ANDHRA KESARI UNIVERSITY ::ONGOLE

Model Syllabus for 4-Year UG Honours in B.Sc. (Electronics) as Major in consonance with Curriculum framework w.e.f. AY 2025-26

COURSE STRUCTURE (for Semester I to VI)

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
I	I	1	Fundamental of Electricity and Electronics	3	3
			Fundamental of Electricity and Electronics Practical Course	2	1
		2	Circuit theory and Electronic Devices	3	3
			Circuit theory and Electronic Devices Practical Course	2	1
	II	3	Semiconductor Devices and Materials	3	3
			Semiconductor Devices and Materials Practical Course	2	1
		4	Digital Electronics	3	3
			Digital Electronics Practical Course	2	1
II	III	5	Analog Circuits and Communication	3	3
			Analog Circuits and Communication Practical Course	2	1
		6	Microprocessor System	3	3
			Microprocessor System Practical Course	2	1
		7	Electrical and Electronics Instrumentation	3	3
			Electrical and Electronics Instrumentation Practical Course	2	1
	IV	8	Electronic Communication System	3	3
			Electronic Communication System Practical Course	2	1
		9	Microcontroller and Interfacing	3	3
			Microcontroller and Interfacing Practical Course	2	1
		10	Computer Network	3	3

Year	Semester	Course	Title of the Course	No. of Hrs /Week	No. of Credits
			Computer Network Practical Course	**2**	**1**
III	**V**	**11**	Cellular Mobile Communication	**3**	**3**
			Cellular Mobile Communication Practical Course	**2**	**1**
		12 A	Industrial Electronics	**3**	**3**
			Industrial Electronics Practical Course	**2**	**1**
		OR			
		12 B	Embedded System Design	**3**	**3**
			Embedded System Design Practical Course	**2**	**1**
		13 A	Digital System Design	**3**	**3**
			Digital System Design Practical Course	**2**	**1**
		OR			
		13 B	Consumer Electronics	**3**	**3**
			Consumer Electronics Practical Course	**2**	**1**
	VI	**14 A**	Power Electronics	**3**	**3**
			Power Electronics Practical Course	**2**	**1**
		OR			
		14 B	VLSI Design	**3**	**3**
			VLSI Design Practical Course	**2**	**1**
		15 A	Principles and Utility of Electronic Domestic Applications	**3**	**3**
			Principles and Utility of Electronic Domestic Applications Practical Course	**2**	**1**
		OR			
		15 B	Digital Signal Processing	**3**	**3**
			Digital Signal Processing Practical Course	**2**	**1**

Note: In the III Year (during the V and VI Semesters), students are required to select a pair of electives from one of the Two specified domains. For example: if set 'A' is chosen, courses 12 to 15 to be chosen as 12 A, 13 A, 14 A and 15 A or if set 'B' is chosen, It is to be chosen as 12 B, 13 B, 14 B and 15 B to ensure in-depth understanding and skill development in the chosen domain, students must continue with the same domain electives in both the V and VI Semesters.

PRINCIPAL
T.R.R. Govt. Degree College
KANDUKUR - 523105
Prakasam Dist.

SEMESTER - I

COURSE 1: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

Theory **Credits: 3** **3 hrs/week**

Course Objectives:
The students will learn:
1) Basics of electrostatics, Gauss theorem and its applications, concept of a capacitor, various types of capacitors and dielectric constant, magnetic effects of current, cells and the measuring instruments like ammeter and voltmeter,
2) Basics of p-n junction, rectifying action of a diode, regulated power supplies and wave shaping circuits, and
3) Transistor and its three modes of operation, h-parameter model of a transistor and the frequency response of an amplifier.

UNIT-I (9 Hrs)

Electrostatics: Electric charges - Coulomb's law - Electric field - Electric intensity and electric potential - Relation between electric potential and intensity - Electric intensity and potential due to a uniform charged conducting sphere at a point outside and inside the conductor.

Electric dipole - Dipole moment - Intensity and potential due to a dipole – Statement and proof of Gauss law - Application of Gauss law to uniformly charged solid sphere.

UNIT-II (9 Hrs)

Capacitors: Definition and unit of capacity - Capacitance of a parallel plate capacitor - Effect of dielectric on capacity - Capacitors in series and parallel - Energy stored in a charged capacitors - Loss of energy on sharing of charges between two capacitors - Force of attraction between plates of charged parallel plate capacitor - Kelvin's attracted disc electrometer - Measurement of potential and dielectric constant.

Type of capacitors - Mica capacitor, Electrolytic capacitors, Variable air capacitor - Uses of capacitors.

UNIT-III (9 Hrs)

Electrical Measurements: Carey-Foster bridge - Determination of specific resistance - Potentiometer - Calibration of low and high range voltmeters - Calibration of Low range ammeter.
Magnetic Effect of Current: Biot-Savart's law - Force on a conductor carrying current placed in a magnetic field – Ampere's Law - Principle, construction and theory of a moving coil ballistic galvanometer.

UNIT-IV (9 Hrs)

Diode circuits and power Supplies: Junction diode characteristics - Half and full wave rectifiers - Expression for efficiency and ripple factor - Construction of low range power peak using diodes - Bridge rectifier - Filter circuits - Zener Diode - Characteristics - Regulated power supply using Zener diode –

UNIT-V (9 Hrs)

Transistor circuits: Characteristics of a transistor in CB, CE modes - Relatively merits Graphical analysis in CE configuration - Transistor as an amplifier - RC coupled amplifier - Frequency response - h parameters.
Basis logic gates AND, OR, and NOT - Construction of basic logic gates.

Text Books :

1. Electricity and Magnetism - *M. Narayana moorthi and Others*, National Publishing Co., Chennai.
2. Electricity and Magnetism - *R. Murugeshan*, S. Chand & Co. Ltd., New Delhi, Revised Edition, 2006.
3. Principles of Electronics - *V.K. Mehta*, S. Chand & Co., 4/e, 2001.
4. Basic Electronics - *B.L. Theraja*, S. Chand & Co., 4/e, 2001.

Reference Books :

1. Electricity and Magnetism - *Brijlal & Subrahmanyam*, Ratan Prakashan Mandir, Agra.
2. Fundamentals of Electricity and Magnetism - *B.D. Duggal & C.L. Chhabra*, Shoban Lal Nagin Chand & Co., Jallundur.
3. Physics, Vol. II - *Resnick, Halliday & Krane*, 5/e, John Wiley & Sons, Inc.,.
4. Basic Electronics - *B. Grob*, McGraw - hill, 6/e, NY, 1989.
5. Elements of Electronics - *Bagde & Singh*, S. Chand

SEMESTER - I

COURSE 1: FUNDAMENTALS OF ELECTRICITY AND ELECTRONICS

Practical **Credits: 1** **2 hrs/week**

Course Objectives:

The students will learn:

1) Basics of electrostatics, Gauss theorem and its applications, concept of a capacitor, various types of capacitors and dielectric constant, magnetic effects of current, cells and the measuring instruments like ammeter and voltmeter,

2) Basics of p-n junction, rectifying action of a diode, regulated power supplies and wave shaping circuits, and

3) Transistor and its three modes of operation, h-parameter model of a transistor and the frequency response of an amplifier.

List of Experiments:

1. Kirchoff's verification
2. Logic Gates – Verification of Truth Tables
3. PN Junction Diode – V-I Characteristics
4. Zener Diode – V-I Characteristics
5. Zener Diode as a Voltage Regulator
6. Carey- Fasters Bridge.
7. Series and Parallel Combination of Resistors and Capacitors
8. Bridge Rectifier – L and π filters

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SEMESTER - I

COURSE 2: CIRCUIT THEORY AND ELECTRONIC DEVICES

Theory **Credits: 3** **3 hrs/week**

Course Objectives :

1. To explain the basic concepts and laws of DC and AC electrical networks and solve them using mesh and nodal analysis techniques.
2. To analyze circuits in time and frequency domain.
3. To synthesize the networks using passive elements.
4. To understand the construction, working and VI characteristics of electronic devices.
5. To understand the concept of power supply.

UNIT- 1: (9 Hrs)

SINUSOIDAL ALTERNATING WAVEFORMS:

Definition of current and voltage. The sine wave, general format of sine wave for voltage or current, phase relations, average value, effective (R.M.S) values. Differences between A.C and D.C. Phase relation of R, L and C

UNIT-II: (9 Hrs)

PASSIVE NETWORKS AND NETWORKS THEOREMS (D.C):

Branch current method, Nodal Analysis, star to delta & delta to star conversions. Superposition Theorem, Thevenin's Theorem, Norton's Theorem, Maximum Power, Milliman and Reciprocity theorems .

UNIT-III: (9 Hrs)

RC, RL AND RLC CIRCUITS:

Frequency response of RC and RL circuits, their action as low pass and high pass filters. Passive differentiating and integrating circuits. Series resonance and parallel resonance circuits, Q – Factor.

UNIT-IV: (9 Hrs)

BJT, FET and UJT:

BJT: Construction, working, and characteristics of CE Configurations. Hybrid parameters and hybrid equivalent circuit of CE Transistor,

FET: Construction, working and characteristics of JFET and MOSFET. Advantages of FET over BJT.

UJT: Construction, working and characteristics of UJT. UJT as a Relaxation oscillator.

UNIT-V: (9 Hrs)

POWER SUPPLIES & PHOTO ELECTRIC DEVICES

Rectifiers:Half wave ,full wave rectifiers-Efficiency-ripple factor- Filters- L- section & π-section filters. Three terminal fixed voltage I.C.regulators (78XX and &79XX). Light Emitting Diode – Photo diode and LDR.

TEXT BOOKS:

1. Introductory circuit Analysis (UBS Publications)---------- Robert L. Boylestad.
2. Electronic Devices and Circuit Theory ---------- Robert L. Boylestad & Louisashelsky.
3. Circuit Analysis by P.Gnanasivam- Pearson Education
4. Electronic Devices and Circuit Theory ---------- Robert L. Boylestad & Louis Nashelsky.
5. Electronic Devices and Circuits I – T.L.Floyd- PHI Fifth Edition

REFERENCE BOOKS:

1. Engineering Circuit Analysis By: Hayt & Kemmerly - MG.
2. Networks and Systems – D.Roy Chowdary.
3. Unified Electronics (Circuit Analysis and Electronic Devices) byAgarwal- Arora
4. Electric Circuit Analysis- S.R. Paranjothi- New Age International.
5. Integrated Electronics – Millmam & Halkias.
6. Electronic Devices & Circuits – Bogart.
7. Sedha R.S., A Text Book Of Applied Electronics, S.Chand & Company Ltd

SEMESTER - I

COURSE 2: CIRCUIT THEORY AND ELECTRONIC DEVICES

Practical **Credits: 1** **2 hrs/week**

Course Outcomes:

`1. Apply concepts of electric network topology, nodes, branches, loops to solve circuit problems including the use of computer simulation.

2. Apply time and frequency concepts of analysis.
    a. Synthesize the network using passive elements.
    b. Know about amplifier circuits, switching circuits and oscillator circuits their design and use in electronics.
    c. Design and construction of a power supply.

List of Experiments :

1. Thevenin's Theorem-verification
2. Norton's Theorem-verification
3. Maximum Power Transfer Theorem-verification
4. LCR series resonance circuit.
5. BJT input and output characteristics
6. FET Output and transfer characteristics
7. UJT VI characteristics
8. LDR characteristics
9. IC regulated power supply(IC-7805)

Lab experiments are to be done on breadboard and simulation software and output values are to be compared and justified for variation.

SEMESTER - II

COURSE 3: SEMICONDUCTOR DEVICES AND MATERIALS

Theory **Credits: 3** **3 hrs/week**

Course Outcomes:

1. To provide basic knowledge and concepts of Semiconductor materials and devices.
2. To facilitate students learn on the physical principles and operational characteristics of Semiconductor devices and some of its important applications. Pre-requisites: Basic understanding of semiconductors.

Learning Objectives:

1. Ability to apply basic concepts of Inorganic and Organic Semiconductor materials for electronic device application in modern electronic industry.
2. Detailed knowledge of various classifications and applications to VLSI, LEDs and solar cells.
3. Holistic view of the latest progress in two-dimensional (2D)-one-dimensional (1D) and nano materials.
4. Emphasis on nano-electronic applications such as Schottky barrier transistors, flexible Electronics.

Unit I: (9 Hrs)

Inorganic and Organic Semiconductor: Energy bands, carrier transport, mobility, drift-diffusivity, excess carrier, injection and recombination of the excess carriers, carrier statistics; High field effects: velocity saturation, hot carriers and avalanche breakdown.

Unit II: (9 Hrs)

Majority carrier Devices: MS contacts rectifier and non-rectifier, MIS structures, MESFET, hetero-junction, HEMT and band diagrams, I-V and C-V characteristics.

Unit III: (9 Hrs)

MOS structures: Semiconductor surfaces; The ideal and non-ideal MOS capacitor band diagrams and CVs; Effects of oxide charges, defects and interface states. MOSFET: Structures and Device Characteristics, Short-Channel effects. Charge coupled Devices (CCDs), application to VLSI.

Unit IV: (9 Hrs)

Nonvolatile Memory Device. Optoelectronic Devices: solar cell, photo detectors, LEDs, laser diodes. Nano structures and concepts: quantum wells, supper lattice structures, nanorod, quantum dot, CNTs, 2D materials: grapheme, BN, MoS_2 etc, matamaterials.

UNIT-V: (9 Hrs)

Multistage Amplifiers: BJT at high frequencies, frequency response of RC coupled amplifiers and transformer coupled amplifier.

Reference Books :

1. Donald A. Neamen, Semiconductor Physics and Devices Basic Principles, 3rdedn.McGraw-Hil (2003)
2. B.G. Streetman and Sanjay Banerjee, Solid State Electronic Devices, 6thEdn., Prentice Hall, 2006.
3. S. M. Sze and Kwok K. Ng Physics of Semiconductor Devices, Wiley (2013).
4. M. Hussa, A. Dimoulas and A. Molle, 2D Materials for Nano Electronics, CRC press (2016)
5. M .S. Tyagi, Introduction to Semiconductor Materials and Devices, Willey, Student Edition

SEMESTER - II

COURSE 3: SEMICONDUCTOR DEVICES AND MATERIALS

Practical **Credits: 1** **2 hrs/week**

List of Experiments:

1. To study the Hall Effect: determine the Hall coefficient, type of semiconductor and carrier concentration in the given semiconductor sample.
2. To study the four probe method: calculate the resistivity and energy band gap of given semiconductor sample.
3. To determine the resistivity of the given semiconductor specimen using Vander Pauw method.
4. To design a MOSFET as switching regulator for given duty cycle and plot the current-voltage (I-V) characteristic of MOSFET using Keithley.
5. To design a phase controlled rectifier using SCR and plot the I-V characteristic of SCR using Keithley.
6. To design a relaxation oscillator using UJT and plot the I-V characteristic of UJT using Keithley.
7. I-V characteristics measurement of a p-n diode/LEDs using Keithley - calculate its ideality factor.

SEMESTER - II

COURSE 4: DIGITAL ELECTRONICS

Theory **Credits: 3** **3 hrs/week**

Course Objectives :

To understand the number systems, Binary codes and Complements.

1. To understand the Boolean algebra and simplification of Boolean xpressions.
2. To analyze logic processes and implement logical operations using combinational logic circuits.
3. To understand the concepts of sequential circuits and to analyze sequential systems in terms of state machines.
4. To understands characteristics of memory and their classification.
5. To implement combinational and sequential circuits using VHDL.

Unit – I (9 Hrs)

NUMBER SYSTEM AND CODES: Decimal, Binary, Hexadecimal, Octal. Codes: BCD, Gray and Excess-3 codes- code conversions- Complements (1's, 2's,9's and 10's), Addition -Subtraction using complement methods.

Unit- II (9 Hrs)

BOOLEAN ALGEBRA AND THEOREMS: Boolean Theorems, De-Morgan's laws. Digital logic gates, Multi level NAND & NOR gates. Standard representation of logic functions (SOP and POS), Minimization Techniques (Karnaugh Map Method: 2,3 variables).

Unit-III (9 Hrs)

COMBINATIONAL DIGITAL CIRCUITS:

Adders-Half & full adder, Subtractor-Half and full subtractors, Parallel binary adder, Magnitude Comparator, Multiplexers (4:1)) and Demultiplexers (1:4), Encoder (8- line-to-3- line) and Decoder (3-line-to-8-line). IC-LOGIC FAMILIES: TTL logic, CMOS Logic families(NAND&NOR Gates).

UNIT-IV (9 Hrs)

SEQUENTIAL DIGITAL CIRCUITS:

Flip Flops: S-R FF , J-K FF, T and D type FFs, Master-Slave FFs, Excitation tables, Registers:- Serial In Serial Out and Parallel In and Parallel Out, Counters Asynchronous-,Mod-8,Mod- 10,Synchronous-4-bit &Ring counter.

UNIT- V (9 Hrs)

MEMORY DEVICES:

General Memory Operations, ROM, RAM (Static and Dynamic), PROM, EPROM, EEPROM, EAROM,

TEXT BOOKS:

1. M. Morris Mano, " Digital Design " 3rd Edition, PHI, New Delhi.
2. Ronald J. Tocci. "Digital Systems-Principles and Applications" 6/e. PHI.New Delhi. 1999. (UNITS I to IV)
3. G.K. Kharate-Digital electronics-oxford university press
4. S. Salivahana & S. Arivazhagan-Digital circuits and design
5. Fundamentals of Digital Circuits by Anand Kumar

Reference Books :

1. Herbert Taub and Donald Schilling. "Digital Integrated Electronics", McGraw Hill. 1985.
2. S.K. Bose. "Digital Systems". 2/e. New Age International. 1992.
3. D.K. Anvekar and B.S. Sonade. "Electronic Data Converters: Fundamentals & Applications". TMH. 1994.
4. *Malvino and Leach. "Digital Principles and Applications". TMG Hill Edition.*

SEMESTER - II

COURSE 4: DIGITAL ELECTRONICS

Practical **Credits: 1** **2 hrs/week**

Course Outcomes:

1. Develop a digital logic and apply it to solve real life problems.
2. Analyze, design and implement combinational logic circuits.
3. Classify different semiconductor memories.
4. Analyze, design and implement sequential logic circuits.
5. Simulate and implement combinational and sequential logic circuits using VHDL

List of Experiments:

1. Verification of IC-logic gates
2. Realization of basic gates using discrete components (resistor, diodes & transistor)
3. Realization of basic gates using Universal gates (NAND & NOR gates)
4. Verify Half adder and full adder using gates
5. Verify Half subtractor and full subtractor using gates.
6. Verify the truth table Multiplexer and demultiplexer.
7. Verify the truth table Encoder and decoder.
8. Verify the truth table of RS , JK, T-F/F using NAND gates
9. 4-bit binary parallel adder and subtractor using IC 7483
10. BCD to Seven Segment Decoder using IC -7447/7448