BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

B.Sc. ELECTRONICS Course Structure under CBCS

(For the candidates admitted from the academic year 2016-2017 onwards)

Semester	Part	Course	Title	Inst. Hours/ Week	Credit	Exam Hours	Marks Internal	Marks External	Total
I	I	Language Course–I (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course - I (ELC)		6	3	3	25	75	100
	III	Core Course–I (CC)	Electronic Devices	6	6	3	25	75	100
		Core Practical – I (CP)	Electronics I (P)	3	-	-	-	-	-
		First Allied Course–I (AC)		4	4	3	25	75	100
		First Allied Course–II (AC)		3	-	-	-	-	-
	IV	Value Education	Value Education	2	2	3	25	75	100
	Total			**30**	**18**				**500**
II	I	Language Course–II (LC)– Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course–II (ELC)		6	3	3	25	75	100
	III	Core Course–II (CC)	Electric and Electronic Circuits	6	6	3	25	75	100
		Core Practical – I (CP)	Electronics II (P)	3	3	3	40	60	100
		First Allied Course–II (AC)		3	3	3	25	75	100
		First Allied Course–III (AC)		4	2	3	25	75	100
	IV	Environmental Studies	Environmental Studies	2	2	3	25	75	100
	Total			**30**	**22**				**700**
III	I	Language Course – III (LC)– Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course-III (ELC)		6	3	3	25	75	100
	III	Core Course – III (CC)	Digital Electronics	6	6	3	25	75	100
		Core Practical – II (CP)	Electronics - II (P)	3	-	-	-	-	-
		Second Allied Course – I (AC)		4	4	3	25	75	100
		Second Allied Course-II (AP)		3	-	-	-	-	-
	IV	Non Major Elective I - for those who studied Tamil under Part-I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Principles of Electronics	2	2	3	25	75	100
	Total			**30**	**18**				**500**

IV	I	Language Course –IV (LC) - Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course – IV (ELC)		6	3	3	25	75	100
	III	Core Course – IV (CC)	Principles of Communication Systems	5	5	3	25	75	100
		Core Practical – II (CP)	Electronics - II (P)	3	3	3	40	60	100
		Second Allied Course - II (AP)		3	3	3	40	60	100
		Second Allied Course - III		3	2	3	25	75	100
	IV	Non Major Elective II-for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Everyday Electronics	2	2	3	25	75	100
		Skill Based Elective - I	Skill Based Elective - I	2	2	3	25	75	100
	Total			**30**	**23**				**800**
V	III	Core Course – V (CC)	Linear Integrated Circuits	5	5	3	25	75	100
		Core Course – VI (CC)	Microprocessor and its Applications	5	5	3	25	75	100
		Core Course – VII (CC)	Control Systems	5	5	3	25	75	100
		Core Practical – III (CP)	Electronics III (P)	4	3	3	40	60	100
		Major Based Elective – I	Mobile Communication / Sensors, Transducers and Measurements	5	5	3	25	75	100
	IV	Skill Based Elective – II	Skill Based Elective – II	2	2	3	25	75	100
		Skill Based Elective – III	Skill Based Elective – III	2	2	3	25	75	100
		Soft Skills Development	Soft Skills Development	2	2	3	25	75	100
	Total			**30**	**29**				**800**
VI	III	Core Course – VIII (CC)	Power Electronics	6	6	3	25	75	100
		Core Course – IX (CC)	Microcontroller and Embedded Systems	6	6	3	25	75	100
		Core Practical – IV (CP)	Electronics IV (P)	5	4	3	40	60	100
		Major Based Elective II	Fiber Optic Communication / Electronic Instrumentation	6	6	3	25	75	100
		Major Based Elective III	Digital Signal Processing / Very Large Scale Integration (VLSI)	6	6	3	25	75	100
	V	Extension Activities	Extension Activities	-	1	-	-	-	-
		Gender Studies	Gender Studies	1	1	3	25	75	100
	Total			**30**	**30**				**600**
Grand Total				**180**	**140**				**3900**

List of Allied Courses

Allied Course I	**Allied Course II**
Mathematics	Chemistry / Computer Science

Language Part – I	-	4	
English Part –II	-	4	
Core Paper	-	9	
Core Practical	-	4	
Allied Paper	-	4	
Allied Practical	-	2	
Non-Major Elective	-	2	
Skill Based Elective	-	3	
Major Based Elective	-	3	
Environmental Studies	-	1	
Value Education	-	1	
Soft Skill Development	-	1	
Gender Studies	-	1	
Extension Activities	-	1	(Credit only)

* for those who studied Tamil upto 10th +2 (Regular Stream)

+ Syllabus for other Languages should be on par with Tamil at degree level

those who studied Tamil upto 10th +2 but opt for other languages in degree level under Part I should study special Tamil in Part IV

** Extension Activities shall be out side instruction hours

Non Major Elective I & II – for those who studied Tamil under Part I

a) Basic Tamil I & II for other language students
b) Special Tamil I & II for those who studied Tamil upto 10th or +2 but opt for other languages in degree programme

Note:

	Internal Marks	External Marks
1. Theory	25	75
2. Practical	40	60

3. Separate passing minimum is prescribed for Internal and External marks

FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]
The passing minimum for University Examinations shall be 40% out of 75 marks [i.e. 30 marks]

FOR PRACTICAL

The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks]
The passing minimum for University Examinations shall be 40% out of 60 marks [i.e. 24 marks]

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CORE COURSE I

ELECTRONIC DEVICES

Objective:

To acquire the knowledge about passive components and various electronic devices and their characteristics.

UNIT I PASSIVE COMPONENTS

Resistors Fixed resistor; Variable resistor; Colour coding; Tolerance, Series and parallel connection, **Capacitors** Basic structure and symbol; Fixed capacitors; Variable capacitors, Series and Parallel Connection, **Inductors** Inductance of the coil; Fixed inductors; Variable inductors; Inductive reactance; Energy stored in an inductor; Q factor , Mutual Inductance; Series and Parallel Connection.

UNIT II DIODES

Introduction-semiconductor-bonds in semiconductor-commonly used semiconductors-energy band description of semiconductors-effect of temperature on semiconductors-hole current-intrinsic semiconductor-extrinsic semiconductor-n type semiconductor-p type semiconductors-charge on n-type and p- type semiconductors-majority and minority carriers– Semiconductor Junction diode – V – I Characteristics – Special Diodes: Zener diode - V-I Characteristics - PIN diode-V-I characteristics.

UNIT III BIPOLAR JUNCTION TRANSISTOR

Introduction to BJT-Construction-Transistor Biasing-Operation of NPN-PNP Transistor-Transistor types –CB, CE and CC configurations-D.C. operating point and load line – Drawing a D.C. Load line – Q-Point and maximum undistorted output – Factors affecting stability of Q-point – Stability factor – Condition for Proper biasing of a Transistor - Method of Biasing: Base bias – Base bias with emitter feedback – Base bias with collector feedback – Voltage divider bias – Emitter bias – Bias Compensation.

UNIT IV FET & THYRISTORS

JFET: Construction, Operation and Characteristics; Comparison between FET and BJT, MOSFET: Types; construction, Working and Characteristics, SCR: Construction, Operation and V-I characteristics; Applications, TRIAC: Construction, Operation and V-I characteristics; Applications, UJT: Construction, Operation and V-I characteristics; Applications, DIAC: Construction and V-I characteristics

UNIT V OPTO ELECTRONIC DEVICES

Photo electric theory – Kinetic energy of emitted electrons – Photo emissive cell – Photo multiplier – Photo conductive devices – Avalanche photo diode – Photo field effect transistor – Photovoltaic cells – Photo resistive devices – Photo potentiometric device - Light emitting diode sources – LDR – Photo transistor.

Text Books:

1. R.S.Sedha, A Text Book of Applied Electronics, S.Chand and Company Ltd., 2010.
2. V.K. Mehta, Rohit Mehta, Principles of Electronics, S.Chand and Company Ltd., 2005.

Reference Books:

1. David Bell, Fundamentals of Electronic Devices and Circuits, Oxford University Press, 2007
2. S. Salivahanan, N. Suresh Kumar, A. Vallavaraj, Electronic Devices and Circuits, Tata McGraw Hill, 2007.

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CORE PRACTICAL I

ELECTRONICS I (P)

Any 16 Experiments

1. Resistors and capacitors in series and parallel
2. Series and parallel resonant circuit.
3. Characteristics of PN junction diode
4. Characteristics of Zener diode
5. Characteristics of transistor – Common Emitter configuration.
6. Characteristics of transistor – Common Base configuration.
7. Characteristics of JFET.
8. Characteristics of UJT.
9. Characteristics of SCR.
10. Characteristics of DIAC
11. Characteristics of TRIAC
12. Characteristics of LED, LDR, Photo diode and photo transistor
13. Characteristics of zener regulated power supply.
14. Regulation Characteristics of full wave rectifier, with and without filter
15. Verification of Kirchhoff's laws.
16. Verification of Ohm's Law
17. Verification of Super position theorem
18. Verification of Maximum power transfer Theorem
19. Verification of Thevenin's Theorem
20. Verification of Norton"s Theorem
21. Common Emitter amplifier.
22. Common source FET amplifier.
23. Hartley Oscillator using transistor
24. Colpitts Oscillator using transistor
25. Phase Shift Oscillator using transistor
26. Astable Multivibrator using transistor
27. Monosatable Multivibrator using transistor
28. Bistable Multivibrator using transistor

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CORE COURSE II

ELECTRIC AND ELECTRONIC CIRCUITS

Objectives:

To impart fundamental knowledge on AC and DC circuits, Network Theorems, H-parameters, Amplifiers and Oscillators

UNIT I AC & DC CIRCUIT FUNDAMENTALS

Alternating current; Peak value; Average value; RMS value; Frequency; Time period, Wave length; Phase angle; Three phase AC Power; AC circuits with resistance
AC circuits with XL; AC circuits with XC; Series reactance and resistance; Parallel reactance and resistance, Series Parallel reactance and resistance; Real power; Apparent power, Series resonance circuit; Parallel resonance circuit, Ohm's law; Kirchhoff's law, Analysis of Series circuit; Parallel circuits and Series Parallel circuits, Voltage divider; Current divider

UNIT II NETWORK THEOREM AND ANALYSIS

Superposition theorem – Thevenin's theorem – Thevenzing a circuit with two voltage source – Thevenzing a Bridge circuits – Norton theorem – Thevenin's Norton conversion – Conversion of voltage and current source – Millman's theorem – Maximum power transfer theorem

UNIT III H PARAMETERS

Introduction – The h-parameters of linear circuits – Determination and meaning of h-parameters – Representation of h-parameters – h-parameter of a transistor – Hybrid equivalent circuit of a transistor – Hybrid Equivalent circuit of a transistor – CE, CB and CC – Amplifier expression – Hybrid formulas for CE amplifier – Determination of Transistor h-parameters: Graphical and Experimental – Variation of Transistor h-parameters

UNIT IV BJT AND FET AMPLIFIERS

DC operating point and load line – Factors affecting stability of Q-point – Methods of Transistor Biasing: Base bias, Base bias with emitter feedback, Base bias with collector feedback, Voltage divider bias, Emitter bias – Transistor as an amplifier - CE amplifier – Analysis of Transistor amplifier – CE amplifier parameters – Complementary symmetry amplifier – Biasing FET: Gate bias, Self bias, Voltage divider bias, Source bias – Common source amplifier – Analysis of common source amplifier

UNIT V SINUSOIDAL AND NON SINUSOIDAL OSCILLATORS

Feedback amplifiers: Types, principles of feedback amplifier – Oscillators: Classification, Frequency stability of an oscillator, Barkhausen Criterion – Hartley Oscillator – Colpitts Oscillator – Crystal Oscillator – Phase Shift

Oscillator – UJT relaxation oscillator – Multivibrators: Astable Multivibrator, Monosatable Multivibrator, Bistable Multivibrator

Text Books:

1. R.S.Sedha, A Text Book of Applied Electronics, S.Chand and Company Ltd., 2010.
2. Bernard Grob, Basic Electronics, Tata McGraw-Hill, Ninth Edition, 2003.
3. N.N. Bhargava, D.C. Kulshreshtha & S.C. Gupta, Basic Electronics and Linear Circuits, Tata McGraw-Hill, 2006.

Reference Books:

1. V.K. Mehta, Rohit Mehta, Principles of Electronics, S.Chand and Company Ltd., 2005.
2. Albert Malvino & David J. Bates, Electronic Principles, Tata McGraw-Hill, 7th Edition, 2007.

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CORE COURSE III

DIGITAL ELECTRONICS

Objectives:

To impart fundamental knowledge on Number systems, Combinational and Sequential logic circuits.

UNIT I NUMBER SYSTEM AND CODES

Number System: Binary, Decimal, Octal and Hexadecimal numbers and Conversion - Floating point representation of numbers - Arithmetic Operations – 1's and 2's complements; Binary Coded Decimal (BCD) - **Codes:** Weighted codes and Non-weighted codes - Error detecting codes; Error correcting codes; Alphanumeric Codes

UNIT II BOOLEAN ALGEBRA AND LOGIC GATES

Boolean Algebra: Boolean logic operations - Basic laws of Boolean algebra – DeMorgan's theorem; Sum of Products and Product of Sums; Karnaugh map - **Logic Gates:** OR, AND, NOT, NAND, NOR, EX-OR and EX-NOR gates, NAND and NOR as universal gates

UNIT III ARITHMETIC AND COMBINATIONAL CIRCUITS

Half adder - Full adder - Half Subtractor - Full Subtractor - Parallel binary adder - 4 bit binary adder AND Subtractor - BCD adder - **Combinational Circuits:** Multiplexer – Demultiplexer –Decoders - Encoders Parity generators / checkers - Binary-to-Gray code converter - Gray-to-Binary code converter - Magnitude comparator

UNIT IV SEQUENTIAL LOGIC CIRCUITS

Flip-Flops: S-R Flip-flop - Clocked S-R Flip-flop - D Flip-flop and T Flip-flop - J-K Flip-flop - Master-slave Flip-flops - Applications of Flip-flops - **Counters:** Asynchronous / Ripple counter - Up-down counter - Synchronous counter - Design of Synchronous MOD-N counters - **Registers:** Shift Registers and its types

UNIT V DATA CONVERSION CIRCUITS D/A Converters:

Resistive divider network - Binary Ladder network - D/A converter specifications - **A/D Converters** Simultaneous type - Counter type - Successive approximation type - Single and dual-slope type; A/D converter specifications

Text Books:

1. S. Salivahanan, S. Arivazhagan, *Digital Electronics*, Vikas Publishing House, 2010.
2. Anil. K. Maini, *Digital Electronics*, Wiley Publications, 2008.

Reference Books:

1. S. Salivahanan and S. Arivazhagan Digital Circuits and Design, Vikas Publishing House, 2007
2. A. Anand Kumar, Fundamentals of Digital Circuits, PHI, 2003.

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CORE PRACTICAL II

ELECTRONICS II (P)

Any 16 Experiments

1. Logic gates using discrete components.
2. Verification of logic gates
3. NAND and NOR as universal gates
4. Verification of DeMorgan's and Boolean expressions.
5. Half adder and Full adder
6. Half subtractor and Full subtractor
7. Shift Register and Ring Counter
8. 4x2 Encoder and 2x4 Decoder
9. 4:1 Multiplexer and 1:4 Demultiplexer
10. Unclocked and clocked RS Flip-flops using NAND
11. JK flip-flops using NAND.
12. D flip-flop and T flip-flop
13. 3-bit DAC using R-2R Ladder Network
14. 3-bit Flash Analog-to-Digital Converter
15. Amplitude modulation and Detection
16. Frequency modulation and Detection
17. Balanced Modulator
18. Radiation pattern of Yagi – Uda antenna
19. First IF and Second IF Amplifier
20. Study of AM & FM Radio Receiver
21. Pulse Amplitude Modulation
22. Pulse Width Modulation
23. Pulse Position Modulation
24. Pulse Code Modulation
25. Study of FDM/TDM

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NON-MAJORE ELECTIVE I

PRINCIPLES OF ELECTRONICS

Objectives:

To impart fundamental knowledge on Passive and Active components

UNIT I PASSIVE COMPONENTS

Resistors Fixed resistor; Variable resistor; Colour coding; Tolerance, Series and parallel connection, **Capacitors** Basic structure and symbol; Fixed capacitors; Variable capacitors, Series and Parallel Connection, **Inductors** Inductance of the coil; Fixed inductors; Variable inductors; Inductive reactance; Energy stored in an inductor – Q factor

UNI II SEMICONDUCTOR DIODES

Conductor; Semiconductor; Intrinsic Semiconductor; Extrinsic semiconductor, P type and N type Semiconductor- PN junction diode - V-I characteristics - Zener diode - V-I characteristics

UNIT III BIPOLAR JUNCTION TRANSISTORS

Construction of NPN, PNP transistors, Operation of NPN, PNP transistors, Characteristics of CE and CB Transistor configurations

UNIT IV FIELD EFFECT TRANSISTORS

JFET: Construction, Operation and Characteristics; Comparison between FET and BJT, MOSFET: Types; construction, Working and Characteristics

UNIT V THYRISTORS

TRIAC: Construction, Operation and V-I characteristics; Applications, UJT: Construction, Operation and V-I characteristics; Applications, DIAC: Construction and V-I characteristics

Text Books:

1. R.S.Sedha, A Text Book of Applied Electronics, S.Chand and Company Ltd., 2010.
2. Bernard Grob, Basic Electronics, Tata McGraw-Hill, Ninth Edition, 2003.

Reference Books:

1. V.K. Mehta, Rohit Mehta, Principles of Electronics, S.Chand and Company Ltd., 2005.
2. Albert Malvino & David J. Bates, Electronic Principles, Tata McGraw-Hill, 7th Edition, 2007.

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CORE COURSE IV

PRINCIPLES OF COMMUNICATION SYSTEMS

Objectives:

To understand the concepts and techniques in communication systems

UNIT I WAVE PROPAGATION

EM waves – Free space propagation – Surface wave propagation – sky wave propagation – space wave propagation – Trophospheric scatter propagation – Structure of Atmosphere – Virtual height – MUF – Lowest Usable Frequency – Skip Distance – Optimum Working Frequency – Ionospheric abnormalities-duct propagation

UNIT II ANTENNAS

Electromagnetic radiations – Elementary doublet – Current and Voltage Distribution – Resonant antennas, radiation patterns and length calculations – Non resonant antennas – Antenna gain and Effective radiated power – Antenna resistance – Bandwidth, Beam width and Polarization – Grounded and Ungrounded antennas – Effects of height – Feed point – Couplers – Impedance matching – Dipole Arrays - Yagi Uda antenna – Parabolic antenna – Horn and Lens antenna – Helical antenna - Transmission line – Cable types – Co- axial and wire- pair – Maximum power transfer.

UNIT III MODULATION TECHINIQUES

Introduction to Communication Systems – Information – Transmitter – Channel – Noise – Receiver – Need for Modulation Band width requirement – Amplitude modulation: AM Theory – frequency spectrum of AM wave – Representation of AM – Power relations in AM wave – AM Transmitter block diagram – Frequency modulation – System description – Mathematical representation – Frequency Spectrum – Generation of FM – Direct and Indirect methods.

UNIT IV SINGLE SIDEBAND MODULATION

Introduction – Principles – Balanced modulator – SSB Generation: Filter method, Phase shift method and Third method – SSB Reception: Pilot Carrier SSB and Independent Side band – vestigial sideband transmission – Introduction to PAM, PWM, PPM and PCM

UNIT V COMMUNICATION SYSTEMS

Introduction – Super heterodyne Receiver – Choice of IF and Oscillator Frequencies – Image Rejection – Adjacent Channel Selectivity – spurious response - Tracking – AGC – Double conversion receiver - RADAR principle –

Satellite communication fundamentals – Up Link – Down Link – Transponder – Multiplexing technique – Basics of mobile communication.

Text Books:

1. Kennedy and Davis, Electronic Communication Systems, Tata McGraw Hill, 8th Edition, 1999
2. Dennis Roddy and John Coolen, Electronic Communications, PHI, 4th edition, 1995
3. K.D. Prasad, Antenna & Wave Propagation, Satya Prakashan, 2012.

Reference Books:

1. Anok singh & A.K. Chhabra, Principles of Communication Engineering, S.Chand & Company Ltd, 6th Edition, 2007.
2. NIIT, Basics of Electronic Communication, Prentice Hall India Pvt. Ltd, 2004.

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NON-MAJORE ELECTIVE II

EVERYDAY ELECTRONICS

Objectives:

To impart basic knowledge about everyday electronic devices in home and office with their working principle

UNIT I MICROWAVE OVENS

Microwaves - Properties and generation - Microwave oven block diagram - LCD timer with alarm - Controllers - Wiring and Safety instructions - Care and Cleaning

UNIT II WASHING MACHINES

Electronic controller for washing machines - Washing machine hardware and software - Types of washing machines - Fuzzy logic washing machines - Features of washing machines.

UNIT III MOBILE PHONES

Power section - Charging Section - Audio Section - Network Section - Display Section - Light Section - Keyboard Section - Replacing of Faulty Chips using Rework Station

UNIT IV HOME / OFFICE DIGITAL DEVICES

Facsimile machine - Xerographic copier - Calculators - Structure of a calculator - Internal Organization of a calculators - Servicing electronic calculators - Digital clocks - Block diagram of a digital clock

UNIT V DIGITAL ACCESS DEVICES

Digital computer - Internet access - Online ticket reservation - Functions and networks - Barcode Scanner and decoder - Electronic Fund Transfer - Automated Teller Machines (ATMs) - Set-Top boxes - Digital cable TV - Video on demand

Text Books:

1. S.P. Bali, Consumer Electronics, Pearson Education, New Delhi, 2005.
2. Manahar Lotia, Pradeep Nair & Shailesh Tank, Modern Mobile Phone Repairing Using Computer S/W & Service Devices, BPB Publications, 2006.
3. Sanjib Pandit, Advance Mobile Repairing: Multicolour Circuits, Service Diagrams & Repairing, BPB Publications, 2010.

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CORE COURSE V

LINEAR INTEGRATED CIRCUITS

Objectives:

To impart knowledge about IC fabrication, Operational amplifier and 555 timer and its application.

UNIT I IC FABRICATION

Evolution of ICs – SSI, MSI, LSI and VLSl – The Monolithic IC – IC components – Methods of fabricating ICs – Complementary symmetry MOS IC-Classification-Active and passive component for Ics-Development of IC

UNIT II OPERATIONAL AMPLIFIERS

General amplifier characteristics – Operational amplifier – ideal operational amplifier – Practical operational amplifier – Comparator – Inverting and non-inverting amplifier – CMRR – Offset error voltages and currents-open loop configurations.

UNIT III MEASUREMENT OF OPAMP PARAMETERS

Open loop differential voltage gain – Output resistance – Input offset voltage – Differential input resistance – Input bias current – CMRR – Slew rate – Frequency response of operational amplifiers and compensation techniques-First order low pass-High pass- Band Pass-Band Reject Filter

UNIT IV LINEAR ANALOG SYSTEMS

Basic Opamp applications – Sign changer – Scale changer – Phase shifter – Summing amplifier – Subtractor – Voltage to current converter – Current to voltage converter – DC voltage follower – Differential DC amplifier – Bridge amplifier – Integrator – differentiator - Opamp Wien Bridge oscillator – Square wave generator – Triangle wave generator – Schmitt trigger.

UNIT V IC 741 AND 555 TIMER

A general purpose IC Opamp – IC 741 details – Voltage controlled Oscillator (VCO 566) – Opamp voltage regulator- 555 Timer: Description of functional diagram – Monostable and Astable modes of operation – Schmitt trigger using 555 IC timer.Applications: Tone-burst –Water level fill control-Touch Switch-Frequency divider- Missing pulse detector.

Text Books:

1. D.Roy Choudhury and Shahil B Jain, Linear Integrated Circuits, New Age International Publishers, 2004.
2. Millman and Halkias, Integrated Electronics, Tata McGraw Hill– 1993.

Reference Books:

1. K.R. Botkar, Integrated Circuits, Khanna Publishers, 2004
2. K.V. Ramanan, Functional Electronics, Tata McGraw Hill, 1984
3. Ramakant A Gayakwad, Op-Amp and Linear Integrated circuits, PHI, 2009.

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CORE COURSE VI

MICROPROCESSOR AND ITS APPLICATIONS

Objectives:

To acquire the knowledge about microprocessors and programming for various applications.

UNIT I INTEL 8085 ARCHITECTURE AND INSTRUCTION SET

Introduction to INTEL8085 - Register structure - Pin details and functions - Instruction cycle - Timing diagram - Instruction set - Addressing modes - Status flags - Data transfer group - Arithmetic group - Logical group - Branch- Stack, I/O and machine control group.

UNIT II ASSEMBLY LANGUAGE PROGRAMMING

Machine language-Assembly language-one pass and two pass assembler-Stacks-subroutines- Macro- Micro programming – Data transfer and data manipulation programs- Single byte and Multi byte addition- Complement – Shift – Mask- Larger – smaller – Array manipulations- Sum of Series.

UNIT III MEMORY AND I/O INTERFACING TECHNIQUES

Address space partitioning - Memory and I/O interfacing - DMA controller 8257- Data transfer schemes - Interrupts of INTEL 8085 - interfacing and programming 8255 - 8259 programming and interfacing - 8251 programming and interfacing - 8253 programming and interfacing - Programmable interval timer interfacing - 8279 keyboard interfacing.

UNIT IV INTEL 8086 ARCHITECTURE & DATA TRANSFER INSTRUCTION

Introduction to 8086 microprocessor - Internal architecture - Execution unit - General purpose registers - Instruction pointers - Addressing modes - Instruction set - Constructing the machine codes for 8086 instructions - Segment registers - Memory segmentation.

UNIT V MICROPROCESSOR APPLICATIONS

Delay subroutine- 7 Segment LED display - Measurement of frequency-measurement of Voltage and current – Temperature measurement and control-Water level indicator – Interfacing of Stepper motor- Microprocessor based traffic control.

Text Books:

1. Ram. B, Fundamentals of microprocessor and microcomputers, Dhanpat Rai & Sons, 2012
2. Ramesh.S Gaonkar, Microprocessor Architecture, Programming and Applications With the 8085, Penram, 2013.

Reference Book:

1. AP Mathur, Introduction to Microprocessor, TMH, 1989

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CORE COURSE VII

CONTROL SYSTEMS

Objectives:

To acquire the knowledge about basics of control system characteristics, analysis and design.

UNIT I CONTROL SYSTEM AND FEEDBACK CHARACTERISTICS

Open loop-closed loop system of feedback on gain stability, sensitivity and noise transfer functions –Block diagrams –Block reduction – signal flow graphs-Mason's gain formula-sensitivity control system to parameter variations-control of disturbance signal feedback systems-simple problems.

UNIT II TIME DOMAIN PERFORMANCE

Zero order, first order and second order systems – Step and ramp response- steady state error-stability of liner time invariant system-necessary conditions for stability-Hurwitz stability-Routh's stability criterion-Special cases-Simple problems.

UNIT III CLOSED LOOP INDUSTRIAL SYSTEMS

Thermistors control of quench oil temperature- proportional mode pressure control system –strip tension controller –edge guide controls for strip recoiler-Automatic weighing system – Carbon dioxide controllers for carbonizing furnace.

UNIT IV STATE SPACE ANALYSIS OF CONTROL SYSTEM

Introduction to state space representation of systems – solving the time invariant state equations-solution for homogeneous state equations-Laplace transform approach to the solution of non-homogeneous state equation-state transition matrix- solutions of non- homogeneous state equations-Laplace transform approach to the solution of non-homogeneous state equation.

UNIT V DESIGN OF CONTROL SYSTEM BY STATE SPACE METHODS:

Controllability – complete state controllability of continuous time system- Alternate form of the condition for complete controllability – o/p controllability – observability – complete observability of continuous time system – Alternate form of the condition for complete observability – Relationship between controllability, observability-Relationship between reference control system – Adaptive control systems.

Text Books:

1. S.N.Verma and B.S. Manke, Automatic control systems, Khanna Publishers, 2002
2. Benjamin C. Kuo, Automatic Contol systems, John Wiley & Sons, 2002
3. J.Nagarath and M.Gopal, Control Systems engineering, New Age International 2009.

Reference Book:

1. Industrial solid state electronics, Devices and Circuits Timothy J.Malvino
2. Modern Control Engineering – OGATA- Third Edition

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CORE PRACTICAL III

ELECTRONICS III (P)

Any 8 Experiments

1. Addition / subtraction of 8 / 16 bit data using 8085 microprocessor
2. Multiplication / division 8 bit data using 8085 microprocessor
3. Block data transfer
4. Smallest / largest of N numbers.
5. To arrange in ascending / descending order
6. Sum of N 8 bit numbers
7. Traffic light control interface
8. ADC interface.
9. DAC interface.
10. Stepper motor interface.
11. Monostable multivibrators and Astable multivibrator using IC 555
12. Inverting and Non-inverting Amplifier using op-amp.
13. Adder and Subtractor using op-amp.
14. Integrator and Differentiator using op-amp.
15. Schmitt Trigger using op-amp
16. Instrumentation Amplifier
17. Temperature Measurement using Thermistor
18. Lowpass & Highpass filter using op-amp.

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MAJOR-BASED ELECTIVE I (A)

MOBILE COMMUNICATION

Objective

To learn the concepts of Mobile Communication.

UNIT I WIRELESS NETWORKS

Introduction-Difference between wireless and fixed telephone networks-Development of wireless networks-First, second and third generation - common channel signaling (CCS)-Integrated services Digital Network (ISDN)-Signaling System No. 7 (SS7)-An example of SS7 Global cellular network interoperability-Personal communication Services/Networks (PCS/PCNs)-Protocol for network access-Network database-Universal mobile telecommunication system (UMTS).

UNIT II MULTIPLE ACCESS TECHNIQUES

Introduction- Frequency division multiple access [FDMA] – Time division multiple access [TDMA] –Spread spectrum multiple access- Coded division multiple access CDMA] -Space division multiple access- [Capacity of cellular CDMA in single cell-multiple cell) - capacity of SDMA -CDMA digital cellular standard(IS-95)-Frequency and channel specifications-Forward CDMA channel –Reverse CDMA channel.

UNIT III CELLULAR CONCEPT

Introduction-Frequency reuse-channel assignment strategies- handoff strategies- prioritizing handoffs-practical handoff considerations-Interference and system capacity-co-channel interference and system capacity-channel planning for wireless systems –Adjacent channel interference- truncating and grade of service –improving coverage and capacity in cellular systems-cell splitting-sectoring-Repeaters for range extention-Microcell Zone concept.

UNIT IV GLOBAL SYSTEM FOR MOBILE COMMUNICATION

GSM architecture – Layer modeling-Transmission- Channel and channel modes- multiple access scheme- channel coding and interleaving-Radio resource (RR) management – Mobility management (MM) - Communication management (CM) - Network management (NM).

UNIT V INTRODUCTION TO MOBILE WIMAX

IEEE 802.16-IEEE 802.16 MAC-IEEE80216e-Mobile Wimax end to end network architecture-Analysis of MIMO techniques for mobile Wimax systems:-Introduction-Performance trade off-multiple antenna system-Antenna array techniques-MIMO system-M multiple antenna in Wimax: Transmit diversity-Spatial multiplexing- comparison of MIMO option-Multimedia application, services & Deployment:-Cross layer E to E QoS for

scalable video over mobile Wimax:-Introduction-critical end system techniques-TCP friendly method-BW estimation-layer coding and FEC structure for error control-Embedded layer probing-Mobile Wimax QoS provisioning-Internet protocol

Text Books:

1. T.S.Rappaport, Wireless Communications principles and practice,PHI, 2002
2. William C.Y. Lee, Mobile cellular Telecommunications, McGraw-Hill, 1995
3. K.Wang-cheng chen & J.Roberto, B.Demarca, Mobile WiMAX, WilleyPub. (E-Book)

Reference Book:

1. Jochen Schiller, Mobile communications, Pearson Education, 2009.

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MAJOR-BASED ELECTIVE I (B)

SENSORS, TRANSDUCERS AND MEASUREMENTS

Objectives:

To acquire the knowledge about Sensors, Transducers fundamentals and its applications in biomedical instrumentation.

UNIT I MEASUREMENTS AND SENSING FUNDAMENTALS

Measurements - Significance - Concept of Direct and Indirect Measuring Methods - Static and Dynamic Characteristics of Sensors - Mechanical, Thermal and Electrical Dynamic Models of Sensor Elements - Advantages of Sensors - Classifications of Transducers - Primary and Secondary Transducers - Characteristics of Transducers.

UNIT II TRANSDUCERS AND PRIMARY SENSING ELEMENTS

Transducers - Electric transducers - Classification of transducers -Characteristics and choice of transducers - Factors influencing the choice of transducers - Resistive transducers - Strain gauges – Resistance thermometers - Thermistors - Thermocouples - Principle of LVDT – Capacitive transducers -Principle of peizo electric transducers - Principle of hall effect transducers - Magneto resistors.

UNIT III MEASUREMENT OF NON-ELECTRICAL QUANTITIES

Measurement of pressure: using electrical transducers as secondarytransducers - Low pressure: Pirani gauges - Measurement of linear velocity (moving magnet type) - Measurement of angular velocity (D.C. Tachometer generators and Digital methods) - Measurement of vibrations – Seismic transducers - Measurement of liquid level - Measurement of thickness - Measurement of Humidity - Gas analyzer.

UNIT IV SIGNAL CONDITIONERS

Signal conditioning – Op-amp circuit used in instrumentation– Differential amplifier – Voltage follower – Instrumentation amplifier – Filters – Wheatstone bridge – AC bridges.

UNIT V BIOMEDICAL INSTRUMENTATION

Man-Instrument system, components, introduction to physiological system, generation of bio potential, Block diagram and working of EEG, ECG & EMG, electrical shock hazards, precautions, safety codes biomedical

Text Books:

1. A.K. Sawnney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai & Co., 2005
2. H.S. Kalsi, Electronics Instrumentation, 2nd Edition,TMH, 2004.
3. Dr.M. Arumugam, Biomedical Instrumentation, 2nd Edition, Anuradha Publications.

Reference Books:

1. Jacob Fraden, Handbook of Modern sensors - Physics, Designs & applications, Springer, 2004
2. Donald P. Eckman, Industrial Instrumentation, CBS Publishers, 2004.

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CORE COURSE VIII

POWER ELECTRONICS

Objectives:

To learn the operative principles of power electronic devices and their applications

UNIT I POWER SEMICONDUCTOR DEVICES & CHARACTERISTICS

Power semiconductor devices: basic structure – Power diode – Power transistors – Power MOSFET – IGBT – physics of device operation and steady state characteristics. Thyristor: Principle of operation –two transistor analogy – Protection against high di/dt and high dv/dt – turn on and turn off methods – gate triggering circuits – series and parallel operation of thyristors – methods to ensure proper current and voltage sharing- string efficiency.

UNIT II PHASE CONTROLLED RECTIFIERS

Principles of phase control – Single phase half wave circuit with R, RL and RLE load – freewheeling- Single-phase full wave controlled converters – single phase semi converters- estimation of load voltage, load current under continuous current conduction. Three phase half controlled and fully controlled converter circuits – waveform and average load voltage for continuous current operation.

UNIT III CHOPPERS

Principle of chopper operation – Control strategies – Step up Choppers – Types of Chopper circuits: Type A, Type B, Type C, Type D and Type E – Thyristor Chopper Circuits: Voltage commutated chopper – Current commutated chopper – Load commutated chopper.

UNIT IV INVERTERS

Single-phase voltage source inverter: Operating principle – Single-phase bridge inverters – Steady state analysis of single phase inverter – Three Phase Bridge Inverters: Three phase 180 degree mode VSI- Three phase 120 degree mode VSI- Voltage Control in Single-Phase Inverters: External Control of AC output voltage- External Control of DC input voltage- Internal control of Inverter – Pulse-width Modulated Inverters: Single-pulse modulation- Multiple pulse modulation- Current Source Inverters: Single-phase CSI with ideal switches

UNIT V APPLICATIONS

Switched Mode Power Supply: Flyback Converter – Push-pull converter – Half-bridge converter-Full-brige converter- Uninterruptible power supplies – Static Switches: Single-phase AC switches- DC switches- Design of static switches- Static Circuit Breakers: Static AC circuit breakers- Static DC circuit breakers – Solid state relays: DC solid state relays- AC solid state relays.

Text Book:

1. P.S. Bimbhra, Power Electronics, Khanna Publishers, 2004

Reference Books:

1. Muhammad H. Rashid, Power Electronics: Circuits, Devices and Applications, Prentice Hall, 1993
2. M.D. Singh & K.B. Khanchandani, Power Electronics, Tata McGraw Hill, New Delhi, 2007

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CORE COURSE IX

MICROCONTROLLER AND EMBEDDED SYSTEMS

Objective

To acquire the knowledge about Microcontrollers, Embedded and programming for various applications

UNIT I MICROCONTROLLER ARCHITECTURE

Microprocessor and Microcontroller – 8051 Microcontroller hardware: 8051 oscillator andClock – Program counter and data pointer – A & B CPU register – Flags & PSW – Internal memory– Internal RAM – Stack and stack pointer – Special function registers – Internal ROM –Input/output pin, ports and circuits – External memory

UNIT II PERIPHERAL

Counter & Timer: Timer/Counter interrupts – Timing – Timer modes of operation – Counting – Serial data input/output: Serial data interrupt – Data transmission – Data reception –Serial data transmission modesInterrupts: Timer flag interrupt – Serial port interrupt – External interrupt – Reset – Interruptcontrol – Interrupt priority – Interrupt destination – Software generated interrupts

UNIT III APPLICATIONS

LED – LCD – Keyboard interfacing -ADC- DAC- Sensor interfacing – 7 Segment and LCD interfacing -8051 interfacing with the 8255- Motor control: Relay, PWM, DC and Stepper motor—USRAT Initialization-USART use-interfacing

UNIT IV INTRODUCTION TO EMBEDDED SYSTEMS:

Embedded systems-processor embedded into a system-Embedded Hardware units and devices in system- Embedded software in a system –examples of embedded systems – embedded system on-chip (Soc) and use of VLSI circuit design technology

UNIT V DEVICES AND COMMUNICATION BUSES FOR DEVICES NETWORK:

IO types andexamples- Serial communication devices- Parallel device ports- Sophisticated interfacing featuresin device ports- Wireless devices – Timer and counting devices – Watchdog timer – Real time clock– networked embedded systems – serial bus communication protocols – Parallel bus deviceProtocols- Parallel communication network using ISA, PCI, PCI-X and advanced buses – InternetEnabled Systems– Network protocols – Wireless and mobile system protocols.

Text Books:

1. Kenneth J. Ayala, The 8051 Microcontroller architecture, programming and application, Delmar Cengage Learning, 2004
2. Muhammad Ali Mazidi, Jarrice Gillispie Mazidi & Rolin D.Mckinlay, The 8051 Microcontroller and Embedded Systems, Pearson Education, 2007
3. Rajkamal, "Embedded Systems Architecture, Programming and Design", TATA McGraw-Hill, 2009

Reference Books:

1. Krishna kant, Microprocessors and microcontrollers :Architecture, Programming and system Design, 8085, 8086, 8051, 8096, PHI**,** 2013

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CORE PRACTICAL IV

ELECTRONICS IV (P)

Any 8 Experiments

1. Burglar Alarm
2. Automatic street light controller
3. Thyristor Chopper
4. Full wave rectifier using SCR
5. Triggering of SCR by R and C
6. Speed control of DC motor using SCR and UJT
7. Fan Regulator using TRIAC
8. Design of Snubber circuit
9. Arithmetic and Logical Operations in 8051
10. KEY and LED Interface with 8051
11. Solid State Relay Interface with 8051
12. DC motor control using 8051
13. ADC interface with 8051
14. Object counter using interrupt
15. Stepper motor interface with 8051
16. Serial port interface using RS232
17. LCD Interface with 8051
18. Ultrasonic based Distance Measurement

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MAJOR-BASED ELECTIVE II (A)

FIBER OPTIC COMMUNICATION

Objective

To impart knowledge about the optical fiber communication and applications

UNIT I OPTICAL FIBER FUNDAMENTALS

Optical fiber modes and configuration – Fiber types: step index fiber structure – ray optic representation – Wave representation –Mode theory of circular wave guides-Maxwell's equation – Wave guide equations – Wave equation for step-index fibers-Model equation – Modes in step index fibers- Power flow in step index fiber – Graded index fiber structure – Graded index numerical Aperture.

UNIT II SIGNAL DEGRADATION IN OPTICAL FIBERS

Overview Attenuation – Attenuation unit- Absorption- Scattering loss-Bending losses-Core and Cladding loss-Signal distortion in optical wave guides – Information capacity determination – Group delay – Material dispersion-pulse broadening in graded index wave guides-Mode coupling.

UNIT III POWER LAUNCHING AND COUPLING

Source of fiber power launching- Source output pattern- Power coupling calculations –Power launching versus wavelength –Equilibrium numerical aperture-Lensing schemes for coupling improvement Non-imaging micro sphere-Laser diode to fiber coupling – fiber to fiber joints –Mechanical misalignment –Fiber splicing losses –Fiber end face preparation –Splicing techniques –optical fiber connectors.

UNIT IV APPLICATIONS AND FUTURE DEVELOPMENTS

Introduction- Public network application: Trunk network, Junction Network, Local access networks-Submerged systems-Synchronous network-Military, Civil, Consumer and Industrial applications.

UNIT V ADVANCED SYSTEMS AND TECHNIQUES

Wavelength division multiplexing –LAN: Optical fiber bus-Ring topology –Star architecture-Fail safe fiber optic nodes. OPTICAL AMP: Basic applications-Optical amp types-gain-Amp noise figure-optical bandwidth –Photonic switching – Mechanical switches – Integrated optical switch

Text Books:

1. Gerd Keiser, Optical Fiber Communication, TMH, 2008
2. John M.Senior, Optical Fiber Communication Principle and Practice, PHI, 2009.

Reference Books:

1. Henry Zanger and Cynthia Zanger, Fiber Optic Communication and other Applications, Macmillan Publishing Company, 1991.

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MAJOR-BASED ELECTIVE II (B)

ELECTRONIC INSTRUMENTATION

Objective

To impart the working principles of Electronic Instruments

UNIT I BUILDING BLOCKS OF INSTRUMENTATION SYSTEM AND TRANSDUCERS

Block diagram of instrumentation system-performance characteristics of instruments-accuracy, precision sensitivity, linearity, resolution, hysterisis, errors. Electrical transducers-classification-basic requirement of a transducer-displacement transducer variable resistance-variable inductance-LVDT-RVDT-variable capacitance-Hall effect, digital, piezoelectric, pressure and temperature transducers-flow meter and photosensitive transducers

UNIT II SIGNAL PROCESSING AND CONDITIONING

Transducer bridges-instrumentation amplifier –isolation amplifier-logarithmic amplifier-voltage and current amplifier-integrator-differentiator – Phase sensitive detector-peak detector –sample and hold circuit-RMS count –comparator linearization -V to f and f to V converters-filters

UNIT III DATA ACQUISITION

Single channel, mutli channel data conversion-A/D, D/A converters – multiplexers – PID controller –application of microprocessors: temperature controller-control of petrol engine. Firing angle control of SCR- atmospheric data acquisition

UNIT IV ELECTRONIC INSTRUMENTS, RECORDERS AND DISPLAYS

Standard lab. Equipments- signal generator-pulse generator-CRO -VTVM- wave analysis recorders-analog recorders-XY – recorders- stripe chart recorder-oscilloscope recorder-digital recorder- digital readout CRO

UNIT V GENERAL PURPOSE ELECTRONIC INSTRUMENTS

Digital voltmeters and multimeters-electronic counters- AC millivoltmeter-wave analyzers and spectrumanalyzers-frequency synthesizers –lock in amplifier-frequency response analyzerphase meter.

Text Books:

1. C.S Rangan, G.R. Sharma and V.S.V. Mani, Instrumentation Devices and Systems, TMH, 1983
2. W.D. Cooper, A.D. Helfrix, Electronic Instrumentation and Measurement Techniques, PHI, 1988.
3. D. Patranabis, Principles of Industrial Instrumentation, TMH, 2001.
4. A.K. Sawnney, A Course in Electrical & Electronic Measurements & Instrumentation, Dhanpat Rai & Co., 2005

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MAJOR-BASED ELECTIVE III (A)

DIGITAL SIGNAL PROCESSING

Objectives:

To impart the algorithms of Signal Processing.

UNIT I DISCRETE TRANSFORMS

Introduction to Digital Signal Processing - Discrete Transforms - Discrete- Time Fourier Transform (DTFT), Discrete Convolutions: Linear, Circular and Sectioned Convolution - Discrete Fourier Transform - Properties – Frequency Analysis of Signals using DFT-Decimation-in-Time - FFT algorithms - Inverse FFT.

UNIT II FINITE IMPULSE RESPONSE (FIR) FILTERS

Symmetric and anti-symmetric FIR filters - Design of linear-phase FIR filters using windows: Rectangular - Blackman - Hamming - Hanning - Design of linear-phase FIR filters by frequency-sampling method – Optimum Equi-ripple linear-phase FIR filter - Comparison of design methods for linear-phase FIR filter.

UNIT III INFINITE IMPULSE RESPONSE (IIR) FILTERS

IIR filter design by approximation of derivatives - Impulse invariance method - Bilinear transformation - Characteristics of analog filters: Butterworth - Chebyshev - Frequency transformation in the analog and digital domain.

UNIT IV EFFECTS OF FINITE WORD LENGTH

Rounding and truncation error-Quantization effects in A/D conversion of signal-Coefficient Quantization effects in direct form realization of IIR filter-limit cycle oscillation-product quantization. (Concepts only)
Applications: Voice processing: Speech signal- Channel Vocoder -sub band coding-Voice privacy-Application of Radar- Application of Image processing

UNIT V ASSEMBLY LANGUAGE INSTRUCTION AND PROGRAMMING

Syntax - Addressing modes - Load / Store instruction - Addition/Subtraction instruction - Move Instruction - Multiplication instruction – NORM instruction - Program control instruction - Peripheral control - Program for familiarization of the addressing modes - Program for familiarization of the arithmetic instruction - Real time signal processing program.

Text Books:

1. Ramesh Babu P, Digital Signal Processing, , Scitech Publication Pvt. Ltd, 2007.
2. Salivahanan S, Vallavaraj A, Gnanapriya C, Digital Signal Processing, Tata McGraw Hill Publishing, 2003.
3. Venkataramani B, Bhaskar M., “Digital signal processors - Architecture, Programming and Applications, TATA McGraw Hill, 2003.

Reference Book:

1. John G. Proakis, Dimitris G. Manolakis, Digital Signal Processing Principles, Algorithm and Applications, PHI, 2007.

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MAJOR-BASED ELECTIVE III (B)

VERY LARGE SCALE INTEGRATION (VLSI)

Objectives:

The students will learn MOSFET, CMOS, and IC Fabrication Process

UNIT I INTRODUCTION TO MOSFET

Structure of MOSFET: Enhancement mode MOSFET-Depletion Mode MOSFET – MOS Transistor Theory: Figure of merit-MOS Device design equations-equivalent circuits of MOSFETS- Basic structure of CMOS-Solved examples

UNIT II BASIC MOS & CMOS AND BIPOLAR LOGIC CIRCUITS

Pass Transistor (or) Transmission gate- Inverters: The nMOS Inverter-MOSFET as a resistance-determination of pull-up to pull-down ratio for an n-MOS inverter by another n-MOS inverter-pull-up to pull-down ratio for an n-MOS inverter driven through one or more pass transistors-Different forms of pull-up-BICMOS Inverter – Tristate Inverter –Differential Inverter-Bipolar logic circuits- DTL- ECL-Integrated injection logic

UNIT III VLSI FABRICATION PROCESS

Crystal growth and wafer preparation-epitaxy-oxidation-diffusion: Constant source diffusion-limited source diffusion-Parameters affect diffusion-Diffusion Systems-Diffusion Furnace -Ion Implementation- lithography-Dielectric and polysilicon Film Deposition-Etching –Metallization-Yield and reliability

UNIT IV FABRICATION OF TYPICAL IC COMPONENTS

Monolithic resistors-Monolithic capacitors-Monolithic diodes-Monolithic Transistors-An overview of MOSFET technology-CMOS Technology-Solved Examples

UNIT V APPLICATION OF CMOS

An Increment/Decrement circuit-Shift Registers: Left/Right Register- Serial/ Parallel Registers-Comparators for a two bit number- Two Phase non- Overlapping clock generator

Text Book:

1. Dilip K. Roy, Principles of VLSI, Galgotia Publication Limited, 2005

Reference Books:

1. Neil H. E. Weste, Principles of CMOS VLSI Design, Addison-Wesley Publishing Company, 1993
2. Introduction to VLSI Systems Carver Mead Lynn Conway BS Publication, 2003

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