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 :- 25/04/2025

NOTIFICATION

Sub :- CBCS Syllabi of B. Sc. in Electronics (Sem. V & VI)

Ref. :- Decision of the Academic Council at its meeting held on 22/04/2025.

The Syllabi of B. Sc. in Electronics (Fifth and Sixth Semesters) as per **NATIONAL EDUCATION POLICY – 2020 (2023 Pattern)** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2025-26.

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

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STRUCTURE AND SYLLABUS

B.Sc. Honours/Honours with Research (T.Y.B.Sc. Electronics)

Under Choice Based Credit System (CBCS)

and

as per NEP-2020 Guidelines

[w.e.f. Academic Year: 2025-26]

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 ofElectronics.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 Electronics. 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 Electronics, Analog Electronics and Applications, Linear Integrated Circuits, Microprocessor, Microcontrollers, Analog and Digital Communication, Sensor and Transducer, Electronic Instrumentation, Physics of Semiconductor Devices, Power Electronics, Industrial Electronics, optoelectronics, control system components, Network Analysis, Biomedical instrumentation, Programmable Logic Control, Digital Signal Processing and included skilled enhancement 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 structuredtodeveloped practical skills as per requirementin the Industrial Sector, research field, and Entrepreneurshipetc. 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.

Hence, Board of Studies in Electronics in its meeting held on 22/03/2025 resolved to accept therevised syllabus for S. Y. B. Sc. (Electronics) based on Choice Based Credit System (CBCS) ofUGC, NEP-2020 and the Government of Maharashtra guidelines.

Program Outcomes (PO) for B.Sc. Program:

Program outcomes associated with a B.Sc. degree are as follows:

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.

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

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

PSO No.	PSO
PSO1	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.
PSO2	Advanced electronics application areas such as embedded system, biomedical instrumentation, Agri Electronics, Mechatronics, Programmable Logic Control, LabVIEW, ARDUINO.
PSO 3	Laboratory skills enabling them to take measurements in an electronics laboratory and analyze the measurements to draw valid conclusion.
PSO 4	Design and simulation of electronics devices/ system and develop research oriented skills.
PSO 5	Critically thinking and work independently.
PSO 6	Skills and modern technological/scientific/engineering software/tools for professional practices.

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

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

F.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1)	Subject-II (M-2)	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
I (4.5)	I	DSC-1(2T) DSC-2(2P)	DSC-1(2T) DSC-2(2P)	DSC-1(2T) DSC-2(2P)	OE-1(2T)	---	AEC-1(2T) (Eng) VEC-1(2T) (ES) IKS(2T)	CC-1(2T)	22	**UG Certificate**
	II	DSC-3(2T) DSC-4(2P)	DSC-3(2T) DSC-4(2P)	DSC-3(2T) DSC-4(2P)	OE-2(2T) OE-3(2P)	---	AEC-2(2T) (Eng) VEC-2(2T) (CI)	CC-2(2T)	22	
	Cum. Cr.	**8**	**8**	**8**	**6**	**---**	**10**	**4**	**44**	
Exit option: Award of UG Certificate with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										

S.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1) Major*		Subject-II (M-2) Minor #	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
		Mandatory (DSC)	Elective (DSE)	(MIN)							
2 (5.0)	III	DSC-5(2T) DSC-6(2T) DSC-7(2P)	---	MIN-1(2T) MIN-2(2T) MIN-3(2P)	---	OE-4(2T)	SEC-1(2T)	AEC-3(2T) (MIL)	CC-3(2T) CEP(2)	22	UG Diploma
	IV	DSC-8(2T) DSC-9(2T) DSC-10(2P)	---	MIN-4(2T) MIN-5(2P)	---	OE-5(2T)	SEC-2(2T) SEC-3(2P)	AEC-4(2T) (MIL)	CC-4(2T) ۞ FP(2)	22	
	Cum. Cr.	**12**	**---**	**10**	**---**	**4**	**6**	**4**	**8**	**44**	
	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 & Minor.										

***** Student must choose one subject as a Major subject out of M-1, M-2 and M-3 that he/she has chosen at First year

#Student must choose one subject as a Minor subject out of M-1, M-2 and M-3 that he/she has chosen at First year (Minor must be other than Major)

۞ OJT/Internship/CEP should be completed in the summer vacation after 4th semester

T.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1) Major		Subject-II (M-2) Minor	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
		Mandatory (DSC)	Elective (DSE)	(MIN)							
3 (5.5)	V	DSC-11(2T) DSC-12(2T) DSC-13(2T) DSC-14(2P) DSC-15(2P)	DSE-1A/B (2T) DSE-2A/B (2P)	---	---	---	VSC-1(2T) VSC-2(2P)	---	OJT/Int (4)	22	UG Degree
	VI	DSC-16(2T) DSC-17(2T) DSC-18(2T) DSC-19(2T) DSC-20(2T) IKS DSC-21(2P) DSC-22(2P)	DSE-3A/B (2T) DSE-4A/B (2P)	---	---	---	VSC-3(2T) VSC-4(2P)	---	---	22	
	Cum. Cr.	**24**	**8**	**---**	**---**	**---**	**8**	**---**	**4**	**44**	
	Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										

Fourth Year B.Sc. (Honours)

Year (Level)	Sem	Major Core Subjects		Research Methodology (RM)	VSC, SEC (VSEC)	OE	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
IV (6.0)	VII	DSC-23(4T) DSC-24(4T) DSC-25(4T) DSC-26(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	---	22	UG Honours Degree
	VIII	DSC-27(4T) DSC-28(4T) DSC-29(4T) DSC-30(2P)	DSE-7A/B (2T) DSE-8A/B (2P)	---	---	---	---	OJT/Int (4)	22	
	Cum. Cr.	**28**	**8**	**4**	**---**	**---**	**---**	**4**	**44**	
	Four Year UG Honors Degree in Major and Minor with 176 credits									

Fourth Year B.Sc. (Honours with Research)

Year (Level)	Sem	Major Core Subjects		Research Methodology (RM)	VSC, SEC (VSEC)	OE	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
IV (6.0)	VII	DSC-23(4T) DSC-24(4T) DSC-26(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	RP(4)	22	UG Honours with Research Degree
	VIII	DSC-27(4T) DSC-28(4T) DSC-30(2P)	DSE-7A/B (2T) DSE-8A/B (2P)	---	---	---	---	RP(8)	22	
	Cum. Cr.	**20**	**8**	**4**	**---**	**---**	**---**	**12**	**44**	
	Four Year UG Honours with Research Degree in Major and Minor with 176 credits									

Sem- Semester, **DSC**- Department Specific Course, **DSE**- Department Specific Elective, **OE/GE**- Open/Generic elective, **VSC**- Vocational Skill Course, **SEC**- Skill Enhancement Course, **VSEC**- Vocation and Skill Enhancement Course, **AEC**- Ability Enhancement Course, **IKS**- Indian Knowledge System, **VEC**- Value Education Course, **T**- Theory, **P**- Practical,**CC**-Co-curricular **RM**- Research Methodology, **OJT**- On Job Training, **FP**- Field Project, **Int**- Internship, **RP**- Research Project, **CEP**- Community Extension Programme, **ENG**- English, **CI**- Constitution of India, **MIL**- Modern Indian Laguage

- Number in bracket indicate credit
- The courses which do not have practical 'P' will be treated as theory 'T'
- If student select subject other than faculty in the subjects M-1, M-2 and M-3, then that subject will be treated as Minor subject, and cannot be selected as Major at second year.

Details of T.Y. B.Sc. (Electronics)

Course	Course Type	Course Code	Course Title	Credits	Teaching Hours/ Week			Marks			
					T	P	Total	Internal		External	
								T	P	T	P
Semester V, Level – 5.5											
DSC-11	DSC	ELE-DSC-351	8086 Microprocessor	2	2	---	2	20	---	30	---
DSC-12	DSC	ELE-DSC-352	Electronic Instrumentation	2	2	---	2	20	---	30	---
DSC-13	DSC	ELE-DSC-353	Solid State Electronic Devices	2	2	---	2	20	---	30	---
DSC-14	DSC	ELE-DSC-354	Practical on 8086 microprocessor	2	---	4	4	---	20	---	30
DSC-15	DSC	ELE-DSC-355	Practical on Electronic Instrumentation and Devices	2	---	4	4	---	20	---	30
DSE-1A	DSE	ELE-DSE-351A	Embedded System	2	2	---	2	20	---	30	---
DSE-1B	DSE	ELE-DSE-351B	Internet of Things (IoT)*	2	2	---	2	20	---	30	---
DSE-2A	DSE	ELE-DSE-352A	Practical on Embedded System	2	---	4	4	---	20	---	30
DSE-2B	DSE	ELE-DSE-352B	Practical on Internet of Things (IoT)	2	---	4	4	---	20	---	30
VSC-1	VSC	ELE-VSC-351	PCB Designing	2	2	---	2	20	---	30	---
VSC-2	VSC	ELE-VSC-352	Practical on PCB designing	2	---	4	4	---	20	---	30
OJT/Int	OJT	ELE-OJT-351	On Job Training/Internship	4	---	8	8	---	40	---	60
Semester VI, Level – 5.5											
DSC-16	DSC	ELE-DSC-361	Power Electronics	2	2	---	2	20	---	30	---
DSC-17	DSC	ELE-DSC-362	Electronic Communication System	2	2	---	2	20	---	30	---
DSC-18	DSC	ELE-DSC-363	Industrial Automation	2	2	---	2	20	---	30	---
DSC-19	DSC	ELE-DSC-364	Advanced Digital System Design	2	2	---	2	20	---	30	---
DSC-20	DSC/ IKS	ELE-DSC-365	Evolution of Electronics in India	2	2	---	2	20	---	30	---
DSC-21	DSC	ELE-DSC-366	Practical on Power Electronics and Communication system	2	---	4	4	---	20	---	30
DSC-22	DSC	ELE-DSC-367	Practical on Industrial Automation and Digital System	2	---	4	4	---	20	---	30
DSE-3A	DSE	ELE-DSE-361A	Python Programming	2	2	---	2	20	---	30	---
DSE-3B	DSE	ELE-DSE-361B	Biomedical Instrumentation**	2	2	---	2	20	---	30	---
DSE-4A	DSE	ELE-DSE-362A	Practical on Python Programming	2	---	4	4	---	20	---	30
DSE-4B	DSE	ELE-DSE-362B	Practical on Biomedical Instrumentation	2	---	4	4	---	20	---	30
VSC-3	VSC	ELE-VSC-361	Consumer Electronic Product and Maintenance	2	2	---	2	20	---	30	---
VSC-4	VSC	ELE-VSC-362	Practical on Consumer Electronic Product	2	---	4	4	---	20	---	30

*** NPTEL**
****SWAYAM**

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. 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 3 out of 4 sub-question; each 4 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 conditionis required.
- There shall be 05 marks for journal and viva-voce. Certified journal is compulsory to appear for practical examination.

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.

SEMESTER-V

T.Y. B.Sc. Electronics (Major)
Semester-V
ELE-DSC-351: 8086 Microprocessor

Total Hours: 30 **Credits: 2**

Course Objectives	▪ Study of architecture, feature and operation of 8086 microprocessor. ▪ Understand the addressing mode and instructions set of 8086 microprocessor. ▪ Understand the assembly language programming for 8086 microprocessor. ▪ Understand the interfacing of 8255 peripheral IC.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand the necessity, features and architecture of 8086. ▪ Analyse the addressing modes and understand the functions of 8086 instructions. ▪ Write simple assembly language programs. ▪ Understand features of 8255 peripheral ICs.	
Unit	**Contents**	**Hours**
Unit I	**Architecture of 8086 microprocessor** Introduction to Microprocessors, Features, Pin functions and internal architecture of 8086. Flag register, Memory segmentation, Segment Registers, Physical address - calculation with examples, Physical memory organization Interrupt, Interfacing 8086 with memory and I/O devices under minimum mode (Block-diagram level), Comparison between Minimum mode and Maximum mode configuration	**10**
Unit II	**8086 Instruction set** Addressing modes - with example, Role of index and pointer registers. 8086 instruction set :Data transfer, arithmetic, logical, shift and rotate, branching, loop control and string instructions, processor control instructions with simple examples.	**08**
Unit III	**8086 Programming** ALP program development cycle,development tools,MASM-Assembler directives, Structure of assembly program, Simple arithmetic and code conversion program.	**08**
Unit IV	**8255 Peripheral ICs** Functional block diagram, features, various operating modes of IC 8255, simple programs.	**04**
Study Resources	▪ Ray, A. K., &Bhurchandi, K. M. (2013). Advanced microprocessor & peripherals (3rd ed.). Tata McGraw-Hill. ▪ Hall, D. V. (2006). Microprocessor & interfacing: Programming and hardware (2nd ed.). Tata McGraw-Hill. ▪ Brey, B. B. (2008). The Intel microprocessors: Architecture, programming, and interfacing (8th ed.). Pearson Education India. ▪ Liu, Y. C., & Gibson, G. A. (2006). Microcomputer systems: The 8086 / 8088 family architecture, programming and design (2nd ed.). Prentice Hall of India.	

T.Y. B.Sc. Electronics (Major)
Semester-V
ELE-DSC-352: Electronic Instrumentation

Total Hours: 30 **Credits: 2**

Course Objectives	▪ Aware fundamentals of measurement of quantity and error. ▪ Understand the basic principle of bridges in electronics instruments. ▪ Analyze the working principle of various electronic meters. ▪ Familiar with Virtual instrumentation and LabVIEW.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Describe significance of electrical quantity measurements. ▪ Analyze the operation of bridge circuits in electronics instruments. ▪ Understand the basic functioning of various electronic meters. ▪ Describe implication of Virtual instrumentation and basic knowledge of LabVIEW.	
Unit	**Contents**	**Hours**
Unit I	**Measurements and Errors** **Measurements:** Introduction, Significance of measurements, methods of measurements, instruments and measurement systems, Functions of instruments and measurement systems, Applications of measurement systems. **Measurement Errors:** Introduction Gross errors and systematic errors, Absolute and relative errors, basic concepts of accuracy, Precision, Resolution and Significant figures, Measurement error combinations. (relevant problems)	**06**
Unit II	**Bridges** **DC bridges:**Introduction, Wheatstone's bridge, Kelvin Bridge **AC bridges:** Capacitance Comparison Bridge, inductance Comparison Bridge, Maxwell's bridge, Schering Bridge. (relevant problems)	**08**
Unit III	**Meters:** CRO: Block Diagram, Cathode Ray Tube, Measurement of Frequency, Measurement of Voltage and Current, Digital Oscilloscope, Digital voltmeter,Dual Slope Integrating Type DVM,Digital Multimeter, DSO	**08**
Unit IV	**Virtual instrumentation** VI: Virtual instrumentation, Traditional instrumentation, Applications, LAbVIEW: LabVIEW environment, front panel, block diagram, Concept of dataflow programming, modular programming DAQ: Sensors, Signal condition, hardware	**08**
Study Resources	▪ Kalsi, H. S. (2004). Electronic instrumentation. Tata McGraw-Hill. ▪ Bell, D. A. (2006). Electronic instrumentation and measurements. PHI/Pearson Education. ▪ Sawhney, A. K. (2004). Electrical and electronic measurements and instrumentation (7th ed., Reprint 2004). Dhanpat Rai & Co. Pvt. Ltd. ▪ Beately, J. P. (2000). Principles of measurement systems (3rd ed.). Pearson Education. ▪ Cooper, D., & Helfrick, A. D. (1998). Modern electronic instrumentation and measuring techniques. PHI. ▪ Walf,W. & Smith, R.F.MElectronics Instrumentation Laboratories. 2nd ed PHI	

T.Y. B.Sc. Electronics (Major)
Semester-V
ELE-DSC-353: Solid State Electronic Devices

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To understand basic of semiconductor crystal structures. ▪ To understand energy levels and charge carriers in semiconductor. ▪ To understand the behavior of charge carriers by applying field. ▪ To have an awareness of device modeling mathematically and device fabrication techniques.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Identify and calculate different parameters of crystal structure. ▪ Describe energy levels and charge carriers in semiconductor. ▪ Analyze the effect of electric and magnetic field on change carrier. ▪ Describe device modeling and device fabrication steps.	
Unit	**Contents**	**Hours**
Unit I	**Crystal Structure** Types of Materials, Lattice, Basis and Crystal Structure, Translational Vectors, Unit cell, Primitive Translational Vectors for SC, BCC and FCC, Co-ordination number, Atomic radii, Packing fraction for SC, BCC and FCC structure, Miller indices, Inter planer distances,Reciprocal lattice and its properties.	**08**
Unit II	**Energy bands and charge carriers in semiconductors** Atomic structure, Formation of energy levels and Energy bands, Fermi Level, Energy bands for Metals, Semiconductor and Insulator, Variation of energy bands with alloy, Concepts of Electrons and holes, Effective mass, Intrinsic material, Extrinsic material, Acceptor, Donor materials.	**08**
Unit III	**Effect of field on Charge Carriers** Elemental and Compound semiconductors, Direct and Indirect band gap semiconductors, Degenerate and Non-degenerate semiconductors, Effect of Carrier concentration on Fermi level, Electron-hole concentration at equilibrium, Conductivity and mobility, Hall effect.	**06**
Unit IV	**P-N Junction & Semiconductor Devices** P-N junction, Equilibrium condition, Contact potential, space charge at junction, Forward and reverse bias junction: Qualitative description of current flow at a junction, Zener breakdown and Avalanche breakdown, Capacitance in reverse biased P-N junction. Fabrication of P-N junction: Enlist different methods of fabrication of P-N junction and comparison, Diffusion method(process, application).	**08**
Study Resources	▪ Kittel, C. (1995). Introduction to solid state physics (7th ed.). John Wiley & Sons. ▪ Streetman, B. G., & Banerjee, S. K. (2018). Solid state electronic devices (7th ed.). Pearson. ▪ Kasap, S. O. (2010). Principles of electronic materials and devices (3rd ed.). McGraw-Hill Education. ▪ Choudhury, D. R., & Jain, S. B. (2021). Linear integrated circuits (6th ed.). New Age International Publisher. ▪ Bakshi, U. A., Godse, A. P., & Bakshi, A. V. (2022). Linear integrated circuits. Technical Publications. ▪ Weste, N. H. E., Harris, D., & Banerjee, A. (2011). CMOS VLSI design (3rd ed.). Pearson Education.	

T.Y. B.Sc. Electronics (Major)
Semester-V
ELE-DSC-354: Practical on 8086 Microprocessor

Total Hours: 60 **Credits: 2**

Course Objectives	▪ Understand 8086 microprocessor instruction set. ▪ Understand the addressing mode of 8086 microprocessor. ▪ Understand the arithmetic and code conversion programming for 8086 microprocessor. ▪ Perform operation on string.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Describe addressing mode and instruction set of 8086. ▪ Assemble and execution of assembly language program. ▪ Write simple assembly language programs. ▪ Describe steps operation while performing any task using microprocessor.	
Sr. No.	**Contents**	**Hours**
1	Write an assembly language program to multiply two 16-bit numbers.	**4**
2	Write an assembly language program to divide two numbers.	**4**
3	Write an assembly language program to convert binary to BCD.	**4**
4	Write an assembly language program to multiply two ASCII no.s.	**4**
5	Write an assembly language program to find the cube of a number.	**4**
6	Write an assembly language program to evaluate any arithmetic expression.	**4**
7	Write an assembly language program to find the series of a number(even/odd/cube/even).	**4**
8	Write an assembly language program to perform the conversion from BCD to binary.	**4**
9	Write an assembly language program to find largest no. From the given array.	**4**
10	Write an assembly language program to find smallest no from the given array.	**4**
11	Write an assembly language program to sort a given set of 16 bit numbers into ascending order.	**4**
12	Write an assembly language program to transfer of a string in forward direction.	**4**
13	Write an assembly language program to reverse string.	**4**
14	Write an assembly language program to search a character in a string.	**4**
15	Write an assembly language program to count number of characters in a string.	**4**
16	Write an assembly language program to concatenate two strings	**4**
17	Write an assembly language program to compare two strings.	**4**
Study Resources	▪ Kittel, C. (1995). Introduction to solid state physics (7^{th}ed.). John Wiley & Sons. ▪ Streetman, B. G., & Banerjee, S. K. (2018). Solid state electronic devices (7th ed.). Pearson. ▪ Kasap, S. O. (2010). Principles of electronic materials and devices (3^{rd}ed.). McGraw-Hill Education.	

	▪ Choudhury, D. R., & Jain, S. B. (2021). Linear integrated circuits (6th ed.). New Age International Publisher. ▪ Bakshi, U. A., Godse, A. P., &Bakshi, A. V. (2022). Linear integrated circuits. Technical Publications. ▪ Weste, N. H. E., Harris, D., & Banerjee, A. (2011). CMOS VLSI design (3rd ed.). Pearson Education.	

T.Y. B.Sc. Electronics (Major)
Semester-V
ELE-DSC-355: Practical on Electronic Instrumentation and Devices

Total Hours: 60 **Credits: 2**

Course Objectives	▪ Provide practical hands on measurement of quantity using bridge circuits. ▪ Practical experience and handling of electronics measuring instruments. ▪ Experiential learning of semiconductor material. ▪ Applied learning of semiconductor diode.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Get exposure of practical experience to handle the electronics instruments. ▪ Describe and troubleshoot the fault while measurement of quantity in bridge circuits. ▪ Experience different phenomenon/parameters of semiconductor material. ▪ Understand the behavior of semiconductor diode.	
Sr. No.	**Contents**	**Hours**
1	Measurement of resistance using Wheatstone's bridge.	**4**
2	Measurement of resistance using Kelvin bridge.	**4**
3	Measurement of unknown frequency and phase using CRO.	**4**
4	Measurement of capacitance.	**4**
5	Study of CRO.	**4**
6	Study of DSO.	**4**
7	Study of Digital multimeter.	**4**
8	Measurement of strain using strain gauge.	**4**
9	Study and measurement of voltage, frequency and phase difference of a.c. quantities using C.R.O.	**4**
10	Study of function generator (IC8038).	**4**
11	Built and test square and triangular wave generator using opamps.	**4**
12	Study the generation of Lissajous figures to find unknown frequency and phase shift.	**4**
13	Measure the angular displacement using potentiometric (resistive) transducer.	**4**
14	To Study the Crystal Structure of a given specimen (S.C , B.C.C., and F.C.C.).	**4**
15	Study the temperature dependence of resistivity of a semiconductor (Four probe method) and to determine band gap of experimental material	**4**
16	Measurement of resistivity by four probe method.	**4**
17	Measurement of conductivity of semiconductor material.	**4**
18	Find mobility of semiconductor material.	**4**
19	Determination of hall coefficient by using hall apparatus	**4**
Study Resources	▪ Kalsi, H. S. (2004). Electronic instrumentation. Tata McGraw-Hill. ▪ Bell, D. A. (2006). Electronic instrumentation and measurements. PHI/Pearson Education ▪ Sawhney, A. K. (2004). Electrical and electronic measurements and instrumentation (17th ed., Reprint 2004). Dhanpat Rai & Co. Pvt. Ltd. ▪ Beately, J. P. (2000). Principles of measurement systems (3rded.). Pearson	

	Education. ▪ Cooper, D., & Helfrick, A. D. (1998). Modern electronic instrumentation and measuring techniques. PHI. ▪ Kittel, C. (1995). Introduction to solid state physics (7^{th}ed.). John Wiley & Sons. ▪ Streetman, B. G., & Banerjee, S. K. (2018). Solid state electronic devices (7th ed.). Pearson.	

T.Y. B.Sc. Electronics (Elective)
Semester-V
ELE-DSE-351A: Embedded System

Total Hours: 30 **Credits: 2**

Course Objectives	▪ Understand internal organization of embedded system. Also aware about designing and selection parameters of Embedded System. ▪ To learn architecture of 8051 microcontroller. ▪ To learn 8051 microcontroller programming. ▪ To learn the interfacing of peripheral devices with 8051.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Analyse the embedded system organization. ▪ Understand 8-bit microcontroller system a ▪ Do program for embedded system using 8051. ▪ Design circuit for real life applications.	
Unit	**Contents**	**Hours**
Unit I	**Fundamental of Embedded System:** Embedded Systems, Purpose, Applications, and Components: Hardware and Software, Characteristics, Factors to be considered in a selecting controller, Recent Trends in Embedded System Design.	**04**
Unit II	**Architecture of 8051 Microcontroller** Features, Block diagram, Pin out diagram, CPU registers, Flags and Program Status Word, Program Counter, Data Pointer,Special Function Registers & their Format, Stack& Stack Pointer, Internal RAM /ROM, Oscillator & Clock, Concept External Memory, Ports-0,1,2 & 3, Counter and Timers, Serial data input/ output transfers, Interrupts, Addressing modes, instruction sets	**08**
Unit III	**Embedded Programming :** Timer Programming : Mode1, Mode 2 programming Interrupt programming: Timer, External Interrupt, Serial port interrupt. Embedded C: Distinguishing Embedded C from standard C, programming style, and basic C program structure, Data Types and Variables, Operators and Expressions, Using conditional statements (if, else, switch), loops (for, while, do-while), and jump statements (break, continue), function, Array, pointer.	**10**
Unit IV	**Interfacing:** Switch, temperature sensor (LM35), ADC, DAC, DC motor, stepper motor, OLED display.	**08**
Study Resources	▪ Ayala, K. J. (2004). The 8051 microcontroller: Architecture, programming, & applications (2nd ed.). THOMSON Delmar Learning. ISBN: 9812542612. ▪ Shibu, K. V. (2017). Introduction to embedded systems (2nd ed.). McGraw-Hill Education India Private Limited. ISBN: 9339219686. ▪ Shah, S. (2010). 8051 microcontrollers. Oxford University Press. ISBN: 9780198063575. ▪ Mazidi, M. A. (2017). 8051 microcontroller and embedded systems (2nd ed.). Pearson Education India. ISBN: 978-8131710265. ▪ Abubeker, K. M., & Baskar, S. (2020). 80C51 µC - Embedded C & ALP programming (1st ed.). Notion Press. ▪ Udayashankara, V. (2017). 8051 microcontroller (1sted.). McGraw-Hill Education.	

T.Y. B.Sc. Electronics (Elective)
Semester-V
ELE-DSE-351B: Internet of Things (IoT)
(NPTEL course: noc25-cs147)

Total Hours: 30 **Credits: 2**

Course Objectives	▪ Understand the fundamental and architecture of IoT and its application. ▪ Understand IoT communication protocols and networking. ▪ Discuss role of sensor, sensor technology and Data acquisition techniques from sensors. ▪ Understand methodology to send sensor data over internet.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Describe IoT fundamental and architecture and recognize the importance of IoT. ▪ Implement IoT communication networking and protocols. ▪ Describe sensor technology used in IoT. ▪ Visualize sensor dataover internet.	
Unit	**Contents**	**Hours**
Unit I	**IOT Fundamentals** Introduction to IoT: Evolution of IoT, Definition & Characteristics of IoT, Architecture of IoT, Technologies for IoT, Applications of IoT, Industrial IoT, Security in IoT	**08**
Unit II	**Communication network & protocols:** Architecture of IoT, communication network: Home Area Network (HAN), Neighbourhood Area Network (NAN), Field Area Network (FAN), Wide Area Network (WAN), Wireless Sensor Networks (WSNs), protocols: Ethernet, zeebee, Bluetooth, wifi	**08**
Unit III	**Sensor technology:** Sensors, Sensor Technology, Actuators, Radio Frequency Identification: types, working principle, feature, advantages, disadvantages, application, Data acquisition techniques from IoT sensors	**06**
Unit IV	**Sending Sensor Data Over Internet** Introduction to ESP8266 NODEMCU WiFi Module,Programming NODEMCU using Arduino, IDE – Using WiFi and NODEMCU to transmit data from temperature sensor.	**08**
Study Resources	▪ Margolis, M. (2011). Arduino cookbook. O'Reilly Media. ▪ Schwartz, M. (2016). Internet of things with ESP8266. Packt Publishing. ▪ Raj, P., & Raman, A. C. (2017). The Internet of things: Enabling technologies, platforms, and use cases(1st ed.). CRC Press. ▪ Karvinen, T., Karvinen, K., Valtokari, V., & Kemo. (2014). Make sensors. Maker Media. ▪ Bahga, A., &Madisetti, V. (2015). Internet of things: A hands-on approach (1st ed), Orient Blackswan Private Limited - New Delhi. ▪ Dargie, W., &Poellabauer, C. (2011). Fundamentals of wireless sensor networks: Theory and practice(1st), Welley. ▪ Bell, C. (2013). Beginning sensor networks with Arduino and Raspberry Pi. Apress. ▪ https://nptel.ac.in/courses/106/105/106105166/Introduction to IoT Part I – Lecture 1 2 ▪ https://ocw.cs.pub.ro/courses/iot/courses/02Electronics for Internet of Things – Lecture II 3 ▪ https://nptel.ac.in/courses/106105166/Introduction to Arduino – I – Lecture 22	

T.Y. B.Sc. Electronics (Elective)
Semester-V
ELE-DSE-352A: Practical on Embedded System

Total Hours: 60 **Credits: 2**

Course Objectives	▪ Understand internal organization of Embedded system. Also aware aboutdesigning and selection parameters of Embedded System. ▪ To learn architecture of 8051 microcontroller. ▪ To learn 8051 microcontroller programming. ▪ To learn the interfacing of peripheral devices with 8051.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Analyse the embedded system organization. ▪ Understand 8-bit microcontroller system a ▪ Do program for embedded system using 8051. ▪ Design circuit for real life applications.	
Sr. No.	**Contents**	**Hours**
1	Write a 8051 Assembly Language program to perform addition/subtraction of two BCD numbers	**4**
2	Write a 8051 Assembly Language program to perform addition/subtraction of two 16 bit numbers	**4**
3	Write a 8051 Assembly Language program to find that the given numbers is prime or not.	**4**
4	Write a 8051 Assembly Language program to find the factorial of a number.	**4**
5	Write a 8051 Assembly Language program to covert an ASCII number to Hex number.	**4**
6	Write a 8051 Assembly Language program to the smallest/Largest of an array of N 8 bit unsigned numbers (N is an 8 bit numbers).	**4**
7	Write a 8051 Assembly Language program to the organize array in ascending /descending order of N 8 bit unsigned numbers (N is an 8 bit numbers).	**4**
8	Write a 8051 Assembly Language program to generate terms of Fibonacci series	**4**
9	Use one of the four ports of 8051 for interfacing eight LED. Simulate binary counter (8 bit) on LED	**4**
10	Interface OLED display with 8051 and display the message ‘Hello’ on it.	**4**
11	Interface ON and OFF of LED by switch interface with 8051.	**4**
12	Interface stepper motor to 8051 and write a 8051 Assembly Language program to move the motor through given angle in clockwise or anti-clock wise direction.	**4**
13	Write a 8051 Assembly Language program to covert packed BCD to ASCII number.	**4**
14	Write a 8051 Assembly Language program to covert binary to ASCII character.	**4**
15	Write a 8051 Assembly Language program to perform addition of series of 8 bit numbers	**4**
16	Interface DC motor.	**4**
17	Speed control of DC motor	**4**
18	Rotate stepper motor with a particular angle	**4**

19	Interface LM 35 with 8051.	**4**
Study Resources	▪ Ayala, K. J. (2004). The 8051 microcontroller: Architecture, programming, & applications (2nd ed.). THOMSON Delmar Learning. ISBN: 9812542612. ▪ Shibu, K. V. (2017). Introduction to embedded systems (2nd ed.). McGraw-Hill Education India Private Limited. ISBN: 9339219686. ▪ Shah, S. (2010). 8051 microcontrollers. Oxford University Press. ISBN: 9780198063575. ▪ Mazidi, M. A. (2017). 8051 microcontroller and embedded systems (2nd ed.). Pearson Education India. ISBN: 978-8131710265. ▪ Abubeker, K. M., & Baskar, S. (2020). 80C51 µC-Embedded C & ALP programming (1st ed.). Notion Press. ▪ Udayashankara, V. (2017). 8051 Microcontroller (1st ed.). McGraw Hill Education.	

T.Y. B.Sc. Electronics (Elective)
Semester-V
ELE-DSE-352B: Practical on Internet of Things (IoT)

Total Hours: 60 **Credits: 2**

Course Objectives	▪ Understand the fundamental and architecture of IoT and its application. ▪ Understand IoT communication protocols and networking. ▪ Discuss role of sensor, sensor technology and Data acquisition techniques from sensors. ▪ Understand methodology to send sensor data over internet.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Describe IoT fundamental and architecture and recognize the importance of IoT. ▪ Implement IoT communication networking and protocols. ▪ Describe sensor technology used in IoT. ▪ Visualize sensor dataover internet.	
Sr. No.	**Contents**	**Hours**
1	Blinking of LED.	**4**
2	Control an LED with a push button.	**4**
3	Interface RGB LED.	**4**
4	Read multiple analog inputs	**4**
5	Vary the brightness of an LED using PWM and a potentiometer.	**4**
6	Interface DC motor to rotate continuously.	**4**
7	Interface DC motor and control the speed of motor.	**4**
8	Interface ultrasonic sensor (HC-SR04) to measure distance.	**4**
9	Interface motion sensor	**4**
10	Interface LM35 temperature sensor and measure temperature.	**4**
11	Interface a light-dependent resistor (LDR) to control an LED based on ambient light intensity.	**4**
12	Interface a buzzer to emit sound based on a sensor input	**4**
13	Interface buzzer if the switch is pressed.	**4**
14	Interface IR sensor.	**4**
15	Interface stepper motor.	**4**
Study Resources	▪ Margolis, M. (2011). Arduino cookbook. O'Reilly Media. ▪ Schwartz, M. (2016). Internet of things with ESP8266. Packt Publishing. ▪ Raj, P., & Raman, A. C. (2017). The Internet of things: Enabling technologies, platforms, and use cases (1st ed.). CRC Press. ▪ Karvinen, T., Karvinen, K., Valtokari, V., &Kemo. (2014). Make sensors. Maker Media. ▪ Bahga, A., &Madisetti, V. (2015). Internet of things: A hands-on approach (1st ed), Orient Blackswan Private Limited - New Delhi. ▪ Dargie, W., &Poellabauer, C. (2011). Fundamentals of wireless sensor networks: Theory and practice(1st), Welley. ▪ Bell, C. (2013). Beginning sensor networks with Arduino and Raspberry Pi. Apress. ▪ https://nptel.ac.in/courses/106/105/106105166/Introduction to IoT Part I – Lecture 1 2 ▪ https://ocw.cs.pub.ro/courses/iot/courses/02Electronics for Internet of Things – Lecture II 3 ▪ https://nptel.ac.in/courses/106105166/Introduction to Arduino – I – Lecture 22	

T.Y. B.Sc. Electronics (Vocational)
Semester-V
ELE-VSC-351: PCB Designing

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To introduce students to the basic concepts of PCB design, including its history, types, and manufacturing processes. ▪ To provide knowledge about various component package types and PCB materials used in electronic circuit design. ▪ To enable students to understand the importance of Electronic Design Automation (EDA) tools and gain hands-on experience with industry-standard software. ▪ To develop skills in schematic designing, layout creation, and fabrication techniques, ensuring students can design and develop functional PCBs.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand the fundamental principles of PCB design, manufacturing techniques, and quality control processes. ▪ Identify and select appropriate components and materials for different PCB applications. ▪ Gain practical exposure to PCB design software such as OrCAD and PROTEUS, enabling them to create professional circuit layouts. ▪ Acquire the necessary skills to design, fabricate, and assemble PCBs, ensuring their readiness for industry applications.	
Unit	**Contents**	**Hours**
Unit I	**PCB designing concepts** Introduction & Brief History: What is PCB, Difference between PWB and PCB, Types of PCBs: Single Sided (Single Layer), Multi-Layer (Double Layer). Photo printing, filmmaster production, reprographic camera, basic process for double sided PCBs photo resists, Screen printing process, plating, relative performance and quality control, Etching machines, Solders alloys, fluxes, soldering techniques, Mechanical operations.	**08**
Unit II	**Component Package Types and PCB Materials** Through Hole Packages : Axial lead, Radial Lead, Single Inline Package(SIP), Dual Inline Package DIP), Transistor Outline(TO), Pin Grid Array(PGA), Metal Electrode Face(MELF), Leadless Chip Carrier(LCC), Small Outline Integrated Circuit(SOIC), Quad Flat Pack(QPF) and Thin QFP (TQFP), Ball Grid Array(BGA), Plastic Leaded Chip Carrier(PLCC). PCB Materials : Standard FR-4 Epoxy Glass, Multifunctional FR-4, Tetra Functional FR-4, NelcoN400-6, GETEK, BT Epoxy Glass, Cyanate Aster, Plyimide Glass, Teflon	**08**
Unit III	**Electronic design Automation (EDA) and Development Tools** Brief History of EDA, Latest Trends in Market, How it helps and Why it requires, Different EDA tools, Introduction to SPICE and PSPICE Environment, Introduction to PCB Design using OrCAD tool, Introduction to PCB Design using PROTEUS tool	**07**

Unit IV	**Detailed description and practical of PCB designing** PCB Designing Flow Chart, Schematic Entry, Net listing, PCB Layout Designing: Prototype Designing, Design Rule Check(DRC), Design For Manufacturing(DFM), PCB Making: Printing, Etching, Drilling, Assembly of components.	**07**
Study Resources	▪ Khandpur, R. S. (2006). Printed circuit board design, fabrication assembly and testing. Tata McGraw-Hill. ▪ Bosshart, W. C. (1983). Printed circuit board design and technology.McGraw Hill Education. ▪ Coombs, C. F., Jr., & Holden, H. T. (2016). Printed circuits handbook (6^{th} ed.). McGraw-Hill Education. ▪ Mitzner, K., Doe, B., Akulin, A., Suponin, A., & Müller, D. (2009). Complete PCB design using OrCAD capture and PCB editor (2^{nd}ed.).Academic Press Inc.	

T.Y. B.Sc. Electronics (Vocational)
Semester-V
ELE-VSC-352: Practical on PCB designing

Total Hours: 60 **Credits: 2**

Course Objectives	▪ To familiarize students with PCB manufacturing techniques, including photo printing, etching, soldering, and assembly. ▪ To enable students to identify different electronic component packages and understand their mounting techniques (Through-Hole and SMD). ▪ To provide practical exposure to industry-standard EDA tools such as OrCAD, PROTEUS, and PSPICE for circuit design and simulation. ▪ To develop students' skills in designing, fabricating, and testing single-layer and multi-layer PCBs for real-world applications.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Acquire hands-on experience in PCB fabrication, soldering, and quality control measures. ▪ Work with Electronic Components and PCB Materials and gain expertise in identifying, mounting, and testing various electronic components on different PCB substrates. ▪ To design and simulate PCBs using OrCAD, PROTEUS, and PSPICE, ensuring accuracy before fabrication. ▪ Design, fabricate, assemble, and test fully functional PCBs, preparing them for industrial and academic projects.	
Sr. No.	**Contents**	**Hours**
1	Study of PCB types, materials, and manufacturing processes.	**4**
2	Hands-on practice in creating a film master for PCB design.	**4**
3	PCB Layout Development using Screen Printing and Etching	**4**
4	Hands-on Soldering Techniques and Quality Control Measures	**4**
5	Identification and Classification of Electronic Component Packages	**4**
6	Analysis of different PCB materials such as FR-4, Polyimide, and Teflon.	**4**
7	Mounting and Testing of Through-Hole Components on PCB	**4**
8	Surface Mount Device (SMD) Soldering and Testing	**4**
9	Schematic Design and PCB Layout Creation using OrCAD	**4**
10	PCB Design and Circuit Simulation using PROTEUS	**4**
11	Circuit Analysis and Simulation using SPICE/PSPICE	**4**
12	Design Rule Check (DRC) and PCB Layout Error Correction	**4**
13	Fabrication and Testing of a Single-Layer PCB	**4**
14	Fabrication and Testing of a Double-Layer PCB	**4**
15	PCB Assembly, Component Placement, and Functional Testing	**4**
Study Resources	▪ Khandpur, R. S. (2006). Printed circuit board design, fabrication, assembly, and testing(1st ed.). Tata McGraw-Hill. ▪ Bosshart, W. C. (1983). Printed circuit board design and technology. ▪ Montrose, M. I. (1998). EMC and printed circuit board design theory and layout. IEEE Compatibility Society. ▪ Mitzner, K., Doe, B., Akulin, A., Suponin, A., & Müller, D. (2009). Complete PCB design using OrCAD Capture and PCB Editor (2nd ed.), Academic Press Inc.	

T.Y. B.Sc. Electronics (On Job Training)
Semester-V
ELE-OJT-351: On Job Training/Internship

Total Hours: 120 **Credits:4**

Course objectives	• To provide the students with actual work experience • To make aware prescribe standards and guidelines at work • To develop the employability of participating student • To avail an opportunities to eventually acquire job experiences
Course outcomes	After successful completion of this course, students are expected to: • Get actual work experience with office and virtual exposure to various management styles, technical, industrial, and proceduralsystems • Acquaintthe knowledge related to working hours, work protocols and guidelines • Understand the roles and responsibilities of employee as well as team work • Justify job experiences that match theirpotentials, skills, and competencies

Internship

An internship is a professional learning experience that offers meaningful, practical work related to a student's field of study or career interest. An internship gives a student the opportunity for career exploration and development, and to learn new skills.

On the job training

On the job training is a form of training provided at the workplace. During the training, employees are familiarized with the working environment they will become part of. Employees also get a hands-on experience using machinery, equipment, tools, materials, etc.

Internship / OJT Mechanism:

1. **Pre-Approval**: Students should seek approval from the college before starting the Internship / OJT. This ensures that the Internship / OJT aligns with the curriculum and meets the necessary criteria.
2. **Mentor and Supervisor**: Each student should have an assigned mentor at the organization/industry where they are interning. Additionally, anInternship / OJT supervisor from the college will be appointed to guide and monitor the progress.
3. **Regular Reporting:** Students should maintain regular communication with their supervisor and mentor, providing progress reports and seeking feedback.
4. **Professional Conduct**: Students must adhere to professional conduct throughout the Internship / OJT, including punctuality, respect for colleagues, and adherence to the organization's/industry's policies and guidelines.
5. **Student Diary**: Students should maintain a diary to document their experiences, challenges faced, and lessons learned during the Internship / OJT.
6. **Final Report**: At the end of the Internship / OJT, students should submit a comprehensive final report, summarizing their accomplishments, contributions, and key takeaways.
7. **Evaluation**: The Internship / OJT is worth 4 credits (equivalent to 100 marks), and the evaluation will be divided into two categories: one by the mentor and the other by the Internship / OJT supervisor. The mentor's evaluation (internal examination) will carry 40 marks, and it will be based on the student's performance during the Internship / OJT. External examination will be conducted by mentor and supervisor which will be based on the student's diary, the final report prepared by the student, and their performance in the final viva voce, and will carry60 marks. The total marks obtained by the students in both evaluations will be added together for the purpose of final evaluation. The evaluation of the students will be conducted by the mentor using the evaluation sheet provided by the college.

Internal Evaluation Criteria for Students by the Mentor:

1. **Quality of Work** (10 marks): How well did the student perform their assigned tasks during the Internship / OJT? Evaluate the accuracy, thoroughness, and attention to detail in their work.
2. **Initiative and Proactiveness**(10 marks): Did the student show initiative in taking on additional responsibilities or tasks beyond their assigned role? Did they demonstrate a proactive attitude towards problem-solving?
3. **Communication Skills** (10 marks): Assess the student's ability to communicate effectively with colleagues, superiors, and clients (if applicable). Consider both written and verbal communication.
4. **Problem-Solving SkillsandTime Management** (10 marks): Evaluate the student's ability to analyze problems, propose solutions, and implement effective strategies to overcome challenges.How well did the student manage their time during the Internship / OJT? Were they able to meet project deadlines and handle multiple tasks efficiently?

External Evaluation Criteria for Students by the Supervisor and Mentor:

1. **Student Diary** (15 marks): Review the student's diary to understand their reflections, insights gained, and self-assessment of their performance during the Internship / OJT.
2. **Final Report** (15 marks): Evaluate the quality and comprehensiveness of the student's final report, including the clarity of their achievements and contributions.
3. **Presentation of Student in Viva Voce** (30 marks): Evaluate the responses given by the student to the questions asked by the faculty in the Viva Voce.

Evaluation Criteria for Final Viva Voce:

1. Presentation Skills
2. Knowledge of the Internship / OJT Project
3. Practical Application and Work Experience
4. Problem-Solving and Critical Thinking
5. Communication and Professionalism

SEMESTER-VI

T.Y. B.Sc. Electronics (Major)
Semester-VI
ELE-DSC-361: Power Electronics

Total Hours: 30 **Credits: 2**

Course Objectives	▪ Familiarize the students to the construction details, operation, and characteristics of different semiconductor power electronics devices. ▪ Introduction of different power conversion circuits. ▪ To make strong base of students for further study of power electronics circuits and systems ▪ To introduce the practical application in power electronics	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Have fundamental knowledge of semiconductor power electronic device ▪ Familiar about different power conversion circuits. ▪ Describe operation and performance of power devices and switching circuits. ▪ Apply this knowledge for designing power electronic circuits	
Unit	**Contents**	**Hours**
Unit I	**Introduction to Power Devices**: Need for semiconductor power devices, Power diodes,Reverse blocking capacity,Introduction to family of thyristors. Silicon Controlled Rectifier (SCR): symbol,structure, working, I-V characteristics, ratings, Factors affecting the characteristics/ratings of SCR.	**08**
Unit II	**DIAC and TRIAC:**Symbol,structure,working, I-V characteristics and switching characteristics, Applications. **IGBT and MOSFET: S**ymbol,structure,working, I-V characteristics and switching characteristics, Applications. Comparison between SCR, TRIAC, MOSFET and IGBT	**08**
Unit III	**Thyristor Triggering Circuits**: Methods of triggering-gate triggering, voltage triggering and radiation triggering.Commutation- Natural and Forced Commutation, Classes of Commutation, Triggering of SCR using UJT and BJT.	**08**
Unit IV	**Application of Power Devices**: Introduction to Invertor and Convertor, Fan regulator, Battery Charger, Overvoltage protection, Thyristor based speed control of DC and AC motors.	**06**
Study Resources	▪ Sen, P. C. (2017). Power electronics (2nd ed.). McGraw-Hill Education. ▪ Dutta, S. K. (1984). Power electronics & controls. Brady (Robert J.) Co. ▪ Singh, M. D., &Khanchandani, K. B. (2017). Power electronics (2nd ed.). McGraw-Hill Education. ▪ Rashid, M. H. (2013). Power electronics: Circuits, devices, and applications (3rd ed.). Pearson Education. ▪ Mohan, N., Undeland, T. M., & Robbins, W. P. (2022). Power electronics: Applications and design. Wiley. ▪ Babu, K. H. (2009). Power electronics. Scitech Publication.	

T.Y. B.Sc. Electronics (Major)
Semester-VI
ELE-DSC-362: Electronic Communication System

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To give basic concept of Electronic Communication. ▪ To provide basic idea about various amplitude modulation and demodulation techniques.To understand the effect of noise on the performance of AM and FM receivers ▪ To understand the angle modulation and demodulation techniques. ▪ To understand basic principles of Digital modulation techniques	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Have understanding of basic Elements of communication systems such as amplitude, frequency, and Phase modulations & demodulations, Radio transmission & reception and noise. ▪ Understand different modulation and demodulation techniques. ▪ Describe principles of PAM, PWM, and PPM, TDM, and FDM techniques and its applications. ▪ Have knowledge of basic terms in digital data transmission and different techniques.	
Unit	**Contents**	**Hours**
Unit I	**Fundamentals of Communication** Importance of Electronic communication, Types of Signals-Analog signal, Digital signal & base band signal,concept of channels (Definition only), Block diagram of an electronic communication system, electromagnetic spectrum-band designations and applications, need for modulation, Concept of Noise.	**08**
Unit II	**Modulation and Demodulation** Amplitude Modulation, modulation index and frequency spectrum. Generation of AM, Transistorized AM Modulator (Emitter Modulator) Amplitude Demodulation (diode detector), Concept of side bands modulation, Block diagram of AM Transmitter and Receiver, Advantages, disadvantages and applications of Amplitude Modulation Angle (Frequency and Phase) modulation, modulation index and frequency spectrum, equivalence between FM and PM, Generation of FM (direct and indirect methods). Block diagram of FM Transmitter and Receiver Comparison between AM, FM and PM.	**08**
Unit III	**Pulse Modulation and Multiplexing** Pulse Analog Modulation:Introduction, Need and Advantages of pulse Modulation, Channel capacity, Sampling theorem, Introduction to PAM, PWM and PPM. Pulse Code Modulation:Need for digital transmission, Quantizing, Uniform and Non-Uniform Quantization, Quantization Noise, Companding, Coding, Decoding, Regeneration. Multiplexing Techniques:Introduction of FDM and TDM.	**08**

Unit IV	**Digital Modulation Techniques** Block diagram of digital transmission and reception, Information capacity, Bit Rate, Baud Rate and M-ary coding. Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK)	**06**
Study Resources	▪ Roddy, D., & Coolen, J. (n.d.). Electronic communications. Pearson Education. ▪ Lathi, B. P. (2011). Modern digital and analog communication systems (4th ed.). Oxford University Press. ▪ Kennedy, G. (1999). Electronic communication systems (3rd ed.). Tata McGraw-Hill. ▪ Frenzel, L. E. (2007). Principles of electronic communication systems (3rd ed.). McGraw-Hill. ▪ Haykin, S. (2006). Communication systems. Wiley India. ▪ Blake, J. (2012). Electronic communication system (5th ed.). Cengage.	

T.Y. B.Sc. Electronics (Major)
Semester-VI
ELE-DSC-363: Industrial Automation

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To provide introductory knowledge about Industrial Automation. ▪ To familiarize students about Sensors and Actuators used in industries. ▪ To provide primary knowledge of Ladder and SCADA Programming. ▪ To give introductory knowledge of PLCs used in industries.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Basic blocks of industrial automation, their characteristics, and parameters. ▪ Knowledge of Sensors and Actuators. ▪ Basics of PLC, ladder programming and SCADA system fundamentals and its applications. ▪ Basics of computer-based controllers and computer applications in process control.	
Unit	**Contents**	**Hours**
Unit I	**Fundamentals of Process Automation** Introduction, Block diagram of Process control system, Continuous control, discrete statecontrol, composite discrete/continuous control, Process Characteristics: Process equation,Process load, Process lag, self-regulation, Control system parameters: Error, Variable range,control parameter range, control lag, dead time, cycling.	**06**
Unit II	**Sensors and Actuators in Automation** **Sensors:** Introduction to Sensors, Classification sensors (based on power requirement, Mean of detection, energy conversion and data output), Types of Sensors - Temperature Sensors, Pressure sensors, Torque sensor, Level sensors, Infrared sensors, Proximity sensors, Gas sensors, Optical Sensors, MEMS Sensors, Applications of Sensor. **Actuators:** Introduction to Actuators, Classification actuators (based on motion and energy source), types of Actuators - Electric Linear Actuator, Electric Rotary Actuator, Hydraulic Linear Actuator, Hydraulic Rotary Actuator, Pneumatic Linear Actuator, Pneumatic Rotary Actuator, Piezoelectric Actuators, Application of Actuators.	**10**
Unit III	**Ladder programming basics:** Ladder diagram elements with examples and symbols, PLCprogramming procedure with examples, auxiliary commands and functions: PLC basicfunctions: register basics, timer functions, counter functions. Case study: bottle filling plant, elevator control, sorting of objects.	**04**
Unit IV	**PLC and Advanced PLC Systems:**PLC system basics: Definition, overview, block diagram, selecting PLC, PLC hardware-IOdevices, IO processing, CPU and Power, isolators, PLC software, Types and applications ofPLC: Modular PLC, Redundant PLC, micro-PLC, Virtual PLC.SCADA systems: fundamentals, overview, advantages, disadvantages and applications,Interfacing PLC to SCADA.	**10**
Study Resources	▪ Johnson, C. D. (2014). Process control instrumentation technology (8th ed.). Pearson New International Edition. ▪ Bolton, W. (2009). Programmable logic controllers. Newness.	

	▪ Kalsi, H. S. (n.d.). Electronic instrumentation (2nd ed.). Tata McGraw-Hill. ▪ Patranabis, D. (2008). Sensors and transducers. Prentice Hall. ▪ Automationdirect.com. PLC handbook: Practical guide to programmable logic controllers.	

T.Y. B.Sc. Electronics (Major)
Semester-VI
ELE-DSC-364: Advanced Digital System Design

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To familiarize students with designing techniques of sequential circuits. ▪ Understand the concept of counter circuit design. ▪ Discuss the basic concept of VHDL. ▪ Discuss the programming structure of combinational and sequential logic circuits using VHDL.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Describe the steps of sequential circuits ▪ Design counters circuits for the specific applications. ▪ Describe the basic of VHDL and its programming style. ▪ Implement designing of combinational and sequential logic circuits using VHDL.	
Unit	**Contents**	**Hours**
Unit I	**Sequential Logic Design** Clock, State table, state diagram, state equation, Excitation table of R-S, J-K, T and D flip flops flip flop conversions: R-S to J-K, S-R to T, J-K to D and T	**06**
Unit II	**Counter Circuit Design** State diagram, Moduls N, Mod 6, ripple counter, binary counter using T FF Design of synchronous 3 bit up-down counter using T flip flop, Design of synchronous 10 bit up-down counter using JK flip flop, Design of synchronous modulo 6 Grey code counter.	**08**
Unit III	**Introduction to VHDL** Introduction, library, entity, architecture, modeling style, concurrent and sequential statements, data object and data types, attributes.	**08**
Unit IV	**VHDL Programming** VHDL Programming: half and full adder, four bit binary adder, multiplexer and demultiplexers, Flip flops S-R, D, J-K, and T, Mod-6 asynchronous counter, 3 bit up-down counter.	**08**
Study Resources	▪ Palan, N. G. (2014). Digital electronics and logic design. Technova Publications. ▪ Kumar, A. A. (2014). Fundamentals of digital circuits. Prentice Hall India. ▪ Mono, M. M. (1979). Digital logic and computer design (1st ed.). Pearson India. ▪ Mano, M. M., & Ciletti, M. D. (2008). Digital design (4th ed.). Pearson India. ▪ Jain, R. P. (2003). Modern digital electronics (3rd ed.). Tata McGraw-Hill Publishing.	

	▪ Shalivahanan, S., & Arivazhagan, S. (2013). Digital circuits and design (4th ed.). Vikas Publishing House. ▪ Bhaskar, J. (2015). VHDL primer (3rded.). Pearson Education India. ▪ Perry, D. L. (2002). VHDL programming by example (4thed.). McGraw-Hill Education. ▪ Brown, S., &Vranesic, Z. (2017). Fundamentals of digital logic with VHDL design (3rded.). McGraw-Hill Education.	

T.Y. B.Sc. Electronics (Major with IKS)
Semester-VI
ELE-DSC-365: Evolution of Electronics in India

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To provide introductory knowledge about Electronics and Technology in India. ▪ To familiarize students about Electronics R&D institutes and industries in India. ▪ To provide information about Electronics related revolutions in India ▪ To provide Govt. of India policies about Electronics field.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Acquire introductory knowledge about Electronics and Technology in India. ▪ Have knowledge about Research and Development institutions working in India. ▪ Have knowledge about Public and Private Industries working in the field of Electronics in India. ▪ Have knowledge about Electronics and related Revolutions in India and knowledge about history of Government policies about Electronics in India.	
Unit	**Contents**	**Hours**
Unit I	**History of Electronics and Government Policies in India** Introduction, History of Electronics in India. Review of Govt. Policiesfor Electronics. Introduction to Projects & Initiatives by MeitY (Govt. of India), NITI Aayog.	**6**
Unit II	**R&D Organizations and Academic Institutions of Electronics** Introduction toR&D Organizations:Meity, C-DAC, C-MET, NIELIT, SAMEER, STPI, ERNET, BISAG(N), Semiconductor Lab (Mohali), CEERI, CEL, C-DOT, SITAR (DRDO), CSIO and NIC. Introduction to - Statutory Bodies: CCA, ICERT and UDAIAcademic Institutes: IITs, NITs, IISc, NIELIT and GIoE.	**10**
Unit III	**Electronics Industries in India** Public Sector Companies: BEL, ECIL, CIL, BSNL, MTNL, BBNL, SECI, Rajasthan Electronics and Instruments Limited, HTL, Digital India Corporation, NISG and CSC-e governance services India Ltd. (Brief description of each) Private Sector Companies: Consumer Electronics Companies, Telecommunication Companies, Computer Hardware Industries, Defense Electronics Industries. Brief review of challenges for Indian Electronics Industries (Brief description of each)	**8**
Unit IV	**Electronics Revolutions in the Modern India** Satellite and Communication Revolution, Telecom Revolution, Mobile Revolution, IT Revolution, Railway Computerization, Digital India, Milestones of India in Science and Technology.	**6**
Study Resources	▪ https://www.iksindia.org ▪ https://www.meity.gov.in ▪ https://www.isro.gov.in ▪ https://www.nsilindia.co.in ▪ https://www.wikipedia.org ▪ https://www.byjus.com ▪ https://www. yourarticlelibrary.com ▪ https://www.drdo.gov.in/	

T.Y. B.Sc. Electronics (Major)
Semester-VI
ELE-DSC-366: Practical on Power Electronics and Communication system

Total Hours: 60 **Credits: 2**

Course Objectives	▪ Familiar with power electronic devices characteristics and circuits ▪ Design and implement power electronics circuits. ▪ To understand the electronics communication system. ▪ Practical experience with communication circuits	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand power electronic devices and circuits ▪ Design and development of power electronics circuits. ▪ Measure and analyze the communication signal. ▪ Apply communication principles to real –world problems.	
Sr. No.	**Contents**	**Hours**
1	I-V characteristics of DIAC.	**4**
2	I-V characteristics of a TRIAC.	**4**
3	I-V characteristics of a SCR.	**4**
4	SCR as a half wave and full wave rectifiers with R and RL loads.	**4**
5	DC motor control using SCR.	**4**
6	Designing of SMPS/IC 723	**4**
7	Build and test DC to DC converter.	**4**
8	To study TRAIC power control circuits used as a dimmer or to control the speed of fan.	**4**
9	I-V characteristics of DIAC.	**4**
10	To build and test an Amplitude Modulator using transistor	**4**
11	To build and test diode detector for demodulation of AM signal	**4**
12	To build and test FM generator and detector circuit	**4**
13	To study TDM/FDM	**4**
14	To study PCM using Simulation	**4**
15	To study PAM/PWM/PPM using Simulation	**4**
Study Resources	▪ Sen, P. C. (2017). Power electronics (2nd ed.). McGraw-Hill Education. ▪ Dutta, S. K. (1984). Power electronics & controls. Brady (Robert J.) Co. ▪ Singh, M. D., &Khanchandani, K. B. (2017). Power electronics (2nd ed.). McGraw-Hill Education. ▪ Rashid, M. H. (2013). Power electronics: Circuits, devices, and applications (3rd ed.). Pearson Education. ▪ Mohan, N., Undeland, T. M., & Robbins, W. P. (2022). Power electronics: Applications and design. Wiley. ▪ Babu, K. H. (2009). Power electronics. Scitech Publication. ▪ Roddy, D., & Coolen, J. (n.d.). Electronic communications. Pearson Education. ▪ Lathi, B. P. (2011). Modern digital and analog communication systems (4th ed.). Oxford University Press. ▪ Kennedy, G. (1999). Electronic communication systems (3rd ed.). Tata McGraw-Hill. ▪ Frenzel, L. E. (2007). Principles of electronic communication systems (3rd ed.). McGraw-Hill. ▪ Haykin, S. (2006). Communication systems. Wiley India. ▪ Blake, J. (2012). Electronic communication system (5th ed.). Cengage.	

T.Y. B.Sc. Electronics (Major)
Semester-VI
ELE-DSC-367: Practical on Industrial Automation and Digital System

Total Hours: 60 **Credits: 2**

Course Objectives	▪ To provide practical understanding of Sensors and Actuators ▪ To introduce with hardware components of PLC and practical understanding of Ladder Programming ▪ To provide the knowledge and practical exposure of building digital circuits using VHDL.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Practical knowledge of designing of Industrial automation problems. ▪ Basic automation programming skills. ▪ Practical knowledge of designing of digital systems. ▪ Gain basic concept of VHDL programming.	
Sr. No.	**Contents**	**Hours**
1	To convert a Boolean expression into logic gate circuit and assemble it using logic gate IC's.	**4**
2	Simulation of logic gates using VHDL.	**4**
3	Simulation of Half adder/Full adder using VHDL	**4**
4	Simulation of Half subtractor/Full subtractor using VHDL.	**4**
5	Simulation of 4 bit binary adder using VHDL.	**4**
6	Simulation of RS Filp Flop using VHDL.	**4**
7	Simulation of counter using VHDL	**4**
8	Identification of given Sensors and Actuators	**4**
9	Introduction to PLC trainer & its installation with PC	**4**
10	Interfacing of Proximity sensor with PLC	**4**
11	Interfacing of Relay with PLC	**4**
12	Develop and Execute a ladder program for the given application using following:- timer, counter, comparison, logical, arithmetic instruction.	**4**
13	Develop and test ladder program to blink LED.	**4**
14	Use PLC to test the START / STOP logic for two inputs and one output.	**4**
15	Measure temperature of the given liquid using Thermocouple and PLC.	**4**
Study Resources	▪ Bhaskar, J. (2015). VHDL primer (3rd ed.). Pearson Education India. ▪ Perry, D. L. (2002). VHDL programming by example (4thed.). McGraw-Hill Education. ▪ Brown, S., &Vranesic, Z. (2017). Fundamentals of digital logic with VHDL design (3rd ed.). McGraw-Hill Education. ▪ Roddy, D., & Coolen, J. (2001). Electronic communications. Pearson Education India. ▪ Lathi, B. P. (2011). Modern digital and analog communication systems (4th ed.). Oxford University Press. ▪ Kennedy, G. (1999). Electronic communication systems (3rded.). Tata McGraw-Hill.	

	▪ Frenzel, L. E. (2007). Principles of electronic communication systems (3rd ed.). McGraw-Hill. ▪ Haykin, S. (2006). Communication systems. Wiley India. ▪ Blake, J. (2012). Electronic communication system (5th ed.). Cengage. ▪ Johnson, C. D. (2014). Process control instrumentation technology (8th ed.). Pearson New International Edition. ▪ Bolton, W. (2009). Programmable logic controllers. Newness. ▪ Kalsi, H. S. (2004). Electronic instrumentation (2nd ed.). Tata McGraw-Hill. ▪ Patranabis, D. (2008). Sensors and transducers. Prentice Hall. ▪ Automationdirect.com. PLC handbook: Practical guide to programmable logic controllers.	

T.Y. B.Sc. Electronics (Elective)
Semester-VI
ELE-DSE-361A: Python Programming

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To provide Basic knowledge of Python programming aad Learn data types input output functions. ▪ To understand and work with python strings and list. ▪ To understand and work with python tuples and dictionary. ▪ To understand python function and module.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand Python syntax and structure ▪ Handle python string and list. ▪ Implement programming related to Python tuples and Dictionary. ▪ Implement programming related to Python function and modules.	
Unit	**Contents**	**Hours**
Unit I	**Basic of Python Programming** Introduction to Python, History of Python, Version of Python, Need, Features of Python, Applications of Python, Installing Python on Linux and Windows, Installing Python IDE, Python Identifiers, Variables and Keywords, Putting Comments, Expressions and Statements, Standard Data Types – Basic, None, Boolean, Numbers. Type Conversion Function, Operators in Python, Operator Precedence, Accepting Input and Displaying Output Flow Control Statements, Conditional Statements, Looping Statements, break, continue, pass Statements	**06**
Unit II	**Python Strings and List** Introduction to String, String Literals, Assign String to a Variable, Multiline Strings, Operations on Strings, Index Operator: Working with the Characters of a String, String Methods, Length, The Slice Operator, String Comparison, Concepts of Python Lists: Creating, Initializing and Accessing elements in lists, Traversing, Updating and deleting elements from Lists. List Operations: Concatenation, List Indexing, Slices, Built- in List functions and methods, Aliasing, Cloning Lists	**08**
Unit III	**Python Tuples and Dictionary** Introduction to Tuples, Creating Tuples, Deleting Tuples, Accessing elements in a Tuple, Tuples Operations: Concatenation, Repetition, Membership, Iteration, Built- in Tuples functions and methods Introduction to Dictionary, Dictionaries: Concept of key-value pair, Creating, Initializing and Accessing elements in a Dictionary, Traversing, Updating and Deleting elements in a Dictionary, Built- in Dictionary functions and methods	**08**
Unit IV	**Python Functions and Modules** Introduction to Functions, defining a Function (def), Calling a Function, Function Arguments - Required arguments, Keyword arguments, Default arguments, Variable-length arguments, Scope of Variables, Void functions and function returning values, Recursion, Advance Function Topics: Anonymous Function Lambda, Mapping Functions, Functional Programming Tools: filter and reduce Introduction to Modules, Creating Modules and Packages, Importing Modules, Using the dir() Function, Built-in Modules	**08**

Study Resources	▪ Guttag, J. V. (2013). Introduction to computation and programming using Python. Prentice Hall of India. ▪ Norton, P. C., Samuel, A., & others. (2005). Beginning Python. Wrox Publication. ▪ Rao, N. R. (2016). Core Python programming. Dreamtech Press. ▪ Chun, W. J. (2006). Core Python programming (2^{nd} ed.). Prentice Hall. ▪ Goodrich, M. T., Tamassia, R., & Goldwasser, M. H. (2013). Data structures and algorithms in Python. Wiley. ▪ Lambert, K. A. (2011). Fundamentals of Python: First programs. CENGAGE Publication. ▪ Sneeringer, L. (2015). Professional Python. Wiley Inc.	

T.Y. B.Sc. Electronics (Elective)
Semester-VI
ELE-DSE-361B: Biomedical Instrumentation**

(SWAYAM course: noc25-bt49)

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To introduce basic of biomedical instrumentation. ▪ To provide knowledge of electrical signals present in human body and their measurement. ▪ To understand the measurement and analysis techniques for physiological parameters ▪ Understand the functioning of modern imaging system	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand and measure biological signals present in human body ▪ Aware various blocks of biomedical instrumentation such as electrode, recorder ▪ Understand the working principles of various therapeutic and monitoring systems ▪ Understand the patient imaging and monitoring systems.	
Unit	**Contents**	**Hours**
Unit I	**Introduction to Medical Instrumentation** Block diagram of Medical Instrumentation System, Physiological system of human body, operational modes, Medical measurement constraints, Classification of Biomedical Instrumentation, Biostatistics, Static characteristics, dynamic characteristics, Design Criteria. Interfacing the computer with medical instruments. Biomedical instruments.	**06**
Unit II	**Biomedical signals & Physiological transducers** Biomedical Signal and recorder: Source of biomedical signal, Origin o bioelectric signals, recording electrodes, Electrodes for ECG, EMG & EEG. Biomedical recorders: ECG, EEG & EMG.	**08**
Unit III	**Biomedical instruments** **Patient Monitoring systems and measurements**: Cardiac monitor, Bedside patient monitor, measurement of heart rate, pulse rate, blood pressure, temperature & respiration rate. Cardio to cograph, oximeter, blood flow meter, spirometer, blood gas analyzer, blood gas counter, Audiometer, pH **Therapeutic Equipment's:** Cardiac pacemakers, cardiac defibrillators, Hemodialysis machine, surgical diathermy machine	**08**
Unit IV	**Modern Imaging systems:** Introduction, Basic principle & Block diagramof X-ray machine, X-ray Computed Tomography (CT), Magnetic resonance imaging system (MRI), Nuclear Medical Imaging system, ultrasonic imaging system. Eco-Cardiograph, Eco Encephalography	**08**
Study Resources	▪ Khandpur, R. S. (2004). Handbook of biomedical instrumentation (2nd ed.). McGraw-Hill Professional. ▪ Webster, J. G., & John, G. (2009). Medical instrumentation: Application and design (4th ed.). John Wiley & Sons. ▪ Cromwell, L., Weibell, F. J., & Pfeiffer, E. A. (1990). Biomedical instrumentation and measurements (2nd ed.). PHI. ▪ Carr, J. J., Brown, J. M., & John, M. (1997). Introduction to biomedical equipment technology (3rd ed.). Pearson.	

T.Y. B.Sc. Electronics (Elective)
Semester-VI
ELE-DSE-362A: Practical on Python Programming

Total Hours: 60 **Credits: 2**

Course Objectives	▪ To provide Basic knowledge of Python. ▪ To learn how to design and program Python applications. ▪ To develop problem solving skills and their implementation through Python. ▪ To understand python string, list, tuples, dictionary, function and module.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Explain basic concept of Python programming language ▪ Apply the best features of mathematics, engineering and natural sciences to program real life problems. ▪ Understand Python syntax and structure ▪ Implement programming related to Python string, list, tuples, dictionary, function and module	
Sr. No.	**Contents**	**Hours**
1	Write a program of sum of 100 numbers.	**4**
2	Write a program of to find prime number.	**4**
3	Write a program of generate Fibonacci series.	**4**
4	Write a program to find factorial of a number.	**4**
5	Write a program to generate random numbers.	**4**
6	Write a program to demonstrate the use of slicing in string.	**4**
7	Write a programs related to functions & modules.	**4**
8	Write a program that demonstrate concept of functional programming.	**4**
9	Write a program to demonstrate the use of tuple.	**4**
10	Write a program to check Armstrong number.	**4**
11	Write a program to find the root of equation.	**4**
12	Write a program to find the area of circle.	**4**
13	Write a program to find compound interest.	**4**
14	Write a program to generate natural numbers.	**4**
15	Write a program to reverse the string.	**4**
16	Write a program to find the size of a tuple	**4**
17	Write a program to find the sum of all items in a dictionary.	**4**
18	Write a program to swap two elements of a list.	**4**
Study Resources	▪ Guttag, J. V. (2013). Introduction to computation and programming using Python. Prentice Hall of India. ▪ Norton, P. C., Samuel, A., & others. (2005). Beginning Python. Wrox Publication. ▪ Rao, N. R. (2016). Core Python programming. Dreamtech Press. ▪ Chun, W. J. (2006). Core Python programming (2nd ed.). Prentice Hall. ▪ Goodrich, M. T., Tamassia, R., & Goldwasser, M. H. (2013). Data structures and algorithms in Python. Wiley. ▪ Lambert, K. A. (2011). Fundamentals of Python: First programs. CENGAGE Publication. ▪ Sneeringer, L. (2015). Professional Python. Wiley Inc.	

T.Y. B.Sc. Electronics (Elective)
Semester-VI
ELE-DSE-362B: Practical on Biomedical Instrumentation

Total Hours: 60 **Credits: 2**

Course Objectives	▪ To introduce field of biomedical instrumentation. ▪ To provide knowledge of electrical signals present in human body and their measurement. ▪ To understand the measurement and analysis techniques for physiological parameters ▪ Understand the functioning of modern imaging system	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand and measure biological signals present in human body ▪ Aware various blocks of biomedical sensors ▪ Understand the working principles of various therapeutic and monitoring systems ▪ Understand the patient imaging and monitoring systems.	
Sr. No.	**Contents**	**Hours**
1	Study of ECG/EEG/EMG electrodes.	**4**
2	Study of temperature sensor for contact measurement (LM35//Thermistor).	**4**
3	Study of non-contact temperature measurement system (Infrared thermometers).	**4**
4	Study of ultrasonic sensors (Sensitivity/Directivity)/.	**4**
5	Study of social distance maintenance equipment	**4**
6	Study of heart rate sensor.	
7	To design a band pass filter to obtain the alpha frequency band of an amplified EEG signal.	**4**
8	Study of electronics stethoscope.	**4**
9	Study of ECG/EEG/EMG electrodes.	**4**
10	Study of temperature sensor for contact measurement (LM35//Thermistor).	**4**
11	Study of non-contact temperature measurement system (Infrared thermometers).	**4**
12	Study of Various Leads for Monitoring of Electrocardiogram (ECG)	**4**
13	Monitoring of Electrocardiogram (ECG) for bipolar limb	**4**
14	Monitoring of Electrocardiogram (ECG) for augmented leads	**4**
15	Monitoring of electrocardiogram (ECG) for chest leads	**4**
16	Study of various leads and electrode position for Electroencephalogram (EEG)	**4**
17	Monitoring of Electroencephalogram (EEG) signal for different lobes	**4**
18	Study of various leads present in different lobes	**4**
19	Measurement PH using PH meter	**4**
20	Study of types of electrode	**4**
Study Resources	▪ Khandpur, R. S. (2004). Handbook of biomedical instrumentation (2nd ed.). McGraw-Hill Professional. ▪ Guttag, J. V. (2013). Introduction to computation and programming using Python. Prentice Hall of India. ▪ Rajaraman, V. (1993). Computer-oriented numerical methods (3rd ed.). Prentice Hall India. ▪ Virtual Lab: https://bmi-iitr.vlabs.ac.in/List%20of%20experiments.html	

T.Y. B.Sc. Electronics (Vocational)
Semester-VI
ELE-VSC-361: Consumer Electronic Product and Maintenance

Total Hours: 30 **Credits: 2**

Course Objectives	▪ To give depth knowledge of various electronic audio devices and systems. ▪ To get knowledge of various electronic video devices and system. ▪ To create skill of installation of various electronics appliances like Set Top box (D2H), CATV and Dish TV. ▪ To understand the basics of various types of consumer appliances.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Get knowledge about audio and video system. ▪ Understand various types of consumer products and acquaint the skill of installation. ▪ Acquaint the knowledge of different types of Television Technology skill of electronics appliances like Set Top Box, CATV and Dish TV ▪ Understand the basic working of domestic appliances	
Unit	**Contents**	**Hours**
Unit I	**Audio System** Microphone: Characteristics of microphone, different types of microphone, Electret & carbon microphones (principle, construction, working and characteristics). Loudspeaker: Characteristics of Loudspeaker, Horn type, Multiway speaker system (Woofers & Tweeters). P.A. System: Need and Use, Block diagram of P.A. system.	**06**
Unit II	**Digital Television** Elements of TV communication system, Scanning and its need, Difference between a conventional CTV with LCD & LED TVs. Principle of LCD and LED TV and function of its different section, plasma TV, OLED, Basic principle and working of 3D TV. IPS panels and their features. Different types of interfaces like HDMI, USB, RGB etc. TV Remote Control.	**08**
Unit III	**Satellite Television Technology** Basic satellite communication, Merits& Demerits of satellite communication, applications, types of satellite & its orbits, Satellite Frequency Bands. Basic components of DTH system: PDA, LNBC, Satellite receiver terminal, dish installation aspects, Azimuth & elevation settings of dish/ DTH receiver.Set top box - features, block diagram and working	**08**
Unit IV	**Domestic and commercial appliances** Washing machine: Block diagram, semi-automatic and fully automatic machines, basic working principle, features.Vacuum cleaner: Block diagram, working principle, features. Working principle of - Electric Motors (Water Pump, Mixer and Grinder), Electric Heaters, Water Purifiers (RO and UV), Induction Cook Top.	**08**
Study Resources	▪ Bali, R. P. (2008). Consumer electronics (1st ed.). Pearson Education. ▪ Gupta, R. G. (2004). Audio and video systems. Tata McGraw-Hill. ▪ Chitode, J. S. (2007). Consumer electronics(1st ed.). Technical Publication Pune. ▪ Sinclair, I., & Dunton, J. (2007). Electronic and electrical servicing: Consumer and commercial electronics (2nd ed.).Rutledge.	

T.Y. B.Sc. Electronics (Vocational)
Semester-VI
ELE-VSC-362: Practical on Consumer Electronic Product

Total Hours: 60 **Credits: 2**

Course Objectives	▪ To give the practical knowledge of audio system and its various parts. ▪ To understand the practical knowledge of video system. ▪ To learn the skill of installation of various electronics appliances. ▪ To understand the basic working of domestic consumer products.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand the application of audio system. ▪ Gain the practical knowledge of video system. ▪ Understand the basic working of some consumer products. ▪ Obtained the skill of installation of domestic appliances.	
Sr. No.	**Contents**	**Hours**
1	Plot the Directional response of Microphone.	**4**
2	Study of different types of microphones.	**4**
3	Plot the directional response of a Loud Speaker.	**4**
4	Study of Public Address System.	**4**
5	Installation of CCTV system.	**4**
6	Assembling of water purifier.	**4**
7	Market Survey of Products (At least one from each module).	**4**
8	Installation of Dish Antenna for best reception.	**4**
9	Study of mixer grinder-speed, overload protection.	**4**
10	Installation of Set top box.	**4**
11	Interfacing of HDMI cable.	**4**
12	Study of Washing machine using user manual.	**4**
13	Study of Vacuum cleaner using user manual.	**4**
14	Study of Electric motor using user manual.	**4**
15	Study of Electric heater & iron.	**4**
16	Study of OLED TV.	**4**
Study Resources	▪ User Manuals ▪ Bali, R. P. (2008). Consumer electronics(1st ed.). Pearson Education. ▪ Gupta, R. G. (2004). Audio and video systems. Tata McGraw Hill. ▪ Chitode, J. S. (2007). Consumer electronics(1st ed.). Technical Publication Pune. ▪ Sinclair, I., & Dunton, J. (2007). Electronic and electrical servicing: Consumer and commercial electronics (2nded.). Rutledge.	

Skills acquired and Job prospects for the Electronics students

Electronics combines the concept of physics, engineering, technology and application. The specified Degree program in electronics develops the student for the upcoming technologies. The students are acquired skills like Designing and Simulation, Building and testing of Digital and Analog electronic circuits or system. A significant attraction of the course is the development of appropriate practical skills suitable as per industrial need and indirectly it provides the interesting and challenging job opportunities.

After successful completion of three years degree course in Electronics, student will be expert in laboratory skills as well as transferable skills.

Laboratory Skills:

- Designing and Simulation, of Analog/ Digital electronic circuit/system
- Building and testing of Analog/ Digital electronic circuits
- Laboratory safety practices
- Good understanding of microcontrollers and its interfacing
- Programming in 'C', python, Assembly language
- Skillful handling of basic and advanced instruments

Transferable Skills:

During the course student will develop skills other than laboratory skills that are transferable across the number of career areas which include;

- Analytical skill, Observational skill
- Planning and Time management
- Mathematical and IT skills
- Creative thinking, Problem solving
- Report writing skill, Presentation skill

Job Opportunities:

After successful completion of B.Sc. in Electronics, student may continue further studies like M.Sc. in Electronics and then Ph.D. in Electronics and make career in research field. Students have opportunities in private as well as public (Government) sectors.

Private Sector:

- Communication equipment Manufacturing industries

- PCB Design and Fabrication Industries
- Consumer Electronics Industries
- Electronic Components and Devices Manufacturing
- Semiconductor Manufacturing Industries
- Instrumentation and Control Industries
- Mobile Phone assembly Industries
- Medical Electronics Industries
- Automation and Control Industries

Public Sectors:

- Public Sector Undertakings (like BHEL, BEL, HAL, IOCL, HPCL, ISRO, DRDO NTPC, SAIL etc)
- Civil Services
- Defense and Railway
- Any government department where eligibility of any graduation
- Banking
- Educator

Job profiles:

Project manager, Electronics design engineer, R & D Engineer, Electronics and Communication Consultant, Laboratory Technician, Research Associates, Research Officers, Research Scientist, Industrial Administrator, Technical executive, software testing, software developer etc. and many other job profiles depending on the job profile and interest to work in the field.

Opportunities in higher studies

After successful completion of B.Sc. in Electronics, student may continue further studies like M.Sc. in Electronics and pursue other higher studies like MBA and MCA. Even students can pursue other courses where graduation is essential.