2	25	75	100
	IV	233AT/ 23BEC3S2	SEC-V	Adipadai Tamil 1/ Python Programming	T	2	2	25	75	100
			NMC							
				Total		**23**	**30**	**200**	**600**	**800**
IV	I	2341T	T/OL	**தமிழும் அறிவியலும்** / Other Languages	T	3	6	25	75	100
	II	2342E	E	General English – IV	T	3	6	25	75	100
	III	23BEC4C1	CC-VII	Communication	T	4	4	25	75	100
		23BEC4P1	CC-VIII	Communication Lab	P	3	3	25	75	100
		--	Generic Elective (Allied)	Allied – IV (Mathematics/ Physics/ Computer Science/ Electronics)	T	3	3	25	75	100
				Allied Lab - Lab part of the respective Allied Course	P	2	2	25	75	100
	IV	23BEC4S1	SEC-VI	Small Business Management	T	2	2	25	75	100
		234AT/ 23BEC4S2	SEC-VII	Adipadai Tamil 2/ Introduction to Arduino Programming	T	2	2	25	75	100

		23BES4	E.V.S	Environmental Studies	T	2	2	25	75	100
			NMC							
				Total		**24**	**30**	**225**	**675**	**900**
V	III	23BEC5C1	CC-IX	Microprocessor and Microcontroller	T	4	5	25	75	100
		23BEC5C2	CC-X	Internet of Things	T	4	5	25	75	100
		23BEC5P1	CC-XI	Microprocessor and Microcontroller Lab	P	4	5	25	75	100
		23BEC5P2	CC-XII	Internet of Things Lab	P	4	5	25	75	100
		23BEC5E1/ 23BEC5E2/ 23BEC5E3	DSE-I	Optical Communication/Satellite Communication/Radar Technologies	T	3	4	25	75	100
		23BEC5E4/ 23BEC5E5/ 23BEC5E6	DSE-II	Antenna and Wave Propagation/Avionics/Optoelectronic Devices	T	3	4	25	75	100
	IV	23BVE5		Value Education	T	2	2	25	75	100
		23BEC5I/ 23BEC5IV/ 23BEC5FV		Internship/Industrial Visit/ Field Visit	PR	2	-	25	75	100
			NMC							
				Total		**26**	**30**	**200**	**600**	**800**
VI	III	23BEC6C1	CC-XIII	Mobile and Wireless Communication	T	4	6	25	75	100
		23BEC6PR/ 23BEC6D	CC-XIV	Project / Dissertation	PR	8	12	25	75	100
		23BEC6E1/ 23BEC6E2/ 23BEC6E3	DSE-III	Computer Networks/Image Processing/Fundamentals of Artificial Intelligence	T	3	5	25	75	100
		23BEC6E4/ 23BEC6E5/ 23BEC6E6	DSE-IV	Biomedical Instrumentation/VLSI Design/ Industry 4.0	T	3	5	25	75	100
	IV	23BEC6S1		Essential Reasoning and Quantitative Aptitude	T	2	2	25	75	100
	V	23BEA6		Extension Activity	P	1	-	25	75	100
			NMC							
Total						**21**	**30**	**150**	**450**	**600**
Grand Total						**140**	**--**	**1175**	**3525**	**4700**

- TOL-Tamil/Other Languages,
- E – English
- CC-Core course
- Generic Elective (Allied)
- SEC-Skill Enhancement Course
- FC-Foundation Course
- DSE – Discipline Specific Elective

Discipline Specific Electives (DSE)

Semester	DSE	Elective	Title of the Paper
V	DSE-I	Elective-I	Optical Communication
		Elective-II	Satellite Communication
		Elective-III	Radar Technologies
	DSE-II	Elective-IV	Antenna and Wave Propagation
		Elective-V	Avionics
		Elective-VI	Optoelectronic Devices
VI	DSE-III	Elective-VII	Computer Networks
		Elective-VIII	Image Processing
		Elective-IX	Fundamentals of Artificial Intelligence
	DSE-IV	Elective-X	Biomedical Instrumentation
		Elective-XI	VLSI Design
		Elective-XII	Industry 4.0

Chairperson details: DR. V. Dharuman, Associate Professor, Department of Bioelectronics and Biosensors, Alagappa University, Karaikudi. Mobile No: 9865679897

<table>
<tr><td>Title of the Course</td><td colspan="7">Electronic Devices and Circuit Theory</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td>Credits</td><td>4</td><td>Course Code</td><td>23BEC1C1</td></tr>
<tr><td>Semester</td><td>I</td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td></td><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To introduce semiconductor devices such as diodes, Characteristics, BJTs, and biasing methods
➢ To familiarize FET and MOSFET, their characteristics, operations and applications
➢ To introduce concepts of feedback in electronic circuits and give understanding of various types of amplifier circuits and oscillators.
➢ To equip with the knowledge of circuit theorems for electric circuit analysis
➢ To familiarize two port network parameters and their exploration</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">SEMICONDUCTOR DEVICES</td><td>16 hrs</td></tr>
<tr><td colspan="7">Theory of PN junction diode –PN Junction Diode as a Rectifier (half wave, full wave & bridge) – V-I Characteristics - Zener Diode – V-I Characteristics -Voltage Regulation
NPN, PNP transistor (BJT) - Working – CB, CE, CC configurations – relation between α and β - CE transistor characteristics – Transistor as an amplifier –Q point – Cut off, Saturation and Active region Transistor biasing methods</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">FIELD EFFECT TRANSISTORS</td><td>16 hrs</td></tr>
<tr><td colspan="7">Construction - Operation - Characteristics of P Channel & N - Comparison of JFET & BJT - Comparison of P Channel & N Channel JFET - JFET as a Voltage Variable Resistor.
Construction - Operation- Characteristics of P Channel & N Channel Depletion MOSFET – Construction-Operation-Characteristics P Channel & N Channel Enhancement MOSFET - Comparison of P Channel MOSFET with N Channel MOSFET</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">TRANSISTOR AMPLIFIERS AND OSCILLATORS</td><td>15 hrs</td></tr>
<tr><td colspan="7">Amplifiers – Classification of amplifiers- Class A power amplifiers-Push-pull amplifier-Class B amplifier-Cross over distortion- Coupling Schemes-RC coupled amplifier- Transformer coupled amplifier
Basic concepts of feedback-Effects of negative feedback - Barkhausen criterion- Hartley, Colpitts, RC phase shift oscillator, Wien bridge oscillator</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">CIRCUIT THEOREMS</td><td>14 hrs</td></tr>
<tr><td colspan="7">KCL, KVL, Nodal & Mesh Analyses, Thevenin‟s Theorem, Norton‟s Theorem, Superposition theorem, Maximum Power Transfer Theorem, Reciprocity theorem.</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">TWO PORT NETWORK PARAMETERS</td><td>14 hrs</td></tr>
<tr><td colspan="7">Impedance parameters, Admittance parameters, Hybrid parameters, Transmission parameters, Scattering parameters, Relationship between parameters, Interconnection of Networks, T and pi networks</td></tr>
</table>

Text Books	1. V K Mehta & Rohit Mehta (2020) "*Principles of Electronics*", S Chand Publishing 2. A Sudhakar, S.S.Palli, *"Circuits and networks – Analysis and synthesis*", McGrawHill (India) Pvt. Ltd., 5th Edition. 3. Salivahanan and N. Suresh Kumar,(2017) "*Electronic Devices and Circuits*", 4th Edition,Mc Graw Hill Education (India) Private Ltd., 4. Millman J, Halkias.C.and Sathyabrada Jit, (2015)"*Electronic Devices and Circuits*", 4thEdition, McGraw Hill Education(India)Private Ltd.,
Reference Books	1. B L Theraja & R S Sedha (2002) "Principles of Electronic Devices and Circuits", S Chand Publishing 2. Millman, J, and Halkias, C., (2007) "*Integrated Electronics*", 4th Edition, TMH, 3. David A. Bell, (2008) "*Electronic Devices & Circuits*", 5th Edition, Oxford UniversityPress. 4. Thomas L. Floyd – "*Principles of Electric Circuits*", 3rd ed/-, Merrill Publishing company, 5. Ohio.William H. Hayt, Jack E. Kemmerly, Steven M. Durbin – "*Engineering Circuit Analysis*", Tata McGraw Hill, 2002 6. Singh, B. P, and Rekha Singh., (2006) "*Electronic Devices and Integrated Circuits*",Pearson Education.
Web Resources	1. https://archive.nptel.ac.in/courses/108/108/108108122/ 2. https://archive.nptel.ac.in/content/storage2/courses/115102014/downloads/module5.pdf 3. https://svbitec.files.wordpress.com/2013/10/fet-nptel.pdf 4. https://www.tutorialspoint.com/amplifiers/transistor_as_an_amplifier.htm#:~:text=as%20an%20amplifier.-,Transistor 5. https://www.udemy.com/course/moseft-transistor-the-complete-course-for-beginners/ 6. https://nptel.ac.in/courses/108105053 7. https://archive.nptel.ac.in/courses/108/106/108106172/

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand PN junction diode, Zener diode and BJT behaviour, characteristics and applications
	CO2	Analyse construction, operation and characteristics of BJT, JFET, MOSFET
	CO3	Describe different types of amplifiers, oscillators and their working based on their performance, coupling schemes and feedback
	CO4	Explain circuit theorems and analyze electrical circuits using circuit theorems
	CO5	Define two port network parameters and determine the values in networks

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	S	S	M	L	S
CO2	S	S	M	M	S	L	S
CO3	S	M	S	S	S	M	S
CO4	S	S	S	S	M	L	S
CO5	S	S	S	M	S	S	M

STRONG (S), MEDIUM (M) and LOW (L) – 3
Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

<table>
<tr><td>Course Title</td><td colspan="7">Electronic Devices and Circuit Theory Lab</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core II</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>I</td><td rowspan="2">Credits</td><td rowspan="2">4</td><td rowspan="2">Couse Code</td><td rowspan="2">23BEC1P1</td></tr>
<tr><td>Semester</td><td>I</td></tr>
<tr><td rowspan="2">Instructional hours per</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td colspan="2">-</td><td colspan="2">4</td><td colspan="2">4</td></tr>
<tr><td>Course Objectives</td><td colspan="7">➢ To perform the characteristic analysis of diodes and transistors
➢ To construct and understand the working of amplifiers and oscillators
➢ To gain practical experience on electric circuits and verification of theorems.</td></tr>
<tr><td colspan="8">Any 10 Experiments
1. PN Junction diode Characteristics
2. Zener diode Characteristics
3. Zener Voltage Regulation
4. BJT Characteristics (Input and Output) – Common Base (CB)
5. BJT Characteristics (Input and Output) – Common Emitter (CE)
6. BJT Characteristics (Input and Output)– Common Collector (CC)
7. CE amplifier Characteristics
8. RC coupled amplifier
9. Transformer Coupled amplifier
10. Hartley Oscillator
11. Colpitt‟s Oscillator
12. Wien Bridge Oscillator
13. RC phase shift oscillator
14. Verification of Kirchhoff‟s Law
15. Verification of Norton‟s Theorem
16. Verification of Thevenin‟s Theorem
17. Verification of Superposition Theorem
18. Maximum Power Transfer Theorem
19. Reciprocity theorem
20. T-π Network conversion</td></tr>
<tr><td>Text Books</td><td colspan="7">1. David M. Buchla, (2007) “Electronic Devices: Laboratory Exercises”, VIII Ed.
2. Herbert W. Jackson, “Introduction to Electrical Circuits: Lab Manual”, VIII Edition Oxford University Press, 2008.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Zbar, Malvino & Miller, “Basic Electronics - A Text Lab Manual” Tata McGraw Hill.
2. R. Sugaraj Samuel & Horsley Solomon, “B.E.S. Practicals”, Department of Electronic Science, C.T.M. College of Arts and Science, Chennai.</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://nptel.ac.in/courses/122106025
2. https://www.youtube.com/watch?v=GUTvr9gJtgI
3. https://www.youtube.com/watch?v=yeChL1V1GrA
4. https://www.gopracticals.com/electronics/basic-electronics/electronics-transistor-characteristics/
5. https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/ElectricalCircuitsLab-EE0211.pdf</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	Depict the biasing characteristics of diodes
	CO2	Analyze the characteristics of CB, CE and CC transistor configuration
	CO3	Design and demonstrate the working of transistor amplifiers and oscillators
	CO4	Construct electric circuits and verify circuit theorems

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	S	S	S	S
CO2	S	S	S	L	S	M	S
CO3	S	S	S	M	S	M	L
CO4	S	S	L	S	M	L	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

<table>
<tr><td>Course Title</td><td colspan="7">Consumer Electronics</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC – I</td></tr>
<tr><td>Category</td><td>SEC</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Couse Code</td><td>23BEC1S1</td></tr>
<tr><td></td><td></td><td>Semester</td><td>I</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td colspan="2">Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td></td><td colspan="2">2</td><td colspan="2">-</td><td colspan="2">-</td><td>2</td></tr>
<tr><td>Course Objectives</td><td colspan="7">➢ To train and develop professional skills for installation, problem diagnosis and rectification of minor and major malfunctioning in microwave oven, washing machine, air conditioner, refrigerator and digital devices like xerox copier, clock, computer, bar code reader and ATM</td></tr>
<tr><td>Units</td><td colspan="7">Course Details</td></tr>
<tr><td>Unit-I</td><td colspan="7">MICROWAVE OVENS
Microwaves - Properties and generation - Microwave oven block diagram - LCD timer with alarm - Controllers - Wiring and Safety instructions - Care and Cleaning</td></tr>
<tr><td>Unit - II</td><td colspan="7">WASHING MACHINES
Electronic controller for washing machines - Washing machine hardware and software - Types of washing machines - Fuzzy logic washing machines - Features of washing machines.</td></tr>
<tr><td>Unit-III</td><td colspan="7">AIR CONDITIONERS AND REFRIGERATORS
Air Conditioning - Components of air conditioning systems - All water air conditioning systems - All air conditioning systems - Unitary and central air conditioning systems - Split air conditioners.</td></tr>
<tr><td>Unit-IV</td><td colspan="7">HOME / OFFICE DIGITAL DEVICES
Xerographic copier - Calculators - Structure of a calculator - Internal Organization of a calculator - Servicing electronic calculator - Digital clock - Block diagram of a digital clock.</td></tr>
<tr><td>Unit-V</td><td colspan="7">DIGITAL ACCESS DEVICES
Digital computer - Internet access - Online ticket reservation - Functions and networks - Barcode Scanner and decoder - Electronic Fund Transfer - Automated Teller Machines (ATMs)</td></tr>
<tr><td>Text Books</td><td colspan="7">1. S.P. Bali, (2005) “Consumer Electronics” Pearson Education, New Delhi,
2. Douglas Kinney, (2006) “A Beginners Guide to Consumer Electronics Repair” iUniverse</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Shashi Bhushan Sinha, (2016) “Handbook of Repair and Maintenance of Domestic Electronics Appliances”, BRP Publications</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://studiousguy.com/microwave-oven-working-principle/
2. https://www.slideshare.net/anmolbagga/home-appliances
3. https://www.powershow.com/viewfl/4693e1-MmU3M/ELECTRICAL_APPLIANCES_powerpoint_ppt_presentation</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand working of microwave ovens and handle safely
	CO2	Explain the functioning of washing machines and repair faulty accessories
	CO3	Recognize the operation of refrigerator, air conditioner, could identify and rectify error
	CO4	Comprehend the concept of digital calculator, digital clock, photocopier and could rectify failures
	CO5	Understand working of digital computers, ATMs and handle them securely

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	M	S	S
CO2	M	M	S	S	M	S	L
CO3	S	S	M	S	S	L	S
CO4	M	S	S	M	S	S	M
CO5	M	M	L	S	L	M	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	2	2
CO3	3	3	3	2	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3
Weightage	15	14	15	13	14
Weighted Percentage of Course Contribution to PSOs	3	2.8	3	2.6	2.8

<table>
<tr><td>Course Title</td><td colspan="7">Electronic Instrumentation</td></tr>
<tr><td>Paper No.</td><td colspan="7">Foundation Course</td></tr>
<tr><td>Category</td><td>FC</td><td>Year
Semester</td><td>I
I</td><td>Credits</td><td>2</td><td>Couse Code</td><td>23BEC1FC</td></tr>
<tr><td>Instructional hours per week</td><td colspan="2">Lecture
2</td><td colspan="2">Tutorial
-</td><td colspan="2">Lab Practice
-</td><td>Total
2</td></tr>
<tr><td>Course Objectives</td><td colspan="7">➢ To enable the students to understand and gain the knowledge in, digital instruments and R, L, C measurements
➢ To acquaint the students with construction and working of oscilloscopes and signal generators
➢ To equip students with the knowledge and skills in digital waveform /spectrum analyzer</td></tr>
<tr><td>Units</td><td colspan="7">Course Details</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">DIGITAL INSTRUMENTS</td><td>5 hrs</td></tr>
<tr><td colspan="7">Digital Instruments basics – Digital displays – Digital counters – ADC and DAC – DigitalVoltmeter – Digital Multimeter – Digital Frequency meter – Frequency meter accuracy – Time and ratio measurements.</td></tr>
<tr><td rowspan="2">Unit - II</td><td colspan="6">R, L AND C MEASUREMENTS</td><td>7 hrs</td></tr>
<tr><td colspan="7">Low, High and Precise Resistance Measurements – Voltmeter and Ammeter methods –Wheatstone Bridge – Low, High and Precise measurement methods– AC bridge theory – Capacitance bridges – Inductance bridges –Digital R, C, L measurements – Digital LCR meter</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">OSCILLOSCOPES</td><td>6 hrs</td></tr>
<tr><td colspan="7">CRT – Dual trace Oscilloscopes – Voltage, frequency and phase measurements – Analog storage oscilloscopes – Digital storage oscilloscopes – Sampling oscilloscopes</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">SIGNAL GENERATORS</td><td>6 hrs</td></tr>
<tr><td colspan="7">Function generators – Pulse generators – Sweep frequency generators – RF signal generators – Frequency synthesizer – Arbitrary waveform generator – DSO applications</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">RECORDING AND WAVEFORM ANALYZING INSTRUMENTS</td><td>6 hrs</td></tr>
<tr><td colspan="7">Strip chart recorders – X-Y Plotters – Plotting device characteristics – Plotter – Digitalwaveform recorder / analyzer – Spectrum analyzer – Digital spectrum analyzer Strip chart recorders – X-Y Plotters – Plotting device characteristics – Plotter – Digitalwaveform recorder / analyzer – Spectrum analyzer – Digital spectrum analyzer</td></tr>
<tr><td>Text Books</td><td colspan="7">1. David A.Bell (2003), “Electronic measurements and Instruments”, Prentice Hall of India,2/e,
2. J.B.Gupta, “A Course In Electronic and Electrical Measurements and Instrumentation”, 12th Edition, S.K Kataria & Sons.
3. R.S. Sedha, “Electronic measurements and Instrumentation”. Chand</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Alan S Morris, (2001) “Measurement and Instrumentation Principles”, 3rd Edition,Butterworth- Heinemann.
2. J P Navani, “Electronic Measurement And Instrumentation”, S Chand Publications
3. A.K. Sawhney,(2015), “A Course in Electronic Measurements and Instrumentation”,Dhanpat Rai & Co.,</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://archive.nptel.ac.in/courses/108/105/108105153/
2. https://freevideolectures.com/course/4111/nptel-electrical-measurement-electronic-instruments</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand the principles and working of digital displays, meters and counters
	CO2	Explain the principles of AC/DC bridges and their measurements
	CO3	Recognize the applications of oscilloscopes in measurements
	CO4	Demonstrate skills of using function generators for waveform generation
	CO5	Study and analyze the outputs of waveform/spectrum analyzer

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	M	M	S	S	M
CO2	M	S	S	S	M	L	M
CO3	S	M	M	S	L	M	S
CO4	M	M	S	S	M	L	S
CO5	M	S	S	L	S	M	L

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

Title of the Course	Digital Electronics						
Paper No.	Core III						
Category	Core	Year	I	Credits	4	Course Code	23BEC2C1
		Semester	II				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	4	1	-		5		
Objectives ofthe course	➢ To provide basic knowledge about number systems and postulates of Boolean algebra ➢ To introduce the students to the digital logic families ➢ To learn different logic design concepts and circuits ➢ To present the different types of memory devices and their features						
Units	Course Details						75 hrs
Unit-I	NUMBER SYSTEM AND CODES						13 hrs
	Binary Numbers - Decimal, Binary, Octal and Hexadecimal number systems- base conversions – Binary addition – subtraction (1‟s and 2‟s compliment method) - BCD code- BCD-Excess3-gray code-alphanumeric codes						
Unit-II	BOOLEAN ALGEBRA AND MINIMIZATION						15 hrs
	Basic logic gates - Basic theorems – Boolean functions – De Morgan‟s Theorem - Canonical and Standard forms – Minimization techniques – K- map up to five variables – Don‟t care condition - NAND and NOR implementation						
Unit-III	COMBINATIONAL LOGIC DESIGN						15 hrs
	Design using gates – Binary adder – BCD adder - Subtractor – Multiplier – Divider - Multiplexer and Demultiplexer – Encoder and decoder– Parity checker – Parity generator – Magnitude comparator						
Unit-IV	SEQUENTIAL LOGIC DESIGN						16 hrs
	Flip-flops - SR, JK, D, T, and Master-Slave - asynchronous ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Modulo–n counter – Shift registers						
Unit-V	MEMORY DEVICES						16 hrs
	Classification of memories – ROM organization – PROM – EPROM – EEPROM– RAM organization – Static RAM Cell - Dynamic RAM cell – Programmable Logic Devices – Programmable Logic Array (PLA) – Programmable Array Logic (PAL).						
Text Books	1. M. Morris Mano and Michael D. Ciletti, “Digital Design”, 5th Edition, Pearson, 2014 2. Donald P.Leach,Albert Paul Malvino & Gautom Saha, “DigitalPrinciples and Applications”,8th Edition, McGraw Hill, August 2014 3. S.Salivahanan and S.Arivazahagan. “Digital circuits and design”, Vikas publishing house Ltd., 2000.						
Referenc eBooks	1. Thomas L. Floyd, “Digital Fundamentals”, 10th Edition, Pearson Education Inc, 2011 2. Anand Kumar A., “Fundamentals of Digital Circuits”, 4th Edition, PHI Learning Private Limited, 2016 3. Dr. R. S. Sedha, “Digital Electronics”, S. Chand Publications, (3rd Revised Edition).						

	4. Anil K.Maini, "Digital Electronics", Wiley, 2014
Web Resources	1. https://archive.nptel.ac.in/content/storage2/courses/106108099//Digital%20Systems.pdf 2. https://archive.nptel.ac.in/courses/108/105/108105132/ 3. https://archive.nptel.ac.in/courses/108/105/108105113/ 4. https://pages.uoregon.edu/rayfrey/DigitalNotes.pdf

COURSE OUTCOMES:

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

Course Outcomes	CO1	Perform conversion of number systems
	CO2	Simplify Boolean functions using Karnaugh Map
	CO3	Explain the functions of various digital logic circuits and ICs
	CO4	Discuss the working of flip flops, counters and registers
	CO5	Describe memory devices used in digital circuits

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	L	S
CO2	S	S	M	M	S	L	S
CO3	S	M	S	S	S	M	S
CO4	S	S	S	S	M	L	S
CO5	S	S	S	M	S	S	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

Course Title	Digital Electronics Lab						
Paper No.	Core IV						
Category	Core	Year	I	Credits	4	Couse Code	23BEC2P1
		Semester	II				
Instructional hours per week	Lecture		Tutorial	Lab Practice		Total	
	-		-	4		4	
Course Objectives	➢ To design and implement any Boolean function using logic gates. ➢ To design and analyze combinational logic circuits ➢ To design and analyze sequential logic circuits.						

Any 10 Experiments

1. Verification of Basic Gates
2. Realize Basic gates from universal gates
3. Verification of Demorgan"s Theorem
4. Solve simple Boolean Equations
5. Half Adder and Full Adder
6. Half Subtractor and Full Subtractor
7. Binary to Gray code converter and vice-versa
8. 4-bit Binary Adder
9. Binary to Gray code converter
10. Multiplexer and Demultiplexer
11. Encoder and Decoder
12. Study of Flip flops
13. Shift Registers
14. Ring Counter
15. Mod Counter
16. Up-Down counter

Text Books	1. Roger Tokheim, "*Digital Electronics Experiments Manual: Principles and Applications*", 8th Ed., McGraw-Hill Science Engineering, 2013
Reference Books	1. Zbar, Malvino & Miller, "Basic Electronics - A Text Lab Manual" Tata McGraw Hill. 2. Cherry Bhargava, "Digital Electronics: A Comprehensive Lab Manual", BS Publications, 2020
Web Resources	1. https://de-iitr.vlabs.ac.in/exp/truth-table-gates/procedure.html 2. http://eie.sliet.ac.in/files/2021/03/Lab-Mannual-for-Digital-Electronics-Lab.pdf

COURSE OUTCOMES:

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

Course Outcomes	CO1	Verify the truth tables of digital ICs
	CO2	Construct arithmetic and logic circuits using ICs
	CO3	Verify the outputs of flip flops using ICs
	CO4	Implement counter circuits and verify the output
	CO5	Demonstrate MUX / DEMUX working

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	L	M
CO2	S	S	S	M	L	S	L
CO3	S	M	S	L	M	S	M
CO4	S	S	M	S	M	S	S
CO5	S	M	S	M	S	M	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	2
CO2	3	3	3	2	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	13	14
Weighted Percentage of Course Contribution to PSOs	3	3	3	2.6	2.8

<table>
<tr><td>Course Title</td><td colspan="7">C Programming</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC – II</td></tr>
<tr><td>Category</td><td>SEC</td><td>Year</td><td>I</td><td>Credits</td><td>2</td><td>Couse Code</td><td>23BEC2S1</td></tr>
<tr><td></td><td></td><td>Semester</td><td>II</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Instructional hours per week</td><td colspan="2">Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td colspan="2">2</td><td>-</td><td colspan="2">-</td><td colspan="2">2</td></tr>
<tr><td>Course Objectives</td><td colspan="7">➢ To understand basic C program data structures, concepts and statements
➢ To know applications in C using functions, pointers and structures
➢ To familiarize with the Programming basics</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>30 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">INTRODUCTION TO C</td><td>6 hrs</td></tr>
<tr><td colspan="7">Basic Structure of C program – Constants, variables and Datatypes –Operators and Expressions - Compilation and Execution of C programs</td></tr>
<tr><td rowspan="2">Unit - II</td><td colspan="6">STATEMENTS</td><td>6 hrs</td></tr>
<tr><td colspan="7">Structure of C Program - Library Functions - Data input and output
- Control Statements - IF Statement, IF…ELSE Statement, Nesting of IF…Else Statement – Switch Statement - Loop Controls – FOR, WHILE, DO-WHILE Loops, Break Continue, Exit, GO...TO Statement</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">FUNCTIONS</td><td>6 hrs</td></tr>
<tr><td colspan="7">The Need of a Function - definition - User Defined and Library Function - Prototype of a Function - Calling of a function - Function Argument - Passing arguments to function - Return Values - Nesting of Function - Command Line Argument – Recursion</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">ARRAYS AND STRINGS</td><td>6 hrs</td></tr>
<tr><td colspan="7">Arrays -Single and Multi-dimensional arrays, Declaration and Initialization of arrays and strings, pointers and one-dimensional arrays-Structures-Definition, declaration of structure variables, accessing structure members – unions</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">PROGRAMMING EXAMPLES</td><td>6 hrs</td></tr>
<tr><td colspan="7">Sum of digits - Armstrong number - Prime number - Fibonacci series - Adam number - reverse string - minimum and maximum of „n“ numbers using array - ascending /descending order - add / multiply two matrices</td></tr>
<tr><td>Text Books</td><td colspan="7">1. E. Balaguruswamy, Programming with C, TMH.
2. Byron Gottfried, Programming with C, Schaum“s Outline Series, TMH.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. N.Rajaram, “C Programming Made Easy”, Scitech Publications, 1998.
2. Yashavant Kanetkar, Let Us C, Eighteenth Edition, BPB Publications, 2021</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://archive.nptel.ac.in/courses/106/104/106104128/
2. https://codeforwin.org/
3. https://www.vssut.ac.in/lecture_notes/lecture1424354156.pdf</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand the programming structure in C
	CO2	Discuss statements used in C(branching and looping, arrays)
	CO3	Describe the functions in C (Calling, Passing, Return)
	CO4	Apply the programming principles learnt in real-time problems
	CO5	Write and test simple C programs

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	S	S	M	S	M
CO2	S	S	M	S	L	S	S
CO3	S	S	L	M	S	S	S
CO4	S	M	S	L	S	S	S
CO5	S	S	S	S	S	S	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	2	3	3	3	3
Weightage	14	15	14	15	15
Weighted Percentage of Course Contribution to PSOs	2.8	3	2.8	3	3

Course Title	Fundamentals of Nanoelectronics						
Paper No.	SEC – III						
Category	SEC	Year	I	Credits	2	Course Code	23BEC2S2
		Semester	II				

Instructional hours per week	Lecture	Tutorial	Lab Practice	Total
	2	-	-	2

Course Objectives	➢ To understand the concepts of nano electronics and quantum electronics ➢ To understand the concepts of nano electronic devices, transistors, tunnelingdevices and superconducting devices ➢ To realize the basics of nanotube devices	
Units	Course Details	30 hrs
Unit-I	INTRODUCTION TO NANOELECTRONICS	6 hrs
	Scaling to nano - Light as a wave and particle- Electrons as waves and particles- origin of quantum mechanics - General postulates of quantum mechanics - Time independent Schrodinger wave equation- Electron confinement - Quantum dots, wires and well-Spin and angular momentum	
Unit – II	DEPOSITION (THIN FILM) TECHNIQUES	8 hrs
	Basics of physical methods, Glow discharge DC Sputtering, Radio frequency sputtering, Magnetron sputtering, Ion beam sputtering, Vacuum evaporation, Resistive heat Evaporation, Flash Evaporation, Electron Beam Evaporation, LASER evaporation, Fundamentals of chemical methods, Chemical Vapour Deposition, LASER chemical Vapour Deposition, Photo Chemical Vapour Deposition, Plasma enhanced Vapour Deposition, Metal Organo Chemical Vapour Deposition, Chemical Bath Deposition, Electro less Deposition, Anodization, Liquid Phase Epitaxy, Sol-Gel method, Spin Coating, Spray Pyrolysis Technique	
Unit-III	THIN FILM CHARACTERIZATION TECHNIQUES	5 hrs
	Cyclic Voltammetry, Thickness measurement Techniques, X-Ray Diffraction Technique, Raman Spectral Study, Scanning Electron Microscopy, Energy Dispersive Analysis, Atomic Force Microscopy	
Unit-IV	NANOELECTRONIC DEVICES	6 hrs
	Digital and Switching abstraction, Quantum Cellular Automata (QCA), Realization oflogic gates using QCA, Types and synthesis of molecular bundles, principle and types of spin wave devices, Array minimum/maximum computation with spin wave devices	
Unit-V	NANOTUBES AND NANOSTRUCTURE DEVICES	5 hrs
	Carbon Nanotube - Fullerenes - Types of nanotubes – Formation of nanotubes –Assemblies –Purification of carbon nanotubes – Electronic properties – Synthesis of carbon nanotubes – Nanotube for memory applications - Nano structures and nano structured devices.	

Text Books	1. S L Kakani, “Nanoelectronics”, New Age International Publishers, IEd., 2019 2. Hanson, “Fundamentals of Nanoelectronics”, Pearson Education, 2009.
Reference Books	1. Mircea Dragoman, Daniela Dragoman, “Nanoelectronics: Principles and Devices”,Artech House, 2009. 2. Robert Puers, Livio Baldi, Marcel Van de Voorde and Sebastiaan E. Van Nooten,“Nanoelectronics: Materials, Devices, Applications”, Wiley, 2017. 3. Brajesh Kumar Kaushik, “Nanoelectronics: Devices, Circuits and Systems”, ElsevierScience, 2018

Web Resources	1. https://nptel.ac.in/courses/117108047 2. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SEC1615.pdf 3. https://www.tutorialsweb.com/nanotech/index.htm

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand the basics of nanoelectronics including quantum wires, dots and wells
	CO2	Emphasize various physical and chemical deposition techniques with their principle
	CO3	Discuss the characterization techniques used for the development of nanoelectronic devices
	CO4	Understand nanoelectronic devices like QCA, molecular bundles and spin waves
	CO5	Apply the knowledge in the development of nanotubes and nanostructured devices

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	L	S	S
CO2	M	S	S	S	S	M	L
CO3	S	S	M	S	S	L	S
CO4	S	S	S	L	S	S	S
CO5	S	M	S	S	S	S	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	2	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	14	15	14
Weighted Percentage of Course Contribution to PSOs	3	3	2.8	3	2.8

<table>
<tr><td>Title of the Course</td><td colspan="7">Linear Integrated Circuits</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC3C1</td></tr>
<tr><td>Semester</td><td>III</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To get fundamental knowledge of operational amplifier
➢ To familiarize with the applications of op-amp
➢ To understand the functions of A/D and D/A converters
➢ To know the special functions of IC-741, IC-555 and IC-723</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">CIRCUIT CONFIGURATION FOR LINEAR IC</td><td>15 hrs</td></tr>
<tr><td colspan="7">Internal circuit diagrams of IC 741 – DC and AC performance characteristics –Slew rate – Open and closed loop configurations – Integrated Circuit fabrication process.</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">APPLICATIONS OF OPERATIONAL AMPLIFIERS</td><td>15 hrs</td></tr>
<tr><td colspan="7">Sign changer, scale changer, phase shift circuits – Voltage follower – V-to-I and I-to-V converters – Adder – Subtractor –Integrator – Differentiator– Logarithmic amplifier – Antilogarithmic amplifier – Comparators – Schmitt trigger – Peak detector – Clipper and clamper – Low- pass – High-pass and band filters.</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">PHASE LOCKED LOOP</td><td>15 hrs</td></tr>
<tr><td colspan="7">Operation of the basic PLL – Closed loop analysis – Voltage controlled oscillator – Monolithic PLL IC 565 – Application of PLL for AM detection – FM detection – FSK modulation – demodulation</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">A / D AND D / A CONVERTERS</td><td>15 hrs</td></tr>
<tr><td colspan="7">D/A converter – Specifications – Weighted resistor type – R- 2R ladder type A/D converters – Specifications – Flash type – Successive approximation type – Single slope type – Dual slope type</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs</td><td>15 hrs</td></tr>
<tr><td colspan="7">Sine-wave generators – Multivibrators and triangular wave generator – Saw-tooth wave generator – ICL8038 function generator – Timer IC 555 – IC voltage regulators – Three terminal fixed and adjustable voltage regulators – IC 723 general purpose regulator – Frequency to voltage and voltage to frequency converter</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Ramakant A. Gayakwad,"OP-AMP and Linear ICs", 4th Edition, Prentice Hall / Pearson Education,2015.
2. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", 5th Edition, New Age International Pvt.Ltd., 2018.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Gray and Meyer, "Analysis and Design of Analog Integrated Circuits" , Wiley International,5th Edition, 2009
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 4th Edition, Tata Mc Graw-Hill, 2016
3. William D.Stanley, "Operational Amplifiers with Linear Integrated</td></tr>
</table>

	Circuits", Pearson Education, 4th Edition, 2001. 4. B.S.Sonde, "System design using Integrated Circuits", 2nd Ed., New Age Pub, 2001.
Web Resources	1. https://archive.nptel.ac.in/courses/108/108/108108111/ 2. https://www.scribd.com/document/378055721/Linear-Integrated-Circuits-Lecture-Notes-Study-Material-and-Important-Questions-Answers 3. https://www.brainkart.com/subject/Linear-Integrated-Circuits_220/

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand the fundamentals and the operation of IC741.
	CO2	Design and demonstrate different applications based on Operational Amplifiers
	CO3	Gain knowledge about multiplier IC"s, PLL IC and its applications
	CO4	Categorize and learn about A/D and D/A converters.
	CO5	Demonstrate the functioning of waveform generator, timer and voltage regulators

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	S	S
CO2	S	S	S	S	M	S	L
CO3	M	S	L	S	S	M	S
CO4	S	M	S	S	L	S	S
CO5	S	S	S	M	S	S	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	14	15	14
Weighted Percentage of Course Contribution to PSOs	3	3	2.8	3	2.8

Course Title	Linear Integrated Circuits Lab						
Paper No.	Core VI						
Category	Core	Year	II	Credits	4	Couse Code	23BEC3P1
		Semester	III				

Instructional hours per	Lecture	Tutorial	Lab Practice	Total
	-	-	4	4

Course Objectives

- To get knowledge to connect Op-Amp with power supply
- To understand how the Op-Amp is used for various application
- To understand how the 555 timer operates in various modes
- To design converter and wave generators

Any 10 Experiments

1. Inverting and Non-inverting amplifier
2. Differential amplifier
3. Inverting and Non Inverting Summing Amplifier
4. Op-Amp: Adder and Subtractor
5. Integrator and Differentiator.
6. Active low pass
7. High pass
8. Band pass filters.
9. Astable and Monostable multivibrators using Op-Amp
10. Schmitt trigger using Op-Amp.
11. Phase shift oscillator using Op-Amp
12. Wien bridge oscillator using Op-Amp
13. Astable and Monostable multivibrators using IC555 timer.
14. PLL characteristics and its use as frequency multiplier.
15. Analog to Digital Converter
16. Digital to Analog Converter
17. Audio Power Amplifier design using LM380

Note: Op-Amps uA741, LM 301, LM311, LM 324 and AD 633 may be used

Text Books

1. L. Malathi, P. Devi, "Linear Integrated Circuits Laboratory Manual", Notion Press

Reference Books

1. Nikola Sorak, "Linear Integrated Circuits: Laboratory Experiments", Merrill; 2nd edition, 1990

Web Resources

1. https://infonics.files.wordpress.com/2015/03/ec232-analog-integrated-circuits-lab-manual-click-here-to-download-pdf.pdf
2. https://www.scribd.com/document/396544650/EC8462-Linear-Integrated-Circuits-Lab-Manual

COURSE OUTCOMES:

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

Course Outcomes	CO1	Develop their skill to handle Op-Amp for various applications and its circuit design
	CO2	To design and analyze amplifiers and wave shaping circuits using IC741.
	CO3	To design and analyze multivibrators and oscillators using IC741.
	CO4	To design and analyze multivibrator using IC555

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	S	M	S	L	S	S	M
CO3	S	S	S	S	S	S	L
CO4	S	S	S	M	S	M	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	12	12	12	12
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

Course Title	Python Programming						
Paper No.	SEC – IV						
Category	SEC	Year	II	Credits	2	Cours eCode	23BEC3S2
		Semester	III				

Instruction alhours per	Lecture	Tutorial	Lab Practice	Total
	2	-	-	2

Course Objectives	➢ To introduce Python and its basic statements, functions ➢ To familiarize with the data structures ➢ To introduce OOPS concepts ➢ To understand tuples, set, dictionaries ➢ To write simple Python programs

Units	Course Details	30 hrs
Unit-I	**BASICS OF PYTHON PROGRAMMING**	6 hrs
	Features of Python, variables and identifiers, operators and expressions. **Decision control Statements:** Selection/Conditional branching statements, basic loop structures/iterative Statements, nested loops, break, continue, and pass Statements. **Functions and Modules**: function definition, function call, more on defining functions, recursive function	
Unit - II	**DATA STRUCTURES**	6 hrs
	Strings: Introduction, built-in string methods and functions, slice operation, String Module. Regular Expressions. **Lists:** Introduction, nested list, cloning lists, basic list operations, list methods. **Functional programming** filter (), map (), reduce () function.	
Unit-III	**FILES AND EXCEPTIONS**	6 hrs
	Read and writing files, pickling, handling exceptions. Built-in and user- defined exceptions. OOPS Concepts: Introduction, classes and object, class method and self-argument, the init () method, class variables and object variables, public and private data members	
Unit-IV	**TUPLES**	6 hrs
	Introduction, basic tuple operations, tuple assignment, tuples for returning multiple values, nested tuples, tuple methods and functions. Set: Introduction, Set operations. Dictionaries: Basic operations, sorting items, looping over dictionary, nested dictionaries, built-in dictionary functions	
Unit-V	**PROGRAMMING IN PYTHON**	**6 hrs**
	Practice with expressions, conditionals, loops, list, dictionary, and strings, largest and smallest numbers, Primary number, Armstrong number , Palindrome, greatest common divisor , least common multiple , smallest and largest	

Text Books	1. Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python", Mc-Graw Hill Education, 2018. 2. Allen B. Downey, ``Think Python: How to Think Like a Computer Scientist,,,,, 2nd edition, Updatedfor Python 3, Shroff/O,,Reilly Publishers, 2016. 3. VamsiKurama, "Python Programming: A Modern Approach", Pearson Education.
Reference Books	1. Mark J Guzdial, Introduction to Computing and programming in Python, 3 Edition (2013), Pearson India 2. ReemaThareja, "Python Programming using problem solving approach", First Edition, 2017, Oxford University Press. 3. Dr. R. NageswaraRao, "Core Python Programming", First Edition, 2017, Dream

	tech Publishers. 4. Albert Lukaszewski, "My SQL for python ", PACKT publishers 5. Mark Lutz, "Learning Python", O"Reilly Publications. 6. Stewart Venit and Elizabeth Drake, Prelude to Programming: Concepts and Design, 6th Edition, (2015), Pearson India
Web Resources	1. https://archive.nptel.ac.in/courses/106/106/106106182/ 2. http://nptel.ac.in/courses/117106113/34 3. www.scipy-lectures.org/intro/language/python_language.html 4. https://www.geeksforgeeks.org/python-programming-language/ 5. https://en.wikipedia.org/wiki/Python_(programming_language) 6. https://rajivbhandari.files.wordpress.com/2018/11/nptel-6.pdf

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand the basics of Python – variables, operators, expressions
	CO2	Summarize the stings, list and functional programming in Python
	CO3	Describe files, pickling, handling, exceptions and OOPS concept
	CO4	Depict tuple operations, set operations and dictionary functions
	CO5	Develop a PYTHON program for a given problem and test for its correctness

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	M	L	S	M
CO2	S	M	S	L	M	S	S
CO3	S	M	S	M	S	L	S
CO4	S	S	M	S	S	S	L
CO5	S	L	M	S	S	M	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3
CO2	3	3	2	3	3
CO3	3	3	3	3	3
CO4	3	3	2	3	3
CO5	3	3	3	3	3
Weightage	15	14	13	15	15
Weighted Percentage of Course Contribution to PSOs	3	2.8	2.6	3	3

<table>
<tr><td>Title of the Course</td><td colspan="7">Communication</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core VII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>II</td><td>Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC4C1</td></tr>
<tr><td>Semester</td><td>IV</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To introduce the concept of various analog modulations techniques.
➢ To know functions and correlations used in modulation
➢ To understand frequency modulation and phase modulation
➢ To comprehend the effect of noise in communication systems
➢ To realize Analog to Digital transitions</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">REPRESENTATION OF SIGNALS AND LINEAR MODULATION</td><td>16 hrs</td></tr>
<tr><td colspan="7">Classification of signals-Fourier transform and its properties-Dirac Delta function Spectral density-Auto correlation function-Cross correlation functions-Ideal low pass filters- Generation and demodulation of AM, DSBSC, SSB and VSB signals – Comparison of amplitude modulation systems– Frequency translation</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">ANGLE MODULATION</td><td>15 hrs</td></tr>
<tr><td colspan="7">Definition of frequency modulation and phase modulation-Inter- relationship-Single Tone FM-Narrow band and wide band FM-Multitone FM waves-Transmission Bandwidth- Generation and Demodulation of FM waves.</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">NOISE THEORY</td><td>16 hrs</td></tr>
<tr><td colspan="7">Noise – Shot noise – Thermal noise and white noise – Narrow band noise – Noise temperature – Noise figure – Super heterodyne radio receiver and its characteristics – SNR – Noise in DSBSC systems using coherent detection – Noise in AM system using envelope detection FM system – FM threshold effect – Pre-emphasis and de-emphasis in FM – Comparison of performances.</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">TRANSITION FROM ANALOG TO DIGITAL</td><td>13 hrs</td></tr>
<tr><td colspan="7">Sampling Process – PAM – TDM – PPM – Quantization Process – PCM – Delta Modulation – Theme Examples – Impulse radio and MPEG, ISI, Eye pattern.</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">DIGITAL MODULATION SCHEMES</td><td>15 hrs</td></tr>
<tr><td colspan="7">Baseband M-ary PAM – Band-pass transmission model – Transmission of Binary PSK and FSK, M-ary Data transmission systems, Comparison of noise performances of various PSK and FSK systems – OFDM.</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Simon Haykin and Michael Moher, “Communication Systems”,5th Edition, John Wiley & Sons
2. S.Vasuki, Karthik.K. “Communication Theory”, Charulatha Publications</td></tr>
</table>

Reference Books	1. Bruce Carlson., "Communication Systems", 3rd Ed., TMH, 1996B. 2. Dennis Roddy and John Coolen., "Electronic Communication", 4th Edition, PHI, 2006. 3. H P Hsu, Schaum, "Outline Series-Analog and Digital communications", TMH 2006. 4. Herbert Taub and Donald L Schilling., "Principles of Communication Systems", 4th Edition, TMH, 2015.
Web Resources	1. https://nptel.ac.in/courses/106106097 2. https://archive.nptel.ac.in/courses/117/105/117105143/ 3. https://www.brainkart.com/subject/Communication-Theory_214/

COURSE OUTCOMES:

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

Course Outcomes	CO1	Define Dirac Delta functions
	CO2	Describe frequency and phase modulation
	CO3	Depict the effect of noise in communication
	CO4	Explain the PAM, PCM, TDM, PPM and Delta modulation
	CO5	Discuss the different digital modulation techniques in communication

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	S	S
CO2	S	S	S	M	S	S	S
CO3	S	S	S	S	M	S	S
CO4	S	S	S	S	S	S	S
CO5	S	M	S	S	S	S	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

Course Title	Communication Lab						
Paper No.	Core VIII						
Category	Core	Year	II	Credits	3	Couse Code	23BEC4P1
		Semester	IV				

Instructional hours per	Lecture	Tutorial	Lab Practice	Total
	-	-	3	3

Course Objectives	➢ To identify the elements used and modulation and demodulation circuits ➢ To understand modulation and demodulation techniques ➢ To construct modulation and demodulation circuits

Any 10 Experiments

1. Amplitude Modulation
2. Amplitude Demodulation
3. Frequency Modulation
4. Frequency Demodulation
5. Pulse Amplitude Modulation
6. Pulse Amplitude Demodulation
7. Pulse Width Modulation
8. Pulse Width Demodulation
9. Pulse Position Modulation
10. Pulse Position Demodulation
11. Amplitude Shift Keying Modulation
12. Amplitude Shift Keying Demodulation
13. Frequency Shift Keying Modulation
14. Frequency Shift Keying Demodulation
15. Pre-emphasis and De-emphasis
16. Sample and Hold Circuit
17. Time Division Multiplexing

Text Books	1. M. Krishnamoothy, "Advanced Communication Lab Book", Sip- Page Turners, 2012
Reference Books	1. B. Preetham Kumar, "Communications System Laboratory", CRC Press, 2016
Web Resources	1. https://people.iitism.ac.in/~download/lab%20manuals/ece/7.%20ECC305%20Communication%20System%20Lab.pdf 2. https://vemu.org/uploads/lecture_notes/19_12_2022_753995718.pdf

COURSE OUTCOMES:

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

Course Outcomes		
	CO1	To design AM, FM, PAM, PPM, PWM etc., modulation and demodulation circuits
	CO2	To execute FSK, ASK modulation and demodulation
	CO3	To verify the obtained outputs with theoretical perceptions
	CO4	To analyse the performance of sample & hold, TDM circuits

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	S	S	M	S	S	S	S
CO3	S	S	S	S	S	M	M
CO4	S	M	S	S	S	S	S
CO5	S	S	S	M	S	S	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

<table>
<tr><td>Course Title</td><td colspan="7">Introduction to Arduino Programming</td></tr>
<tr><td>Paper No.</td><td colspan="7">SEC – VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">SEC</td><td>Year</td><td>II</td><td rowspan="2">Credits</td><td rowspan="2">2</td><td rowspan="2">Couse Code</td><td rowspan="2">23BEC4S2</td></tr>
<tr><td>Semester</td><td>IV</td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td></td><td>2</td><td colspan="2">-</td><td colspan="2">-</td><td colspan="2">2</td></tr>
<tr><td>Course Objectives</td><td colspan="7">➢ To understand the pros of Arduino and IoT in modern day life
➢ To learn Arduino architecture and programming
➢ To understand sensors and programming them using Arduino
➢ To get hands on experience in designing various IoT applications</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>30 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">INTRODUCTION</td><td>6 hrs</td></tr>
<tr><td colspan="7">Fundamentals of Arduino Electronics, Software and Hardware Tools for Arduino, Understanding IoT fundamentals, IOT Architecture and protocols , Various Platforms for IoT, Real time Examples of IoT, Overview of IoT components and IoT Communication Technologies, Challenges in IOT</td></tr>
<tr><td rowspan="2">Unit – II</td><td colspan="6">ARDUINO SIMULATION ENVIRONMENT</td><td>6 hrs</td></tr>
<tr><td colspan="7">Arduino Uno Architecture, Setup the IDE, Writing Arduino Software, Arduino Libraries, Basics of Embedded C programming for Arduino, Interfacing LED, push button</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">SENSOR AND ACTUATORS WITH ARDUINO</td><td>6 hrs</td></tr>
<tr><td colspan="7">Overview of Sensors working, Analog and Digital Sensors, Interfacing of Temperature, Humidity, Motion, Light and Gas Sensor with Arduino, Interfacing of Actuators with Arduino, Interfacing of Relay Switch and Servo Motor with Arduino</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">BASIC NETWORKING WITH ESP8266 WIFI MODULE</td><td>6 hrs</td></tr>
<tr><td colspan="7">Basics of Wireless Networking, Introduction to ESP8266 Wi-Fi Module, Various Wi-Fi library, Web server- introduction, installation, configuration, Posting sensor(s) data to web server</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">CLOUD PLATFORMS FOR IOT</td><td>6 hrs</td></tr>
<tr><td colspan="7">Virtualization concepts and Cloud Architecture, Cloud computing, benefits, Cloud services -- SaaS, PaaS, IaaS, Cloud providers & offerings, Study of IOT Cloud platforms, Thing Speak API and MQTT, Interfacing ESP8266 with Web services</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Enamul Hassan, “Arduino Beginners Guide Book - Basic Robotics”,Prayog India, 2023
2. Mike Cheich , “Arduino Book for Beginners”, Programming Electronics Academy, 2021</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Pradeeka Seneviratne,” Building Arduino PLCs: The essential techniquesyou need to develop Arduino-based PLCs”, Apress, 2017
2. Marco Schwartz, “Arduino Home Automation Projects : Automate yourHome using the powerful Arduino Platform”, 2014
3. B.K. Tripathy, Anuradha, “Internet of things (IoT) : technologies, applications, challenges and solutions”, CRC Press, 2018</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://archive.nptel.ac.in/courses/106/105/106105166/
2. https://www.slideshare.net/eoinbrazil/imediaarduino08
3. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCSA1407.pdf
4. https://elec-club-iitb.github.io/tutorials/arduino/</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand the basics of Arduino and IoT
	CO2	Understand Arduino's architecture, including inputs and connectors for add-on devices.
	CO3	Program Arduino to control lights, motors, and other devices
	CO4	Demonstrate the use Arduino for networking
	CO5	Test, debug, and deploy the Arduino to solve real world problems

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	M	S	S	S	S	M	S
CO3	S	S	S	M	S	S	S
CO4	S	M	S	S	S	S	M
CO5	S	S	M	S	S	S	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

<table>
<tr><td>Title of the Course</td><td colspan="7">Microprocessor and Microcontroller</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core IX</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC5C1</td></tr>
<tr><td>Semester</td><td>V</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To get fundamental knowledge and programming concepts in 8085
➢ To gain knowledge of interfacing techniques
➢ To understand interfacing of peripherals
➢ To familiarize with microcontroller 8051 architecture, I/O ports and instructions, counters and timers
➢ To equip with microcontroller 8051 instructions</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">8085 ARCHITECTURE AND PROGRAMMING</td><td>16 hrs</td></tr>
<tr><td colspan="7">The 8085 Microprocessor Pin Details – 8085 Architecture – Bus Organization - Demultiplexing AD0-AD7 – Generation of control Signals – Programming Model of 8085 – addressing modes – Instruction Set –Simple Programs.</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">INTERFACING I/O DEVICES USING 8255</td><td>15 hrs</td></tr>
<tr><td colspan="7">Basic Interfacing concept – Memory Mapped I/O – I/O mapped I/O – Memory Interfacing – Programmable I/O 8255A – LED interfacing –Seven Segment Display Interfacing - Stepper Motor –interfacing – ADC Interfacing – DAC Interfacing – Temperature controller.</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">PROGRAMMABLE INTERFACING PERIPHERALS</td><td>12 hrs</td></tr>
<tr><td colspan="7">DMA Data Transfer – Interfacing 8257-DMA Controller-8085 Interrupts – Interfacing 8259 – Serial Data Communication – Interfacing 8251</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">8051 ARCHITECTURE</td><td>16 hrs</td></tr>
<tr><td colspan="7">Introduction-Hardware-Architecture –Pin diagram-SFR-Input /Output Pins – Ports-External Memory-Counters and Timers-Serial Data Input/Output-Interrupts</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">PROGRAMMING 8051</td><td>16 hrs</td></tr>
<tr><td colspan="7">Basic assembly language programming concepts-Moving Data-Arithmetic operations - Logical operations – Jump, call and return operations – Rotate and swap operations – Delay operations – Serial port communication Parallel port communication – Simple programs.</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Ramesh S Gaonkar, “Microprocessor Architecture, Programming andapplication with 8085”, 5th Edition, PHI, 2006.
2. Krishna Kant, “Microprocessor and Microcontrollers”, Eastern Company Edition, Prentice – Hall of India, New Delhi, 2007.
3. Rafiquzhman. M, “Microprocessors Theory and Applications: Intel andMotorola”,PHI Pvt.Ltd.,2003.
4. Muhammed Ali Mazidi, Janice Gillispie Manidi, “The 8051 Microcontroller and embedded Systems”, Pearson Education, 2000.
5. Kenneth. J. Ayala, “The 8051 Microcontroller Architecture Programming and Application”, 2nd Edition, Penram International Publishers(India),1996</td></tr>
</table>

Reference Books	1. D.V.Hall , "Microprocessors and Interfacing: Programming and Hardware", 3rd Edition, TATA Mc-Graw Hill,2012. 2. Ray A K and Burchandi K M, "Intel Microprocessors Architecture Programming and Interfacing", TMH, 2000. 3. A.P.Mathur, Introduction to Microprocessors, 3rd edition. TMH 2004 4. R.Theagarajan , "Microcontrollers and its applications", SCITECH Publications, 2014 5. John B.Peatman, "Design with PIC Microcontrollers", Pearson education, 2002.
Web Resources	1. https://archive.nptel.ac.in/courses/108/105/108105102/ 2. https://nptel.ac.in/courses/117104072 3. https://books.google.co.in/books?id=mwAeEAAAQBAJ&printsec=copyright&redir_esc=y#v=onepage&q&f=false

COURSE OUTCOMES:

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

Course Outcomes	CO1	Define architecture, addressing modes and instruction set in 8085
	CO2	Discuss 8255, 8279, 8253, 8259 and 8237 interfacing
	CO3	Understand programming and interfacing in 8085
	CO4	Recall microcontroller 8051 architecture and pin configuration
	CO5	Explain assembly language programming in 8051

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	M	S	M	L
CO2	M	S	S	M	L	M	S
CO3	S	M	M	S	S	L	M
CO4	M	S	S	S	L	S	S
CO5	S	L	L	S	M	S	M

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

<table>
<tr><td>Title of the Course</td><td colspan="7">Internet of Things</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">4</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC5C2</td></tr>
<tr><td>Semester</td><td>V</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>4</td><td colspan="2">1</td><td colspan="2">-</td><td colspan="2">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To know fundamentals of IoT
➢ To understand IoT and M2M
➢ To learn design methodology of IoT
➢ To familiarize with interfacing devices</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">INTRODUTION TO INTERNET OF THINGS</td><td>15 hrs</td></tr>
<tr><td colspan="7">Introduction – Physical Design of IoT – Logical Design of IoT – IoTEnabling Technologies – IoT levels and Deployment – Domain Specific IoTs</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">IOT and M2M</td><td>15 hrs</td></tr>
<tr><td colspan="7">M2M – Difference between IoT and M2M – SDN and NFV for IoT – IoT System Management – Simple Network Management Protocol – NETCONF – YANG</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">DEVELOPING IOT</td><td>15 hrs</td></tr>
<tr><td colspan="7">IoT Design Methodology – Case Study on IoT System for Weather Monitoring</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">LOGICAL DESIGN USING PYTHON PROGRAMMING</td><td>15 hrs</td></tr>
<tr><td colspan="7">Python data types and Data Structures – Control Flow – Functions – Modules – Packages –File Handling – Date/Time Operations – Classes – Python Packages of Interest for IoT</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">IOT PHYSICAL DEVICES AND ENDPOINTS</td><td>15 hrs</td></tr>
<tr><td colspan="7">Raspberry Pi – Interfaces – Programming with Python – Python Web Application Framework – Designing Web API – Amazon Web Services for IoT</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things: A Hands-On Approach”, 2014.
2. Marco Schwartz, “Internet of Things with the Arduino UNO”,Packet Publishing, 2014.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things”, Cisco Press, 2017.
2. Olivier Hersent, David Boswarthick, Omar Elloumi , “The Internet of Things – Key applications and Protocols”, Wiley, 2012.</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://archive.nptel.ac.in/courses/106/105/106105166/
2. https://www.studocu.com/in/document/kalinga-institute-of-industrial-technology/internet-of-things/iot-notes/17415649</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	To understand physical and logical design of IoT
	CO2	To interpret different networking systems
	CO3	To describe IoT system for weather monitoring
	CO4	To predict python programming for IoT
	CO5	To illustrate IoT interfacing using Raspberry Pi

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	S	M	S	M
CO2	S	M	S	M	S	S	S
CO3	M	S	M	S	L	S	M
CO4	S	M	S	L	S	M	S
CO5	S	S	M	S	S	L	S

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	2
CO2	3	3	3	3	2
CO3	3	3	3	2	3
CO4	3	2	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	14	13
Weighted Percentage of Course Contribution to PSOs	3	3	3	2.8	2.6

<table>
<tr><td>Course Title</td><td colspan="7">Microprocessor and Microcontroller Lab</td></tr>
<tr><td>Paper No.</td><td colspan="7">Core XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">Core</td><td>Year</td><td>III</td><td rowspan="2">Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC5P1</td></tr>
<tr><td>Semester</td><td>V</td></tr>
<tr><td rowspan="2">Instructional hours per</td><td>Lecture</td><td colspan="2">Tutorial</td><td colspan="2">Lab Practice</td><td colspan="2">Total</td></tr>
<tr><td>-</td><td colspan="2">-</td><td colspan="2">5</td><td colspan="2">5</td></tr>
<tr><td>Course Objectives</td><td colspan="7">➢ To write simple programs in 8085 / 8051
➢ To write programs to interface ADC, DAC, LCD, LED, Stepper motor etc.</td></tr>
<tr><td colspan="8">1. Any 10 Experiments
2. Addition of 8 / 16 bit Data using 8085
3. Subtraction of 8 / 16 bit Data using 8085
4. Multiplication of 8 bit Data using 8085
5. Division of 8 bit Data using 8085
6. Smallest / largest of N Numbers
7. Block of Data transfer using 8085
8. To arrange in ascending / Descending Order
9. Addition of 8 / 16 bit Data using 8051
10. Subtraction of 8 / 16 bit Data using 8051
11. Multiplication of 8 bit Data using 8051
12. Division of 8 bit Data using 8051
13. Logical operations using 8051
14. ADC Interfacing
15. DAC Interfacing
16. Stepper Motor interfacing
17. Interfacing LCD
18. Interfacing LED</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Ram. B, “Fundamentals of microprocessor and microcomputers”, Dhanpat Rai & Sons, 2012</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. A. Nagoor Kani, “Microprocessor and Microcontroller”, McGraw Hill Education, 2016.
2. V. Vijayendran, “Fundamental of Microprocessor 8085: Architecture Programming, and Interfacing”, 2009.</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://gnindia.dronacharya.info/ECE/Downloads/Labmanuals/Microprocessor_Lab_Manual.pdf
2. https://www.scribd.com/document/540110257/MM-Lab-Manual-8085-Part1</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	To write simple programs in 8085 and 8051
	CO2	To execute the programs in 8085 / 8051 and verify the output
	CO3	To illustrate external device interfacing concepts in 8085 and 8051

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	M
CO2	S	S	S	M	M	S	S
CO3	S	M	S	S	S	S	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
Weightage	9	9	9	9	9
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

Course Title	Internet of Things Lab						
Paper No.	Core XII						
Category	Core	Year	III	Credits	4	Course Code	23BEC5P2
		Semester	V				
Instructional hours per	Lecture	Tutorial		Lab Practice	Total		
	-	-		5	5		
Course Objectives	➢ To program Arduino/ Raspberry Pi to control lights, motors, and other devices ➢ To test, debug, and deploy the Arduino / Raspberry Pi to solve real world problems						

Any 10 Experiments

1. Arduino / Raspberry Pi software installation
2. Interface LED / Buzzer with Arduino / Raspberry Pi
3. Interface IR / LDR sensor with Arduino / Raspberry Pi
4. Interface temperature sensor with Arduino / Raspberry Pi
5. Interface humidity sensor with Arduino / Raspberry Pi
6. Interface motor using relay Arduino / Raspberry Pi
7. Interface OLED display and push button with Arduino / Raspberry Pi
8. Controlling domestic appliances using Arduino / Raspberry Pi
9. Remote monitoring using Arduino / Raspberry Pi
10. Surveillance with camera using Arduino / Raspberry Pi
11. Interface blue tooth with Arduino / Raspberry Pi
12. Storing and retrieving data from cloud with Arduino / Raspberry Pi
13. Performing basic SQL quarries using MySQL data base on Arduino / Raspberry Pi
14. Subscribing MQTT broker for data on Arduino / Raspberry Pi
15. Creating TCP server on Arduino / Raspberry Pi
16. Creating UDP server on Arduino / Raspberry Pi

Text Books	1. Yashavant Kanetakr, Shrirang Korde, "21 IOT Experiments", BPB Publications, 2018
Reference Books	1. Anbazhagan .K, "IOT Based Simple and efficient projects using Arduino, Raspberry pi", 2019
Web Resources	1. https://link.springer.com/content/pdf/bfm%3A978-1-4842-1377-3%2F1.pdf 2. https://www.electroniclinic.com/diy-arduino-projects-iot-projects-raspberry-pi-projects=-2020/ 3. https://www.nitttrchd.ac.in/imee/Labmanuals/manual%20Internet%20of%20Things%20I.pdf

COURSE OUTCOMES:

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

Course Outcomes	CO1	To write programs for Arduino / Raspberry Pi
	CO2	To recall the basics of sensors, its functioning
	CO3	To acquire thinking capability and ability to design a component with realistic constraints, to solve real world problems
	CO4	Deploy an IoT application and connect to the cloud
	CO5	Analyze applications of IoT in real time scenario

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	S	M
CO2	S	M	S	S	M	L	S
CO3	S	S	S	M	S	S	L
CO4	M	S	S	S	L	M	S
CO5	S	M	S	M	S	S	S

STRONG (S), MEDIUM (M) and LOW (L) – 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	2
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	2	3	3	3	2
Weightage	14	15	15	15	13
Weighted Percentage of Course Contribution to PSOs	2.8	3	3	3	2.6

<table>
<tr><td>Title of the Course</td><td colspan="7">Optical Communication</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – I</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE – I A</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC5E1</td></tr>
<tr><td>Semester</td><td>V</td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td></td><td>3</td><td>1</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To familiarize with optical fibres and the transmission characteristicsof light in fibres
➢ To know optical fibre preparation techniques
➢ To understand the principle and characteristics of optical sources and detectors
➢ To realize digital signal transmission in optical fibres</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>60 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">OVERVIEW OF OPTICAL COMMUNICATION</td><td>12 hrs</td></tr>
<tr><td colspan="7">Introduction - advantages-disadvantages- applications of optical fiber communication - Ray theory – Numerical Aperture - Types of fiber – Wave propagation in Step Index fiber – Multipath time dispersion – Wave propagation in Graded Index fiber – Multipath Time Dispersion – Modes and Fields in Step Index Fiber – Modes and Fields in Graded Index Fiber – Single Mode Fiber - Photonic Crystal Fiber.</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS</td><td>12 hrs</td></tr>
<tr><td colspan="7">Introduction- Attenuation-absorption-scattering losses-bending loss-dispersion-Intra modal dispersion- Inter modal dispersion - Overall fiber dispersion – Nonlinear effects - Soliton Propagation</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">OPTICAL SOURCES AND DETECTORS</td><td>12 hrs</td></tr>
<tr><td colspan="7">Introduction-LED: Structure-Characteristics- LASER diodes: Optical emission from semiconductors-Laser characteristics- Photo detectors-optical detection principles-Absorption-Quantum efficiency-Responsivity - types:PIN photodiode- Avalanche Photodiode</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">OPTICAL FIBER CABLES AND CONNECTORS</td><td>12 hrs</td></tr>
<tr><td colspan="7">Introduction-Preparation of optical fibers-Liquid Phase techniques-Vaporphase deposition techniques-Optical fibers-Optical fiber cables - Cable design-Cable Sheath- Fiber alignment and joint loss-Fiber splices- Fiber connectors-Expanded beam connector-Fiber coupler</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">DIGITAL TRANSMISSION SYSTEM</td><td>12 hrs</td></tr>
<tr><td colspan="7">Point-to-Point links System considerations –Link Power budget –Rise –time budget – Operational Principles of WDM – Erbium-doped Amplifiers.
Basic on concepts of SONET/SDH Network.</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Gerd Keiser, “Optical Fiber Communication” McGraw–Hill International, Singapore, 3rd ed., 2000.
2. Subir Kumar Sarkar, “Optical Fibers and Fiber Optic communication Systems”, S.Chand &Co Ltd. – 2005
3. J.Senior, “Optical Communication, Principles and Practice”, 3rd edition, Prentice Hall of India.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Rajappa Papannareddy, “Light wave communication Systems: A practical Perspective”, Penram International Publishing (India) Pvt. Ltd – 2004
2. Djafar Mymbaev & Lowell L, Scheiner, “Fiber optical communication</td></tr>
</table>

	Technology, (Pearson) 3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001. 4. Joseph C Palais , "Fiber optic communication", 4th Edition, Pearson Education.
Web Resources	1. https://archive.nptel.ac.in/courses/108/106/108106167/ 2. https://archive.nptel.ac.in/courses/108/104/108104113/ 3. https://archive.nptel.ac.in/courses/115/107/115107095/

COURSE OUTCOMES:

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

Course Outcomes	CO1	To describe optical fibres and its types
	CO2	To predict transmission characteristics of light in optical fibres
	CO3	To define optical fibre fabrication and coupling methods
	CO4	To recognize optical sources and detectors used for communication
	CO5	To demonstrate optical communication networks

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	M	S	S
CO2	M	S	S	S	L	S	S
CO3	S	M	S	M	S	S	M
CO4	S	S	M	S	M	L	S
CO5	M	S	S	S	S	S	L

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

Title of the Course	**Satellite Communication**						
Paper No.	**Elective – II**						
Category	**DSE – I B**	**Year**	**III**	**Credits**	**3**	**Course Code**	23BEC5E2
		Semester	**V**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	3	**1**	**-**		**4**		
Objectives of the course	➢ To know the basics of satellite orbits ➢ To recognize the satellite segment and earth segment ➢ To understand Link Power budget calculation ➢ To comprehend the various satellite access and coding technology ➢ To acquire knowledge in GPS						
Units	**Course Details**						**60 hrs**
Unit-I	**SATELLITE ORBITS**						11 hrs
	Kepler‟s Laws, Newton‟s law, orbital parameters, orbital perturbations,station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion						
Unit-II	**SPACE SEGMENT**						13 hrs
	Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders Antenna Subsystem						
Unit-III	**SATELLITE LINK DESIGN**						12 hrs
	Basic link analysis, Uplink and Downlink Design equation, Free space loss-Atmospheric effects, Ionospheric scintillation, Rain induced attenuation and interference, system noise temperature, Link Design with and without frequency reuse						
Unit-IV	**SATELLITE ACCESS AND CODINGTECHNIQUES**						12 hrs
	Modulation and Multiplexing: Voice, Data, Video, Analog – digitaltransmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, PAMA and DAMA Assignment Methods, compression – encryption, Coding Schemes						
Unit-V	**GLOBAL POSITIONING SYSTEM**						12 hrs
	Long range navigation – GPS and basic equation – Complete GPS system – Control segment – Space segment – User segment – GPS receiver – GIS using GPS						
Text Books	1. Dennis Roddy, “Satellite Communication”, 4th Edition, Mc GrawHill International, 2017. 2. Timothy Pratt, Charles,W. Bostain, Jeremy E. Allnutt, "SatelliteCommunication”,3rd Edition, Wiley Publications, 2021. 3. Dr. P. Sivakumar, Ms. L.Mohana Sundari, Mr. K.P.Senthilkumar, “Satellite Communication”, Mahi Publication						
Reference Books	1. Tri T. Ha, “Digital Satellite Communications”, 2nd edition, Mc Graw Hill education, 2017. 2. D.C Agarwal, “Satellite Communication”, - Khanna Publications, 5th Ed. 3. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, “Satellite Communications Systems Engineering”, 2nd edition , Prentice Hall/Pearson , 2013.						

	4. M.Richharia, "Satellite Communication Systems-Design Principles", Macmillan, 1999. 5. Brian Ackroyd, "World Satellite Communication and earth station Design", BSP professional Books, 1990.
Web Resources	1. https://archive.nptel.ac.in/courses/117/105/117105131/ 2. https://www.pdfdrive.com/introduction-to-satellite-communication-3rd-edition-e17443459.html 3. https://pcefet.com/common/library/books/31/711_%5BLouis_J._Ippolito_Jr.%5D_Satellite_Communications_S(b-ok.org).pdf

COURSE OUTCOMES:

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

Course Outcomes	CO1	Identify the satellite orbits
	CO2	Describe the satellite subsystems
	CO3	Discuss the satellite link power budget
	CO4	Identify access technology for satellite
	CO5	To discuss global positioning system

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	M	S
CO2	M	S	M	S	S	S	L
CO3	S	M	S	S	M	S	S
CO4	S	L	S	S	L	S	S
CO5	M	S	L	L	S	M	L

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	3
CO2	3	3	2	2	2
CO3	1	1	1	2	2
CO4	2	2	3	3	3
CO5	3	3	2	3	3
Weightage	12	12	10	12	13
Weighted Percentage of Course Contribution to PSOs	2.4	2.4	2	2.4	2.6

Title of the Course	Radar Technologies						
Paper No.	Elective – III						
Category	DSE – I C	Year	III	Credits	3	Course Code	23BEC5E3
		Semester	V				
Instructional hours per week	Lecture	Tutorial	Lab Practice		Total		
	3	1	-		4		
Objectives of the course	➢ Understand the basics of Radar and Radar equation ➢ Understand the types of Radar ➢ Realize tracking Radar ➢ Know the various signal processing in Radar ➢ Recognize the Subsystems in Radar						
Units	Course Details						60 hrs
Unit-I	**INTRODUCTION TO RADAR**						12 hrs
	The Origins of Radar, Radar principles, Basic Block Diagram, Radar classifications based on Frequencies, Wave form and application, Radar Fundamentals: Detection, Range, velocity, The simple form of the Radar Equation, Pulsed Radar equation, Detection of Signals in Noise- Receiver Noise, Signal-to-Noise Ratio, Probabilities of Detection and False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets, Transmitter Power, Pulse Repetition Frequency, Antenna Parameters, System losses.						
Unit-II	**CW, MTI AND PULSE DOPPLER RADAR**						12 hrs
	CW and Frequency Modulated Radar, Doppler and MTI Radar- Delay Line Cancellers, Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target 163 Detector, Limitations to MTI Performance, MTI from a Moving Platform (AMIT), Pulse Doppler Radar						
Unit-III	**TRACKING RADAR**						12 hrs
	Tracking with Radar, Monopulse Tracking, Conical Scan, Sequential Lobing, Limitations to Tracking Accuracy, Low-Angle Tracking - Comparison of Trackers, Track while Scan (TWS) Radar- Target prediction, state estimation, Measurement models, alpha – beta tracker, Kalman Filtering, Extended Kalman filtering						
Unit-IV	**RADAR SIGNAL PROCESSING**						12 hrs
	Radar Signal Processing Fundamentals, Detection strategies, Optimal detection, Threshold detection, Constant False alarm rate detectors, Adaptive CFAR, pulse compression waveforms, compression gain, LFM waveforms matched filtering, radar ambiguity functions, radar resolution, Detection of radar signals in Noise and clutter, detection of non-fluctuating target in noise, Doppler spectrum of fluctuating targets, Range Doppler spectrum of stationary and moving radar						
Unit-V	**RADAR TRANSMITTERS AND RECEIVERS**						12 hrs
	.Radar Transmitter, Linear Beam Power Tubes, Solid State RF Power Sources, Magnetron, Crossed Field Amplifiers, Other RF Power Sources. The Radar Receiver, Receiver noise power, Super heterodyne Receiver, Duplexers and Receiver Protectors- Radar Displays. Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters						

Text Books	1. Habibur Rahman, "Fundamental Principles of Radar", CRC press, Taylor and Francis, 2019. 2. M. R. Richards, J. A. Scheer, W. A. Holm, Editors "Principles of Modern Radar, Basic Principles", SciTech Publishing, 2012 3. S.N. Raju, "Radar Engineering and Fundamentals of Navigational Aids", I K International publishing House Pvt.Ltd., 2008.
Reference Books	1. Nathansan, "Radar design principles-Signal processing and environment", PHI, 2nd Edition, 2007. 2. M.I.Skolnik , "Introduction to Radar Systems", Tata McGraw Hill 2006. 3. Mark A. Richards, "Fundamentals of Radar Signal Processing", McGraw-Hill, 2005.
Web Resources	1. https://nptel.ac.in/courses/108105154 2. https://www.ll.mit.edu/outreach/radar-introduction-radar-systems-online-course 3. https://mrcet.com/downloads/digital_notes/ECE/IV%20Year/Radar%20Systems.pdf

COURSE OUTCOMES:

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

Course Outcomes	CO1	Identify the Radar parameters
	CO2	Differentiate various radar types
	CO3	Describe different tracking and filtering schemes
	CO4	Apply signal processing in target detection
	CO5	Depict Radar transmitter and receiver blocks

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	M	S	S	M
CO2	S	M	S	L	S	L	S
CO3	S	S	M	M	M	S	S
CO4	S	M	M	S	S	S	L
CO5	S	S	S	S	S	L	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	2
CO2	3	3	2	3	2
CO3	3	2	2	3	1
CO4	3	3	2	2	2
CO5	3	3	2	2	2
Weightage	15	14	10	13	9
Weighted Percentage of Course Contribution to PSOs	3	2.8	2	2.4	1.8

Title of the Course	**Antenna and Wave Propagation**						
Paper No.	**Elective – IV**						
Category	**DSE – II A**	**Year**	**III**	**Credits**	**3**	**Course Code**	23BEC5E4
		Semester	**V**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	3	**1**	**-**		**4**		
Objectives of the course	➢ To get knowledge in wave propagation concepts ➢ To study antenna parameters and characteristics ➢ To learn special antennas used for wave propagation ➢ To familiarize with different types of antenna arrays ➢ To understand measurements concepts in antenna						
Units	**Course Details**						**60 hrs**
Unit-I	**WAVE PROPAGATION**						12 hrs
	Electromagnetic waves – Free Space Propagation – Reflection, Refraction and Diffraction – Ground Wave Propagation – Sky wave Propagation (Ionosphere) – Space wave Propagation _ Tropospheric scatter Propagation – Line of Sight Propagation – Propagation in Mobile / Portable environment – Repeaters and Cellular system						
Unit-II	**ANTENNA CHARACTERISTICS**						12 hrs
	Simple Antenna – Equivalent Circuit – The half wave dipole – Radiation Resistance – Radiation Pattern – Radiation Power – impedance – Gain and Directivity – Polarization – Area – Length of antenna						
Unit-III	**TYPES OF ANTENNA**						12 hrs
	Folded Dipole Antenna – Ground Plan Antenna – Loop Antenna – Ferrite rod Receiving antenna – Yagi Array antenna — VHF-UHF Antenna Parabolic Reflector Antenna – Cell Cite Antenna – Mobile and Portable Antenna						
Unit-IV	**ANTENNA ARRAYS**						12 hrs
	Array of two point sources-Pattern Multiplication-Broadside array, End fire array, N-element linear array, Evaluation of null directions and maxima, amplitude distributions, Binomial arrays-Dolph-Tchebychev arrays-Log periodic array- Phased array						
Unit-V	**ANTENNA MEASUREMENTS**						12 hrs
	Measurement of Radiation pattern-Beam width-Gain-Directivity-Polarization-Input impedance-Bridge method-SWR method-Reflection coefficient-VSWR- Antenna Test Ranges: Elevated ranges- Ground reflection ranges-Anechoic chambers & absorbing materials- Compact Antenna Test Ranges(CATRS)						
Text Books	1. John D Kraus, Ronald J Marhefka. "Antenna and Wave Propagation", 4th edition, Tata McGraw. 2. Prasad.K.D, "Antennas and Wave Propagation", Sathya Prakashan, 3rd Ed, 2009 3. Harish and Sachidananda, "Antennas and Wave Proapagation", Oxford Press, 2007						
Reference Books	1. Constantine A. Balanis, "Antenna Theory-Analysis and Design", 3rd edition, Wiley- India, 2010 2. Sisir K Das, Annapurna Das, "Antenna and Wave Propagation", Tata McGraw hill Education Pvt limited, 2013						

	3. R.E.Collin, "Antennas and Radiowave Propagation", McGraw Hill, 2002
Web Resources	1. https://archive.nptel.ac.in/courses/108/101/108101092/ 2. https://nptel.ac.in/courses/117107035 3. https://elearningatria.files.wordpress.com/2013/10/ece-vi-antennas-and-propagation-10ec64-notes.pdf

COURSE OUTCOMES:

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

Course Outcomes	CO1	Discuss various medium of wave propagation
	CO2	Learn the different characteristic parameters of antennas used for wave propagation
	CO3	Describe Q-factor, bandwidth and efficiency of special antennas
	CO4	Explain the various types antenna arrays
	CO5	Outline antenna measurements like directivity, radiation pattern, polarization etc.

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	M	S	S	S
CO2	S	S	S	M	S	M	L
CO3	S	M	S	S	M	M	S
CO4	M	S	L	S	L	S	S
CO5	S	S	M	S	S	S	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	2	3
CO2	3	3	2	2	3
CO3	3	3	3	2	2
CO4	3	3	2	2	2
CO5	3	2	3	2	2
Weightage	15	13	13	10	12
Weighted Percentage of Course Contribution to PSOs	3	2.6	2.6	2	2.4

<table>
<tr><td>Title of the Course</td><td colspan="7">Avionics</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – V</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE – II B</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC5E5</td></tr>
<tr><td>Semester</td><td>V</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>3</td><td>1</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To introduce the basic of avionics and its need for civil and militaryaircrafts
➢ To impart knowledge about the avionic architecture and variousavionics data buses
➢ To gain more knowledge on various avionics subsystems
➢ To understand the concepts of navigation systems.
➢ To gain knowledge on auto pilot system</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>60 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">INTRODUCTION TO AVIONICS</td><td>12 hrs</td></tr>
<tr><td colspan="7">Need for avionics in civil and military aircraft and space systems – integratedavionics and weapon systems – typical avionics subsystems, design,
technologies – Introduction to digital computer and memories</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">DIGITAL AVIONICS ARCHITECTURE</td><td>10 hrs</td></tr>
<tr><td colspan="7">Avionics system architecture – data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">FLIGHT DECKS AND COCKPITS</td><td>12 hrs</td></tr>
<tr><td colspan="7">Control and display technologies: CRT, LED, LCD, EL and plasma panel – Touch screen – Direct voice input (DVI) – Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">INTRODUCTION TO NAVIGATION SYSTEMS</td><td>13 hrs</td></tr>
<tr><td colspan="7">Radio navigation – ADF, DME, VOR, LORAN, DECCA, OMEGA, ILS, MLS – Inertial Navigation Systems (INS) – Inertial sensors, INS block diagram – Satellitenavigation systems – GPS</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">AIR DATA SYSTEMS AND AUTO PILOT</td><td>13 hrs</td></tr>
<tr><td colspan="7">Air data quantities – Altitude, Air speed, Vertical speed, Mach Number, Total air temperature, Mach warning, Altitude warning – Auto pilot – Basic principles, Longitudinal and lateral auto pilot</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Albert Helfrick.D., "Principles of Avionics", Avionics Communications Inc.,2004
2. Collinson.R.P.G. "Introduction to Avionics", Chapman and Hall, 1996</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Middleton, D.H., Ed., "Avionics systems, Longman Scientific and Technical",Longman Group UK Ltd., England, 1989.
2. Pallet.E.H.J., "Aircraft Instruments and Integrated Systems", Pearsons, Indianedition 2011.
3. Spitzer, C.R. "Digital Avionics Systems", Prentice-Hall, Englewood Cliffs,N.J., U.S.A. 1993.
4. Spitzer. C.R. "The Avionics Hand Book", CRC Press, 2000</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://mrcet.com/downloads/digital_notes/AE/IV%20Year/Avionics.pdf
2. https://www.acsce.edu.in/acsce/wp-content/uploads/2020/03/Avionics-Vol_1.pdf</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	Familiarize the basics of Avionics
	CO2	Describe various standards and techniques of Digital Avionics
	CO3	Explain the various electronic systems in flight decks and cockpits
	CO4	Brief on the various navigation systems
	CO5	Describe the method of calculating the avionic parameters

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	M	S	M	S
CO2	S	S	S	M	M	S	L
CO3	M	S	L	S	S	L	S
CO4	S	M	M	S	L	S	S
CO5	L	S	M	S	M	S	M

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	1	2	2	2
CO3	1	2	2	1	2
CO4	2	2	2	2	2
CO5	2	1	2	2	2
Weightage	9	9	10	8	10
Weighted Percentage of Course Contribution to PSOs	1.8	1.8	2	1.8	2

<table>
<tr><td>Title of the Course</td><td colspan="7">Optoelectronic Devices</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – VI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE – II C</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC5E6</td></tr>
<tr><td>Semester</td><td>V</td><td></td></tr>
<tr><td>Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td></td><td>3</td><td>1</td><td colspan="2">-</td><td colspan="3">4</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To learn the basics of solid state physics.
➢ To study about the display devices and laser.
➢ To explain about the optical detection devices.
➢ To design optoelectronic integrated circuits.</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>60 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">ELEMENTS OF LIGHT AND SOLID STATE PHYSICS</td><td>14 hrs</td></tr>
<tr><td colspan="7">Wave nature of light – Polarization – Interference – Diffraction – Light source – Review of quantum mechanical concept – Review of solid state physics – Review of semiconductor physics and semiconductor junction device</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">DISPLAY DEVICES AND LASERS</td><td>14 hrs</td></tr>
<tr><td colspan="7">Introduction – Photo luminescence – Cathode luminescence – Electro luminescence – Injection luminescence – Injection luminescence – LED – Plasma display – Liquid Crystal Display (LCD) – Numeric displays – Laser emission – Absorption – Radiation – Population inversion – Optical feedback – Threshold condition – Laser modes – Classes of lasers – Mode locking – Laser applications</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">OPTICAL DETECTION DEVICES</td><td>10 hrs</td></tr>
<tr><td colspan="7">Photo detector – Thermal detector – Photo devices – Photo conductors – Photo diodes – Detector performance</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">OPTOELECTRONIC MODULATOR</td><td>11 hrs</td></tr>
<tr><td colspan="7">Introduction – Analog and digital modulation – Electro-optic modulators –Magneto optic devices – Acousto-optic devices – Optical – Switching and
logic devices</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">OPTOELECTRONIC INTEGRATED CIRCUITS</td><td>11 hrs</td></tr>
<tr><td colspan="7">Introduction – Hybrid and monolithic integration – Application of opto electronic integrated circuits – Integrated transmitters and receivers – Guided wave devices</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Pallab Bhattacharya, “Semiconductor Opto Electronic Devices”, PHIPvt Ltd., 2006
2. Wilson J and Haukes J., “Opto Electronics – An Introduction”, PHIPvt. Ltd., 1998</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Jasprit Singh, “Opto Electronics – An Introduction to Materials and Devices”,TMH International Edition, 1998.
2. S C Gupta, “Opto Electronic Devices and Systems”, Prentice Hall of India,2005</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://archive.nptel.ac.in/courses/115/102/115102026/
2. https://archive.nptel.ac.in/courses/113/104/113104012/
3. https://archive.nptel.ac.in/courses/113/106/113106065/</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand the concept of solid state physics
	CO2	Gain knowledge on display devices
	CO3	Describe optical detection devices
	CO4	Discuss optoelectronic modulator
	CO5	Design optoelectronic integrated circuits

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	M	L
CO2	S	M	S	S	M	S	M
CO3	M	S	M	S	S	S	S
CO4	S	S	L	M	S	L	S
CO5	M	S	S	S	M	M	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	2	2
CO2	3	2	3	3	3
CO3	3	2	3	3	3
CO4	3	3	3	3	3
CO5	3	3	2	2	2
Weightage	15	13	13	13	13
Weighted Percentage of Course Contribution to PSOs	3	2.6	2.6	2.6	2.6

Title of the Course	**Internship/Industrial Visit/ Field Visit**						
Paper No.							
Category		**Year**	**III**	**Credits**	**2**	**Course Code**	23BEC5I/ 23BEC5IV/ 23BEC5FV
		Semester	**V**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	--	--	-		--		
Objectives of the course	➢ To understand the functioning of the industry ➢ To provide an insight into the real working environment ➢ To present way to interact with the experts ➢ To enhance employability						
Course Details							
During the V semester an industrial visit / internship may be arranged (Central/ State Government/ Private Industry) to provide an exposure to students about practical industrial working environment. They also provide students a good opportunity to gain real time knowledge on the industrial practices.							

COURSE OUTCOMES:

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

Course Outcomes	CO1	Participate in the projects in industries during industrial visit
	CO2	Describe use of advanced tools and techniques encountered duringindustrial visit.
	CO3	Interact with industrial personnel and follow practices and discipline prescribed in industry.
	CO4	Prepare professional work reports and presentations

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	L
CO2	M	M	S	M	S	S	S
CO3	S	M	S	L	S	S	M
CO4	M	S	S	M	S	S	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	3	3	2	3
CO2	3	2	2	1	3
CO3	3	2	2	3	2
CO4	3	3	1	3	2
Weightage	11	10	8	8	10
Weighted Percentage of Course Contribution to PSOs	2.75	2.5	2	2	2.5

Title of the Course	**Mobile and Wireless Communication**						
Paper No.	**Core XIII**						
Category	**Core**	**Year**	**III**	**Credits**	**4**	**Course Code**	23BEC6C1
		Semester	**VI**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	4	**2**	**-**		**6**		
Objectives of the course	➢ To enhance knowledge in wireless communication ➢ To learn cellular architecture and channel assignment ➢ To recognize digital signalling for fading channels ➢ To know multipath mitigation and multiple antenna techniques						
Units	**Course Details**						**75 Hrs**
Unit-I	**WIRELESS CHANNELS**						17 hrs
	Large scale path loss – Path loss models: Free Space and Two-Ray models - Link Budget design – Small scale fading- Parameters of mobile multipath channels – Time dispersion parameters - Coherence bandwidth – Doppler spread & Coherence time, fading due to Multipath time delay spread– flat fading – frequency selective fading – Fading due to Doppler spread – fast fading – slow fading						
Unit-II	**CELLULAR ARCHITECTURE**						15 hrs
	Multiple Access techniques - FDMA, TDMA, CDMA – Capacity calculations–Cellular concept- Frequency reuse - channel assignment- hand off- interference & system capacity- trunking & grade of service – Coverage and capacity improvement						
Unit-III	**DIGITAL SIGNALING FOR FADING CHANNELS**						15 hrs
	Structure of a wireless communication link, Principles of Offset-QPSK, pi/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle – Cyclic prefix,Windowing, PAPR						
Unit-IV	**MULTIPATH MITIGATION TECHNIQUES**						15 hrs
	Equalization – Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms. Diversity – Micro and Macro diversity, Diversity combining techniques, Error probability in fading channels with diversity reception, Rake receiver.						
Unit-V	**MULTIPLE ANTENNA TECHNIQUES**						12 hrs
	MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming – transmitter diversity, receiver diversity- Channel stateinformation-capacity in fading and non-fading channels						
Text Books	1. Andreas.F. Molisch, “Wireless Communications”, John Wiley, India, 2006 2. Rappaport,T.S, “Wireless Communications”, Pearson Education, 2nd Ed,2010 3. Sanjay Sharma, “Mobile & Wireless Communication”, S.K. Kataria &Sons 2019						
Reference Books	1. Andrea Goldsmith, “Wireless Communication”, Cambridge UniversityPress, 2011 2. David Tse and Pramod Viswanath, “Fundamentals of Wireless						

	Communication", Cambridge University Press, 2005. 3. Van Nee.R, and Ramji Prasad, "OFDM for wireless multimedia communications", Artech House, 2000
Web Resources	1. https://archive.nptel.ac.in/courses/108/106/106106167/ 2. https://nptel.ac.in/courses/117104115 3. https://www.studocu.com/row/document/maseno-university/information-and-communication-technology/introduction-to-mobile-and-wireless-communications/22898914

COURSE OUTCOMES:

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

Course Outcomes	CO1	To predict the concepts involved in wireless channels
	CO2	To discuss multiple access techniques in cellular architecture
	CO3	To define structure and principles of wireless communication
	CO4	To recognize various smoothening techniques in wireless communication
	CO5	To explain MIMO techniques

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	M	M	S
CO2	S	S	S	M	S	L	S
CO3	S	M	S	S	M	S	L
CO4	M	S	S	M	S	S	M
CO5	M	S	M	S	S	M	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	2	3	3
Weightage	15	15	14	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	2.8	3	3

Title of the Course	**Project / Dissertation**						
Paper No.	**XIV**						
Category	**Core**	**Year**	**III**	**Credits**	**8**	**Course Code**	23BEC6PR
		Semester	**VI**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	---	**---**	**12**		**12**		
Objectives of the course	➢ To provide detailed knowledge on the specific area of technology. ➢ To present the technical ideas, strategies and methodologies in prototype. ➢ To develop the skills to plan, develop and implement the ideas to address industrial problems.						
Course Details							**180 hrs**
Students must have demonstrated a real-time application project related to Electronics and Communication Engineering and other fields.							

COURSE OUTCOMES:

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

Course Outcomes	CO1	Show practical knowledge in the chosen area of technology
	CO2	Analyse, formulate and handle projects with a systematic approach.
	CO3	Prepare and validate the developed prototype
	CO4	Show their efficiency as an individual or in a team in development of technical projects.

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	S	S	M	S	S
CO2	M	L	S	M	S	S	M
CO3	S	M	L	S	S	S	M
CO4	S	S	M	S	L	S	L

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	3	3	3
CO2	3	3	2	3	2
CO3	3	3	3	3	3
CO4	3	3	3	3	3
Weightage	12	11	11	12	12
Weighted Percentage of Course Contribution to PSOs	3	2.75	2.75	3	3

<table>
<tr><td>Title of the Course</td><td colspan="7">Computer Networks</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – VII</td></tr>
<tr><td rowspan="2">Category</td><td>DSE – III A</td><td>Year</td><td>III</td><td>Credits</td><td>3</td><td>Course Code</td><td>23BEC6E1</td></tr>
<tr><td></td><td>Semester</td><td>VI</td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To learn fundamentals of data communication
➢ To familiarize with sliding window techniques and Ethernet
➢ To recognize network layer services
➢ To get knowledge in application layer</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">DATA COMMUNICATION</td><td>15 hrs</td></tr>
<tr><td colspan="7">Components and categories – Types of connections – Topologies – Protocols and standards– ISO / OSI model – Transmission media – Line coding – Modems – RS232 interfacing sequences</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">DATA LINK LAYER</td><td>17 hrs</td></tr>
<tr><td colspan="7">Error – Detection and correction – Parity – LRC – CRC – Hamming code – Flow control and Error control: Stop and wait – Go Back N ARQ – Selective repeat ARQ – Sliding window techniques – HDLC. LAN: Ethernet IEEE 802.3 – IEEE 802.4 and IEEE 802.5 – IEEE 802.11 – FDDI – SONET – Bridges</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">NETWORK LAYER</td><td>15 hrs</td></tr>
<tr><td colspan="7">Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwarding of IP Packets – Network Layer Protocols: IP, ICMP v4 – Routing – Distance vector routing– Link state routing – Unicast Routing Algorithms – Protocols – Multicasting Basics – IPV6 Addressing – IPV6 Protocol</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">TRANSPORT LAYER</td><td>15 hrs</td></tr>
<tr><td colspan="7">Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion control – Quality of Services (QOS) – Integrated services –SCTP</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">APPLICATION LAYER</td><td>13 hrs</td></tr>
<tr><td colspan="7">Domain Name Space (DNS) – SMTP – SNMP – FTP – HTTP – WWW – Security – Cryptography</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Behrouz A. Foruzan, “Data communication and Networking”, 5th Ed, TMH, 2013</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, 6th Edition, Pearson Education, 2013
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, 5th Edition, Morgan Kaufmann Publishers Inc., 2012.
3. Nader F. Mir, “Computer and Communication Networks”, 2nd Edition, Prentice Hall, 2014.
4. William Stallings, “Data and Computer Communications”, 10th Edition, Pearson Education, 2013.</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://archive.nptel.ac.in/courses/106/105/106105183/
2. https://archive.nptel.ac.in/courses/106/105/106105080/
3. https://www.javatpoint.com/computer-network-tutorial</td></tr>
</table>

COURSE OUTCOMES:

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

Course Outcomes	CO1	To define topologies, protocols and standards in data communication
	CO2	To explain different data link layers
	CO3	To describe network layer services and routing phenomenon
	CO4	To summarize the duties of transport layer
	CO5	To discuss application layer, security and cryptography in data communication

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	L	M	S	S	M	L	M
CO2	L	M	S	M	S	S	L
CO3	S	S	M	S	M	S	M
CO4	S	M	S	M	S	M	S
CO5	M	S	L	S	M	L	L

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	2	2
CO2	2	2	2	2	2
CO3	3	2	2	2	2
CO4	3	3	3	2	2
CO5	2	2	2	3	2
Weightage	12	11	11	11	10
Weighted Percentage of Course Contribution to PSOs	2.4	2.2	2.2	2.2	2

Title of the Course	**Image Processing**						
Paper No.	**Elective – VIII**						
Category	**DSE – III B**	**Year**	**III**	**Credits**	**3**	**Course Code**	23BEC6E2
		Semester	**VI**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	4	**1**	**-**		**5**		

Objectives of the course

- To become familiar with digital image fundamentals
- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression and recognition methods

Units	**Course Details**	**75 hrs**
Unit-I	**DIGITAL IMAGE FUNDAMENTALS**	16 hrs
	Steps in Digital Image Processing – Components – Elements of Visual Perception – Image Sensing and Acquisition – Image Sampling and Quantization – Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT	
Unit-II	**IMAGE ENHANCEMENT**	16 hrs
	Spatial Domain: Gray level transformations – Histogram processing – Basics of Spatial Filtering– Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform– Smoothing and Sharpening frequency domain filters – Ideal, Butterworth and Gaussian filters, Homomorphic filtering, Color image enhancement	
Unit-III	**IMAGE RESTORATION**	14 hrs
	Image Restoration - degradation model, Properties, Noise models – Mean Filters – Order Statistics – Adaptive filters – Band reject Filters – Band pass Filters – Notch Filters – Optimum Notch Filtering – Inverse Filtering – Wiener filtering	
Unit-IV	**IMAGE SEGMENTATION**	14 hrs
	Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds – basic concepts – Dam construction – Watershed segmentation algorithm	
Unit-V	**IMAGE COMPRESSION AND RECOGNITION**	15 hrs
	. Need for data compression, Huffman, Run Length Encoding, Shift codes, Arithmetic coding, JPEG standard, MPEG. Boundary representation, Boundary description, Fourier Descriptor, Regional Descriptors – Topological feature, Texture - Patterns and Pattern classes - Recognition based on matching	

Text Books	1. Rafael C. Gonzalez, Richard E. Woods, „Digital Image Processing“, Pearson, Third Edition, 2010. 2. Anil K. Jain, „Fundamentals of Digital Image Processing“, Pearson, 2002
Reference Books	1. Kenneth R. Castleman, „Digital Image Processing“, Pearson, 2006. 2. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins, „Digital Image Processing using MATLAB“, Pearson Education, Inc., 2011.

	3. D,E. Dudgeon and RM. Mersereau, „Multidimensional Digital Signal Processing“, Prentice Hall Professional Technical Reference, 1990. 4. William K. Pratt, „Digital Image Processing“, John Wiley, New York, 2002 5. Milan Sonka et al „Image processing, analysis and machine vision“, Brookes/Cole, Vikas Publishing House, 2nd edition, 1999.
Web Resources	1. https://nptel.ac.in/courses/106105032 2. https://archive.nptel.ac.in/courses/117/105/117105135/ 3. https://sisu.ut.ee/imageprocessing/book/3

COURSE OUTCOMES:

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

Course Outcomes	CO1	understand the basics and fundamentals of digital image processing, such as digitization, sampling, quantization, and 2D-transforms
	CO2	Operate on images using the techniques of smoothing, sharpening and enhancement
	CO3	Understand the restoration concepts and filtering techniques
	CO4	Learn the basics of segmentation, features extraction, compression and recognition methods for color models
	CO5	Comprehend image compression concepts

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	S	S
CO2	M	S	S	M	M	S	S
CO3	S	M	S	S	L	M	S
CO4	M	S	M	S	S	M	L
CO5	S	M	S	M	S	S	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	2	3	2
CO3	3	3	3	3	3
CO4	3	3	3	2	3
CO5	3	2	3	3	2
Weightage	15	14	14	14	14
Weighted Percentage of Course Contribution to PSOs	3	2.8	2.8	2.8	2.8

Title of the Course	**Fundamentals of Artificial Intelligence**						
Paper No.	**Elective – IX**						
Category	**DSE – III C**	**Year**	**III**	**Credits**	**3**	**Course Code**	23BEC6E3
		Semester	**VI**				
Instructional hours per week	**Lecture**	**Tutorial**	**Lab Practice**		**Total**		
	4	**1**	**-**		**5**		

Objectives ofthe course	➢ To understand the various characteristics of Intelligent agents ➢ To learn the different search strategies in AI ➢ To learn to represent knowledge in solving AI problems ➢ To understand the different ways of designing software agents ➢ To know about the various applications of AI.	
Units	**Course Details**	**75 hrs**
Unit-I	**INTRODUCTION**	15 hrs
	Introduction–Deinition - Future of Artiicial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems – Search Strategies- Uninformed- Heuristics- Informed	
Unit-II	**PROBLEM SOLVING METHODS**	16 hrs
	Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games	
Unit-III	**REPRESENTATION OF KNOWLEDGE**	16 hrs
	First Order Predicate Logic – Prolog Programming – Uniication – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information	
Unit-IV	**PLANNING**	15 hrs
	Planning- Planning problems, Simple planning agent, Planning languages, Blocks world ,Goal stack planning, Mean Ends Analysis, Non-linear Planning, Conditional planning, Reactive planning, Implementation of block world problem	
Unit-V	**APPLICATIONS**	13 hrs
	AI applications – Language Models – Information Retrieval- InformationExtraction – Natural Language Processing - Robot – Hardware – Perception – Planning – Moving.	

Text Books	1. . Russell and P. Norvig,, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009. 2. I. Bratko, "Prolog,: Programming for Artificial Intelligenc"e, Fourth Edition, Addison - Wesley Educational Publishers Inc., 2011.
Reference Books	1. M. Tim Jones, "Artiicial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc.; First Edition, 2008 2. Nils J. Nilsson, "The Quest for Artiicial Intelligence", Cambridge University Press, 2009. 3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.

Web Resources	1. https://archive.nptel.ac.in/courses/112/103/112103280/ 2. https://nptel.ac.in/courses/106105078
	3. https://www.youtube.com/watch?v=i2mZylgP1Fk 4. https://books.google.co.in/books?id=uSvYmki2yg0C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false

COURSE OUTCOMES:

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

Course Outcomes	CO1	Formulate a problem and build intelligent agents.
	CO2	Apply appropriate searching techniques to solve a real-world problem
	CO3	Analyse the problem and infer new knowledge using suitable knowledge representation schemes
	CO4	Develop planning and apply learning algorithms on real world problems
	CO5	Design an expert system and implement natural language processing techniques.

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	M	S
CO2	M	S	S	M	S	L	S
CO3	S	M	S	S	S	S	M
CO4	S	S	L	S	M	S	L
CO5	S	M	S	M	S	S	S

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	3	3
CO2	3	3	3	3	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	15	15	15	15
Weighted Percentage of Course Contribution to PSOs	3	3	3	3	3

<table>
<tr><td>Title of the Course</td><td colspan="7">Biomedical Instrumentation</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – X</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE – IV A</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC6E4</td></tr>
<tr><td>Semester</td><td>VI</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To know the essentials of biomedical instruments
➢ To familiarize with patient care monitoring and diagnostic instruments
➢ To learn biotelemetry and modern imaging systems</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">BASIC CONCEPTS OF BIOMEDICAL INSTRUMENATION</td><td>13 hrs</td></tr>
<tr><td colspan="7">Basic transducer principle – bio electric potentials – Electrodes – Cardiovascular systems and measurements</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">PATIENT CARE AND MONITORING</td><td>15 hrs</td></tr>
<tr><td colspan="7">Intensive care monitoring – Patient monitoring equipment – Hospital organization – Pacemakers – Defibrillators – Tests and instrumentation for respiratory system – Oximeters– Blood flow and cardiac output measurements</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">DIAGOSTIC INSTRUMENTATION</td><td>15 hrs</td></tr>
<tr><td colspan="7">Temperature measurements – Ultrasonic measurements – Ultrasonic diagnostics – Psychophysiological measurements – Instrumentation for testing motor responses and sensory responses</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">BIOTELEMETRY AND CLINICAL LAB</td><td>16 hrs</td></tr>
<tr><td colspan="7">Introduction to biotelemetry – Components of biotelemetry systems – Implantable units – telemetry in patient care – Wireless Telemetry systems – Tests on blood cells – Chemical tests – Automation of chemical tests – BloodPh, PCO2, PO2 measurements</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">MODERN IMAGING SYSTEMS</td><td>16 hrs</td></tr>
<tr><td colspan="7">Generation of Ionization radiation – Instrumentation for diagnostic X-rays – Medical use of radioisotopes – Radiation therapy – Principles and concepts of X-Ray computed Tomography, Nuclear Medical Imaging Systems, Magnetic Resonance Imaging systems, Ultrasonic imaging systems and Thermal imaging systems</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Leslie Cromwell, „Biomedical Instrumentation and Measurements“, Pearson education, 2007.
2. R.S. Khandpur, „Hand Book of Bio-Medical instrumentation“, Tata McGraw Hill Pub
3. Rakesh Kumar, “Bio-Medical Electronics & Instrumentation”, S. K. Kataria & Sons, 2007</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. M.Arumugam, „Bio-Medical Instrumentation“, Anuradha Agencies, 2003.
2. Duane Knudson, Fundamentals of Biomechanics, Springer, 2nd Edition,2007.
3. Joseph J.carr and John M. Brown, Introduction to Biomedical EquipmentTechnology, John Wiley and sons, New York, 4th Edition, 2012.</td></tr>
</table>

Web Resources	1. https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SIC1311.pdf 2. https://www.ktunotes.in/ktu-ect425-biomedical-instrumentation-notes/ 3. https://archive.nptel.ac.in/courses/108/105/108105101/ 4. https://www.scribd.com/document/356998793/BMI-notes

COURSE OUTCOMES:

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

Course Outcomes	CO1	To define transducer principle, bioelectric potentials and electrodes
	CO2	To recite intensive care monitoring systems like pacemaker, oximeters, blood flow etc.,
	CO3	To explain diagnostic measurement instruments
	CO4	To recall components of biotelemetry and wireless telemetry systems
	CO5	To discuss X ray, NMR, MRI and ultrasonic imaging systems

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	S	M	L	S	S
CO2	S	S	M	S	S	M	L
CO3	M	L	S	S	M	S	S
CO4	S	S	S	S	S	S	S
CO5	S	S	S	M	S	L	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	3	3
CO2	3	3	3	3	3
CO3	3	3	2	3	2
CO4	3	3	3	3	3
CO5	3	3	3	3	2
Weightage	14	14	14	15	13
Weighted Percentage of Course Contribution to PSOs	2.8	2.8	2.6	3	2.6

<table>
<tr><td>Title of the Course</td><td colspan="7">VLSI Design</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – XI</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE – IV B</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC6E5</td></tr>
<tr><td>Semester</td><td>VI</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To give an exposure to VLSI design process.
➢ To get familiarized with layout design and stick diagrams.
➢ To learn the concept of modelling a digital system using Hardware Description Language.
➢ To learn the different FPGA architectures and testability of VLSI circuits</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">INTRODUCTION TO MOS TRANSISTOR</td><td>16 hrs</td></tr>
<tr><td colspan="7">MOS transistors, CMOS logic, inverters, pass transistor, transmission gates, layout design rule, stick diagram, MOS DC equation, RC delay model, Elmore delay model, linear delay model</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">COMBINATIONAL MOS LOGIC CIRCUITS</td><td>16 hrs</td></tr>
<tr><td colspan="7">Static CMOS, Rationed Circuits, cascaded voltage Switch logic, domino logic, dual rail domino, CPL, DCVSPG, Dynamic power, static Power, low power architecture</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">VERILOG HARDWARE DESCRIPTION LANGUAGE</td><td>15 hrs</td></tr>
<tr><td colspan="7">Overview of digital design with Verilog HDL – Hierarchical modeling concepts– Modules and port definitions – Gate level modeling– Data flow modeling – Behavioral modeling – Task and functions – Test bench</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="5">VLSI SYSTEM COMPONENTS CIRCUITS WITH PHYSICAL DESIGN</td><td>13 hrs</td></tr>
<tr><td colspan="7">Multiplexers – Decoders – Comparators – Priority encoders – Shift registers – Arithmetic circuits – Ripple carry adders – Carry look ahead adders – High- speed adders – Multipliers</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">IMPLEMENTATION STRATEGIES AND TESTING</td><td>15 hrs</td></tr>
<tr><td colspan="7">FPGA building block architecture, FPGA interconnect routing procedures, design for testability: ad-hoc testing, scan design, BIST, IDDQ testing, Design of Manufacturability, Boundary Scan</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Neil H. E. Weste and Kamran Eshraghian, “Principles of CMOSVLSI Design”, 2nd Edition,Pearson Education Asia, 2000.
2. John P. Uyemura, “Introduction to VLSI Circuits and Systems”, JohnWiley and Sons, Inc., 2002.</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Wayne Wolf, “Modern VLSI Design System on chip”, Pearson Education,2007
2. Samir Palnitkar, “Verilog HDL”, 2nd Edition, Pearson Education, 2004.
3. M.J Smith, “Application Specific Integrated Circuits”, Addison &Wesley,1997
4. R. Jacob Baker, Harry W.LI David E. Boyee, “CMOS circuit design, Layoutand simulation”, • Prentice hall of India 2005</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://nptel.ac.in/courses/117106092
2. https://archive.nptel.ac.in/courses/108/107/108107129/</td></tr>
</table>

	3. https://www.pdfdrive.com/vlsi-design-a-practical-guide-for-fpga-and-asic-implementations-e162070798.html

COURSE OUTCOMES:

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

Course Outcomes	CO1	Understand logic and layout design of MOS, CMOS
	CO2	Design combinational MOS circuits and power strategies.
	CO3	Apply the concept of modelling a digital system using Hardware Description Language
	CO4	Analyse CMOS logic styles with power factor
	CO5	Implement FPGA design flow and perform testing

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	M	S	S	S	L
CO2	S	S	S	M	S	L	S
CO3	M	S	S	S	M	S	S
CO4	S	M	S	L	S	M	S
CO5	S	M	S	S	L	S	M

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3
CO2	3	3	3	2	3
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	15	14	15	14	15
Weighted Percentage of Course Contribution to PSOs	3	2.8	3	2,8	3

<table>
<tr><td>Title of the Course</td><td colspan="7">Industry 4.0</td></tr>
<tr><td>Paper No.</td><td colspan="7">Elective – XII</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">DSE – IV C</td><td>Year</td><td>III</td><td>Credits</td><td rowspan="2">3</td><td rowspan="2">Course Code</td><td rowspan="2">23BEC6E6</td></tr>
<tr><td>Semester</td><td>VI</td><td></td></tr>
<tr><td rowspan="2">Instructional hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td colspan="3">Total</td></tr>
<tr><td>4</td><td>1</td><td colspan="2">-</td><td colspan="3">5</td></tr>
<tr><td>Objectives of the course</td><td colspan="7">➢ To make the students know about industrial revolutions with technological breakthroughs
➢ To understand the compelling forces and challenges for Industry 4.0
➢ To present case studies on industry 4.0 and show the emerging trends</td></tr>
<tr><td>Units</td><td colspan="6">Course Details</td><td>75 hrs</td></tr>
<tr><td rowspan="2">Unit-I</td><td colspan="6">INTRODUCTION</td><td>16 hrs</td></tr>
<tr><td colspan="7">Industrial Revolution 1.0, 2.0, 3.0 – overview, enabling technologies, productivity and lifestyle effects; Industry 4.0 – enablers: Digitization, Digitalization, Big Data, Smart Sensors, Cyber Physical Systems, AI/ML, Cloud, IT/OT Integration</td></tr>
<tr><td rowspan="2">Unit-II</td><td colspan="6">IOT OVERVIEW</td><td>16 hrs</td></tr>
<tr><td colspan="7">Internet of Things (IoT) – 3 layer view, field devices and their integration, communication protocols across various layers, Industrial Control Protocols; IT/OT Integration – requirements, challenges, security, safety, availability and privacy issues; 5G</td></tr>
<tr><td rowspan="2">Unit-III</td><td colspan="6">SMART SYSTEMS</td><td>16 hrs</td></tr>
<tr><td colspan="7">Industrial IoT, smart city, smart factory, smart building, smart grid. Application of AI/ML for smart systems – root cause analysis, predictive and prescriptive analytics - Role of edge analytics - Role of Visualization and AR/VR technologies</td></tr>
<tr><td rowspan="2">Unit-IV</td><td colspan="6">AUTOMATION</td><td>15 hrs</td></tr>
<tr><td colspan="7">Automation Pyramid - Subsystems: Instrumentation- Measurement and data acquisition, Control, Human Machine Interface: Definition, need, Hardware based, Software based: Operator stations – Data acquisition and control - Network Control Systems (NCS) – Supervisory Control and Data Acquisition (SCADA) systems. Industrial/Distributed Control Systems; IEC61131 languages</td></tr>
<tr><td rowspan="2">Unit-V</td><td colspan="6">FUTURE OF INDUSTRY 4.0</td><td>12 hrs</td></tr>
<tr><td colspan="7">Automation to Autonomous Systems; Unmanned Factories; Future Operator Workstation, Case Studies of Industry 4.0</td></tr>
<tr><td>Text Books</td><td colspan="7">1. Anand Kumar Singh, “Industry 4.0”, Shashwat Publication
2. Ortiz, Jesús Hamilton, “Industry 4.0: Current Status and Future Trends”, InTech Open, 2020</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. Alasdair Gilchrist, “Industry 4.0: The Industrial Internet of Things”,Apress, 2019
2. Klaus Schwab,”The Fourth Industrial Revolution”, Currency, 2017.
3. Bartodziej, Christoph Jan,”The Concept Industry 4.0: An EmpiricalAnalysis of Technologiesand Applications in Production Logistics”,Springer, 2017</td></tr>
<tr><td>Web Resources</td><td colspan="7">1. https://onlinecourses.nptel.ac.in/noc19_cs32/preview
2. https://smartcities.ieee.org/images/files/pdf/SCWhitePaper - IoTNetworking.pdf</td></tr>
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	3. https://ieeexplore.ieee.org/document/6842585 4. https://www.industryweek.com/technology-and-iiot/nine-smart-factories-lighting-waywinning-industry-40-strategy 5. https://blog.inmindcloud.com/3-industry40-success-stories-manufacturers

COURSE OUTCOMES:

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

Course Outcomes	CO1	Explain Industry 4.0 and its impact on society and industry
	CO2	Describe role of Cyber Physical Systems in automation and autonomous systems
	CO3	Discuss impact of AI/ML, Cloud, Connectivity technologies in engineering systems.
	CO4	Describe the Industrial/Distributed Control Systems
	CO5	Explain the features of automation

Mapping with Program Outcomes (POs) & Program Specific Outcomes (PSOs):

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	M	S	S
CO2	M	L	S	M	S	S	M
CO3	S	M	L	S	S	S	M
CO4	S	S	M	S	L	S	L
CO5	M	S	S	S	S	M	S

STRONG (S), MEDIUM (M) and LOW (L) - 3 Point Scale

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	3	3
CO2	3	3	2	3	2
CO3	3	3	3	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3
Weightage	14	14	14	15	15
Weighted Percentage of Course Contribution to PSOs	2.8	2.8	2.8	3	3

<table>
<tr><td colspan="2">Title of the Course</td><td colspan="6">ESSENTIAL REASONING AND QUANTITATIVE APTITUDE</td></tr>
<tr><td colspan="2">Paper Number</td><td colspan="6">Professional Competency Skill</td></tr>
<tr><td rowspan="2">Category</td><td rowspan="2">PCS</td><td>Year</td><td>III</td><td>Credits</td><td>2</td><td colspan="2" rowspan="2">Course Code
23BEC6S1</td></tr>
<tr><td>Semester</td><td>VI</td></tr>
<tr><td colspan="2" rowspan="2">Instructional Hours per week</td><td>Lecture</td><td>Tutorial</td><td colspan="2">Lab Practice</td><td>Total</td></tr>
<tr><td>1</td><td>1</td><td colspan="2">-</td><td>2</td></tr>
<tr><td colspan="2">Objectives of the Course</td><td colspan="6">• Develop Problem solving skills for competitative examinations
• Understand the concepts of averages , simple interest , compound interest</td></tr>
<tr><td colspan="2">UNIT-I:</td><td colspan="6">Quantitative Aptitude: Simplifications=averages-Concepts –problem-Problems on numbers-Short cuts- concepts –Problems</td></tr>
<tr><td colspan="2">UNIT-II:</td><td colspan="6">Profit and Loss –short cuts-Concepts –Problems –Time and work - Short –uts -Concepts -Problems.</td></tr>
<tr><td colspan="2">UNIT-III:</td><td colspan="6">Simple interest –compound interest- Concepts- Prolems</td></tr>
<tr><td colspan="2">UNIT-IV:</td><td colspan="6">Verbal Reasoning : Analogy- coding and decoding –Directions and distance –Blood Relation</td></tr>
<tr><td colspan="2">UNIT-V:</td><td colspan="6">Analytical Reasoning :Data sufficiency
Non-Verbal Reasoning : Analogy ,Classification and series</td></tr>
<tr><td colspan="2"></td><td colspan="6"></td></tr>
<tr><td colspan="2">Skills acquired from this course</td><td colspan="6">Studnets relating the concepts of compound interest and simple interest</td></tr>
<tr><td colspan="2">Recommended Text</td><td colspan="6">1.”Quantitative Aptitude” by R.S aggarwal ,S.Chand & Company Ltd 2007</td></tr>
<tr><td colspan="2"></td><td colspan="6"></td></tr>
<tr><td colspan="2">Website and e-Learning Source</td><td colspan="6">https://nptel.ac.in</td></tr>
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