K. C. E. Society's
Moolji Jaitha College
An 'Autonomous College' Affiliated to
K.B.C. North Maharashtra University, Jalgaon.
NAAC Reaccredited Grade - A (CGPA : 3.15 - 3rd Cycle)
UGC honoured "College of Excellence" (2014-2019)
DST(FIST) Assisted College

KNOWLEDGE IS POWER
ESTD. 1945

के. सी. ई. सोसायटीचे
मूळजी जेठा महाविद्यालय
क.ब.चौ. उत्तर महाराष्ट्र विद्यापीठ, जळगाव संलग्नित
'स्वायत्त महाविद्यालय'
नॅकद्वारा पुनर्मानांकित श्रेणी – 'ए' (सी.जी.पी.ए. : ३.१५ – तिसरी फेरी)
विद्यापीठ अनुदान आयोगाद्वारा घोषित 'कॉलेज ऑफ एक्सलन्स' (२०१४-२०१९)
डी.एस.टी. (फीस्ट) अंतर्गत अर्थसहाय्य प्राप्त

Date :- 01/08/2023

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc. in Electronics (Sem. I & II)

Ref. :- Decision of the Academic Council at its meeting held on 26/07/2023.

The Syllabi of B. Sc. in Electronics (First and Second Semesters) as per **NATIONAL EDUCATION POLICY - 2020** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2023-24.

Copy of the Syllabi Shall be downloaded from the College Website (www.kcesmjcollege.in)

Sd/-
Chairman,
Board of Studies

To :

1) The Head of the Dept., M. J. College, Jalgaon.
2) The office of the COE, M. J. College, Jalgaon.
3) The office of the Registrar, M. J. College, Jalgaon.

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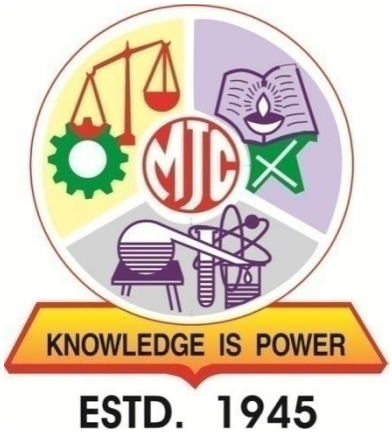
समर्थ कॉलनी जवळ, जळगांव – ४२५ ००२. (महाराष्ट्र, भारत) । दूरध्वनी क्र. : +९१ २५७–२२३७३६३, २२३४२८१ । ई–मेलः mjcollege@kces.in । वेबसाईटः mjcollege.kces.in

Khandesh College Education Society's

Moolji Jaitha College,Jalgaon

An "Autonomous College"

Affiliated to
Kavayitri Bahinabai Chaudhari
North Maharashtra University, Jalgaon-425001



STRUCUTRE AND SYLLABUS

B.Sc Hounour/Honours with Research (F.Y.B.Sc.Electronics)

Under Choice Based Credit System (CBCS)
and
as per NEP-2020 Guidelines

[w.e.f.AcademicYear:2023-24]

Preface

Skilled human resource is a prerequisite in higher education, and it is to be acquired through thorough knowledge of theoretical concepts and hands-on laboratory methods of the subject. The MooljiJaitha College (Autonomous) has adopted a department-specific model as per the guidelines of UGC, NEP-2020 and the Government of Maharashtra. The Board of Studies in Electronics of the college has prepared the syllabus forthe first-year undergraduate of Electronics.The syllabus cultivates theoretical and practical knowledge required in the different fields of Electronics. The contents of the syllabus have been prepared to accommodate the fundamental aspects of various fields of Electronics and to build the foundation for various applied sectors of Electroncis. Besides this, in the first year, the students will be enlightened with the skill related to basic electronic circuits/ system and testing, which will enhance students' employability.

The overall curriculum of three / four-year covers some basic and advanced electronics courses such as Basic electronic Components, Digital Electroncis, Analog Electronics and Applications, Linear Intetgrated Circuits, Microprocessor, Microcontrollers, Analog and Digital Communication, Sensor and Transducer, Electronic Instrumentation, Physics of Semiconductor Devices, Power Electronics, Industrial Electronics, optoelectronics, control system componets, Network Analysis, Biomedical instrumentation, Progrmmable Logic Control, Digital Signal Processing and included skilled enhacement courses such as ARDUINO, Embedded System, PCB designing etc. Also covers various designing and simulation tools such as VHDL, OrCAD, MATLAB, Python, LabVIEW. Furthermore, the syllabus is structured to devlope practical skills as per reqirement in the Industrial Sector, research field, and Entrepreneurship etc. Hence, the curriculum is endowed with more experiments that shall run hand-in-hand with theory. The detailed syllabus of each paper is appended with a list of suggested readings.

Program Outcomes (PO) for B.Sc. Electronics Honours/ Honours with Research:

Upon successful completion of the B.Sc. program, student will be able to:

PO No.	PO
1	Graduates should have a comprehensive knowledge and understanding of the fundamental principles, theories, and concepts in their chosen field of study.
2	Graduates should possess the necessary technical skills and competencies related to their discipline, including laboratory techniques and data analysis.
3	Graduates should be able to identify, analyze, and solve complex problems using logical and critical thinking skills. They should be able to apply scientific methods and principles to investigate and find solutions.
4	Graduates should be proficient in effectively communicating scientific information, both orally and in writing.
5	Graduates should have a basic foundation in research methods and be capable of designing and conducting scientific investigations.
6	Graduates should be able to work effectively as part of a team, demonstrating the ability to collaborate with others, respect diverse perspectives, and contribute to group projects.
7	Graduates should recognize the importance of ongoing learning and professional development. They should be equipped with the skills and motivation to engage in continuous learning, adapt to new technologies and advancements in their field, and stay updated with current research.

Program Specific Outcome (PSO) B.Sc. Electronics Honours/ Honours with Research:

After completion of this course, students are expected to learn/understand the:

PO No.	PSO
1	Core knowledge in electronics, including the major areas of Analog and Digital Electronics, operational amplifiers, power electronics, instrumentation, optoelectronics, microprocessor, electronic communication, sensors and transducers.
2	Advanced electronics application areas such as embedded system, biomedical instrumentation, Agri Electronics, Mechatronics, Programmable Logic Control, LabVIEW, ARDUINO.
3	Laboratory skills enabling them to take measurements in an electronics laboratory and analyze the measurements to draw valid conclusion.
4	Design and simulation of electronics devices/ system and develop research oriented skills.
5	Critically thinking and work independently.
6	Skills and modern technological/scientific/engineering software/tools for professional practices.

Credit distribution structure for Three/ Four year Honors/ Honors with Research Degree Programme with Multiple Entry and Exit

Level	Sem	Major (Core) Subjects		Minor Subjects (MIN)	GE/ OE	VSC, SEC (VESC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/Sem	Degree/ Cumulative Cr.
		Mandatory (DSC)	Elective (DSE)							
4.5	I	DSC-1 (2T) DSC-2 (2T) DSC-3 (2P)	—	MIN-1 (2T) MIN-2 (2P)	OE-1 (2T)	SEC-1 (2T) SEC-2 (1P)	AEC-1 (2T) (ENG) VEC-1 (2T) (ES) IKS (1T)	CC-1 (2)	22	UG Certificate 44
	II	DSC-4 (2T) DSC-5 (2T) (IKS) DSC-6 (2P)	...	MIN-3 (2T) MIN-4 (2P)	OE-2 (2T)	SEC-3 (2T) SEC-4 (1P)	AEC-2 (2T) (ENG) VEC-2 (2T) (CI) IKS (1T)	CC-2 (2)	22	
	Cum. Cr	12	...	8	4	6	4+4+2	4	44	
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										
5.0	III	DSC-7 (2T) DSC-8 (2T) DSC-9 (2P) DSC-10 (2P)	...	MIN-5 (2T) MIN-6 (2P)	OE-3 (2T) OE-4 (2P)		AEC-3 (2T) (MIL)	CC-3 (2) CEP (2)	22	UG Diploma 88
	IV	DSC-11 (2T) DSC-12 (2T) DSC-13 (2P) DSC-14 (2P)	...	MIN-7 (2T) MIN-8 (2P)	OE- 5 (2T) OE-6 (2P)		AEC-4 (2T) (MIL)	CC-4 (2) FP (2)	22	
	Cum. Cr	28	...	16	10	6	8+4+2	8+2+2	88	
Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										
5.5	V	DSC-15 (2T) DSC-16 (2T) DSC-17 (2T) DSC-18 (2P) DSC-19 (2P)	DSE-1 (2T) A/B DSE-2 (2P) A/B	MIN-9 (2T/P)	...	VSC-1 (2T) VSC-2 (2P)	...	OJT/Int(2)	22	UG Degree 132
	VI	DSC-20 (2T) DSC-21 (2T) DSC-22 (2T) DSC-23 (2P) DSC-24 (2P)	DSE-3 (2T) A/B DSE-4 (2P) A/B	MIN-10(2T/P)	—	VSC-3 (2T) VSC-4 (2P)	...	OJT/Int(2)	22	
	Cum. Cr.	48	08	20	10	8+6	8+4+2	8+2+2+4	132	
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										
6.0	VII	DSC-25 (4T) DSC-26 (4T) DSC-28 (4T) DSC-27 (2P)	DSE-5 (2T) A/B DSE-6(2P) A/B	RM (4T)	—	...	...		22	UG Honors Degree 176
	VIII	DSC-29 (4T) DSC-30 (4T) DSC-32 (4T) DSC-31 (2P)	DSE-7 (2T) A/B DSE-8(2P) A/B		—	...	...	OJT/Int (4)	22	
	Cum. Cr.	76	16	20+4	10	8+6	8+4+2	8+2+2+8	176	
Four Year UG Honors Degree in Major and Minor with 176 credits										
6.0	VII	DSC-25 (4T) DSC-26 (4T) DSC-27 (2P)	DSE-5 (2T) A/B DSE-6 (2P) A/B	RM (4T)	...	...	...	RP (4)	22	UG Honors with Research Degree 176
	VIII	DSC-29 (4T) DSC-30 (4T) DSC-31 (2P)	DSE-7 (2T) A/B DSE-8 (2P) A/B		...	...	...	RP (8)	22	
	Cum. Cr.	68	16	20+4	10	8+6	8+4+2	8+2+2+8+12	176	
Four Year UG Honours with Research Degree in Major and Minor with 176 credits										

Sem- Semester, **DSC**- Department Specific Course, **DSE**- Department Specific Elective, **T**- Theory, **P**- Practical, CC-Cocurricular**RM**- Research Methodology, **OJT**- On Job Training, **FP**- Field Project, **Int**- Internship, **RP**- Research Project,

Multiple Entry and Multiple Exit options: The multiple entry and exit options with the award of UG certificate/ UG diploma/ or three-year degree depending upon the number of credits secured;

Levels	Qualification Title	Credit Requirements		Semester	Year
		Minimum	Maximum		
4.5	UG Certificate	40	44	2	1
5.0	UG Diploma	80	88	4	2
5.5	Three Year Bachelor's Degree	120	132	6	3
6.0	Bachelor's Degree- Honours **Or** Bachelor's Degree- Honours with Research	160	176	8	4

F. Y. B. Sc. Electronics Structure and Syllabus

Semester	Course Module	Credit	Hours/ week	TH/ PR	Code	Title
I	DSC	2	2	TH	ELE-DSC-111	Introduction to Electronic Components
	DSC	2	2	TH	ELE-DSC-112	Basic Digital Electronics
	DSC	2	**4**	**PR**	ELE-DSC-113	Practical course on Electronic Components and Digital Electronics
	MIN	2	2	TH	ELE-MIN-111	Digital Electronics
	MIN	2	**4**	**PR**	ELE-MIN-112	Practical course on Digital Electronics
	OE/GE	2	2	TH	ELE-OE-111	Electrical Circuits
	SEC	2	2	TH	ELE-SEC-111	Computer Networking and Installation
	SEC	1	**2**	**PR**	ELE-SEC-112	Practicals on Computer Networking and Installation
	AEC	2	**2**	**TH**	ENGS-AEC-111	English
	VEC	2	**2**	**TH**	ES -VEC-111	Environmental studies
	IKS	1	**1**	**TH**	IKS-111	Indian knowledge system
	CC	2	**2**	**CC**	NCC-CC-111 NSS-CC-111 SPT-CC-111 CUL-CC-111	NCC NSS Sports Cultural
II	DSC	2	2	TH	ELE-DSC-121	Analog Electronics and Applications
	DSC	2	2	TH	ELE-DSC-122	Linear Integrated Circuits
	DSC	2	**4**	**PR**	ELE-DSC-123	Practicals on Analog Electronics and Linear Integrated Circuits.
	MIN	2	2	TH	ELE-MIN-121	Computer Organisation
	MIN	2	**4**	**PR**	ELE-MIN-122	Practical course on Computer Organization
	OE/GE	2	2	TH	ELE-OE-121	Electronic Communication
	SEC	2	2	TH	ELE-SEC-121	Introduction to ARDUINO
	SEC	1	**2**	**PR**	ELE-SEC-122	Practical course on ARDUINO Applications
	AEC	2	**2**	**TH**	ENGS-AEC-121	English
	VEC	2	**2**	**TH**	CI-VEC-121	Constitution of India
	IKS	1	**1**	**TH**	IKS-121	Indian knowledge system
	CC	2	**2**	**CC**	NCC-CC-121 NSS-CC-121 SPT-CC-121 CUL-CC-121	NCC NSS Sports Cultural

DSC : Department-Specific Core course
DSE : Department-Specific elective
GE/OE : Generic/ Open elective
SEC : Skill Enhancement Course
MIN : Minor course
AEC : Ability Enhancement Course
VEC : Value Education Courses
ENG : English
ES : Environmental studies
CI : Constitution of India

IKS	**:**	Indian Knowledge System	**TH**	**:**	Theory
CC	**:**	Co-curricular course	**PR**	**:**	Practical

Examination Pattern

Theory Question Paper Pattern:

- 30 (External) +20 (Internal) for 2 credits
    - External examination will be of 1½ hours duration
    - There shall be 3 questions Q1 carrying 6 marks and Q2, Q3 carrying 12 marks each. while the tentative pattern of question papers shall be as follows;
    - Q1 Attempt any 2 out of 3 sub-questions; each 3 marks
    - Q 2 and Q3 Attempt any 2 out of 3 sub-question; each 6 marks.

Rules of Continuous Internal Evaluation:

The Continuous Internal Evaluation for theory papers shall consist of two methods:

1. Continuous & Comprehensive Evaluation (CCE): CCE will carry a maximum of 30% weightage (30/15 marks) of the total marks for a course. Before the start of the academic session in each semester, the subject teacher should choose any three assessment methods from the following list, with each method carrying 10/5 marks:

i. Individual Assignments
ii. Seminars/Classroom Presentations/Quizzes
iii. Group Discussions/Class Discussion/Group Assignments
iv. Case studies/Case lets
v. Participatory & Industry-Integrated Learning/Field visits
vi. Practical activities/Problem Solving Exercises
vii. Participation in Seminars/Academic Events/Symposia, etc.
viii. Mini Projects/Capstone Projects
ix. Book review/Article review/Article preparation
x. Any other academic activity
xi. Each chosen CCE method shall be based on a particular unit of the syllabus, ensuring that three units of the syllabus are mapped to the CCEs.

2. Internal Assessment Tests (IAT): IAT will carry a maximum of 10% weightage (10/5 marks) of the total marks for a course. IAT shall be conducted at the end of the semester and will assess the remaining unit of the syllabus that was not covered by the CCEs. The subject teacher is at liberty to decide which units are to be assessed using CCEs and which unit is to be assessed on the basis of IAT.

The overall weightage of Continuous Internal Evaluation (CCE + IAT) shall be 40% of the total marks

for the course. The remaining 60% of the marks shall be allocated to the semester-end examinations. The subject teachers are required to communicate the chosen CCE methods and the corresponding syllabus units to the students at the beginning of the semester to ensure clarity and proper preparation.

Practical Examination Credit 2: Pattern (30+20)

External Practical Examination (30 marks):

- Practical examination shall be conducted by the respective department at the end of the semester.
- Practical examination will be of 3 hours duration and shall be conducted as per schedule.
- Practical examination shall be conducted for 2 consecutive days for 2 hr/ day where incubation condition is required.
- There shall be 05 marks for journal and viva-voce. Certified journal is compulsory to appear for practical examination.
- External practical examination of SEC will be of 25 marks and there will be no internal exam for SEC practical.

Internal Practical Examination (20 marks):

- Internal practical examination of 10 marks will be conducted by department as per schedule given.
- For internal practical examination student must produce the laboratory journal of practicals completed along with the completion certificate signed by the concerned teacher and the Head of the department.
- There shall be continuous assessment of 30 marks based on student performance throughout the semester. This assessment can include quizzes, group discussions, presentations and other activities assigned by the faculty during regular practicals. For details refer internal theory examination guidelines.
- Finally 40 (10+30) marks performance of student will be converted into 20 marks.

F. Y. B. Sc
Semester-I
ELE-DSC-111: Introduction to Electronic Components

Total Hours: 30 **Credits: 2**

Course objectives	• To introduce passive components such as resistors, capacitors and inductors. • To introduce basic semiconductor devices. • Understanding the operation and application of semiconductor devices. • To introduce an integrated circuit (IC).	
Course outcomes	After successful completion of this course, students are expected to: • identify and test the electronics component. • analysis the electronics circuit. • analyse electrical circuits and calculate the main parameters. • understand the basics of integrated circuit (IC).	
Unit	**Contents**	**Hours**
Unit I	**Basic Components** Resistor: Construction and working. Types of Resistors (Carbon film, metal-film, carbon composition, wire wound and variable type), properties and characteristics of resistor (size, voltage, tolerance temperature and frequency dependence, voltage dependent (VDR).), noise consideration, specification and applications. Capacitors: Construction and working. Types of Capacitors (polyester, Metalized polyester, ceramic paper mica and electrolytic tantalum and solid aluminium types), properties and characteristics of capacitor, specifications, applications. Inductors: Construction and working. Types of Inductors (Iron Core Inductor, Air Core Inductor, Iron Powder Inductor, Ferrite Core Inductor), Transformers and RF coils, Properties of cores, Needs and type of shielding. Relays, Batteries, Switches, Fuses, Cables, Connectors, (Their working principle, symbols, enlists types, specifications and applications), Soldering iron and materials.	**8**
Unit II	**Semiconductor Diodes** PN junction diode – construction and workind principle and symbol, Depletion layer, forward and reverse biasing, Forward and breakdown voltage, Diode Equation and I-V characteristics. Ideal diode, Zener diode- I-V characteristics, Zener and avalanche breakdown, Reverse saturation current, Zener diode as voltage regulator, Tunnel Diode, Varactor diode, Light emitting diode (L.E.D), Photo diode and Photo voltaic or solar cell (Construction, working principle, symbol and Applications expected).	**7**
Unit III	**Transistors** BJT, UJT, FET- JFET, MOSFET, SCR: Construction and working principle, characteristics, testing and applications.	**8**
Unit IV	**Integrated Circuits:** Types of Integrated Circuit (categories of integrated circuits)- Digital Integrated Circuit, Analog Integrated Circuit, Mixed Integrated Circuit. Basic features of an integrated circuit (Construction, Packaging, Size), Classification of ICs-SSI, MSI, LSI, VLSI, ULSI Applications of ICs, Advantages of IC.	**7**

Study Resources	• Nasar, S. A. (2004). Electric Circuits, Schaum's outline series, Tata McGraw Hill. • Nahvi, M. & Edminister J. (2005). Electrical Circuits, Schaum's Outline Series, Tata McGraw-Hill. • Smith, K.A. & Alley, R.E. (2014). Electrical Circuits, Cambridge University Press. • Ryder, J. D. (1961). Network, Lines and Fields. (2nd ed.). Prentice-Hall, India. • Mahadevan, K. & Chitra, C. (2015). Electrical Circuit Analysis. PHI Learning. • Theraja, B. L. (2007). Electronics devices and circuits. Chand Publishing. • Mehta, V. K. & Mehta, R. (1980). Principles of Electronics. S. Chand & company.	

F. Y. B. Sc
Semester-I

ELE-DSC-112: Basic Digital Electronics

Total Hours: 30 **Credits: 2**

Course objectives	• To familiarize with various number systems and provide basic concepts related to digital logic and circuit design • To introduce the basic concepts and laws involved in the Boolean algebra and logic gates. • To design combinational and sequential circuits utilized in the different digital circuits. • Applying the concept of digital logic families with circuit implementation.	
Course outcomes	After successful completion of this course, students are expected to: • understand the number systems, codes and their conversion among others. • familiar with digital signals, Boolean algebra, logic gates, logical variables, truth tables, • design the different types of combinational and sequential circuits • design and apply for real time digital systems.	
Unit	**Contents**	**Hours**
Unit I	**Number System and Codes:** Decimal, Binary, Octal and Hexadecimal number systems, base conversions. Concept of positive and negative logic. Representation of signed and unsigned numbers, BCD code (8421), Gray code, Binary addition, Subtraction by 1's and2's complement method. Octal and hexadecimal addition and subtraction.	**8**
Unit II	**Logic Gates and Boolean algebra:** Logic symbol, logic equation and Truth Tables of OR, AND, NOT, NOR, NAND, XOR and their IC pin configuration. NAND and NOR as universal Gates, Demorgan's theorem, Basic postulates and fundamental theorems of Boolean algebra.	**7**
Unit III	**Combinational Digital Circuits and Design:** Standard representation of logic functions (SOP & POS), Min and max terms, Minimization Techniques (Karnaugh map minimization up to 4 variables for SOP). Arithmetic Circuits: Binary Addition. Half and Full Adder Data processing circuits: Multiplexers (2:1 and 4:1), De-multiplexers (1:2 and 1:4), Decoders (BCD to Decimal Decoder), Encoders (Decimal to BCD Encoder).	**8**
Unit IV	**Sequential Circuits:** S-R, D, J-K and T Flip flop, Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in J-K Flip-Flop. Master-slave J-K Flip-Flop. Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only 4 bits). Counters (4 bits): Asynchronous counters, Decade Counter. Synchronous Counter.	**7**
Study Resources	• Malvino, A.P., Leach D.P. & Saha. (2011). Digital Principles and Applications. Tata McGraw. • Kumar, A. (2009). Fundamentals of Digital Circuits. PHI Learning Pvt. Ltd.	

	• Venugopal, K. R. (2011). Digital Circuits and systems. Tata McGraw Hill Education. • Thomas, L. F. (1994). Digital Fundamentals.Pearson Education, Asia. • Tokheim R. L. (1994). Digital Principles. Schaum's Outline Series, (3rd ed.), Tata McGraw- Hill • Taub, H. & Schilling, D. (1985). Digital Integrated Electronics. McGraw Hill.	

F. Y. B. Sc
Semester-I
ELE-DSC-113: Practical course on Electronic Components and Digital Electronics

Total Hours: 60 **Credits: 2**

Course objectives	• To identify and test various electronic components. • To understand the characteristics of diode and transistor practically. • To study the Combinational circuits. • To understand the concepts of flipflops, registers and counters**.**	
Course Outcomes	After successful completion of this course, students are expected to: • identify and testing R, L& C components, potentiometers, breadboards, Diodes, Transistors , Multimeters, CRO and Function Generators. • understand the diode and transistor characteristics. • learn the basics of gates and Construct and verify basic combinational circuits. • learn about counters and Shift registers.	
Sr. No.	**Contents**	**Hours**
Section A: Electronic Components (Perform any 7 or 8 experiments)		
1	Identification of electronic components, testing and their specification (R, C, L),	4
2	Identification of electronic components, testing and their specification (Switches, Fuse, Transformer and Relay),	4
3	Identification of active electronic components and their specification (Diode and Transistors	4
4	Study of the I-V Characteristics of P-N junction Diode.	4
5	Build and Test PN junction as Clipper/Clamper	4
6	Study of the I-V Characteristics of Zener Diode	4
7	Study of the I-V Characteristics of BJT	4
8	Study of the I-V Characteristics of UJT	4
9	Study of UJT Relaxation Oscillator	4
10	Study of the I-V Characteristics of JFET	4
11	Study of Zener diode as a voltage regulator.	4
12	Study of Integrated Circuits(IC).	4
Section B: Digital Electronics (Perform any 7 or 8 experiments)		
13	Verification of truth table of logic gates OR, AND, NOT, NOR, NAND, XOR using ICS	4
14	To design a combinational logic system for a specified Truth Table. (b) To convert Boolean expression into logic circuit and design it using logic gate ICs. (c) To minimize a given logic circuit.	4
15	Study of Half Adder and Full Adder.	4
16	Study of Half Subtractor and Full Subtractor.	4

17	Study of BCD to seven-segment decoder.	4
18	To build and test Flip-Flop (Clocked RS, D-type) circuits using NAND gates.	4
19	To build and test JK Master-slave flip-flop using Flip-Flop ICs.	4
20	To build and test Counter using D-type/JK Flip-Flop ICs and study timing diagram.	4
21	To build and test Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.	4
22	To study decade counter using IC 7490.	4
23	Study of 4-1 line multiplexer.	4
24	Study of NAND or NOR gate as universal Gate.	4
Study Resources	• Theraja, B. L. (2007). Electronics devices and circuits. Chand Publishing. • Mehta, V. K. & Mehta R. (1980). Principles of Electronics. S. Chand & Company. • Malvino, A.P., Leach, D.P. & Saha. (2011). Digital Principles and Applications. Tata McGraw. • Kumar, A. (2009). Fundamentals of Digital Circuits. PHI Learning Pvt. Ltd.	

Note: At least 12 experiments should be performed.

F. Y. B. Sc
Semester-I
ELE-MIN-111: Digital Electronics

Total Hours: 30 **Credits: 2**

Course objectives	• To get familiar with various numbers systems and conversion • To understand logic gates and its operation. • To understand combinational logic circuits and • To understand sequential logic circuits in digital electronic circuits.	
Course outcomes	After successful completion of this course, students are expected to: • do conversions in number systems • design and analyse combinational circuits. • design and analyse sequential circuits. • design and apply for real time digital systems	
Unit	**Contents**	**Hours**
Unit I	**Number System** Number System, types of Number system, radix, Conversions, BCD, Gray Code, Excess-3 code, Alphanumeric Codes, Error Detecting Codes, Error Correcting Codes.	**7**
Unit II	**Logic Gates** OR gate, AND gate, NOT gate (symbol, Truth Table, implementation using diode or Transistor), NAND gate, NOR gate, EXOR gate, EXNOR gate, Integrated IC's, TTL Logic family, CMOS logic family, PMOS and NMOS logic. Demorgon's Theorem, Boolean Algegra.	**8**
Unit III	**Digital Circuits** Multiplexer, Demultiplexer, BCD to Decimal Conversion, Parity Generator and Checker. Half and Full Adder, Half and Full Subtractor. Flip-Flop: Clock RS FF, JK FF, T FF, D FF, Counter, Shift Register (Concept, type and application).	**7**
Unit IV	**Semiconductor Memories** Volatile and non-volatile memory, types of Memory, read and write operation, MOS memory cell, Flash memory, cache memory, PAL, PLA.	**8**
Study Resources	• Malvino, A.P., Leach, D.P. & Saha. (2011). Digital Principles and Applications. Tata McGraw. • Kumar, A. (2009). Fundamentals of Digital Circuits. PHI Learning Pvt. Ltd. • Venugopal, K. R. (2011). Digital Circuits and systems. Tata McGraw Hill Education. • Thomas, L. F. (1994). Digital Fundamentals. Pearson Education, Asia. • Tokheim, R. L. (1994). Digital Principles. Schaum's Outline Series, (3rd ed.), Tata McGraw- Hill • Taub, H. & Schilling, D. (1985). Digital Integrated Electronics. McGraw Hill.	

F. Y. B. Sc
Semester-I
ELE-MIN-112: Practical course on Digital Electronics

Total Hours: 60 **Credits: 2**

Course objectives	• To provide hands on the digital system. • To demostate working principle of logic gates.. • To design combinational and sequential circuits utilized in the different digital circuits. • Applying the concept of digital logic in circuit implementation.
Course Outcomes	After successful completion of this course, students are expected to: • analyse the digital system. • understand the function of logic gates. • design the different types of combinational and sequential circuits. • design and apply real time digital systems.

Sr. No.	Contents (Perform any 15 experiments)	Hours
1	Build, test and verify the AND logic Gates.	4
2	Build, test and verify the OR logic Gates.	4
3	Build, test and verify the NOT logic Gates.	4
4	Study the NAND gate as universal gate.	4
5	Study the NOR gate as universal gate.	4
6	Build and test 4 to1 multiplexer.	4
7	Build and test 1 to 4 De-multiplexer.	4
8	Build and test Decade Counter.	4
9	Build and test BCD to Decimal convertor.	4
10	Build and test Parity Generator.	4
11	Build and test Parity Checker.	4
12	Build and test clocked RS FF.	4
13	To build and test Shift Register (serial-in and serial-out) using D-type/JK Flip-Flop ICs.	4
14	Build and Test Half Adder and Full Adder.	4
15	Build and Test Half Subtractor and Full Subtractor.	4
16	Demostrate Demorgon's Theorems.	4
18	Build and Test Decade Counter.	4

Study Resources	• Malvino, A.P., Leach, D.P. & Saha. (2011). Digital Principles and Applications. Tata McGraw. • Kumar, A. (2009). Fundamentals of Digital Circuits. PHI Learning Pvt. Ltd. • Venugopal, K. R. (2011). Digital Circuits and systems. Tata McGraw Hill Education. • Thomas, L. F. (1994). Digital Fundamentals, Pearson Education, Asia. • Tokheim, R. L. (1994). Digital Principles, Schaum's Outline Series. (3rd ed.). Tata McGraw- Hill. • Taub, H. & Schilling, D. (1985). Digital Integrated Electronics, McGraw Hill.	

Note: At least 12 experiments should be performed.

F. Y. B. Sc
Semester-I
ELE-OE-111: Electrical Circuits

Total Hours: 30 **Credits: 2**

Course objectives	• To introduce concept of electrical quantity. • To understand the electrical citcuits.. • Understanding operation of AD and DC motors.. • Understand the wiring of Conductors.	
Course outcomes	After successful completion of this course, students are expected to: • understand the basic electrical quantity and its use in daily life. • analyse or understand electrical circuits and functioning. • understand AC and DC machines. • understand and do electrical wiring.	
Unit	**Contents**	**Hours**
Unit I	**Basic Electricity Principles** Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC Electricity. DC Power sources, Familiarization with multimeter, voltmeter and ammeter.	**7**
Unit II	**Understanding Electrical Circuits** Main electric circuit elements (R,L,C) and their combination. Rules to analyze DC sourced electrical circuits (KCL, KVL) Current and voltage drop across the DC circuit elements, Diode and rectifiers, . Response of inductors and capacitors with DC or AC sources Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Power factor. Saving energy and money.	**8**
Unit III	**Electric Machines** Principle of DC/AC generators, construction of DC generator, Operation of transformers, Single-phase AC & DC motors (Basic design), Speed & power of ac motor. BLDC motor.	**7**
Unit IV	**Electrical wiring and protection** Different types of conductors and cables. Basics of wiring-Star and delta connection. Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop, Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps, terminal blocks, split bolts, and solder. Preparation of extension board, Relays. Fuses and disconnect switches. Circuit breakers. Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection.	**8**
Study Resources	• Thereja, B.L., & Thereja, R. (2008). Basic Electrical Engineering. S Chand & Co. • Say, M.G. (2002). Performance and design of AC machines. CBS. • Kothari, D.P., & Nagrath, I.J. (2019). Basic Electrical Technology. McGrawHill.	

F. Y. B. Sc
Semester-I
ELE-SEC-111: Computer Networking and Installation

Total Hours: 30 **Credits: 2**

Course objectives	• To develop an understanding of the basic concepts of computer networking. • To explore basic networking models. • Provides in-depth coverage of the most important concepts in contemporary networking such as TCP/IP, Ethernet, wireless transmission, and security. • To Understand the difference between the OSI and TCP/IP protocol suit.	
Course outcomes	After successful completion of this course, students are expected to: • understand basic computer network technology, Data Communications System and its components • analyze basic networking protocols and their use in network design • gain expertise to build networks from scratch and maintain, upgrade and troubleshoot existing networks. • design and implement a network protocol.	
Unit	**Contents**	**Hours**
Unit I	**Computer Networking Overview:** Network Fundamentals, Data Transmission, Network topology, Network technology, Network Classification: Based on transmission technology (point to point, multipoint, broadcast), Based on physical size (PAN, LAN, MAN, WAN, VPN), Based on architecture (peer to peer, Client server and advantages), LAN Hardware/Network Devices- Repeaters, Hub, Bridge, Switches, Router, Ethernet LANs, Token-Ring LAN.Internet Applications, Storage-Area Networks,Internet Security.	**7**
Unit II	**Network Models**: Protocol Hierarchies-Layered Approach, Interfaces, Services, Protocols and Packets, Layer Protocols,Design issues for layering,OSI reference model-functionality of each layer,Addressing in TCP/IP (physical, logical, port and specific), OSI Model Vs.TCP/IP, TCP/JP Protocol: Layers and their functions, The ISO-OSI model.	**8**
Unit III	**TCP/IP protocol suit:** Network Layer Protocols-SLIP, PPP, Internet Layer Protocols-IP, ARP,RARP,ICMP, Transport Layer Protocols-TCP, UDP, Application Layer Protocols-FTP, HTTP, SMTP, TELNET, DNS, BOOTP, DHCP.	**7**
Unit IV	**Wireless LANS, Virtual Circuit Networks and Installation:** Introduction,Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, Connecting devices and Virtual LANS. Network installations types, configurations, types of network services, types of server, Software.	**8**
Study Resources	• Shanmavgoan, K. S. (1979). Digital and Analog Communication system, Wiley, John and sons. • Tanenbaum, A. S. (2003). Computer Networks, (4th ed.). Prentice Hall, Netherland. • Forouzan, B. A.(2013). Data Communications and Networking, (5th ed.). McGraw-Hill, Higher Education. • Black, U. D. (1987), Data Communication and Distributed Networks, (2nd ed.). Prentice-Hall, Englewood Cliffs. • Stallings, W. (2007). Data and Computer Communications. (8th ed.), Pearson Prentice Hall. • Kahate, A. (2017). Cryptography and network security, McGraw Hill Education, New Delhi.	

F. Y. B. Sc
Semester-I
ELE-SEC-112: Practicals on Computer Networking and Installation

Total Hours:30 **Credits:1**

Course objectives	• To provides hands on training and knowledge about the analysis, design, troubleshooting, modeling, testing and evaluation of computer networks. • To make students aware about various types of cables used in guided media like coaxial cable, optical fiber cable, twisted pair cables and its categories. • To implement a simple LAN with hubs, bridges and switches. • To know the concept of data transfer between nodes.	
Course Outcomes	After successful completion of this course, students are expected to: • implement any topology using network devices. • analyze performance of various communication protocols. • implement device sharing on network. • learn the major software and hardware technologies used on computer networks.	
Sr. No.	**Contents**	**Hours**
1	Study of Network components (To observe Components of Network in your Computer Network Lab and its type and network features).	4
2	Prepare a Straight Cable and Network Cross over Cable and test by Line Tester. (connecter connection is expected).	4
3	To Connect Computers in Star Topology using Wired Media and any Network control Device.	4
4	Preparing setting up wireless network.	4
5	To connect two hubs/switch by creating crossover connection and to Configure Peer-to-Peer Network.	4
6	To Share Printer and Folder in Network.	4
7	Troubleshooting network.	4
8	Preventive maintenance.	4
9	Handling network admin function.	4
10	To visit server room and prepare report on 1. Proxy Server 2. Server Configuration 3. Router Configuration 4. Firewall Configuration 5. Network setup details (Topology, Back up, IP range, network software, UPS).	4
Study Resources	• Kurose, J. (2016). Computer Networking: A Top-Down Approach. (7th ed.). Pearson. • Forouzan, B. (2017). Data Communication and Networking. (5th ed.). TMH. • Tanenbaum, A. S. & Wetherall, D. J.(2013). Computer Network. (5th ed.). Pearson.	

Note: At least 8 experiments should be performed.

F. Y. B. Sc
Semester-II
ELE-DSC-121: Analog Electronics and Applications

Total Hours: 30 **Credits: 2**

Course objectives	• To study the construction and characteristics of semiconductor diode. • To study the construction and characteristics of Transistor. • To study the working principle of Amplifier. • To study the working principle of Oscillator.	
Course outcomes	After successful completion of this course, students are expected to: • understand working of analog circuits. • design voltage and power amplifier as per the requirement. • design desire oscillator for the application. • apply the concept and knowledge of electronics devices to real life problems.	
Unit	**Contents**	**Hours**
Unit I	**Semiconductor Diode** Working of Diode, Biasing: Forward and Reverse Biasing, IV characteristics, breakdown, Zener Diode, Rectifier Circuits: Half Wave and Full wave Bridge rectifier Circuit: circuit diagrams, working and waveforms, PIV, ripple factor and their efficiency (Derivation not expected). Comparison of rectifiers, Filter-types, Shunt capacitor filter, its role in power supply, output waveform, and working. Zener diode as voltage regulator, Clipper Circuit.	**7**
Unit II	**Transistor** Working of Transistor: PNP and NPN transistor, transistor configuration: CE, CB, CC, Characteristics of CE connection, Transistor as a switch, Transistor as an Amplifier in CE configuration, DC loads line, Q point, Transistor Biasing: its need, types, Voltage divider Bias method, stabilization.	**8**
Unit III	**Amplifiers** Voltage Amplifier: Frequency response of Single stage Amplifier, gain, decibel gain, bandwidth, Multistage amplifier, Coupling: its types and Comparison, RC coupled amplifier. Power Amplifier: Small Signal and High Signal Amplifier, Difference between voltage and Power Amplifier, Practical power Amplifier, important terms: collector efficiency and distortion, types of power amplifier, Push Pull Amplifier, thermal runway and heat sink.	**7**
Unit IV	**Feedback and Oscillator** Concept of Feedback, Effect of Negative feedback on Amplifier, Emitter follower, Positive feedback in Oscillator, Barkhausen Criteria, types of Oscillators, Colpitts Oscillator, Phase Shift oscillator, Crystal oscillator.	**8**
Study Resources	• Bell, D.A. (2015). Electronic Devices and Circuits (5th ed). Oxford University Press. • Pittet, A &Kandaswamy, K. (2005). Analog Electronics, Prentice Hall of India. • Schilling, D.L. & Belove, C. (1989). Electronic Circuits: Discrete and Integrated. McGraw Hill Education. • Sedra, A. S., Smith, K.C., &Chandorkar, A.N. (2014). Microelectronic circuits. (6th ed). Oxford University Press. • Millman, J., & Halkias, C.C. (2001). Integrated Electronics, Tata	

	McGraw Hill. • Cathey, J. J. (1991). Solved Problems in Electronics, Schaum's outline Series. Tata McGraw Hill. • Grob, B. (1997). Basic Electronics. McGra-Hill Education. • Sedha, R.S. (2008). A text book of Applied Electronics. S. Chand and Company, New Delhi. • Mehta, V.K., & Mehta, R. (2014). Principles of Electronics. S. Chand.	

F. Y. B. Sc
Semester- II
ELE-DSC-122: Linear Integrated Circuits

Total Hours: 30 **Credits: 2**

Course objectives	• To understand various op-amp parameters and their importance in design. • To learn about basic op-amp configurations and applications. • To introduce various timing circuits. • To learn Digital to Analog and Analog to Digital Conversions.	
Course outcomes	After successful completion of this course, students are expected to: • understand and Design OP-Amp circuits. • able design timing circuits. • understand signal conversion. • apply the knowledge to solve the real life problems.	
Unit	**Contents**	**Hours**
Unit I	**Operational Amplifiers** Block diagram of operational amplifier, symbol, Ideal and Practical Characteristics Operational Amplifier (IC 741), Open and closed loop configuration, Frequency Response. CMRR. Slew Rate.	**7**
Unit II	**Applications of Op-Amps:** Inverting and non-inverting amplifiers, concept of Virtual Ground, Summing and Difference Amplifier, Differentiator, Integrator, Wein bridge oscillator, Comparator and Zero-crossing detector, and Active low pass and high pass Butterworth filter (1st order only), Problems based on applications.	**8**
Unit III	**Timer (IC 555)** Multivibrator, Types of multivibrator, Block diagram of IC 555, Astable, Monostable and Bistable multivibrator circuits using IC-555, Period and frequency of multivibrators, Problems.	**7**
Unit IV	**D-A and A-D Conversion** DAC and ADC conversion, Types of DAC, 4-bit binary weighted and R-2R D-A converters, circuit and working. Accuracy and Resolution. A-D conversion, characteristics. Types of ADC (list only), Successive approximation ADC. Problems on DAC.	**8**
Study Resources	• Gaikwad, R. A. (2000). OP-Amps and Linear Integrated Circuit. (4th ed). Prentice Hall. • Bell, D.A. (2011). Operational Amplifiers and Linear ICs. (3rd ed.). Oxford University Press. • Tocci, R.J., & Widmer N.S. (2001). Digital Systems: Principles and Applications, PHI. • Mancini, R.& Carter, B. (2017). Op Amps for Everyone. (5th ed.) Newnes. • Stanley, W.D. (2004). Operational Amplifiers with Linear Integrated Circuits. Pearson Education.	

F. Y. B. Sc
Semester- II
ELE-DSC-123: Practicals on Analog Electronics and Linear Integrated Circuits

Total Hours: 60 **Credits: 2**

Course objectives	• To provide exposure to handle electronics components and circuits. • To familiar semiconductor devices identification and practical characterisitics. • To get hands on Op-AMP and its application. • To design and test small electronics circuits.	
Course Outcomes	After successful completion of this course, students are expected to: • understand diode and transistor circuits. • understand basic operation of Amplifier and Oscillator circuits. • able to design, build and test desired output OP-AMP circuits. • design electronics circuits required in real life.	
Sr. No.	**Contents**	**Hours**
Section A: Analog Electronics (Perform any 7or 8 experiments)		
1	Study of I-V characteristics of Semiconductor Diode.	4
2	Study of Half wave rectifier.	4
3	Study of Full wave bridge rectifier.	4
4	Study of Clamper Circuit using Diode.	4
5	Study of I-V characteristics of Bipolar Junction Transistor.	4
6	Build and Test transistor as a Switch.	4
7	Build and Test Single stage Transistor Amplifier.	4
8	Build and Test Phase Shift Oscillator.	4
9	Build and Test Crystal Oscillator.	4
10	Build and Test Emitter Follower Circuit.	4
Section B: Linear Integrated Circuits (Perform any 7or 8 experiments)		
11	Study of parameter of OP-AMP (input impedance, output impedance, Offset Null arrangement, CMRR, Slew rate).	4
12	Design, Build and Test Inverting and Non-inverting Amplifier.	4
13	Design, Build and Test Adder and Subtractor using OP-AMP.	4
14	Design, Build and Test Integrator using OP-AMP.	4
15	Design, Build and Test Differentiator using OP-AMP.	4
16	Design, Build and Test Low pass/High Pass filter using OP-AMP.	4
17	Design, Build and Test Astable Multivibrator for a desire frequency.	4
18	Design, Build and Test Monostable Multivibrator for a time period.	4

19	Build and Test R-2R ladder DAC.	4
20	Build and Test Analog to Digital Converter.	4
Study Resources	• Schilling, D.L. & Belove, C. (1989). Electronic Circuits: Discrete and Integrated. McGraw Hill Education. • Mehta, V.K., & Mehta R.(2014). Principles of Electronics. S. Chand. • Scherz, P. (2016). Practical Electronics for Inventors. McGraw-Hill. • Gaikwad, R. A. (2000). OP-Amps and Linear Integrated Circuit. (4th ed). Prentice Hall. • Mancini,R.& Carter, B. (20017). Op Amps for Everyone. (5th ed.) Newnes.	

Note: At least 12 experiments should be performed.

F. Y. B. Sc
Semester- II
ELE-MIN-121: Computer Organisation

Total Hours: 30 **Credits: 2**

Course objectives	• To study of basic structure and operation of a digital computer system. • Understanding the concept of Logic and Arithmetic Operations. • To familiarize the basic CPU organization, architecture and functionality of central processing unit. • To study the different ways of communicating with I/O devices and standard I/O interfaces and Understanding various memory devices.	
Course outcomes	After successful completion of this course, students are expected to: • understand the architecture and functionality of central processing unit. • understand the basics of instructions sets and their impact on processor design. • illustrate in a better way the I/O and memory organization. • design Arithmetic logic units and different types of memory blocks and develop a base for advance micro-processors.	
Unit	**Contents**	**Hours**
Unit I	**Basics of Computer:** A simple understanding of Computer:Evolution (Types), Functional units, Basic operational concepts, Bus Structures, Performance, Power wall, Multiprocessors and Multicomputer,Computer System Level Hierarchy, VonNeumann Architecture, comparison of Computer Architecture and Computer Organization, Addressing and addressing modes. Instructions: Operations and Operands, Representing instructions. Multiprocessors - Characteristics of multiprocessors, Interconnection structures, Inter Processor Arbitration, Inter processor Communication and Synchronization.	**7**
Unit II	**Computer micro-operations:** Numbers, Arithmetic Operations and Characters, Addition and Subtraction, Multiplication and Division algorithms,Floating-point Arithmetic Operations, Decimal arithmetic operations, Logical operations, control operations, Shift micro-Operation.	**8**
Unit III	**Basic Computer Organization and Design:** Instruction codes, Computer Registersfor Instruction Execution,Computer Instructions, Machine Instructions and Instruction cycle. Timing and Control, Memory-Reference Instructions, Input-Output and interrupt. Central processing unit: Stack organization, Instruction Formats(Zero, One, Two and Three Address Instruction),Addressing Modes, Data Transfer and Manipulation, Complex Instruction Set Computer (CISC), Reduced Instruction Set Computer (RISC),Register content and Flag status after Instructions.	**7**
Unit IV	**Input/Output Organization and Memory System:** Input and Outputinterface, Interrupts – Interrupt Hardware, Direct Memory Access, Buses, Interface Circuits, Memory mapped I/O and Isolated I/O, Standard I/O Interfaces(PCI Bus, SCSI Bus, USB),Mass storage, Input and Output Devices. Memory Hierarchy, Memory Chip Organization, Cache memory, Virtual memory, RAM, ROM (types), Paging, Secondary Storage, Redundant array of independent disc(RAID).	**8**

Study Resources	• William, S. (2010). Computer Organization and Architecture- designing for performance, (8th ed). Prentice Hall, New Jersy. • Hamacher,C., Vranesic,Z. & Zaky, S. (2002). Computer Organization, (5th ed.). McGraw Hill, New Delhi, India. • Anrew, S. & Tanenbaum. (2006). Structured Computer Organization, (5th ed.). Pearson Education Inc. • Hayes & John P. (1998). Computer Architecture and Organization, (3rd ed.). Tata McGrawHill • Mano, M. M. (2006). Computer System Architecture, (3rd ed.). Pearson/PHI, India.	

F. Y. B. Sc
Semester- II
ELE-MIN-122 : Practical course on Computer Organization

Total Hours: 60 **Credits: 2**

Course objectives	• To understand the behaviour of Logic Gates. • To Design Adders, Decoders, Multiplexers and Flip-Flops using Gates. • To study the combinational circuits. • Understanding the behaviour of ALU, RAM, STACK and PROCESSOR from working modules and the modules designed by the student as part of the experiment.	
Course Outcomes	After successful completion of this course, students are expected to: • analyze the behaviour of logic gates • design combinational circuits for basic components of computer system and applications. • analyze the operational behaviour and applications of various flip-flop • design Arithmetic logic units and different types of memory blocks.	
Sr. No.	**Contents (Perform any 8 experiments)**	**Hours**
1	Introduction to Verilog HDL/VHDL	4
2	Verify the behavior of logic gates using truth tables of AND, OR, NOT)	4
3	Verify the behavior of logic gates using truth tables of NAND, NOR, XOR.	4
4	Implementing HALF ADDER, and FULL ADDER using basic logic gates.	4
5	Implementing Binary -to -Gray, Gray -to -Binary code conversions.	4
6	Implementing 3-8 line DECODER.	4
7	Implementing 4x1 and 8x1 MULTIPLEXERS.	4
8	Verify the excitation tables of various FLIP-FLOPS	4
9	Design of an 8-bit Input/Output system with four 8-bit Internal Registers.	4
10	Design of an 8-bit ARITHMETIC LOGIC UNIT.	4
11	Design of 24x8 (16 byte) RAM.	4
12	Design of 24x8 (16 byte) STACK.	4
13	Implementation of a 4-bit PROCESSOR.	4
14	SMAC0	4
15	Implementing HALF SUBTRACTOR and FULL SUBTRACTOR using basic logic gates.	4
Study Resources	• Bhasker, J. (1997). A Verilog HDL Primer, Star Galaxy Press, Allentown. • Palnitkar, S. (2003). Verilog HDL: A Guide to Digital Design and Synthesis, (2nd ed.). Prentice Hall.	

Note: At least 12 experiments should be performed.

F. Y. B. Sc
Semester- II
ELE-OE-121: Electronic Communication

Total Hours: 30 **Credits: 2**

Course objectives	• To learn the basic concepts of Electronics Communication. • To learn the analog communication system. • To know digital communication system. • To know the concept of networking and internet.	
Course outcomes	After successful completion of this course, students are expected to: • understand basic communication system. • understand analog signal transmission in communication system. • understand conversion of signal to digital signal and digital signal transmission in communication system. • understand internet and network.	
Unit	**Contents**	**Hours**
Unit I	**Electronic Communication** Block diagram of Electronic Communication, Electromagnetic communication spectrum, Types of Electronic Communication, Modes of Communication, Bandwidth, radio transmitter, and receiver.	**7**
Unit II	**Analog Communication** Modulation and Need of Modulation, Type of Modulation, modulation index, Amplitude Modulation, FM, PM (concept, representation, Comparison, modulation index, examples) .	**8**
Unit III	**Digital Communication** Pulse Modulation, PAM, PPM, PWM, Need of Sampling, Multiplexing, Digital Modulation, Pulse Code Modulation, PCM Sampling rate, PCM encoding, Parallel and Serial, Digital Signal Transmission, Processing, Data Conversion, MODEMs.	**7**
Unit IV	**Introduction to Networking and Internet Technologies** Network Fundamentals, LAN Hardware, Ethernet LANs, Token-Ring LAN. Internet, Storage-Area Networks, Internet Transmission Systems, Internet Security, Internet Applications.	**8**
Study Resources	• Frenzel, L.E. (2014). Principles of Electronic communication systems. (3rd ed.). McGrawHill. • Kennedy, G., & Devis, B. (1985). Electronic Communication systems. Tata McGrawHill. • Beasley, J.S., & Miller, G.M. (2007). Modern Electronics Communication. (9th ed.). Pearson. • Roddy, D., & Coolen J. (2008). Electronic Communications. (4th ed.). Pearson Education, India. • Tomasi, W. (2003). Advanced Electronics Communication Systems. (6th ed.). Prentice Hall. • Lathi, B.P. (2017). Modern Digital and Analog Communication Systems. (4th ed.). Oxford University Press. • Haykin, S. (2006). Communication Systems. (4th ed.). Oxford University Press. Wiley India. • Machiel, M. & Haykin, S. (2009). Communication System. (5th ed.). Wiley.	

F. Y. B. Sc
Semester- II
ELE-SEC-121: Introduction to ARDUINO

Total Hours: 30 **Credits: 2**

Course objectives	• To provide basic functional knowledge of the Arduino microcontroller. • To provide design hardware to control external devices using Arduino. • To provide programming skill to control external devices using Arduino. • To understand ARDUINO communication with external word.	
Course outcomes	After successful completion of this course, students are expected to: • understand handle the Arduino board. • get expertise to use ARDUINO function. • go Arduino Programming. • do Arduino communication and interfacing.	
Unit	**Contents**	**Hours**
Unit I	**Introduction to Arduino** Introduction to Arduino, Pin configuration and architecture, Device and platform feature, Concept of digital and analog ports, Familiarizing with Arduino Interfacing Board, Arduino data types.	**7**
Unit II	**Arduino I/O and Time Functions** Pins Configured as INPUT, Pull-up Resistors, Pins Configured as OUTPUT, Looping Techniques, Decision Making Techniques, pinMode() Function, digitalWrite() Function, analogRead() function, Arduino Interrupts, delay() function, delayMicroseconds() function, millis() function, micros() function.	**8**
Unit III	**Arduino Interfacing and Programming** Interfacing 8 bit LCD to Arduino, static display, Push Button switches, Relay, Matrix Keypad, RF module, Buzzer, Humidity Sensor, Temperature Sensor, Ultrasonic Sensor, Stepper motor.	**7**
Unit IV	**Arduino Communications** Parallel Communication, Serial Communication Modules, Types of Serial Communications, Arduino UART, GSM/GPRS Arduino Interfacing.	**8**
Study Resources	• Singh, R. (2017). Arduino-Based Embedded Systems: Interfacing, Simulation, and LabVIEW. (1st ed.). CRC press. • Pajankar, A.(2018). Arduino Made Simple. BPB. • Banzil, M. (2011). Getting Started with Arduino. (2nd ed.). O'reilly.	

F. Y. B. Sc
Semester- II
ELE-SEC-122: Practical course on ARDUINO Applications

Total Hours:30 **Credits:1**

Course objectives	• To provide basic functional knowledge of the Arduino microcontroller. • To provide design hardware to control external devices using Arduino. • To provide programming skill to control external devices using Arduino. • To understand ARDUINO communication with external word.	
Course Outcomes	After successful completion of this course, students are expected to: • understand handle the Arduino board. • get expertise to use ARDUINO board. • do Arduino Programming. • do Arduino communication and interfacing.	
Sr. No.	**Contents**	**Hours**
1	Study of Arduino Board and IDE.	4
2	Study of Design of Proteus Simulation model.	4
3	Study interfacing of eight LEDs with ARDUINO board. Write program to alternate ON/OFF LEDs.	4
4	Study interfacing of LED with ARDUINO board. Write program to simulate decade counter.	4
5	Study interfacing of LCD with ARDUINO board. Write program to display message on LCD.	4
6	Study interfacing of temperature sensor with ARDUINO board. Write program to display temperature on LCD in Celsius and Fahrenheit.	4
7	Study interfacing of temperature sensor and Buzzer with ARDUINO board. Write program to detect high temperature.	4
8	Study interfacing of switch and LED with ARDUINO board. Write program to ON/OFF LED using switch.	4
9	Study interfacing of Humidity Sensor with ARDUINO board. Write program to display humidity reading on LCD.	4
10	Study interfacing of Ultrasonic Sensor with ARDUINO board. Write program to display distance of object on LCD.	4
11	Study interfacing of Ultrasonic Sensor and buzzer with ARDUINO board. Write program to detect an object.	4
12	Study interfacing of Matrix Keyboard with ARDUINO board. Write program to display pressed key on display.	4
13	Study interfacing of relay with ARDUINO board. Write program to ON/OFF relay.	4
14	Study GSM/GPRS Arduino Interfacing.	4
Study Resources	• Singh, R. (2017). Arduino-Based Embedded Systems: Interfacing, Simulation, and LabVIEW (1st ed.). CRC press. • Pajankar, A. (2018). Arduino Made Simple. BPB. • Banzil, M., (2011). Getting Started with Arduino, (2nd ed.). O'reilly.	

Note: At least 8 experiments should be performed.