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 resources skillfully, effectively and efficiently.
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
SYLLABUS UNDER CBCS PATTERN FOR AFFILIATED COLLEGES WITH EFFECT FROM THE ACADEMIC YEAR 2022-23 ONWARDS

B.Sc., ELECTRONICS AND COMMUNICATION
PROGRAMME STRUCTURE

Sem.	Part	Course Code	Courses	Title of the Paper	T/P	Credit	Hours/ Week	Max. Marks		
								Int.	Ext.	Total
I	I	2211T	T/OL	Tamil /Other Languages -I	T	3	6	25	75	100
	II	712CE	E	Communicative English - I	T	3	6	25	75	100
	III	22BEC1C1	CC	Electronic Devices and Circuits	T	5	5	25	75	100
		22BEC1P1	CC	Electronic Devices Lab	P	4	4	40	60	100
		-	AL-IA	Mathematics / Physics /Electronics / Computer Science	T	3	3	25	75	100
		-	AL-IA	Practical-Respective Theory Allied Course	P	2	2	40	60	100
	IV	22BVE1	SEC -I	Value Education	T	2	2	25	75	100
		-	-	Library	-	-	2	-	-	-
				Total		**22**	**30**	**205**	**495**	**700**
II	I	2221T	T/OL	Tamil/Other Languages-II	T	3	6	25	75	100
	II	722CE	E	Communicative English - II	T	3	6	25	75	100
	III	22BEC2C1	CC	Electric Circuit Theory	T	5	5	25	75	100
		22BEC2P1	CC	Electric Circuits Lab	P	4	4	40	60	100
		-	AL-IB	Mathematics / Physics /Electronics / Computer Science	T	3	3	25	75	100
		-	AL-IB	Practical-Respective Theory Allied Course	P	2	2	40	60	100
	IV	22BES2	SEC -II	Environmental Studies	T	2	2	25	75	100
		Naan Mudhalvan Course		Language Proficiency for Employability(Effective English)	-	2	2	25	75	100
				Total		**24**	**30**	**230**	**570**	**800**
III	I	2231T	T/OL	Tamil/Other Languages-II	T	3	6	25	75	100
	II	2232E	E	English for Enrichment – I	T	3	6	25	75	100
	III	22BEC3C1	CC	Digital Electronics	T	3	3	25	75	100
		22BEC3C2	CC	Linear Integrated Circuits	T	3	3	25	75	100
		22BEC3P1	CC	Analog and Digital ICsLab	P	3	3	40	60	100
		-	AL-II A	Mathematics / Physics /Electronics / Computer Science	T	3	3	25	75	100
		-	AL-II A	Practical-Respective Theory Allied Course	P	2	2	40	60	100
	IV	22BE3	SEC –III	Entrepreneurship	T	2	2	25	75	100
		_	NME-I	Adipadai Tamil/ Advance Tamil/ IT skills for Employment/MOOC'S	T	2	2	25	75	100
				Total		**24**	**30**	**255**	**645**	**900**
IV	I	2241T	T/OL	Tamil /Other Languages -IV	T	3	6	25	75	100
	II	2242E	E	English for Enrichment – II	T	3	3	25	75	100
	III	22BEC4C1	CC	Communication Theory	T	4	4	25	75	100
		22BEC4C2	CC	Microprocessors and Applications	T	4	4	25	75	100
		22BEC4P1	CC	Communication Lab	P	3	3	40	60	100
		-	AL-II B	Mathematics / Physics /Electronics / Computer Science	T	3	3	25	75	100
		-	AL-II B	Practical-Respective Theory Allied Course	P	2	2	40	60	100
		-	NME-II	Adipadai Tamil/	T	2	2	25	75	100

				Advance Tamil Small Business Management / MOOC'S						
		Naan Mudhalvan Course		Digital Skills for Employability – (Microsoft-Office Fundamentals)	-	2	3	25	75	100
				Total		**26**	**30**	**255**	**645**	**900**
V	III	22BEC5C1	CC	Optical Communication	T	4	4	25	75	100
		22BEC5C2	CC	Microcontroller and Embedded System	T	4	4	25	75	100
		22BEC5C3	CC	Antenna and WavePropagation	T	4	4	25	75	100
		22BEC5C4	CC	Internet of Things	T	4	4	25	75	100
		22BEC5P1	CC	Microprocessor &Microcontroller Lab	P	4	6	40	60	100
		22BEC5P2	CC	Internet of Things Lab	P	4	6	40	60	100
		-		Career development/employability Skills	-	-	2	-	-	-
				Total		**24**	**30**	**180**	**420**	**600**
VI	III	22BEC6I	DSE	Internship		24	26	150	250	400
	IV	Naan Mudhalvan Course		Advanced Platform Technology for Employability* (Project-based learning)/ Data Analytics with Advanced Tools for Employability** (Project-based learning-Data Analytics & Visualization)	-	2	4	25	75	100
				Total		**26**	**30**	**175**	**325**	**500**
	III	(Or)								
		22BEC6E1	DSE	Computer Networks	T	6	6	25	75	100
		22BEC6E2		Mobile and Wireless Communication	T	6	6	25	75	100
		22BEC6E3		BiomedicalInstrumentation	T	6	6	25	75	100
		22BEC6E4		Satellite Communication	T	6	6	25	75	100
	IV	-	-	Library / Yoga etc	-	-	2	-	-	-
		Naan Mudhalvan Course		Advanced Platform Technology for Employability* (Project-based learning)/ Data Analytics with Advanced Tools for Employability** (Project-based learning-Data Analytics & Visualization)	T	2	4	25	75	100
				Total		**26**	**30**	**125**	**375**	**500**
		(Or)								
	III	22BEC6PR	DSE	Project		6	8	25	75	100
		22BEC6E1		Computer Networks	T	6	6	25	75	100
		22BEC6E2		Mobile and WirelessCommunication	T	6	6	25	75	100
		22BEC6E3		BiomedicalInstrumentation	T	6	6	25	75	100
	IV	Naan Mudhalvan Course		Advanced Platform Technology for Employability* (Project-based learning)/ Data Analytics with Advanced Tools for Employability** (Project-based learning-Data Analytics & Visualization)	-	2	4	25	75	100
				Total		**26**	**30**	**125**	**375**	**500**
				Grand Total		**146**	**--**	**--**	**--**	**4400**

* Advanced Platform Technology for Employability – Government Colleges

** Data Analytics with Advanced Tools for Employability – Government Aided and Self- Financing Colleges

Sem.	Part	Course Code	Title of the Paper	Credits	Hours/ Week	Marks		
						Int.	Ext.	Total
I	III	71BEPP	Professional Physical Sciences –I	4	5	25	75	100
II		71BEPP	Professional Physical Sciences –II	4	5	25	75	100
III		*	Professional Physical Sciences –III	4	5	25	75	100
IV			Professional Physical Sciences –IV	4	5	25	75	100

*The Syllabus of Professional English for III & IV Semester will be provided after Receiving the syllabus from TANSCHE.

As per TANSCHE, the Professional English book will be taught to all four streams apart from the existing hours of teaching/additional hours of teaching (1hour/day) as a 4 credit paper as an add on course on par with Major paper and completion of the paper is a must to continue his/her studies further.

- TOL-Tamil/Other Languages,
- E–English
- CC – Core course Core competency, critical thinking, analytical reasoning, research skill & team work
- Allied –Exposure beyond the discipline
- AECC-Ability Enhancement Compulsory Course (Professional English & Environmental Studies) -Additional academic knowledge, psychology and problem solving etc.,
- SEC-Skill Enhancement Course – Exposure beyond the discipline (Value Education, Entrepreneurship Course, Computer application for Science, etc.,
- NME -Non Major Elective – Exposure beyond the discipline
- DSE– Discipline specific elective – Student choice– either or
    - Internship
    - Internship Marks = Internal = 150 (75+75) two midterm valuation through Viva voce and External 250 marks (Report=150+VivaVoce=100) = Total 400 marks
    - Theory paper
    - Project +3 theory papers.
- MOOCs–Massive Open Online Courses

*T-Theory, P- Practical

Semester- I				
Course Code:	**Core Course-I**	**T/P**	**C**	**H/W**
22BEC1C1	**Electronic Devices and Circuits**	**T**	**5**	**5**

Objectives	➢ To familiarize with the principle and characteristics of diodes, BJT and FET ➢ To understand hybrid parameter analysis ➢ To know BJT and FET amplifiers ➢ To understand working of different amplifiers and oscillators
Unit-I	**SEMICONDUCTOR DEVICES** Theory of PN junction diode – Diode current equation – Break down in PN junction diodes - Zener Diode – NPN, PNP transistor configurations and characteristics – Transistor as an amplifier – Transistor biasing methods – Bias Stability – N-channel JFET – Characteristic parameters – Comparison of JFET and BJT – MOSFET – Enhancement and Depletion Type - Comparison of N-channel and P-channel JFET and MOSFET
Unit-II	**SMALL SIGNAL MODELS FOR TRANSISTORS** Two port devices network parameters-Hybrid model-analysis of transistor amplifier circuits using h-parameters-Simplified hybrid model-Analysis of CC and CB amplifiers using approximate model-Low frequency response of transistor amplifier-Effect of couplingcapacitor-High frequency π model-r_e model of transistor-FET small signal model.
Unit-III	**SMALL SIGNAL AND LARGE SIGNAL AMPLIFIERS** Classification of amplifiers-Small signal analysis of single stage BJT amplifiers-FET amplifiers-Amplifier classification based on biasing condition-Class A power amplifiers-Push-pull amplifier-Class B amplifier-Cross over distortion-Class D and Class S amplifiers.
Unit-IV	**MULTISTAGE AMPLIFIERS** Coupling Schemes-General analysis of cascade amplifier-RC coupled amplifier- Transformer coupled amplifier-Direct coupled amplifier-Single tuned and double tuned amplifiers-Effect of cascading tuned amplifiers-stagger tuned amplifier-video amplifiers.
Unit-V	**FEEDBACK AMPLIFIERS AND OSCILLATORS** Basic concepts of feedback-Effects of negative feedback-types of negative feedback-stability of feedback amplifier - Classification of Oscillators-Barkhausen criterion-General form of LC oscillator-Hartley, Colpitts and Clapp oscillators-Tuned collector oscillator, RC oscillator, Wien bridge oscillator, crystal oscillator-frequency stability of oscillators

Reference and Textbooks:-

Text Books:

Salivahanan and N. Suresh Kumar,(2017) "*Electronic Devices and Circuits*", 4th Edition,Mc Graw Hill Education (India) Private Ltd.,

References:

David A. Bell, (2008) "*Electronic Devices & Circuits*", 5th Edition, Oxford UniversityPress.

Millman J, Halkias.C.and Sathyabrada Jit, (2015)"*Electronic Devices and Circuits*", 4th Edition, McGraw Hill Education(India)Private Ltd.,

Millman, J, and Halkias, C., (2007) "*Integrated Electronics*", 4th Edition, TMH,

Singh, B. P, and Rekha Singh., (2006) "*Electronic Devices and Integrated Circuits*",Pearson Education.

Outcomes	**After completion of the course students will be able** ➢ To recall formation and biasing characteristics of diodes and transistors ➢ To perform hybrid parameter analysis in transistor circuits ➢ To summarize the classification of amplifiers ➢ To discuss the construction and working of multistage amplifiers ➢ To demonstrate the principle and working of oscillators

Semester- I				
Course Code: 22BEC1P1	**Core Practical -I**	**T/P**	**C**	**H/W**
	Electronic Devices Lab	**P**	**4**	**4**

Objectives

- To perform the characteristic analysis of diodes and transistors
- To understand the working of amplifiers and oscillators

Any 12 Experiments

1. PN Junction diode Characteristics
2. Zener diode Characteristics
3. BJT Characteristics (Input and Output) – Common Base (CB)
4. BJT Characteristics (Input and Output) – Common Emitter (CE)
5. BJT Characteristics (Input and Output)– Common Collector (CC)
6. Measurement of stability factor of self-biasing method
7. Measurement of stability factor of fixed-biasing method
8. Field Effect Transistor (FET)characteristics
9. CE amplifier Characteristics
10. RC coupled amplifier
11. Transformer Coupled amplifier
12. Direct Coupled amplifier
13. Class A Large signal amplifier
14. Class B Push pull amplifier
15. Hartley Oscillator
16. Colpitt‟s Oscillator
17. Wien Bridge Oscillator
18. RC phase shift oscillator

Reference and Textbooks:-

Text Books:

David M. Buchla, (2007)"*Electronic Devices: Laboratory Exercises*", VIII Ed.
https://nptel.ac.in/courses/122106025

Outcomes

After completion of the course students will be able

- To depict the biasing characteristics of diodes
- To analyze the characteristics of CB, CE and CC transistor configuration
- To demonstrate the working of transistor amplifiers and oscillators

Semester- II				
Course Code:	**Core Course-II**	**T/P**	**C**	**H/W**
22BEC2C1	**Electric Circuit Theory**	**T**	**5**	**5**

Objectives	➢ To familiarize with the circuit theorems and their DC and AC analysis ➢ To understand the series and parallel connection in coupled circuits ➢ To study the transient responses of R-L, R-C and R-L-C circuits ➢ To define the two port network parameters
Unit-I	**CIRCUIT THEOREMS** KCL, KVL, Nodal & Mesh Analyses, Thevenin's Theorem, Norton's Theorem, Superposition theorem, Maximum Power Transfer Theorem, Reciprocity theorem.
Unit-II	**STEADY STATE AC ANALYSIS** Mesh analysis – Nodal analysis – Theorems – Series resonance & Parallel resonance – impedance – Q factor – bandwidth - Magnification.
Unit-III	**COUPLED CIRCUITS** Mutual inductance – Dot Convention – Coefficient of Coupling – Ideal Transformer –Coupled Circuits – Multi-winding, Series connection, Parallel connection – Tuned Circuits– Analysis of magnetic circuits – Comparison of electric and magnetic circuits .
Unit-IV	**TRANSIENTS** Steady state and transient responses - Transient circuits – R-L, R-C and R-L-C circuits – DC and sinusoidal response.
Unit-V	**TWO PORT NETWORK PARAMETERS** Impedance parameters, Admittance parameters, Hybrid parameters, Transmission parameters, Scattering parameters, Relationship between parameters, Interconnection of Networks, T and pi networks – Conversion - Lattice networks – Image parameters.

Text Books:

A. Sudhakar, S.S.Palli, *"Circuits and networks – Analysis and synthesis*", McGraw Hill (India) Pvt. Ltd., 5th Edition.

References:

Joseph A. Edminister, Mahmood Nahvi - Schaum's *Outline of Electric Circuits*, Sixth Edition, 2014 McGraw-Hill Education

Thomas L. Floyd – Principles of Electric Circuits, 3rd ed/-, Merrill Publishing company, Ohio.

William H. Hayt, Jack E. Kemmerly, Steven M. Durbin – Engineering Circuit Analysis, Tata McGraw Hill, 2002

https://nptel.ac.in/courses/108105053

Outcomes	➢ **After completion of the course students will be able** ➢ To define circuit theorems to electrical circuits ➢ To realize AC responses in resonance circuits ➢ To apply circuit theory and analyze series and parallel connections ➢ To explain DC and AC responses in R-L-C circuits ➢ To find the two port network parameters

Semester- II				
Course Code:	**Core Practical -II**	**T/P**	**C**	**H/W**
22BEC2P1	**Electric Circuits Lab**	**P**	**4**	**4**

Objectives

- To gain practical experience on electric circuits and verification of theorems.
- To simulate various electric circuits

Any 12 Experiments

1. Verification of Kirchhoff's Law
2. Verification of Norton's Theorem
3. Verification of Thevenin's Theorem
4. Verification of Superposition Theorem
5. Maximum Power Transfer Theorem
6. Reciprocity theorem
7. T-π Network conversion
8. Time constant measurement in R-C transient circuit
9. Series Resonance Circuit
10. Parallel Resonance Circuit
11. Simulation / experimental verification of electrical circuit problems usingKirchhoff's voltage and current laws.
12. Simulation /experimental verification of electrical circuit problems usingThevenin's theorem.
13. Simulation /experimental verification of electrical circuit problems usingNorton's theorem.
14. Simulation / experimental verification of electrical circuit problems usingSuperposition theorem.
15. Simulation / experimental verification of Maximum Power transfer Theorem.
16. Simulation / Experimental validation of R-C electric circuit transients.
17. Design / Simulation of series resonance circuit.
18. Design / Simulation of parallel resonant circuits.

Text Books & References:

Herbert W. Jackson, "*Introduction to Electrical Circuits: Lab Manual*", VIII Edition Oxford University Press, 2008.

Outcomes

After completion of the course students will be able

- To verify the circuit theorems
- To analyze the performance of series and parallel resonance circuits
- To virtually realize circuit theorems and principles

Semester- III				
Course Code: 22BEC3C1	**Core Course-III**	**T/P**	**C**	**H/W**
	Digital Electronics	**T**	**3**	**3**

Objectives	➢ To know number systems and their conversion ➢ To familiarize with Boolean Algebra and simplifications ➢ To understand the performance of arithmetic and logical circuits ➢ To learn flip flops, counters, registers and memory devices
Unit-I	**NUMBER SYSTEM AND CODES** Binary Numbers -Number Base Conversions- Decimal, Binary, Octal and Hexadecimalnumber systems- base conversions- representation of signed and unsigned numbers- BCD code- BCD-Excess3-gray code-alphanumeric codes.
Unit-II	**BOOLEAN ALGEBRA AND MINIMIZATION** Basic theorems – Boolean functions – Universal Gates - Canonical and Standard forms –Minimization techniques – K-map up to five variables – NAND and NOR implementation– Exclusive- OR function.
Unit-III	**COMBINATIONAL LOGIC DESIGN** Design using gates –BCD arithmetic circuits – Binary adder - Subtractor – Multiplier – Divider- Design using MSI devices – Multiplexer and Demultiplexer – Encoder and decoder– Parity checker – Parity generator – Code converter – Magnitude comparator
Unit-IV	**SEQUENTIAL LOGIC DESIGN** Latches, Flip-flops - SR, JK, D, T, and Master-Slave -Edge triggering – Level triggering asynchronous ripple or serial counter – Asynchronous Up/Down counter - Synchronous counters – Synchronous Up/Down counters – Modulo–n counter – Shift registers
Unit-V	**MEMORY DEVICES** Classification of memories – ROM organization – PROM – EPROM – EEPROM – EAPROM – RAM organization – Write operation – Read operation – Memory cycle – Timing wave forms – Memory decoding – Memory expansion – Static RAM Cell- Bipolar RAM cell – MOSFET RAM cell– Dynamic RAM cell – Programmable Logic Devices – Programmable Logic Array (PLA) –Programmable Array Logic (PAL).

Reference and Textbooks:-

Text Books:

M. Morris Mano and Michael D. Ciletti, "*Digital Design*", 5th Edition, Pearson,2014

References:

Anand Kumar A., "*Fundamentals of Digital Circuits*", 4th Edition, PHI LearningPrivate Limited, 2016

Anil K.Maini, "*Digital Electronics*", Wiley, 2014

Donald P.Leach,Albert Paul Malvino & Gautom Saha, "*Digital Principles andApplications*",8th Edition, McGraw Hill, August 2014

Thomas L. Floyd, "*Digital Fundamentals*", 10th Edition, Pearson Education Inc,2011

Outcomes	**After completion of the course students will be able** ➢ To perform conversion of number systems ➢ To simplify Boolean equations and K-maps ➢ To depict the functions of arithmetic and logical circuits ➢ To discuss the working of flip flops, counters and registers ➢ To explain memory devices used in digital circuits

Semester- III				
Course Code: 22BEC3C2	**Core Course-IV**	**T/P**	**C**	**H/W**
	Linear Integrated Circuits	**T**	**3**	**3**

Objectives	**Make students** ➢ 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
Unit-I	**CIRCUIT CONFIGURATION FOR LINEAR IC** General operational amplifier stages – Internal circuit diagrams of IC 741 – DC and ACperformance characteristics –Slew rate – Open and closed loop configurations – Integrated Circuit fabrication process.
Unit-II	**APPLICATIONS OF OPERATIONAL AMPLIFIERS** Sign changer, scale changer, phase shift circuits – Voltage follower – V-to-I and I-to-V converters – Adder – Subtractor – Instrumentation amplifier – Integrator – Differentiator– Logarithmic amplifier – Antilogarithmic amplifier – Comparators – Schmitt trigger – Peak detector – Clipper and clamper – Low- pass – High-pass and band filters.
Unit-III	**PHASE LOCKED LOOP** Operation of the basic PLL – Closed loop analysis – Voltage controlled oscillator – Monolithic PLL IC 565 – Application of PLL for AM detection – FM detection – FSKmodulation – demodulation and frequency synthesizing
Unit-IV	**ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS** Analog and digital data conversions – D/A converter – Specifications – Weighted resistor type – R- 2R ladder type – Voltage mode and current-mode R-2R ladder types – A/D converters – Specifications – Flash type – Successive approximation type – Single slope type – Dual slope type – A/D converter using voltage-to-time conversion.
Unit-V	**WAVEFORM GENERATORS AND SPECIAL FUNCTION ICs** 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

Reference and Textbooks:-

Text Books:

D.Roy Choudhry, Shail Jain, "*Linear Integrated Circuits*", 5thEdition, New Age International Pvt. Ltd., 2018

References:

Ramakant A. Gayakwad,"*OP-AMP and Linear ICs*", 4th Edition, Prentice Hall /Pearson Education, 2015.

Robert F.Coughlin, Frederick F.Driscoll, "*Operational Amplifiers and Linear Integrated Circuits*", 6th Edition, PHI, 2001

Salivahanan.S, Kanchana Bhaaskaran. V.S, "*Linear Integrated Circuits*", III Edition, McGraw-Hill Education (India) Pvt Limited, 2018.

Sonde B.S., "*System design using Integrated Circuits*", 2nd Ed, New Age Pub, 2001.

Outcomes	**After completion of the course students will be able** ➢ To define the characteristics of op-amp ➢ To explain the applications of op-amp ➢ To describe the phase locked loop systems ➢ To discuss the types of A/D and D/A converters ➢ To discuss wave generation using ICs

Semester- III				
Course Code:	**Core Practical -III**	**T/P**	**C**	**H/W**
22BEC3P1	**Analog and Digital ICs Lab**	**P**	**3**	**3**

Any 12 Experiments

1. Verification of Basic Gates
2. Realize Basic gates from universal gates
3. Verification of Demorgan's Theorem
4. Half Adder and Full Adder
5. Half Subtractor and Full Subtractor
6. 4-bit Binary Adder
7. Multiplexer and Demultiplexer
8. Encoder and Decoder
9. Study of Flip flops
10. Shift Registers
11. Ring Counter
12. Analog to Digital Converter
13. Digital to Analog Converter
14. Op-Amp: Adder and Subtractor
15. Op-Amp: Integrator and Differentiator
16. Square / Sine wave generator
17. Triangular wave generator
18. Saw tooth wave generator

Reference and Textbooks:-

Text Books:

Zbar, Malvino and Miller, "*Basic Electronics, A Text Lab Manual*", Tata McGrawHill.
R.Sugaraj Samuel & Horsley Solomon, B.E.S. Practical

Outcomes	**After completion of the course students will be able**
	➢ To verify the truth tables of digital ICs ➢ To design arithmetic and logic circuits using ICs ➢ To verify the outputs of flip flops, counters and registers ➢ To construct and generate waveforms using IC-741

Semester- IV				
Course Code: 22BEC4C1	**Core Course-V**	**T/P**	**C**	**H/W**
	Communication Theory	**T**	**4**	**4**

Objectives	**Make Students** ➢ 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
Unit-I	**REPRESENTATION OF SIGNALS AND LINEAR MODULATION** 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.
Unit-II	**ANGLE MODULATION** Definition of frequency modulation and phase modulation-Inter-relationship-Single ToneFM-Narrow band and wide band FM-Multitone FM waves-Transmission Bandwidth- Generation and Demodulation of FM waves.
Unit-III	**NOISE THEORY** 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.
Unit-IV	**TRANSITION FROM ANALOG TO DIGITAL** Sampling Process – PAM – TDM – PPM – Quantization Process – PCM – Delta Modulation – Theme Examples – Impulse radio and MPEG, ISI, Eye pattern.
Unit-V	**DIGITAL MODULATION SCHEMES** 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 PSKand FSK systems – OFDM.

Reference and Textbooks:-

Text Books:

Simon Haykin and Michael Moher, "*Communication Systems*", 5th Edition, JohnWiley & Sons.

References

Bruce Carlson., "*Communication Systems*", 3rd Edition, TMH, 1996B.

Dennis Roddy and John Coolen., "*Electronic Communication*", 4th Edition, PHI,2006.

H P Hsu, Schaum, "*Outline Series-Analog and Digital communications*", TMH2006.

Herbert Taub and Donald L Schilling., "*Principles of Communication Systems*", 4th Edition, TMH, Fourth reprint 2015.

Outcomes	**After completion of the course students will be able** ➢ To define Fourier Transform and Dirac Delta functions ➢ To describe frequency and phase modulation ➢ To depict the effect of noise in communication ➢ To explain the PAM, PCM, TDM, PPM and Delta modulation ➢ To discuss the different digital modulation techniques in communication

Semester- IV				
Course Code: 22BEC4C2	**Core Course-VI**	**T/P**	**C**	**H/W**
	Microprocessors and Applications	**T**	**4**	**4**

Objectives	**Make students** ➢ To learn architecture and addressing modes of microprocessor 8085 ➢ To understand interfacing concept and its applications ➢ To familiarize with various microprocessor configurations
Unit-I	**8085 MICROPROCESSOR** Introduction-Architecture – Instruction set – Addressing modes – Timing diagrams – Assembly language programming – Counters – Time Delays – Interrupts – Memory interfacing – Interfacing I/O devices.
Unit-II	**PERIPHERALS INTERFACING OF 8085** 8255 Programmable Peripheral Interface – 8279 Keyboard and display controller – ADC/DAC interfacing – 8253 Programmable Interval Timer – 8251 Programmable Serial Communication Interface – 8257 Direct Memory Access Controller.
Unit-III	**MICROPROCESSOR APPLICATIONS** Designing Scanned Display-Interfacing a Matrix Keyboard-Memory design-8085 MPU Design-Designing a System: Single Board Microcomputer-Software Design-Development and Troubleshooting Tools.
Unit-IV	**8086 MICROPROCESSOR** Intel 8086 microprocessor Architecture, signals-Instruction set-Addressing modes-Assembler directives Assembly language programming-Procedures, Macros-Interrupts and Interrupt service routine
Unit-V	**MULTIPROCESSOR CONFIGURATIONS** Coprocessor configuration-closely coupled configuration-Loosely coupled configuration-8087 numeric data processor-Data types- Architecture-8089 I/O processor architecture- communication between CPU and IOP.

Reference and Textbooks:-

Text Books:

Ramesh S Gaonkar, "*Microprocessor Architecture, Programming* and applicationwith 8085", 5th Edition, PHI, 2006.

Yn-Cheng Liu and Gibson,G.A., "*Microcomputer systems: The 8086/8088 Family Architecture, Programming and Design*", 2nd Edition, Prentice Hall of India,2009.

References:

John Uffenbeck, "*The 80x86 Families, Design, Programming and Interfacing*", 3rd Edition, Pearson Education, 2002.

D.V.Hall , "*Microprocessors and Interfacing: Programming and Hardware*", 3rdEdition, TATA Mc-Graw Hill,2012.

Ray A K and Burchandi K M, "*Intel Microprocessors Architecture Programming and Interfacing*", TMH, 2000.

Outcomes	**After completion of the course students will be able** ➢ To summarize hardware and addressing modes of microprocessor 8085 ➢ To explain interfacing perceptions in microprocessor 8085 ➢ To analyze the applications of 8085 ➢ To describe architecture, addressing modes and interrupts in 8086 ➢ To discuss multiprocessor 8087, 8089 configuration

Semester- IV				
Course Code: 22BEC4P1	**Core Practical -IV**	**T/P**	**C**	**H/W**
	Communication Lab	**P**	**3**	**3**

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

Any 12 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. Equalizer characteristics
18. Time Division Multiplexing

Reference and Textbooks:-

Text Books:

K. A. Navas, "*Electronics Lab Manual* (Volume 2)", VI Ed., PHI, 2015.

Outcomes	**After completion of the course students will be able** ➢ To design PAM, PPM, PWM etc., modulation and demodulation circuits ➢ To execute FSK, ASK modulation and demodulation ➢ To verify the obtained outputs with theoretical perceptions

Semester- V				
Course Code: 22BEC5C1	**Core Course-VII**	**T/P**	**C**	**H/W**
	Optical Communication	**T**	**4**	**4**

Objectives	**Make students** ➢ To familiarize with optical fibres and the transmission characteristics of light infibres ➢ 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
Unit-I	**OVERVIEW OF OPTICAL COMMUNICATION** Introduction- Historical development- general system-advantages-disadvantages-applications of optical fiber communication-Ray theory transmission-Cylindrical Fiber-Single Mode Fiber-Photonic Crystal Fiber.
Unit-II	**TRANSMISSION CHARACTERISTICS OF OPTICAL FIBERS** Introduction- Attenuation-absorption-scattering losses-bending loss-dispersion-Intra modaldispersion- Inter modal dispersion-Overall fiber dispersion – Non linear effects-Soliton Propagation.
Unit-III	**OPTICAL FIBER CABLES AND CONNECTIONS** Introduction-Preparation of optical fibers-Liquid Phase techniques-Vapor phase deposition techniques-Optical fibers-Opticalfiber cables-Stability of the fiber transmission characteristics- Cable design-Cable Sheath- Fiber alignment and joint loss-Fiber splices- Fiber connectors-Expanded beam connector-Fiber coupler-Optical isolator and circulators.
Unit-IV	**OPTICAL SOURCES AND DETECTORS** Introduction-LED: Structure-Characteristics- LASER diodes: Optical emission from semiconductors-Laser characteristics-Non-semiconductor Lasers- Photo detectors-optical detection principles-Absorption-Quantum efficiency-Responsivity - types: PIN photodiode- Avalanche Photodiode-Phototransistors.
Unit-V	**DIGITAL TRANSMISSION SYSTEM** Point-to-Point links System considerations –Link Power budget –Rise – time budget – Noise Effects on System Performance-Operational Principles of WDM, Soliton – Erbium-doped Amplifiers. Basic on concepts of SONET/SDH Network.

Reference and Textbooks:-

Textbook

Gerd Keiser, "*Optical Fiber Communication*" McGraw–Hill International,Singapore, 3rd ed., 2000.

J.Senior, "*Optical Communication, Principles and Practice*", 3rd edition, PrenticeHall of India.

References

Djafar Mymbaev"& Lowell L, Scheiner, "*Fiber optical communication Technology*,(Pearson)

J.Gower, "*Optical Communication System*", Prentice Hall of India, 2001.

Joseph C Palais , "*Fiber optic communication*", 4th Edition, Pearson Education.

Outcomes	**After completion of the course students will be able** ➢ To describe optical fibres and its types ➢ To predict transmission characteristics of light in optical fibres ➢ To define optical fibre fabrication and coupling methods ➢ To recognize optical sources and detectors used for communication ➢ To demonstrate optical communication networks

Semester- V				
Course Code: 22BEC5C2	**Core Course-VIII**	**T/P**	**C**	**H/W**
	Microcontroller and Embedded System	**T**	**4**	**4**

Objectives	**Make students** ➢ To know hardware descriptions of microcontroller 8051 ➢ To familiarize with the various addressing modes and instructions ➢ To understand the interfacing techniques in microcontroller 8051 ➢ To learn hardware and programming concepts in PIC
Unit-I	**8051 INTRODUCTION AND HARDWARE** Overview of 8051 family-8051 Architecture-hardware-Program counter-Stack Pointer-Register Banks-flags-Special function Registers-I/O Pins, Ports, External memory-Counter and Timers-Serial data-Input/Output.
Unit-II	**8051 ASSEMBLY LANGUAGE AND C PROGRAMMING** Instructions-Addressing Modes-Data Transfer, Arithmetic and Logic instructions-Jump,Loop and Call Instructions-Bit Manipulations-Delay Loops-Look up Tables-Simple Programs for I/O operations.
Unit-III	**8051 PERIPHERALS AND EXTERNAL INTERFACE** Timers-Serial Ports-Interrupts and Subroutines-Timer, External Hardware Interrupts-SerialCommunication-Interrupt Priority-Interfacing-Keyboard-LCD-ADC and DAC Interfacing- External Memory Interfacing-Simple programs to study interrupts and Interfacing.
Unit-IV	**INTRODUCTION TO PIC** Overview of Harvard Architecture and Pipeling-PIC16F887 Architecture-Memory Organization, I/O Ports, Timer modules, Instruction set-SPI-Input port and Output portexpansion.
Unit-V	**PROGRAMMING WITH PIC** PIC 16F887-Programs using Timers, UART, Interrupts-On-chip ADC,I2C memory, Real time clock, PWM generation.

Reference and Textbooks:-

Textbook

John B.Peatman, "*Design with PIC Microcontrollers*", Pearson education, 2002.

Muhammed Ali Mazidi, Janice Gillispie Manidi, "*The 8051 Microcontroller andembedded Systems*", Pearson Education, 2000.

References

Kenneth Ayala, *Programming with 8051 microcontroller,* 2nd edition, Pen ramPublishers,2003

Intel 8051 *Microcontroller Hand book*, Intel Corporation.

PIC 16C6X & PIC 16F877 CMOS MCU Data Sheet

Outcomes	**After completion of the course students will be able** ➢ To recall the architecture of microcontroller 8051 ➢ To describe the addressing modes and instructions in 8051 ➢ To illustrate the interfacing techniques in 8051 ➢ To recognize the hardware of PIC ➢ To explain the programming concepts in PIC

Semester- V				
Course Code: 22BEC5C3	**Core Course-IX**	**T/P**	**C**	**H/W**
	Antenna and Wave Propagation	**T**	**4**	**4**

Objectives	**Make students** ➢ To know the basic parameters involved with antennas ➢ To familiarize with different types of antenna arrays ➢ To learn special antennas used for wave propagation ➢ To get knowledge in wave propagation concepts
Unit-I	**FUNDAMENTALS OF ANTENNA** **Antenna Parameter:** Types of antennas-Radiation mechanism-current distribution on a thin wire antenna-Antenna parameters-Radiation Pattern, Beam solid angle, Radiation intensity, Radiation Power density, Directivity, Gain, Effective aperture, Polarization, Bandwidth, Beam width, antenna impedance, Poynting vector-Friss Transmission formula- Duality of Antennas. **Radiation:** Retarded Potentials-Radiation fields of oscillating dipole, Half wave Dipole, loop antennas-Power radiated and Radiation Resistance.
Unit-II	**ANTENNA ARRAYS** 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-III	**SPECIAL ANTENNAS** Yagi Uda antenna-Folded dipole-Helical antenna-Normal mode and Axial mode-Horn Antenna-Reflector antennas and their feed systems-Micro strip antennas-Rectangular Patch-transmission line model-Quality factor-Bandwidth and Efficiency-Introduction to smart antennas.
Unit-IV	**ANTENNA MEASUREMENTS** 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)
Unit-V	**WAVE PROPAGATION** Modes of propagation-Structure of atmosphere-Characteristics of different ionized regions- Sky Wave propagation-Effects of the Earth's magnetic field on ionospheric radio wave propagation-Virtual Height-Maximum Usable frequency-Critical angle-Skip distance- Ionospheric abnormalities-Duct propagation.

Reference and Textbooks:-

Textbook

John D Kraus, Ronald J Marhefka. "*Antenna and Wave Propagation*", 4th edition,Tata McGraw.

Prasad.K.D, *"Antennas and Wave Propagation*", Sathya Prakashan, 3rd Edn, 2009.

References

Constantine A. Balanis, "*Antenna Theory-Analysis and Design*", 3rd edition, Wiley-India, 2010

Sisir K Das, Annapurna Das, "*Antenna and Wave Propagation*", Tata McGraw hillEducation Pvt limited, 2013..

https://nptel.ac.in/courses/117107035

R.E.Collin, "*Antennas and Radiowave Propagation*", McGraw Hill, 2002.

Outcomes	**After completion of the course students will be able** ➢ To define terms and parameters used in antenna theory ➢ To explain the types antenna arrays ➢ To describe Q-factor, bandwidth and efficiency of special antennas ➢ To outline antenna measurements like directivity, radiation pattern, polarization etc. ➢ To discuss various medium of wave propagation

Semester- V				
Course Code: 22BEC5C4	**Core Course-X**	**T/P**	**C**	**H/W**
	Internet of Things	**T**	**4**	**4**

Objectives	**Make students** ➢ To know fundamentals of IoT ➢ To understand IoT and M2M ➢ To learn design methodology of IoT ➢ To familiarize with interfacing devices
Unit-I	**INTRODUTION TO INTERNET OF THINGS** Introduction – Physical Design of IoT – Logical Design of IoT – IoT Enabling Technologies – IoT levels and Deployment – Domain Specific IoTs
Unit-II	**IOT and M2M** M2M – Difference between IoT and M2M – SDN and NFV for IoT – IoT System Management – Simple Network Management Protocol – NETCONF – YANG
Unit-III	**DEVELOPING IOT** IoT Design Methodology – Case Study on IoT System for Weather Monitoring
Unit-IV	**LOGICAL DESIGN USING PYTHON PROGRAMMING** Python data types and Data Structures – Control Flow – Functions – Modules – Packages –File Handling – Date/Time Operations – Classes – Python Packages of Interest for IoT
Unit-V	**IOT PHYSICAL DEVICES AND ENDPOINTS** Raspberry Pi – Interfaces – Programming with Python – Python Web Application Framework – Designing Web API – Amazon Web Services for IoT.

Reference and Textbooks:-

Textbook

Arshdeep Bahga, Vijay Madisetti, "*Internet of Things: A Hands-On Approach*",2014.

References

David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, ―*IoT Fundamentals: Networking Technologies, Protocols and Use Casesfor Internet of Things*, Cisco Press, 2017.

Olivier Hersent, David Boswarthick, Omar Elloumi , ―*The Internet of Things –Key applications and Protocols*‖, Wiley, 2012.

Outcomes	**After completion of the course students will be able** ➢ To understand physical and logical design of IoT ➢ To interpret different networking systems ➢ To describe IoT system for weather monitoring ➢ To predict python programming for IoT ➢ To illustrate IoT interfacing using Raspberry Pi

Semester- V				
Course Code: 22BEC5P1	**Core Practical -V**	**T/P**	**C**	**H/W**
	Microprocessor & Microcontroller Lab	**P**	**4**	**6**

Objectives	**Make students** ➢ To learn basic programs in microprocessor 8085 and microcontroller 8051 ➢ To adopt interfacing techniques in 8085 and 8051

Any 12 Experiments

8085 MICROPROCESSOR

1. Addition / Subtraction of 8 / 16 bit Data
2. Multiplication / Division 8 bit Data
3. Block of Data Transfer
4. Smallest / largest of N Numbers
5. To arrange in ascending / Descending Order
6. Sum of N 8 bit Numbers
7. ADC Interface
8. DAC Interface
9. Stepper Motor interface

8051 MICROCONTROLLER LAB

10. Arithmetic Programs
11. Logical Programs
12. Key Interface
13. LED Interface
14. Square Wave Generation
15. ADC Interface
16. DAC Interface
17. Stepper Motor Interface
18. LCD Interface

Reference and Textbooks:-

Text Books:

Vijayendran V., *Fundamentals of microprocessor-8085,* S .Viswanathan publishers,Chennai.

Outcomes	**After completion of the course students will be able** ➢ To write simple programs in 8085 and 8051 ➢ To execute the programs in 8085 / 8051 and verify the output ➢ To illustrate external device interfacing concepts in 8085 and 8051

Semester- V				
Course Code: 22BEC5P2	**Core Practical -VI**	**T/P**	**C**	**H/W**
	Internet of Things Lab	**P**	**4**	**6**

Objectives	**Make students** ➢ 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

Reference and Textbooks:-

Text Books:

https://link.springer.com/content/pdf/bfm%3A978-1-4842-1377-3%2F1.pdf

https://www.electroniclinic.com/diy-arduino-projects-iot-projects-raspberry-pi- projects-2020/

Anbazhagan .K, "*IOT Based Simple and efficient projects using Arduino*,Raspberry pi", 2019

Outcomes	**After completion of the course students will be able** ➢ To write programs for Arduino / Raspberry Pi ➢ To recall the basics of sensors, its functioning ➢ To acquire thinking capability and ability to design a component with realistic constraints, to solve real world problems.

Semester- VI				
Course Code: 22BEC6E1	**DSE-I**	**T/P**	**C**	**H/W**
	Computer Networks	**T**	**6**	**6**

Objectives	**Make students** ➢ 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
Unit-I	**DATA COMMUNICATION** Components and categories – Types of connections – Topologies – Protocols and standards– ISO / OSI model – Transmission media – Line coding – Modems – RS232 interfacingsequences.
Unit-II	**DATA LINK LAYER** 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.
Unit-III	**NETWORK LAYER** Network Layer Services – Packet switching – Performance – IPV4 Addresses – Forwardingof 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.
Unit-IV	**TRANSPORT LAYER** Duties of transport layer – Multiplexing – Demultiplexing – Sockets – User Datagram Protocol (UDP) – Transmission Control Protocol (TCP) – Congestion control – Quality of Services (QOS) – Integrated services – SCTP.
Unit-V	**APPLICATION LAYER** Domain Name Space (DNS) – SMTP – SNMP – FTP – HTTP – WWW – Security – Cryptography.

Reference and Textbooks:-

Textbook

Behrouz A. Foruzan, "*Data communication and Networking*", 5th Edition, TMH,2013.

References

James F. Kurose, Keith W. Ross, "*Computer Networking, A Top-Down Approach Featuring the Internet*", 6th Edition, Pearson Education, 2013

Larry L. Peterson, Bruce S. Davie, "*Computer Networks: A Systems Approach*", 5thEdition, Morgan Kaufmann Publishers Inc., 2012.

Nader F. Mir, "*Computer and Communication Networks*", 2nd Edition, PrenticeHall, 2014.

William Stallings, "*Data and Computer Communications*", 10th Edition, PearsonEducation, 2013.

Outcomes	**After completion of the course students will be able** ➢ To define topologies, protocols and standards in data communication ➢ To explain different data link layers ➢ To describe network layer services and routing phenomenon ➢ To summarize the duties of transport layer ➢ To discuss application layer, security and cryptography in data communication

Semester- VI				
Course Code: 22BEC6E2	**DSE-II**	**T/P**	**C**	**H/W**
	Mobile and Wireless Communication	**T**	**6**	**6**

Objectives	**Make students** ➢ To enhance knowledge in wireless communication ➢ To learn cellular architecture and channel assignment ➢ To recognize digital signaling for fading channels ➢ To know multipath mitigation and multiple antenna techniques
Unit-I	**WIRELESS CHANNELS** 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** 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** 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** 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** MIMO systems – spatial multiplexing -System model -Pre-coding - Beam forming – transmitter diversity, receiver diversity- Channel state information-capacity in fading and non-fading channels.

Reference and Textbooks:-

Textbook

Andreas.F. Molisch, "*Wireless Communications*", John Wiley, India, 2006

Rappaport,T.S.,"*Wireless communications*", Pearson Education, 2nd Edition, 2010.

References

Andrea Goldsmith, "*Wireless Communication*", Cambridge University Press, 2011

David Tse and Pramod Viswanath, "*Fundamentals of Wireless Communication*",Cambridge University Press, 2005.

Van Nee.R, and Ramji Prasad, "*OFDM for wireless multimedia communications*",Artech House, 2000

Outcomes	**After completion of the course students will be able** ➢ To predict the concepts involved in wireless channels ➢ To discuss multiple access techniques in cellular architecture ➢ To define structure and principles of wireless communication ➢ To recognize various smoothening techniques in wireless communication ➢ To explain MIMO techniques.

Semester- VI				
Course Code: 22BEC6E3	**DSE-III**	**T/P**	**C**	**H/W**
	Biomedical Instrumentation	**T**	**6**	**6**

Objectives	**Make students** ➢ To know the essentials of biomedical instruments ➢ To familiarize with patient care monitoring and diagnostic instruments ➢ To learn biotelemetry and modern imaging systems
Unit-I	**BASIC CONCEPTS OF BIOMEDICAL INSTRUMENATION** Basic transducer principle – bio electric potentials – Electrodes – Cardiovascular systems and measurements
Unit-II	**PATIENT CARE AND MONITORING** Intensive care monitoring – Patient monitoring equipment – Hospital organization – Pacemakers – Defibrillators – Tests and instrumentation for respiratory system – Oximeters– Blood flow and cardiac output measurements.
Unit-III	**DIAGOSTIC INSTRUMENTATION** Temperature measurements – Ultrasonic measurements – Ultrasonic diagnostics – Psychophysiological measurements – Instrumentation for testing motor responses and sensory responses.
Unit-IV	**BIOTELEMETRY AND CLINICAL LAB** 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 – Blood Ph, PCO_2, PO_2 measurements.
Unit-V	**MODERN IMAGING SYSTEMS** 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.

Reference and Textbooks:-

Textbook

Leslie Cromwell, „*Biomedical Instrumentation and Measurements*", Pearsoneducation, 2007.

R.S. Khandpur, „*Hand Book of Bio-Medical instrumentation*", Tata McGraw HillPublishing Co Ltd., 2005.

References

M.Arumugam, „*Bio-Medical Instrumentation*", Anuradha Agencies, 2003.

Duane Knudson, *Fundamentals of Biomechanics*, Springer, 2nd Edition, 2007.

Joseph J.carr and John M. Brown, *Introduction to Biomedical Equipment Technology*, John Wiley and sons, New York, 4th Edition, 2012.

Outcomes	**After completion of the course students will be able** ➢ To define transducer principle, bioelectric potentials and electrodes ➢ To recite intensive care monitoring systems like pacemaker, oximeters, blood flowetc. ➢ To explain diagnostic measurement instruments ➢ To recall components of biotelemetry and wireless telemetry systems ➢ To discuss X ray, NMR, MRI and ultrasonic imaging systems

Semester- VI				
Course Code: 22BEC6E4	**DSE-IV**	**T/P**	**C**	**H/W**
	Satellite Communication	**T**	**6**	**6**

Objectives	**Make students** ➢ To get an overview of satellite communication ➢ To familiarize with Earth segment, space segment and space link ➢ To learn multiple satellite access techniques ➢ To acquire knowledge in GPS
Unit-I	**OVERVIEW OF SATILLITE SYSTEMS, ORBITS AND LAUNCHING METHODS** Frequency allocations for satellite services – Intelsat – Polar orbiting satellites – Kepler's first law – Kepler's second law – Kepler's third law – Definitions of terms for Earth Orbiting satellites – Orbital elements – Apogee and perigee heights – Orbital perturbations– Atmospheric drag – Inclined orbits –The orbital plane – The geocentric – Equatorial coordinate system – Horizon co-ordinate system – The sub- satellite point – Predicting satellite position
Unit-II	**GEOSTATIONARY ORBIT AND SPACE SEGMENT** Antenna look angles – The polar mount antenna – Limits of visibility – Near geostationary orbits – Earth eclipse of satellite – Sun transit outage – Launching orbits- Power supply – Attitude control – Spinning satellite stabilization – Momentum wheel stabilization – Station keeping – Thermal control– TT&C subsystem – Transponders – Wide band receiver
Unit-III	**EARTH SEGMENT AND SPACE LINK** Receive earth stations – EIRP – Transmission losses – Free-space transmission – Feeder losses – Antenna misalignment losses – Atmospheric and ionospheric losses – Link power budget equation – System noise –Overall system noise temperature – CNR – Uplink – Saturation flux density – Input back off – The Earth station HPA – Downlink – Output back off – Satellite TWTA output – Effects of rain – Uplink rain–fade margin – Downlink rain– fade margin – Combined uplink and downlink CNR.
Unit-IV	**SATELLITE ACCESS** TDMA: Reference burst – Preamble and post amble – Carrier recovery – Network synchronization – Unique word detection – Traffic rate – Frame efficiency and channel capacity – Preassigned TDMA – Demand assigned TDMA – Downlink analysis for digital transmission – Calculation of uplink power requirements for FDMA and TDMA – On-board signal processing for TDMA / FDMA operation – Satellite switched TDMA – Code Division Multiple Access – Direct sequence spread spectrum –Acquisition and tracking.
Unit-V	**GLOBAL POSITIONING SYSTEM** Long range navigation – GPS and basic equation – Complete GPS system – Control segment – Space segment – User segment – GPS receiver – GIS using GPS.

Reference and Textbooks:-

Textbook

Anji Reddy, "*Remote Sensing and Geographical Information Systems*", BSPublications, 2001.

Dennis Roddy,"*Satellite Communication*", 4th Ed,McGraw Hills International, 2006.

References

Timothy Pratt, Charles Bostian and Jeremy Allmuti, "*Satellite Communications*",John Willy and Sons (Asia) Pvt. Ltd. 2004.

Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, "*Satellite Communication Systems Engineering*", Prentice Hall/Pearson, 2007

Outcomes	**After completion of the course students will be able** ➢ To recall Kepler's laws and satellite launching methods

	➢ To describe spinning satellite and momentum wheel stabilization ➢ To analyze free space transmission and losses in satellite communication ➢ To illustrate TDMA and FDMA satellite access techniques ➢ To discuss global positioning system